BAE SYSTEMS

HOLSTON ARMY AMMUNITION PLANT

KINGSPORT, TENNESSEE

TENNESSEE HAZARDOUS WASTE MANAGEMENT FACILITY PERMIT

RENEWAL APPLICATION
PERMIT NUMBER: TNHW-148

OCTOBER 2020

Coterie ENVIRONMENTAL

1150 FIRST AVENUE, SUITE 501 • KING OF PRUSSIA, PA 19406
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Attachment 4-1: Drawings of the Burn Pan Unit
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Section 1. APPLICATION FORMS

This section presents the permit application forms required by Title 40 Code of Federal Regulations (CFR) Section 270.13 and Chapter 0400-12-01-.07(4)(b) of the Tennessee Compilation of Rules and Regulations (TCRR) for all hazardous was permit applications. As required, these forms have been completed and signed by the appropriate responsible officials. The following forms are provided:

- Attachment 1-1 includes copies of the Federal forms developed by the United States Environmental Protection Agency (USEPA), including:
  - USEPA Form 8700-12: Site Identification Form
  - USEPA Form 8700-23: Part A Permit Application
- Attachment 1-2 includes copies of the State forms developed by the Tennessee Department of Environment and Conservation (TDEC), including:
  - Tennessee Form CN-1261: Transportation, Storage, and Disposal Facility (TSDF) Application and other Review Fees
  - Tennessee Form CN-1442: Hazardous Waste Unified Certification Cover Sheet
  - Tennessee Form CN-1445: Hazardous Waste Contact Notification
  - Tennessee Form CN-1446: Hazardous Waste Environmental Activity Notification

Note to reader: Section 16 of this Permit renewal application includes a cross-reference table between the applicable environmental regulatory requirements of 40 CFR Part 270, the TCRR, and the various sections of this application. The table specifies where each of the requirements in 40 CFR Part 270 and TCRR 0400-12-01-.07 can be located within the application.

Attachment 1-1: USEPA FORMS

OMB# 2050-0024; Expires 05/31/2020

United States Environmental Protection Agency
RCRA SUBTITLE C SITE IDENTIFICATION FORM

1. Reason for Submittal (Select only one.)

☐	Obtaining or updating an EPA ID number for an on-going regulated activity that will continue for a period of time. (Includes HSM activity)
☐	Submitting as a component of the Hazardous Waste Report for _____ (Reporting Year)
	☐ Site was a TSD facility and/or generator of ≥ 1,000 kg of non-acute hazardous waste, > 1 kg of acute hazardous waste, or > 100 kg of acute hazardous waste spill cleanup in **one or more months of the reporting year** (or State equivalent LQG regulations)
☐	Notifying that regulated activity is no longer occurring at this Site
☐	Obtaining or updating an EPA ID number for conducting Electronic Manifest Broker activities
☑	Submitting a new or revised Part A Form

2. Site EPA ID Number

T	N	5	2	1	0	0	2	0	4	2	1

3. Site Name

Holston Army Ammunition Plant

4. Site Location Address

Street Address	**4509 West Stone Drive**		
City, Town, or Village	**Kingsport**	County	**Hawkins/Sullivan**
State **TN**	Country **USA**	Zip Code	**37660**

5. Site Mailing Address

☑ Same as Location Address

Street Address		
City, Town, or Village		
State	Country	Zip Code

6. Site Land Type

☐ Private ☐ County ☐ District ☑ Federal ☐ Tribal ☐ Municipal ☐ State ☐ Other

7. North American Industry Classification System (NAICS) Code(s) for the Site (at least 5-digit codes)

A. (Primary) **325920**	C.
B.	D.

8. Site Contact Information

☑ Same as Location Address

First Name **William**	MI	Last Name **Shelton**
Title **Environmental Manager**		
Street Address		
City, Town, or Village		
State	Country	Zip Code
Email **william.shelton@baesystems.com**		
Phone **423-578-6022**	Ext	Fax

9. Legal Owner and Operator of the Site

A. Name of Site's Legal Owner

☑ Same as Location Address

Full Name **U.S. Army**	Date Became Owner (mm/dd/yyyy) **6/6/1942**

Owner Type

☐ Private ☐ County ☐ District ☑ Federal ☐ Tribal ☐ Municipal ☐ State ☐ Other

Street Address		
City, Town, or Village		
State	Country	Zip Code
Email **randolph.s.carpenter.mil@mail.mil**		
Phone **423-578-6012**	Ext	Fax
Comments		

B. Name of Site's Legal Operator

☑ Same as Location Address

Full Name **BAE Systems, Ordnance Systems Inc.**	Date Became Operator (mm/dd/yyyy) **1/1/1999**

Operator Type

☑ Private ☐ County ☐ District ☐ Federal ☐ Tribal ☐ Municipal ☐ State ☐ Other

Street Address		
City, Town, or Village		
State	Country	Zip Code
Email **todd.hayes@baesystems.com**		
Phone **423-578-6369**	Ext	Fax
Comments		

10. Type of Regulated Waste Activity (at your site)

Mark "Yes" or "No" for all current activities (as of the date submitting the form); complete any additional boxes as instructed.

A. Hazardous Waste Activities

☑ Y ☐ N	1. Generator of Hazardous Waste—If "Yes", mark only one of the following—a, b, c	
☑	a. LQG	-Generates, in any calendar month (includes quantities imported by importer site) 1,000 kg/mo (2,200 lb/mo) or more of non-acute hazardous waste; or - Generates, in any calendar month, or accumulates at any time, more than 1 kg/mo (2.2 lb/mo) of acute hazardous waste; or - Generates, in any calendar month or accumulates at any time, more than 100 kg/mo (220 lb/mo) of acute hazardous spill cleanup material.
☐	b. SQG	100 to 1,000 kg/mo (220-2,200 lb/mo) of non-acute hazardous waste and no more than 1 kg (2.2 lb) of acute hazardous waste and no more than 100 kg (220 lb) of any acute hazardous spill cleanup material.
☐	c. VSQG	Less than or equal to 100 kg/mo (220 lb/mo) of non-acute hazardous waste.
☐ Y ☑ N	2. Short-Term Generator (generates from a short-term or one-time event and not from on-going processes). If "Yes", provide an explanation in the Comments section. *Note: If "Yes", you MUST indicate that you are a Generator of Hazardous Waste in Item 10.A.1 above.*	
☑ Y ☐ N	3. Treater, Storer or Disposer of Hazardous Waste—Note: Part B of a hazardous waste permit is required for these activities.	
☑ Y ☐ N	4. Receives Hazardous Waste from Off-site	
☐ Y ☑ N	5 Recycler of Hazardous Waste	
☐	a. Recycler who stores prior to recycling	
☐	b. Recycler who does not store prior to recycling	
☐ Y ☑ N	6. Exempt Boiler and/or Industrial Furnace—If "Yes", mark all that apply.	
☐	a. Small Quantity On-site Burner Exemption	
☐	b. Smelting, Melting, and Refining Furnace Exemption	

B. Waste Codes for Federally Regulated Hazardous Wastes. Please list the waste codes of the Federal hazardous wastes handled at your site. List them in the order they are presented in the regulations (e.g. D001, D003, F007, U112). Use an additional page if more spaces are needed.

D001	**D002**	**D003**	**D007**	**D008**	**D009**	**D011**
D018	**D022**	**D030**	**D035**	**D038**	**F003**	**F005**
K044	**K045**					

C. Waste Codes for State Regulated (non-Federal) Hazardous Wastes. Please list the waste codes of the State hazardous wastes handled at your site. List them in the order they are presented in the regulations. Use an additional page if more spaces are needed.

11. Additional Regulated Waste Activities (NOTE: Refer to your State regulations to determine if a separate permit is required.)

A. Other Waste Activities

☐ Y ☑ N	1. Transporter of Hazardous Waste—If "Yes", mark all that apply.
☐	a. Transporter
☐	b. Transfer Facility (at your site)
☐ Y ☑ N	2. Underground Injection Control
☐ Y ☑ N	3. United States Importer of Hazardous Waste
☐ Y ☑ N	4. Recognized Trader—If "Yes", mark all that apply.
☐	a. Importer
☐	b. Exporter
☐ Y ☑ N	5. Importer/Exporter of Spent Lead-Acid Batteries (SLABs) under 40 CFR 266 Subpart G—If "Yes", mark all that apply.
☐	a. Importer
☐	b. Exporter

B. Universal Waste Activities

☐ Y ☑ N	1. Large Quantity Handler of Universal Waste (you accumulate 5,000 kg or more) - If "Yes" mark all that apply. Note: Refer to your State regulations to determine what is regulated.
☐	a. Batteries
☐	b. Pesticides
☐	c. Mercury containing equipment
☐	d. Lamps
☐	e. Other (specify) _____
☐	f. Other (specify) _____
☐	g. Other (specify) _____
☐ Y ☑ N	2. Destination Facility for Universal Waste Note: A hazardous waste permit may be required for this activity.

C. Used Oil Activities

☐ Y ☑ N	1. Used Oil Transporter—If "Yes", mark all that apply.
☐	a. Transporter
☐	b. Transfer Facility (at your site)
☐ Y ☑ N	2. Used Oil Processor and/or Re-refiner—If "Yes", mark all that apply.
☐	a. Processor
☐	b. Re-refiner
☐ Y ☑ N	3. Off-Specification Used Oil Burner
☐ Y ☑ N	4. Used Oil Fuel Marketer—If "Yes", mark all that apply.
☐	a. Marketer Who Directs Shipment of Off-Specification Used Oil to Off-Specification Used Oil Burner
☐	b. Marketer Who First Claims the Used Oil Meets the Specifications

D. Pharmaceutical Activities

☐ Y ☑ N	1. Operating under 40 CFR 266 Subpart P for the management of hazardous waste pharmaceuticals—if "Yes", mark only one. Note: See the item-by-item instructions for definitions of healthcare facility and reverse distributor.
☐	a. Healthcare Facility
☐	b. Reverse Distributor
☐ Y ☑ N	2. Withdrawing from operating under 40 CFR 266 Subpart P for the management of hazardous waste pharmaceuticals. Note: You may only withdraw if you are a healthcare facility that is no longer an LQG or SQG.

12. Eligible Academic Entities with Laboratories—Notification for opting into or withdrawing from managing laboratory hazardous wastes pursuant to 40 CFR 262 Subpart K.

☐ Y ☑ N	A. Opting into or currently operating under 40 CFR 262 Subpart K for the management of hazardous wastes in laboratories— If "Yes", mark all that apply. Note: See the item-by-item instructions for definitions of types of eligible academic entities.
☐	1. College or University
☐	2. Teaching Hospital that is owned by or has a formal written affiliation with a college or university
☐	3. Non-profit Institute that is owned by or has a formal written affiliation with a college or university
☐ Y ☑ N	B. Withdrawing from 40 CFR 262 Subpart K for the management of hazardous wastes in laboratories.

13. Episodic Generation

☐ Y ☑ N	Are you an SQG or VSQG generating hazardous waste from a planned or unplanned episodic event, lasting no more than 60 days, that moves you to a higher generator category. If "Yes", you must fill out the Addendum for Episodic Generator?

14. LQG Consolidation of VSQG Hazardous Waste

☐ Y ☑ N	Are you an LQG notifying of consolidating VSQG Hazardous Waste Under the Control of the Same Person pursuant to 40 CFR 262.17(f)? If "Yes", you must fill out the Addendum for LQG Consolidation of VSQGs hazardous waste.

15. Notification of LQG Site Closure for a Central Accumulation Area (CAA) (optional) OR Entire Facility (required)

☐ Y ☑ N	LQG Site Closure of a Central Accumulation Area (CAA) or Entire Facility.
	A. ☐ Central Accumulation Area (CAA) or ☐ Entire Facility
	B. Expected closure date: _____ mm/dd/yyyy
	C. Requesting new closure date: _____ mm/dd/yyyy
	D. Date closed : _____ mm/dd/yyyy ☐ 1. In compliance with the closure performance standards 40 CFR 262.17(a)(8) ☐ 2. Not in compliance with the closure performance standards 40 CFR 262.17(a)(8)

16. Notification of Hazardous Secondary Material (HSM) Activity

☐ Y ☑ N	Are you notifying under 40 CFR 260.42 that you will begin managing, are managing, or will stop managing hazardous secondary material under 40 CFR 260.30, 40 CFR 261.4(a)(23), (24), (25), or (27)? If "Yes", you must fill out the Addendum to the Site Identification Form for Managing Hazardous Secondary Material.

17. Electronic Manifest Broker

☐ Y ☑ N	Are you notifying as a person, as defined in 40 CFR 260.10, electing to use the EPA electronic manifest system to obtain, complete, and transmit an electronic manifest under a contractual relationship with a hazardous waste generator?

18. Comments (include item number for each comment)

19. Certification I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations. **Note: For the RCRA Hazardous Waste Part A permit Application, all owners and operators must sign (see 40 CFR 270.10(b) and 270.11).**

Signature of legal owner, operator or authorized representative	Date (mm/dd/yyyy) 10/15/2020
Printed Name (First, Middle Initial Last) Randolph Scott Carpenter	Title Commander
Email randolph.s.carpenter.mil@mail.mil	

Signature of legal owner, operator or authorized representative	Date (mm/dd/yyyy) 10/21/2020
Printed Name (First, Middle Initial Last) Todd D Hayes	Title General Manager
Email todd.hayes@baesystems.com	

EPA ID Number	T	N	5	2	1	0	0	2	0	4	2	1

OMB# 2050-0024; Expires 05/31/2020

United States Environmental Protection Agency

HAZARDOUS WASTE PERMIT PART A FORM

1. Facility Permit Contact

First Name	**William**	MI		Last Name	**Shelton**
Title	**Environmental Manager**				
Email	**william.shelton@baesystems.com**				
Phone	**423-578-6022**	Ext		Fax	

2. Facility Permit Contact Mailing Address

Street Address	**4509 West Stone Drive**		
City, Town, or Village	**Kingsport**		
State **TN**	Country **USA**	Zip Code	**37660-9982**

3. Facility Existence Date (mm/dd/yyyy)

6/6/1942

4. Other Environmental Permits

A. Permit Type	B. Permit Number	C. Description
E	**TN9775956**	**TN State Construction Permit**
P	**TN9776427**	**TN State PSD Construction Permit**
P	**TN9741927**	**TN State PSD Cosntruction Permit**
E	**TN5681887**	**Title V Permit - Area B**
N	**TNR053962**	**Stormwater Discharge Permit**
N	**TN0003671**	**NPDES Permit**
E	**CAO03-HCA002**	**Corrective Action**

5. Nature of Business

The Holston Army Ammunition Plant is a government-owned, contractor operated facility located in Hawkins and Sullivan counties in Northeastern Tennessee. The plant primarily manufactures RDX, HMX, and IMX high explosives and formulations containing these and other explosives. This application is for the Burn Pan Unit, which is used for the treatment and destruction of explosive wastes generated from development, manufacturing, formulating, testing and product storage.

6. Process Codes and Design Capacities

Line Number		A. Process Code			B. Process Design Capacity		C. Process Total Number of Units	D. Unit Name
					(1) Amount	(2) Unit of Measure		
0	1	X	0	1	5,000	J	001	Burn Pan Unit

7. Description of Hazardous Wastes (Enter codes for Items 7.A, 7.C and 7.D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. Processes								
								(1) Process Codes								(2) Process Description (if code is not entered in 7.D1))
0	1	D	0	0	1	1,250,000	P	X	0	1						
		D	0	0	3											Included with above
		D	0	0	7											Included with above
		D	0	1	8											Included with above
		D	0	2	2											Included with above
		D	0	3	0											Included with above
		D	0	3	5											Included with above
		D	0	3	8											Included with above
		K	0	4	4											Included with above
		K	0	4	5											Included with above

8. Map

Attach to this application a topographical map, or other equivalent map, of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all spring, rivers, and other surface water bodies in this map area. See instructions for precise requirements.

9. Facility Drawing

All existing facilities must include a scale drawing of the facility. See instructions for more detail.

10. Photographs

All existing facilities must include photographs (aerial or ground-level) that clearly delineate all existing structures; existing storage, treatment, and disposal areas; and sites of future storage, treatment, or disposal areas. See instructions for more detail.

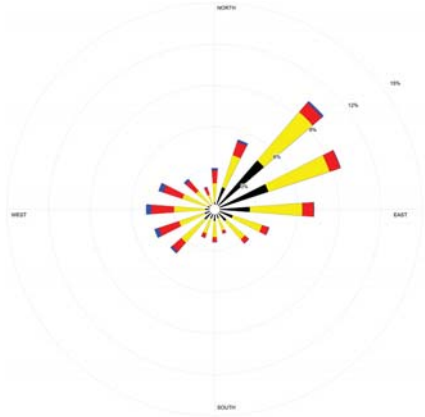
11. Comments

Legend

- Approximate Property Boundary
- Burn Pan Unit
- 1000-Foot Radius

WIND SPEED (m/s)

- >11.06
- 8.49 - 11.06
- 5.40 - 8.49
- 3.34 - 5.40
- 1.80 - 3.34
- 0.51 - 1.80



SOURCE OF WINDSPEED DATA IS THE
STATION #13877 - BRISTOL/TRI CITY AIRPORT, TN,

0 1,000 2,000 FEET

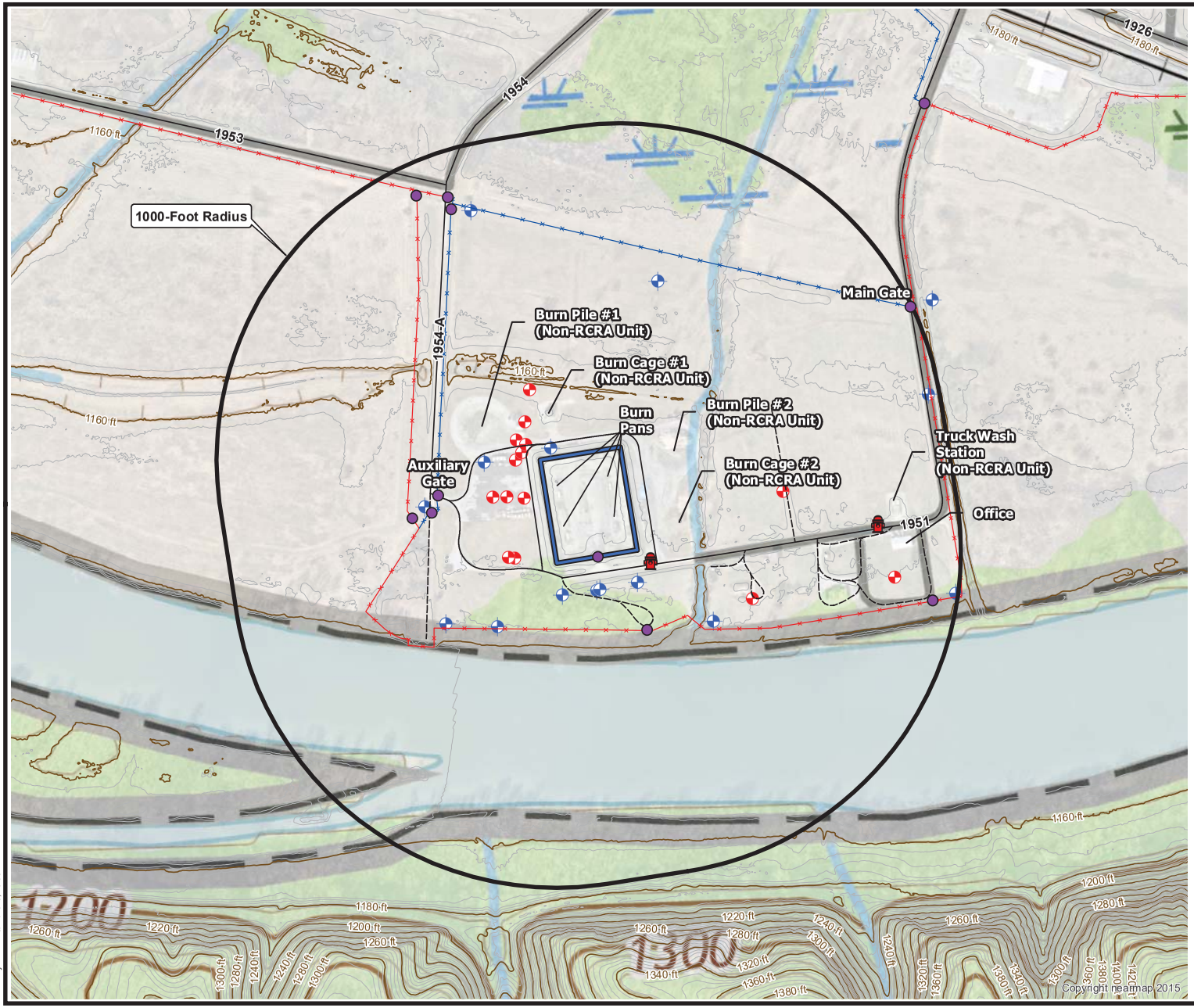
1 " = 2,000 '
1:24,000

HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TENNESSEE

LOCATION MAP

DRAWN BY: SSW	SCALE:	PROJ. NO.	RCRA 2020
CHECKED BY: M GEHRING	AS NOTED	FILE NO.	Fig 2_1 Location Map.mxd
APPROVED BY: M GEHRING	DATE PRINTED:		
DATE: August 2020	*8/25/2020*		

Coterie ENVIRONMENTAL
1150 First Ave., Ste 501
King of Prussia, PA 19406



Legend

- Burn Pan Unit
- Gates
- Interior Fence
- Perimeter Fence
- Primary Road
- Secondary Road
- Fire Hydrant
- Groundwater Monitoring Well (Open)
- Groundwater Monitoring Well (Closed)
- 1000-Foot Radius

WIND SPEED (m/s)

- >11.06
- 8.49 - 11.06
- 5.40 - 8.49
- 3.34 - 5.40
- 1.80 - 3.34
- 0.51 - 1.80

N

0 150 300 FEET

1 " = 300 '
1:3,600

HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TENNESSEE

TOPOGRAPHIC MAP

DRAWN BY:	SSW	SCALE:	PROJ. NO. RCRA 2020
CHECKED BY:	M GEHRING	AS NOTED	FILE NO. Fig 2_3 Topographic Map.mxd
APPROVED BY:	M GEHRING	DATE PRINTED:	
DATE:	August 2020	8/24/2020	

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1150 First Ave., Ste 501
King of Prussia, PA 19406

J:\Proj\Holston Army Ammunition\RCRA 2020\Fig 2_3 Topographic Map.mxd
Printed By: lauri on 8/24/2020, 10:08 AM

Legend

- Burn Pan Unit
- Sewer Drainage Line
- Stormwater Channel
- Backflow Prevention Valve
- Surface Flow Direction
- Groundwater Monitoring Well (Open)
- Groundwater Monitoring Well (Closed)

N

0 90 180 FEET

1 " = 180 '
1:2,160

HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TENNESSEE

STORMWATER CONTROLS AND SURFACE WATER FLOW

DRAWN BY:	SSW	SCALE:	PROJ. NO. RCRA 2020
CHECKED BY:	M GEHRING	AS NOTED	FILE NOFig 2_5 Surfa
APPROVED BY:	M GEHRING	DATE PRINTED:	
DATE:	August 2020	8/25/2020	

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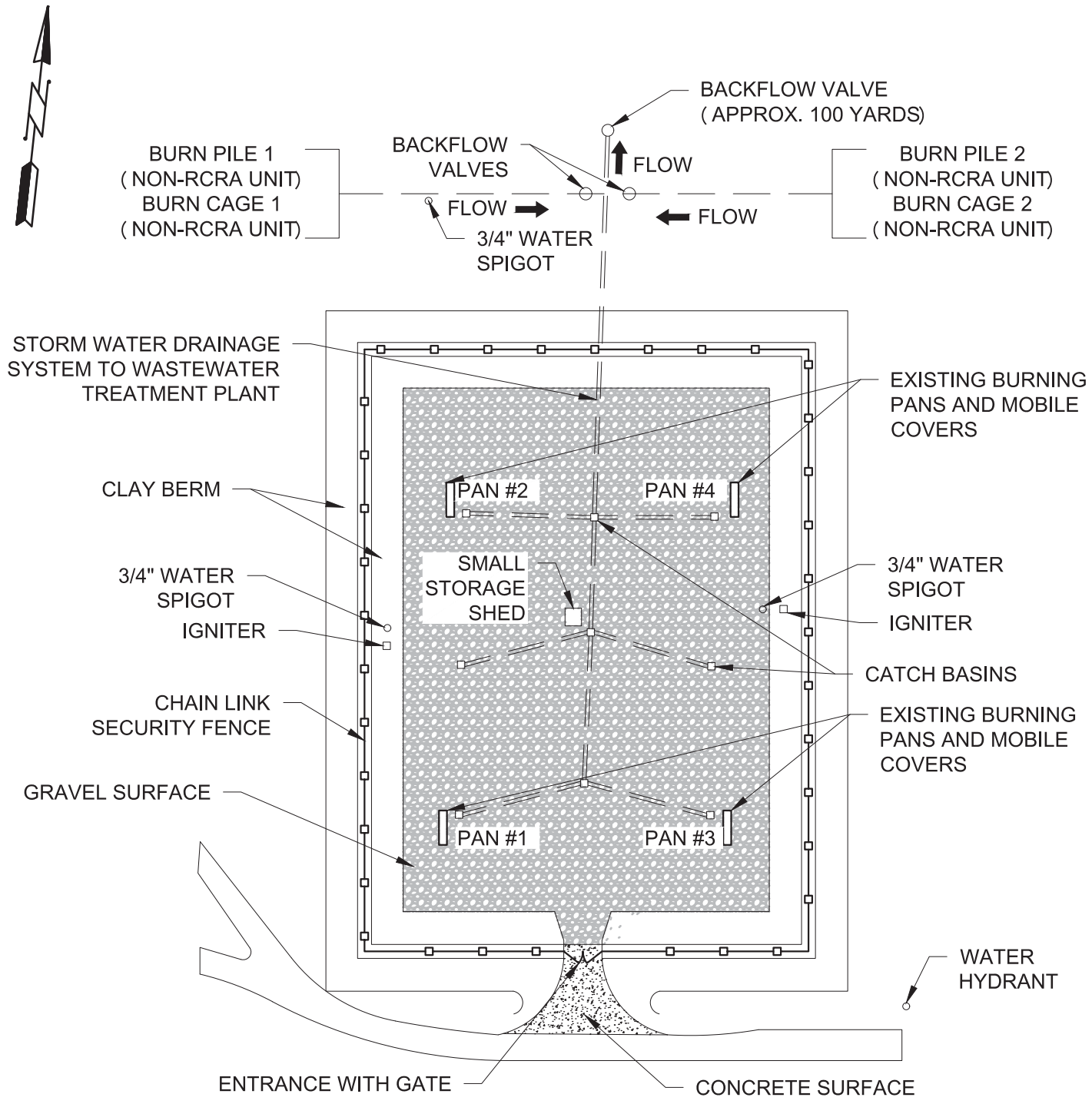
King of Prussia, PA 19406

J:\P\[Holston Army Ammunition\RCRA 2020\Fig 2_5 Surface Water Flow.mxd
Printed By: lauri on 8/25/2020, 07:36 AM



GRAPHIC SCALE

80 0 40 80 160

(IN FEET)

1" = 80'

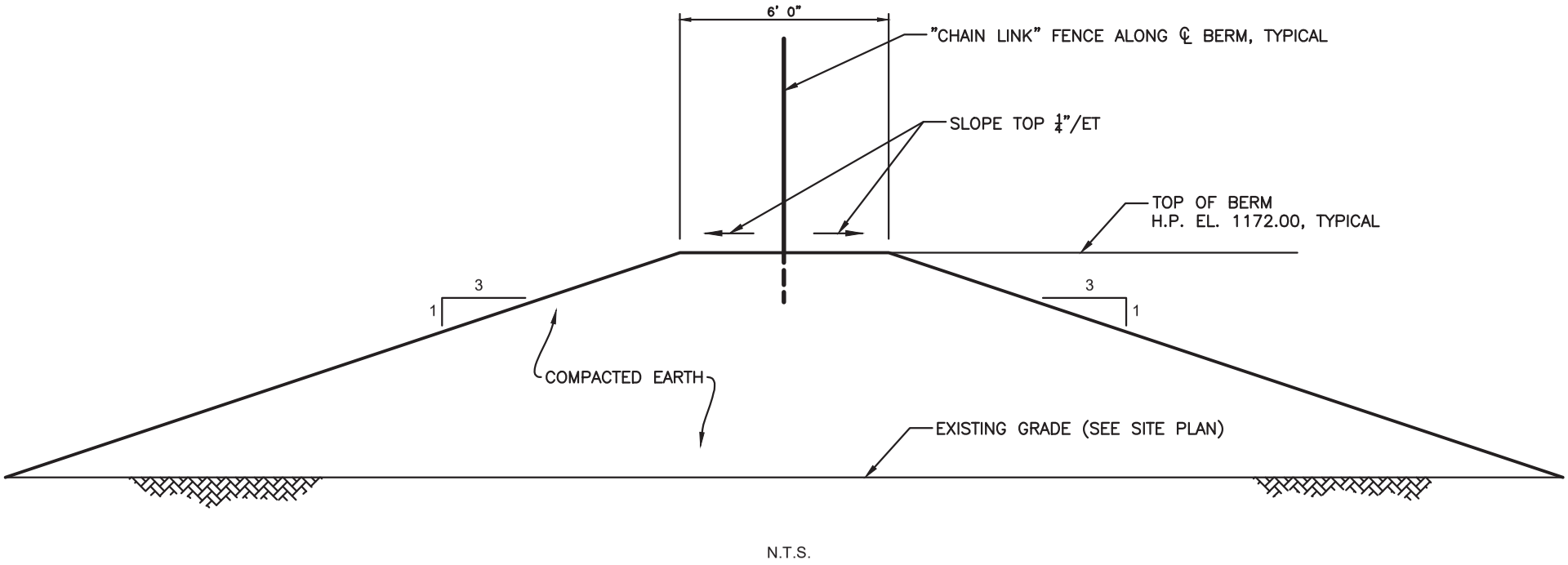
SOURCE: COPY FROM ORIGINAL EXHIBIT

PROJECT NO.	DATE
15242	MAY 2020
FILE NAME	
HOLSTON	

HOLSTON ARMY AMMUNITION PLANT
SUBPART X PERMIT

LAYOUT OF BURN PAN UNIT

THOMPSON & LITTON



N.T.S.

HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TENNESSEE

TYPICAL BERM SECTION AT BURNING PAN AREA

DRAWN BY: SSW	SCALE:	PROJ.	RCRA 2020
CHECKED BY: M GEHRING	See bar scale	FILE NO.	Typical Berm Section.dwg
APPROVED BY: M GEHRING	DATE PRINTED:		
DATE: August 18, 2020			

Coterie ENVIRONMENTAL
1150 First Ave., Ste 501
King of Prussia, PA 19406

PHOTO 1 – BURN PAN UNIT

PHOTO 2 - BURN PAN WITH COVER

PHOTO 3 – BURN PAN WITHOUT COVER

Attachment 1-2: TDEC FORMS

State of Tennessee
Department of Environment and Conservation
Division of Solid Waste Management
William R. Snodgrass Tennessee Tower
312 Rosa L. Parks Avenue, 14th Floor
Nashville, TN 37243

RETURN FORM AND FEES TO THIS ADDRESS

RESET CALCULATIONS
RESET ENTIRE FORM

TSDF-APP

DATE FILED

TREATMENT, STORAGE, DISPOSAL FACILITY (TSDF) APPLICATION AND OTHER REVIEW FEES

EPA ID	SITE, BUSINESS, OR INSTALLATION NAME
TN5210020421	Holston Army Ammunition Plant

CONTACT PERSON LAST NAME	FIRST NAME	PHONE	FAX	E-MAIL
Shelton	William	423-578-6022		william.shelton@baesystems.com

NON PERMITTED FACILITY	SITE ACTIVITY			PERMITTED FACILITY	PERMIT NUMBER(S)
☐ APPLYING FOR PERMIT	STORAGE	☐ ON-SITE	☐ COMMERCIAL	☐ INTERIM STATUS	*ENTER ONLY PERMIT NUMBERS THAT APPLY TO THIS FORM*
☒ PERMIT RENEWAL	TREATMENT	☒ ON-SITE	☐ COMMERCIAL	☒ FULLY PERMITTED	TNHW-148
☐ GENERATOR	DISPOSAL	☐ ON-SITE	☐ COMMERCIAL	☐ CORRECTIVE ACTION	
☐ OTHER	LANDFILL	☐ ON-SITE	☐ COMMERCIAL	☐ CLOSURE / POST CLOSURE	
				☐ OTHER ENFORCEABLE DOCUMENT	

CALCULATING YOUR FEES

IF FILING A SINGLE APPLICATION WITH TWO OR MORE TYPES OF UNITS, COMPUTE YOUR TOTAL BY USING THE HIGHER FEE (OR JUST ONE SET) FOR THAT APPLICATION.
EXAMPLE: IF YOU HAVE STORAGE AND DISPOSAL, THE HIGHER PART B FEE APPLIES.
1) SELECT >> "EXISTING" OR "NEW" PART A FEE
2) SELECT >> "ON-SITE" OR "COMMERCIAL" DISPOSAL PART B FEE

APPLICATION TYPE	LINE	PART	TYPE OF FEE	FEE AMOUNT	# APPLYING FOR	LINE TOTAL	GROUP TOTAL
STORAGE	1	A	☐ EXISTING FACILITY	$600	0	0.00	
	2	A	☐ NEW FACILITY	$2,800	0	0.00	
	3	B	☐ ON-SITE	$15,000	0	0.00	$ 0.00
	4	B	☐ COMMERCIAL	$37,500	0	0.00	STORAGE - 514
TREATMENT	1	A	☒ EXISTING FACILITY	$600	1	600.00	
	2	A	☐ NEW FACILITY	$2,800	0	0.00	
	3	B	☒ ON-SITE	$15,000	1	15,000.00	$ 15,600.00
	4	B	☐ COMMERCIAL	$37,500	0	0.00	TREATMENT- 516
DISPOSAL	1	A	☐ EXISTING FACILITY	$600	0	0.00	
	2	A	☐ NEW FACILITY	$2,800	0	0.00	
	3	B	☐ ON-SITE	$30,000	0	0.00	
	4	B	☐ ON-SITE LANDFILL	$30,000	0	0.00	
	5	B	☐ COMMERCIAL DISPOSAL	$75,000	0	0.00	$ 0.00
	6	B	☐ COMMERCIAL LANDFILL	$75,000	0	0.00	DISPOSAL- 511
POST CLOSURE	1	A	☐ EXISTING FACILITY	$600	0	0.00	
	2	A	☐ NEW FACILITY	$2,800	0	0.00	
	3	B	☐ PREV PERMITTED UNDER OPERATING PERMIT	$15,000	0	0.00	$ 0.00
	4	B	☐ NOT PREV PERMITTED UNDER OPERATING PERMIT	$30,000	0	0.00	POST CLOSURE- 548
CORRECTIVE ACTION	1	A	☐ EXISTING FACILITY	$600	0	0.00	
	2	A	☐ NEW FACILITY	$2,800	0	0.00	$ 0.00
	3	B	☐ APPLICATION	$15,000	0	0.00	COR ACT- 547
OTHER	1	B	☐ EMERGENCY PERMIT	$2,400	0	0.00	$ 0.00
	2	B	☐ R D and D ☐ R D and D RENEWAL	$2,800	0	0.00	OTHER - 516
CLOSURE POST-CLOSURE PLAN REVIEWS	1		☐ CLOSURE / POST CLOSURE PLAN REVIEW	$2,800	0	0.00	
	2		☐ CLASS 1 MODIFICATION OF PLAN	$300	0	0.00	
	3		☐ CLASS 1[1] MODIFICATION OF PLAN	$850	0	0.00	$ 0.00
	4		☐ CLASS 2 MODIFICATION OF PLAN	$1,100	0	0.00	CLOS/POST CLOS PLAN REVW - 548
	5		☐ CLASS 3 MODIFICATION OF PLAN	$1,700	0	0.00	

FD091013

EPA ID	SITE, BUSINESS, OR INSTALLATION NAME
TN5210020421	Holston Army Ammunition Plant

APPLICATION TYPE	LINE	TYPE OF FEE	FEE AMOUNT	# APPLYING FOR	LINE TOTAL	GROUP TOTAL
PERMIT MODIFICATION	1	☐ CLASS 1	$600	0	0.00	
	2	☐ CLASS [1]1	$4,200	0	0.00	
	3	☐ CLASS [1]1 OWNER/OPERATOR CHANGE	$3,800	0	0.00	
	4	☐ CLASS [1]1 M.A.C.T.	$8,000	0	0.00	
	5	☐ CLASS 2 CONTAINER, TANK, DRIP PAD STORAGE AND / OR TREATMENT UNIT OR THERMAL TREATMENT UNIT	$9,700	0	0.00	
	6	☐ CLASS 2 DISPOSAL UNIT; WASTE PILE STORAGE UNIT; CONTAINMENT BLDG; SURFACE IMPOUNDMENT; AND / OR TREATMENT UNIT OR OTHER MISCELLANEOUS UNIT	$12,500	0	0.00	
	7	☐ CLASS 2 POST CLOSURE UNIT	$15,000	0	0.00	
	8	☐ CLASS 3 CONTAINER, TANK, DRIP PAD STORAGE AND / OR TREATMENT UNIT OR THERMAL TREATMENT UNIT	$15,000	0	0.00	
	9	☐ CLASS 3 DISPOSAL UNIT; WASTE PILE STORAGE UNIT; CONTAINMENT BLDG; SURFACE IMPOUNDMENT; AND/OR TREATMENT UNIT OR OTHER MISCELLANEOUS UNIT	$30,000	0	0.00	
	10	☐ CLASS 3 FINAL REMEDIES UNDER CORRECTIVE ACTION	$15,000	0	0.00	
	11	☐ CLASS 3 POST CLOSURE UNIT	$20,000	0	0.00	
	12	☐ TEMPORARY AUTHORIZATION	$3,000	0	0.00	$ 0.00
	13	☐ TEMPORARY AUTHORIZATION RENEWAL	$300	0	0.00	PERMIT MOD- 513
BURN AND / OR ASSESSMENT REVIEW	1	☐ TRIAL BURN EACH TYPE OF UNIT	$11,700	0	0.00	
	2	☐ RISK BURN PLAN EACH TYPE OF UNIT	$11,700	0	0.00	
	3	☐ CERTIFICATE OF COMPLIANCE EACH UNIT	$5,000	0	0.00	
	4	☐ FACILITY RISK ASSESSMENT AND/OR RISK EVALUATION PLAN FOR A LAND BASED UNIT	$11,700	0	0.00	
	5	☐ FACILITY RISK ASSESSMENT AND/OR RISK EVALUATION PLAN FOR COMBUSTION UNIT	$11,700	0	0.00	
	6	☐ INITIAL DISPERSION MODEL AND DIRECT HUMAN HEALTH RISK ASSESSMENT	$11,700	0	0.00	
	7	☐ PERIODIC MODELING AND DIRECT HUMAN HEALTH RISK ASSESSMENT	$5,850	0	0.00	$ 0.00 BURN AND RISK- 544
OTHER REVIEWS	1	☐ VARIANCE OR WAIVER REQUEST	$3,000	0	0.00	
	2	☐ VARIANCE OR WAIVER REQUEST RENEWAL	$650	0	0.00	
	3	☐ CHROMIUM EXCLUSION EACH Cr WASTE STREAM	$2,500	0	0.00	$ 0.00
	4	☐ CONTAINED-IN DETERMINATION	$500	0	0.00	OTHER REVIEWS - 576
REG REVIEW	1	☐ OFFICIAL WRITTEN REGULATORY INTERPRETATION REQUEST PER HOUR	$50	0	0.00	$ 0.00 REG REVIEWS - 577
CONSTRUCTION INSPECTION FEES *APPLIES ALSO TO NEWLY PERMITTED UNITS NOT YET CONSTRUCTED PAYABLE PRIOR TO CONSTRUCTION	1	☐ CLASS 1 MOD STORAGE UNIT	$300	0	0.00	
	2	☐ CLASS 1 MOD TREATMENT, DISPOSAL, POST CLOSURE	$550	0	0.00	
	3	☐ CLASS [1]1MOD STORAGE UNIT	$1,300	0	0.00	
	4	☐ CLASS [1]1MOD TREATMENT, DISPOSAL, POST CLOSURE	$2,700	0	0.00	
	5	☐ CLASS 2 MOD STORAGE UNIT	$2,000	0	0.00	
	6	☐ CLASS 2 MOD TREATMENT, DISPOSAL, POST CLOSURE	$4,000	0	0.00	
	7	☐ *CLASS 3 MOD STORAGE UNIT	$2,700	0	0.00	$ 0.00
	8	☐ *CLASS 3 MOD TREATMENT, DISPOSAL, POST CLOSURE	$5,350	0	0.00	CONST INSPECT - 604

CERTIFICATION I certify under penalty of law that this document and all attachments were prepared by me, or under my direction or supervision. The submitted information is to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment. As specified in Tennessee Code Annotated Section 39-16-702(a)(4), this declaration is made under penalty of perjury.

TOTAL PAY THIS AMOUNT ▶ $15,600.00

SUM GROUP TOTALS Pg 1 and 2

MAKE PAYABLE TO: "TREASURER, STATE OF TENNESSEE"

SIGNATURE OF AUTHORIZED REPRESENTATIVE	PRINTED NAME and TITLE	DATE
	Todd D. Hayes, General Manager	21 Oct 2020

RESET PRINT

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF SOLID WASTE MANAGEMENT
WILLIAM R. SNODGRASS TENNESSEE TOWER
312 ROSA L. PARKS AVENUE, 14TH FLOOR
NASHVILLE, TN 37243

HN-CS

NEW APPLICANTS - SUBMIT THESE FORMS

HAZARDOUS WASTE TRANSPORTERS: SUBMIT FORMS HN-H, HN-EA, TRFDS

OTHERS: SUBMIT FORMS HN-H, NF, HN-EA, WSR

NOTE: ATTACH THIS COVER SHEET TO ALL REQUESTS, PACKETS, DOCUMENTS OR FORMS - A CERTIFICATION SIGNATURE IS REQUIRED IN SEC. 7

UNIFIED CERTIFICATION AND COVER SHEET

1. NOT CURRENTLY REGISTERED

I am applying...

☐ FOR AN EPA ID NUMBER ☐ FOR A USED OIL NUMBER ☐ FOR A HAZARDOUS WASTE TRANSPORTER PERMIT ☐ TO REGISTER FOR OTHER ACTIVITIES I.E. USED OIL, UNIVERSAL WASTE, HAZARDOUS SECONDARY MATERIALS, ETC

2. IF YOU'RE ALREADY REGISTERED...

ENTER YOUR EPA ID: TN5210020421

USED OIL REGISTRATION NUMBER:

2a. CHECK IF APPLICABLE:

☐ **RENEW** HAZARDOUS WASTE TRANSPORTER PERMIT

2b. SITE INFORMATION (REQUIRED FOR ALL)

ENTER YOUR SITE, BUSINESS, OR INSTALLATION NAME: Holston Army Ammunition Plant

TN COUNTY: Hawkins/Sullivan

CURRENT LOCATION ADDRESS - NO P.O. BOX NUMBERS (DIRECTIONS IF NECESSARY): 4509 West Stone Drive

LOCATION CITY	STATE	ZIP	PHONE	FAX	E-MAIL
Kingsport	TN	37660	423-578-6000		william.shelton@baesystems.com

SEND MAIL TO: LAST NAME	FIRST NAME	MI	TITLE / DEPARTMENT
Shelton	William		Environmental Manager

STREET ADDRESS	CITY	STATE	ZIP
4509 West Stone Drive	Kingsport	TN	37660

3. LOCATION INFORMATION

☐ NEW ☐ UPDATE ☐ MOVED TO NEW LOCATION ☐ ORIGINAL LOCATION ADDRESS IS INCORRECT ☐ ADDRESS CHANGED BY 911 EMERGENCY SYSTEM ☐ REZONING / ANNEXATION

COMMENTS:

4. OWNER INFORMATION

☐ NEW ☐ CHANGE OWNER ☐ UPDATE OTHER OWNER INFORMATION

COMMENTS:

5. BUSINESS NAME

☐ NEW ☐ CHANGE

COMMENTS:

6. TRANSFER EPA ID NUMBER

EPA ID OF SITE YOU ARE MOVING TO:

NAME ASSOCIATED WITH THIS EPA ID:

7. CERTIFICATION - REQUIRED

I certify under penalty of law that this document and all attachments were prepared by me, or under my direction or supervision. The submitted information is to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. As specified in Tennessee Code Annotated Section 39-16-702(a)(4), this declaration is made under penalty of perjury.

⇨ Todd Hayes
SIGNATURE OF AUTHORIZED REPRESENTATIVE

General Manager
TITLE

Todd D. Hayes
PRINTED NAME

21 Oct 2020
DATE

FD0081716

EPA ID	USED OIL REGISTRATION NUMBER	SITE OR FACILITY NAME
TN5210020421		Holston Army Ammunition Plant

8. ATTACHMENTS - FEES

FEES ASSOCIATED WITH THIS DOCUMENT (CHECK ALL THAT APPLY)

☒ **PAYMENT IS ATTACHED**

EIN ▶ ☐☐ – ☐☐☐☐☐☐☐

IF YOU HAVE QUESTIONS REGARDING YOUR PAYMENT OR EIN, CONTACT TDEC'S CONSOLIDATED FEE SECTION AT 615-532-0065

☐ HW GENERATOR FEES
☐ HW TRANSFER FAC FEES
☐ USED OIL FEES
☐ UNIVERSAL WASTE FEES
☐ TSDF FEES
☐ TSDF APPLICATION FEES

OTHER (SPECIFY)
Permit TNHW-148 Renewal Application Fees

8a. ATTACHMENTS - ANNUAL REPORTS

☐ HW GENERATOR ANN RPT ☐ CORRECTED ☐ LATE

☐ USED OIL ANN RPT ☐ CORRECTED ☐ LATE

8b. ATTACHMENTS - INFORMATION UPDATES

ENVIRONMENTAL ACTIVITY
☐ ADD (USE FORM HN-EA)
☐ UPDATE (USE FORM HN-EA)
☐ END (USE FORM HN-C)

WASTE STREAMS
☐ ADD
☐ UPDATE
☐ CLOSE
(USE FORM WSR FOR ALL)

CONTACTS
BILLING ADDRESSES ETC
☐ ADD / UPDATE (USE FORM HN-H CONTACTS)

SITE OPERATIONAL STATUS
CLOSING, BUSINESS INTERRUPTION, ETC
☐ UPDATE (USE FORM HN-C)

8c. ATTACHMENTS - OTHER

☐ REGULATORY INTERPRETATION REQUEST
☐ SPECIAL ASSISTANCE REQUEST
☐ RESPONSE TO ENFORCEMENT
☒ OTHER
☐ PRINTED FORMS REQUEST
☐ REQUEST FOR REFUND
☐ SUPPLYING REQUESTED DOCUMENT(S)

COMMENTS:
Permit TNHW-148 Renewal Application

9. DEADLINES FOR ANNUAL SUBMISSIONS

ENVIRONMENTAL ACTIVITY	ACTION	DEADLINE	ADDITIONAL FORMS REQUIRED
HAZARDOUS WASTE GENERATOR	ANNUAL REPORT AND FEES	MARCH 1	G-FDS, HN-H, NF, WSR, OSR
*HAZARDOUS WASTE TRANSPORTER	ANNUAL PERMIT RENEWAL AND FEES	DEC 31	HN-H, TRFDS
HAZARDOUS WASTE TSDF	ANNUAL REPORT AND FEES	MARCH 1	TSD-FDS, HN-H, NF, WSR, OSR, TPA, TWR
*HAZARDOUS WASTE TRANSFER FACILITY	ANNUAL FEES	DEC 31	HN-H, NF
*USED OIL TRANSPORTER	ANNUAL REPORT AND FEES	MARCH 1	HN-H, NF, UO-D
*USED OIL TRANSFER FACILITY	ANNUAL FEES	MARCH 1	HN-H, NF
*USED OIL PROCESSOR / RE-REFINER	ANNUAL REPORT AND FEES	MARCH 1	HN-H, NF
*UNIVERSAL WASTE DESTINATION FACILITY	ANNUAL FEES	MARCH 1	HN-H, NF

***DENOTES FEES ARE DUE AT TIME OF REGISTRATION AND AT THE TIME OF ANNUAL NOTIFICATION; SEE RESPECTIVE FORM FOR DETAILS**

WHERE TO MAIL DOCUMENTS AND CORRESPONDENCE

State of Tennessee
Department of Environment and Conservation
Division of Solid Waste Management
William R. Snodgrass Tennessee Tower
312 Rosa L. Parks Avenue, 14th Floor
Nashville, TN 37243

WHERE TO MAIL PAYMENTS AND FEES:

State of Tennessee
Department of Environment and Conservation
Division of Fiscal Services - Consolidated Fee Section
William R. Snodgrass Tennessee Tower
312 Rosa L. Parks Avenue, 10th Floor
Nashville, TN 37243

MAKE PAYABLE TO: "TREASURER, STATE OF TENNESSEE"

TDEC USE ONLY

FAC ID	LOG ID CODE	INITIALS	DATE	GIA #	UOP NUMBER	( ) NEWLY ASSIGNED ( ) TRANSFERRED EPA ID NUMBER

State of Tennessee
Department of Environment and Conservation
Division of Solid Waste Management
William R. Snodgrass Tennessee Tower
312 Rosa L. Parks Avenue, 14th Floor
Nashville, TN 37243

HN - H (Contacts)

HAZARDOUS WASTE CONTACT NOTIFICATION

ENTER CURRENT EPA ID NUMBER	PROVIDE SITE, BUSINESS, OR INSTALLATION NAME	USED OIL REGISTRATION NUMBER
TN5210020421	Holston Army Ammunition Plant	

1. BILLING ADDRESS - SEND BILLING INFORMATION TO THE ATTENTION OF:

LAST NAME	FIRST NAME	MI	TITLE	DEPARTMENT
Shelton	Billy		Environmental Manager	Environmental

COMPANY, AGENCY OR OTHER	CORPORATE REGION	CORPORATE DISTRICT
BAE Systems		

BUSINESS BILLING STREET ADDRESS	CITY /TOWN / LOCALITY
4509 West Stone Drive	Kingsport

STATE /TERRITORY	ZIP / POSTAL CODE	COUNTRY
TN	37660	United States

PHONE 1	PHONE 2	FAX	EMAIL
(423) 578-6022			william.shelton@baesystems.com

2. MANAGER

☐ PLANT MANAGER ☐ CERTIFYING OFFICIAL ☒ AUTHORIZED REPRESENTATIVE

LAST NAME	FIRST NAME	MI	TITLE	STREET ADDRESS
Hayes	Todd	D	General Mgr	4509 West Stone Drive

CITY /TOWN / LOCALITY	STATE /TERRITORY	ZIP / POSTAL CODE	COUNTRY
Kingsport	TN	37660	United States

PHONE 1	PHONE 2	FAX	EMAIL
(423) 578-6369			todd.hayes@baesystems.com

3. TECHNICAL CONTACT

LAST NAME	FIRST NAME	MI	TITLE	STREET ADDRESS
Reed	Daniel	L	Environmental	4509 West Stone Drive

CITY /TOWN / LOCALITY	STATE /TERRITORY	ZIP / POSTAL CODE	COUNTRY
Kingsport	TN	37660	United States

PHONE 1	PHONE 2	FAX	EMAIL
(423) 578-1296			daniel.reed5@baesystems.com

4. EMERGENCY CONTACT

LAST NAME	FIRST NAME	MI	TITLE	STREET ADDRESS
Shelton	Billy		Environmental Manager	4509 West Stone Drive

CITY /TOWN / LOCALITY	STATE /TERRITORY	ZIP / POSTAL CODE	COUNTRY
Kingsport	TN	37660	United States

PHONE 1	PHONE 2	FAX	EMAIL
(423) 578-6022			william.shelton@baesystems.com

5. OPERATOR

☐ INDIVIDUAL ☒ COMPANY, AGENCY OR OTHER

LAST NAME	FIRST NAME	MI	TITLE	COMPANY, AGENCY OR OTHER	STREET ADDRESS
Hayes	Todd	D	General Mgr	BAE Systems, Ordnance Systems Inc.	4509 West Stone Drive

CITY /TOWN / LOCALITY	STATE /TERRITORY	ZIP / POSTAL CODE	COUNTRY
Kingsport	TN	37660	United States

PHONE 1	PHONE 2	FAX	EMAIL
(423) 578-6369			todd.hayes@baesystems.com

FD041315

EPA ID NUMBER	SITE, BUSINESS, OR INSTALLATION NAME	USED OIL REGISTRATION NUMBER
TN5210020421	Holston Army Ammunition Plant	

6. LICENSE or PERMIT AGENT (FOR HAZARDOUS WASTE TRANSPORTERS, IF APPLICABLE)

LAST NAME	FIRST NAME	MI	TITLE	STREET ADDRESS

COMPANY, AGENCY OR OTHER

CITY /TOWN / LOCALITY	STATE /TERRITORY	ZIP / POSTAL CODE	COUNTRY
	TN		

PHONE 1	PHONE 2	FAX	EMAIL

7. CONTRACTOR 1

LAST NAME	FIRST NAME	MI	TITLE	STREET ADDRESS

COMPANY, AGENCY OR OTHER

CITY /TOWN / LOCALITY	STATE /TERRITORY	ZIP / POSTAL CODE	COUNTRY
	TN		

PHONE 1	PHONE 2	FAX	EMAIL

8. CONTRACTOR 2

LAST NAME	FIRST NAME	MI	TITLE	STREET ADDRESS

COMPANY, AGENCY OR OTHER

CITY /TOWN / LOCALITY	STATE /TERRITORY	ZIP / POSTAL CODE	COUNTRY
	TN		

PHONE 1	PHONE 2	FAX	EMAIL

9. PART A OR PART B PERMIT CONTACT 1

LAST NAME	FIRST NAME	MI	TITLE	STREET ADDRESS

COMPANY, AGENCY OR OTHER

CITY /TOWN / LOCALITY	STATE /TERRITORY	ZIP / POSTAL CODE	COUNTRY

PHONE 1	PHONE 2	FAX	EMAIL

10. PART A OR PART B PERMIT CONTACT 2

LAST NAME	FIRST NAME	MI	TITLE	STREET ADDRESS

COMPANY, AGENCY OR OTHER

CITY /TOWN / LOCALITY	STATE /TERRITORY	ZIP / POSTAL CODE	COUNTRY

PHONE 1	PHONE 2	FAX	EMAIL

11. CERTIFICATION

CERTIFICATION REQUIRED (Complete Form HN-CS Including Section 7)

TDEC OFFICE USE ONLY

FAC ID	LOG ID CODE	STAFF INITIALS	DATE	GIA CUSTOMER #	( ) NEWLY ASSIGNED ( ) TRANSFERRED EPA ID NUMBER

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF SOLID WASTE MANAGEMENT
WILLIAM R. SNODGRASS TENNESSEE TOWER
312 ROSA L. PARKS AVENUE, 14TH FLOOR
NASHVILLE, TN 37243

HN - EA

HAZARDOUS WASTE ENVIRONMENTAL ACTIVITY NOTIFICATION

PERMIT YEAR	
ANNUAL REPORT YEAR	

CERTIFICATION REQUIRED. (COMPLETE AND ATTACH Form CN-1442 HN-CS Including Section 7)

A. NOTIFICATION

A.1 ENTER CURRENT EPA ID NUMBER IF NONE, LEAVE BLANK	A.2 USED OIL REGISTRATION NUMBER IF NONE, LEAVE BLANK	A.3 SITE LOCATION WITHIN TN	A.3 SITE LOCATION OUTSIDE TN	A.4 NAICS CODE *
TN5210020421		X		325920

A.5 SITE, BUSINESS, OR INSTALLATION NAME

Holston Army Ammunition Plant

B. ENVIRONMENTAL ACTIVITY IDENTIFICATION

NOTE: USE MM / DD / YYYY FORMAT FOR DATES

X GENERATOR — 1 / 1 / 1984 ◀ DATE HAZARDOUS WASTE GENERATOR ACTIVITY BEGAN

HAZARDOUS WASTE GENERATOR CATEGORIES - CHECK ONE	EPA ID	ANNUAL RPT	ANNUAL FEES	ANNUAL PERMIT	OTHER FORMS
X **LARGE QUANTITY GENERATOR, LQG** — GENERATES, in any calendar month, 1,000 kg/mo. (2,200 lbs/mo.) or more of hazardous waste; OR GENERATES in any calendar month or ACCUMULATES at any time, Greater than 1 kg/mo. (2.2 lbs/mo.) or more of acute hazardous waste; OR GENERATES in any calendar month or ACCUMULATES at any time, Greater than 100kg/mo. (220 lbs/mo.) or more of acute hazardous spill cleanup material.	YES	YES	YES	NO	HN NF WSR
☐ **SMALL QUANTITY GENERATOR, SQG** — GENERATES, in any calendar month, greater than 100 kg/mo. (220 lbs/mo. but less than 1000 kg/mo. (2,200 lbs/mo.) of NON-ACUTE hazardous waste or ACCUMULATES at any time, more than 0 but less than or equal to 6000 kg/mo. (13,228 lbs/mo. of NON-ACUTE hazardous waste.	YES	YES	YES	NO	HN NF WSR
☐ **CONDITIONALLY EXEMPT SQG, CESQG** — GENERATES, in any calendar month, no more than 100 kg/mo. (220 lbs/mo.) and accumulates (at any time through the entire year) under 1,000 kg (2,200 lbs) of NON-ACCUTE hazardous waste	NO	NO	NO	NO	HN NF WSR

☐ **NON-GENERATOR**
Hazardous waste streams have been closed; form WSR (CN-0773 for each waste stream is attached)

CHECK ALL THAT APPLY FOR HAZARDOUS WASTE GENERATORS

- X GENERATOR, WASTEWATER
- ☐ GENERATOR, EPISODIC (SHORT TERM)
- ☐ GENERATOR, MIXED WASTE
- ☐ US IMPORTER
- ☐ US EXPORTER
- ☐ COMMERCIAL RECYCLER
- ☐ NON-COMMERCIAL RECYCLER
- ☐ HAZARDOUS SECONDARY MATERIALS
- ☐ OPTING INTO SUBPART K
  - ☐ COLLEGE OR UNIVERSITY
  - ☐ TEACHING HOSPITAL
  - ☐ NON PROFIT INSTITUTE
- ☐ WITHDRAWING FROM SUBPART K See Rule 0400-12-01-.03(12)(d)

☐ **TRANSPORTER** — / / ◀ DATE HAZARDOUS WASTE TRANSPORTER ACTIVITY BEGAN

OUT OF STATE TRANSPORTERS MUST POSSESS VALID EPA ID. TN DOES NOT ISSUE EPA IDs FOR OUT OF STATE SITES	EPA ID	ANNUAL RPT	ANNUAL FEES	ANNUAL PERMIT	OTHER FORMS
	YES	NO	YES	YES	HN TRFDS

☐ **TRANSFER FACILITY** — / / ◀ DATE HAZARDOUS WASTE TRANSFER FACILITY ACTIVITY BEGAN

TRANSPORTERS IDENTIFYING OWNERSHIP FOR SEPARATE TRANSFER FACILITY SITES ARE REQUIRED TO OBTAIN SEPARATE EPA IDs FOR EACH LOCATION TSD FACILITIES ARE REQUIRED TO OBTAIN SEPARATE EPA ID FOR HW TRANSFER FACILITY	EPA ID	ANNUAL RPT	ANNUAL FEES	ANNUAL PERMIT	OTHER FORMS
	YES	NO	YES	NO	HN NF

FD0815 16

EPA ID	UOP #	SITE
TN5210020421		Holston Army Ammunition Plant

☐ USED OIL / / ◀ DATE USED OIL ACTIVITY BEGAN

CHECK ALL THAT APPLY	EPA ID	UOP NUMBER	ANNUAL RPT	ANNUAL FEES	ANNUAL PERMIT	OTHER FORMS
☐ BURNER	YES	YES	YES	NO	NO	HN NF UO-AR
☐ FUEL MARKETER	YES	YES	YES	NO	NO	HN NF UO-AR
☐ DIRECTS SHIPMENTS OF USED OIL TO BURNER						
☐ FIRST CLAIMS THE USED OIL IS ON-SPEC						
☐ PROCESSOR / RE-REFINER	YES	YES	YES	YES	NO	HN NF UO-AR
☐ PROCESS ONLY						
☐ RE-REFINE ONLY						
☐ TRANSFER FACILITY	YES	YES	YES	YES	NO	HN NF UO-AR
☐ TRANSPORTER	YES	YES	YES	YES	NO	HN NF UO-AR UO-D
☐ COLLECTION CENTER (COMMERCIAL ONLY)	NO	YES	NO	NO	NO	HN
☐ COLLECTION CENTER (DIY - DO IT YOURSELFER)	NO	NO	NO	NO	NO	HN

☒ TREATMENT STORAGE and DISPOSAL (TSD) 3 /31 / 2011 ◀ DATE HAZARDOUS WASTE TSD ACTIVITY BEGAN

	EPA ID	ANNUAL RPT	ANNUAL FEES	ANNUAL PERMIT	OTHER FORMS
☐ RECYCLER	YES	YES	YES	YES	HN NF
☐ INCINERATOR, BOILER OR INDUSTRIAL FURNACE	ALL	ALL	ALL	ALL	ALL
☐ UNDERGROUND INJECTION CONTROL					
☒ RECEIVER OF HW FROM OFF SITE					
☐ POST CLOSURE ONLY					
☐ CORRECTIVE ACTION ONLY					

EXTENSIVE PERMITTING PROCESS INVOLVED FOR TSDs; CONTACT HAZARDOUS WASTE PERMITTING STAFF

☒ UNIVERSAL WASTE 1 / 1 / 1996 ◀ DATE UNIVERSAL WASTE ACTIVITY BEGAN

	EPA ID	ANNUAL RPT	ANNUAL FEES	ANNUAL PERMIT	OTHER FORMS
☐ DESTINATION FACILITY	YES	NO	YES	NO	HN NF
☐ LAMP CRUSHER, COMMERCIAL					
☐ RECYCLER (ON-SITE)					
☐ LARGE QUANTITY HANDLER	YES	NO	NO	NO	HN NF
☒ SMALL QUANTITY HANDLER	NO	NO	NO	NO	NONE
☐ TRANSPORTER	NO	NO	NO	NO	NONE

IF YOU CHECK LQG OR SQG HANDLER, CHECK BELOW ALL THAT YOU MANAGE OR GENERATE

- ☒ BATTERIES
- ☐ PESTICIDES
- ☒ LAMPS / BULBS
- ☒ MERCURY CONTAINING EQUIPMENT

* NAICS CODES MAY BE FOUND AT: http://www.census.gov/eos/www/naics/

TDEC USE ONLY

FAC ID	LOG ID CODE	INITIALS	DATE	GIA#	UOP NUMBER	EPA ID NUMBER ( ) NEW ( ) TRANSFER

Section 2. FACILITY DESCRIPTION

This section presents a description of the facility and is being provided pursuant to the general Part B permitting requirements specified in 40 CFR Part 270 Subpart B, 40 CFR Part 264 Subpart B, and TCRR 0400-12-01-.07(5). All figures and maps referenced in this section can be found in Attachment 2-1.

2.1 GENERAL DESCRIPTION

[§270.14(b)(1), §264.18, TCRR 0400-12-01-.07(5)(a)1(i), and TCRR 0400-12-01-.06(2)(i)]

The Holston Army Ammunition Plant (HSAAP) is a government-owned, contractor-operated facility used for manufacturing explosive compounds and explosive formulations. HSAAP is located in Hawkins and Sullivan Counties in northeastern Tennessee. The plant is comprised of two distinct manufacturing areas known as Area A and Area B, as well as explosive material storage magazines, an industrial landfill, an industrial wastewater treatment plant, and several office buildings that provide administrative, environmental, health and safety, and security support services.

In Area A, weak acetic acid from Area B is refined and concentrated to make glacial acetic acid. The glacial acetic acid is then sent back to Area B for use in manufacturing explosives. Area B is the heart of the explosive manufacturing operations at the HSAAP. In this area, concentrated nitric acid is used to manufacture end-product or intermediate explosive compounds. In addition, acetic acid is recovered and concentrated, and acetic anhydride is produced. Explosive wastes are only generated in Area B.

Waste explosive material is opened burned at the Burn Pan Unit located in the burning ground area of Area B. The unit is situated in the extreme southern portion of Area B adjacent to the Holston River as shown on Figure 2-1. The topography within and immediately surrounding the Burn Pan Unit is generally flat and has a base elevation of 1,165 feet (msl). The site is located within the 100-year floodplain, but controls have been put in place to help prevent the wash-out of hazardous wastes. (See Section 2.3.3.1 for more detail on the flood prevention plan).

Figure 2-1 provides the location of the Burn Pan Unit relative to the surrounding area. The arrangement of the pans within the Unit is shown on Figure 2-2. Figure 2-3 provides a topographic map of the Burn Pan Unit and the immediate surrounding area. Several shallow and deep groundwater monitoring wells are also located adjacent to the Burn Pan Unit as shown on Figure 2-3.

The Burn Pan Unit is used for the thermal treatment of hazardous waste explosives. Treatment is performed in four burn pans that are evenly spaced 150 feet apart and positioned in the northeast, southeast, southwest, and northwest corners of the area, facing lengthwise north to south. A detailed description of the burn pans is provided in Section 4.1. The Burning Ground Office is located east of the Burn Pan Unit. Active treatment operations are monitored in the office by video camera.

The Burn Pan Unit is surrounded by a berm to protect against floods and to control run-on and run-off. Further details of the berm design can be found in Section 2.3.3.1. Drainage from the Burn Pan Unit is accomplished with a sewer drainage system that collects stormwater and any liquid spills that might occur within the Unit and transfers it to the on-site industrial wastewater treatment plant.

2.2 TOPOGRAPHIC MAP

[§270.14(b)(19) and TCRR 0400-12-01-.07(5)(a)1(xix)]

In accordance with 40 CFR §270.14(b)(19) and TCRR 0400-12-01-.07(5)(a)1(xix), this hazardous waste permit application contains topographic maps of the facility and an area 1,000 feet around it in all directions. These maps are provided to denote the topographic features in and around the Unit and have been scaled down to one inch per 200 feet to clearly show the pattern of surface water flow in the vicinity of and from the Unit. For clarity of the information presented, multiple maps have been provided to satisfy the requirements of this section. These maps, which are provided in Attachment 2-1, include:

- Figure 2-3 provides a topographic map of the Burn Pan Unit and the immediate surrounding area to an area of 1,000 feet in all directions.
- Figure 2-4 provides a zoomed version of the topographic map, scaled to no more than one inch per 200 feet to allow resolution of the topographic contours within the immediate vicinity of the Burn Pan Unit.
- Figure 2-5 presents the surface water flow in the vicinity of the Burn Pan Unit and the stormwater management controls that have been installed.
- Figure 2-6 shows the land use surrounding the facility up to an area of 1,000 feet in all directions.
- Figure 2-7 and 2-8 provide the location of the Burn Pan Unit relative to the 100-year floodplain.

Note that a wind rose has been provided on each of the topographic maps to provide an indication of the wind direction and potential dispersion of emissions from the OBG.

2.2.1 GENERAL REQUIREMENTS

[§270.14(b)(19) and TCRR 0400-12-01-07(5)(a)1(xix)]

Six maps have been prepared for this hazardous waste permit application to satisfy the general requirements of 40 CFR §270.14(b)(19) and TCRR 0400-12-01-07(5)(a)1(xix), as detailed above. These maps, when combined:

- Indicate the map's orientation, scale, and date;
- Show the legal boundaries of the hazardous waste management facility;
- Show all buildings, treatment, storage, and disposal operations, and other structures within the property boundary;
- Identify all operational units within the facility where hazardous waste is or will be treated, stored, or disposed;

- Show all access control points (*e.g.,* fences and gates);
- Identify all nearby surface waters;
- Define the 100-year floodplain area;
- Show all drainage and flood control barriers;
- Identify surrounding land use (*e.g.,* residential, commercial, agricultural, and recreational); and,
- Provide a wind rose showing the predominant wind directions.

2.2.2 ADDITIONAL REQUIREMENTS FOR LAND DISPOSAL FACILITIES (*NOT APPLICABLE*)

[§270.14(c)(3) and TCRR 0400-12-01-07(5)(c)3]

The additional requirements specified for the topographic map for land disposal facilities are not applicable to HSAAP, as the facility does not operate any permitted land disposal units.

2.3 FACILITY LOCATION INFORMATION

[§270.14(b)(11), §270.23(b), §264.18, §264.600, TCRR 0400-12-01-.07 (5)(a)1(xi), TCRR 0400-12-.07(5)(b)(9)(ii), and TCRR 0400-12-01-.06]

As required by 40 CFR §270.14(b)(11), 40 CFR §270.32(b), and the associated TCRR sections, this permit application specifies information related to the location of the HSAAP Burn Pan Unit. The physical location of the HSAAP facility relative to area roads, surface water bodies, *etc.*, is shown on Figure 2-1 in Attachment 2-1. Additionally, information is provided on the surrounding land use, seismic conditions, and floodplain locations, as applicable.

2.3.1 SURROUNDING LAND USE

[§270.23(b), §264.600, TCRR 0400-12-.07(5)(b)(9)(ii), and TCRR 0400-12-.06(27)]

The area surrounding the HSAAP is a mixture of industrial, residential, and forested areas as shown on Figure 2-6. Area A is located within the City of Kingsport, which includes a combination of industrial, commercial, and residential land use areas. Most of the industrial activity is located adjacent to the Holston River, which passes through the southern portion of the city. Commercial businesses are located primarily along major roadways that pass through the city limits. Dense residential areas are located to the north and east of Kingsport, and other less dense residential areas can be found scattered throughout. Area B is encompassed by U.S. Highway 11W to the north, Bay Mountain to the south, and by the Holston River on all other sides. Land use across Highway 11W is predominantly commercial or residential. To the east, primarily single-family residential land lies across the river. A small, multi-family residential area is also located adjacent to the western boundary of Area B. The area immediately south of the Burn Pan Unit across the Holston River is largely forested.

2.3.2 SEISMIC REQUIREMENTS

[§§270.14(b)(11)(i)-(ii), §264.18(a), TCRR 0400-12-01.07(5)(a)1(xi)-(I-II), and TCRR 0400-12-01-.06(2)(i)1]

The information required for HSAAP to demonstrate compliance with the Federal seismic standard is specified in 40 CFR §264.18(a), 40 CFR §270.14(b)(11), and the associated TCRR sections. HSAAP must identify the political jurisdiction in which they are located and must then determine if this jurisdiction is identified in Appendix VI of 40 CFR Part 264 as a jurisdiction that must demonstrate compliance with the seismic standard.

None of the political jurisdictions within the State of Tennessee are included in Appendix VI of Part 264 as a jurisdiction that must demonstrate compliance with the seismic standard. Therefore, there is no additional information required by the Federal or Tennessee state regulations for this portion of the hazardous waste permit application.

2.3.3 FLOODPLAIN REQUIREMENTS

[§270.14(b)(11)(iii)-(iv), §264.18(b), TCRR 0400-12-01-.07(5)(a)1(xi)-(III-IV), and TCRR 0400-12-01-.06(2)(i)2]

The Burn Pan Unit is located adjacent to the Holston River and lies within the 100-year floodplain as shown on Figures 2-7 and 2-8. The floodplain information was taken directly from the authoritative National Flood Hazard Layer (NFHL) web service provided by the Federal Emergency Management Agency (FEMA) and was substantiated by the Tennessee Valley Authority (TVA). TVA defines the 100-year floodplain boundary as the plant railroad embankment north of the Open Burning Grounds. The 100-year floodplain at the Burn Pan Unit is 1,167.6 feet (msl), as referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29), and 1,167.4 feet (msl), as referenced to the North American Vertical Datum of 1988 datum (NAVD 88). The topography within and immediately surrounding the Burn Pan Unit has a base elevation of 1,165 feet (msl), as measured on the interior of the earthen berm, and 1,166 feet (msl), as measured on the exterior of the berm. The top elevation of the berm is 1,172 feet (msl). (Note all unit elevations are based on a NAVD 88 datum).

Attachment 2-2 presents a graph showing the marked and computed flood profiles and backwater curves for the Holston River. The location of the Burn Pan Unit on this graph is at mile marker 139. The 100-year flood level is represented by the 75,000 cubic feet per second profile and confirms the flood elevation to be 1,167.6 feet. The 200-year flood level is represented by the 100,000 cubic feet per second profile and indicates that the flood level at the Burn Pan Unit is 1,169.6 feet. Also included in Attachment 2-2 is a letter from the TVA to HSAAP confirming the flow rates for the 100-year and 200-year flood events and the relative difference (approximately 2 feet) in flood elevation for each event.

Therefore, because the Burn Pan Unit is located within the 100-year floodplain, HSAAP must, according to 40 CFR §264.18(b) and TCRR 0400-12-01-.06(2)(i)2, demonstrate that the facility is

designed, constructed, operated, and maintained to prevent washout of any hazardous waste by a 100-year flood, unless the following conditions are satisfied:

- Procedures are in effect which will cause the waste to be removed safely, before flood waters can reach the facility, to a location where the wastes will not be vulnerable to flood waters; or,
- No adverse effects on human health or the environment will result if washout occurs.

2.3.3.1 DEMONSTRATION OF COMPLIANCE

[§270.14(b)(11)(iv), §264.18(b), TCRR 0400-12-01-.07(5)(a)-1(xi)(IV), and TCRR 0400-12-01-.06(2)(i)2]

The Burn Pan Unit has a base elevation of approximately 1,165 to 1,166 feet (msl). It is surrounded by an earthen berm of clay and riprap with a top elevation of 1,172 feet (msl). This exceeds the 100-year flood elevation by 4.4 feet. The berm is designed to withstand and exclude floodwaters from the Burn Pan Unit in the event of a flood. In addition, a clay liner is provided underneath the Burn Pan Unit to prevent water from rising up through the underlying soils.

In the event that a 100-year flood event is predicted, HSAAP will burn any materials already loaded onto the pans, such as catch basin wastes that have been drying in preparation to burn. New waste materials, such as off-specification products stored in magazines or production areas, will be left in storage unless they can be processed within that same day. Any residue remaining in the pans after this will be left in place, as it is protected from washout by the berms and will likely be too hot to remove. Should pans contain residual material from prior burns that is safe to remove, HSAAP will do so and will store the material until the off-site lab analytical results are returned.

The following sections further detail the design of the berm, liner, and stormwater collection system within the Burn Pan Unit, as well as the flood plan procedures.

BERM

The stormwater berm has been designed with sides that slope inward toward the burn pan area to direct precipitation to the stormwater drainage system. The entire berm is covered with clay and is compacted to a design permeability of 1.0×10^{-7} centimeters per second (cm/sec) or less. The berm is then topped with a 12-inch layer of rock material (riprap) that is designed to prevent erosion of the berm in the event of a flood. Figure 2-9 presents a cross section of the berm. Attachment 2-3 presents structural calculations that show the stability of the berm during a 200-year flood event with an assumed water elevation of 1,169.6 feet and a duration of 6 days.

LINER

A clay liner is provided underneath the Burn Pan Unit to prevent water from rising up through the underlying soils. The clay is a minimum of 6 inches thick and has a design

permeability of no greater than 1.0 x 10^{-7} cm/sec. The compacted clay liner is topped with a protective gravel layer. The gravel protects the compacted clay liner against physical damage from truck and foot traffic. It also helps to shield the clay from the heat released during open burning. The compacted clay liner slopes toward the drop inlets.

STORMWATER COLLECTION SYSTEM

In 1986, HSAAP installed a storm sewer system within the Burn Pan Unit to remove precipitation that falls within the Unit. Figure 2-5 shows the layout of the stormwater management system within the Burn Pan Unit. This system is comprised of nine drop inlets, located downgradient from the burn pans, and associated steel grates, which are distributed uniformly over the area. All discharges from the Unit, including precipitation run-off, leaks, or spills, are routed to the on-site industrial wastewater treatment plant, located in Area B, through standard stormwater piping.

When an advanced flood warning is received, four backflow prevention valves on the stormwater drainage lines will be closed to prevent any backflow of floodwaters into the Burn Pan Unit. These backflow prevention valves are located immediately north of the Burn Pan Unit as shown in Figure 2-5.

FLOOD PLAN PROCEDURES

HSAAP will receive advance warning before a flood event from the National Weather Service. When this warning is received, no additional waste will be sent to the Burn Pan Unit for treatment unless it can be processed in that same day. Any waste that is already in the pans awaiting processing will be treated if conditions allow. If the material cannot be treated, it will be removed and taken to a storage magazine, along with any treatment residues that have cooled enough to remove. If the treatment residues are too hot to remove, the berms should prevent washout of the residues from the pans. Prior to evacuating the area, the mobile covers will be placed over the pans. Once these procedures are complete, a notification will be made to TDEC as required per 40 CFR §266.205(a)(1)(iv) and TCRR 0400-12-01-.09(13)(f)(1)(i)(IV) requesting conditional exemption for temporary storage of military munitions in non-regulated units.

All storage magazines at the Explosive Storage Magazine Area and the bridge that crosses the Holston River and connects the Explosive Storage Magazine Area to Area B are located above the 100-year floodplain level. These magazines meet the requirements of 40 CFR §266.205 and TCRR 0400-12-01-.09(13)(f) for conditional exemption from hazardous waste storage requirements for permitted facilities. These facilities also meet the requirements of the Department of Defense Explosives Safety Board (DDESB).

To prevent any backflow of floodwaters into the Burn Pan Unit through the drainage lines, the Burning Ground Attendant in charge of the Burn Pan Unit will direct the backflow prevention valves on the stormwater drainage lines to be closed. The location of the backflow prevention valves is shown in Figure 2-5.

After all flood preparation measures have been completed, the gate to the area will be closed and locked. Treatment of reactive hazardous wastes in the Burn Pan Unit will not resume until floodwaters have receded and the bermed Burn Pan Unit is once again accessible.

2.4 TRAFFIC PATTERN INFORMATION

[§270.14(b)(10) and TCRR 0400-12-01-.07(5)(a)1(x)]

Traffic into the Burn Pan Unit is restricted to authorized personnel and is regulated by access control at the Burn Pan Unit gate by the Burning Ground Attendant. There is no other plant traffic directed through the Burn Pan Unit. During the treatment of waste, no vehicles are allowed within the unit. The Burning Ground Attendant verifies no personnel or vehicles are present prior to commencement of ignition procedures.

Movement of waste from the storage magazines to the Burn Pan Unit proceeds from the generation point to the Burn Pan Unit utilizing a system of internal roads that are monitored by security and protected via security fencing, *etc.* Once arriving at the Burn Pan Unit, all vehicle traffic must stop and check-in at the Burning Ground Office. Absent vehicles coming to the Burn Pan Unit, the road into and out of the unit has very little traffic, as the road dead-ends at the Unit. Typical traffic that enters the area includes material handling trucks that are equipped with flatbed trailers to facilitate waste loading and unloading, and government or contractor vehicles that are transferring personnel to the Unit. With the exception of the backhoe/front-end loader used to move non-hazardous wastes onto the adjacent burn pile, no substantive vehicles, such as tractor trailers, frequent the area.

Attachment 2-1: MAPS AND FIGURES OF THE BURN PAN UNIT

1000-Foot Radius

Burn Pan Unit

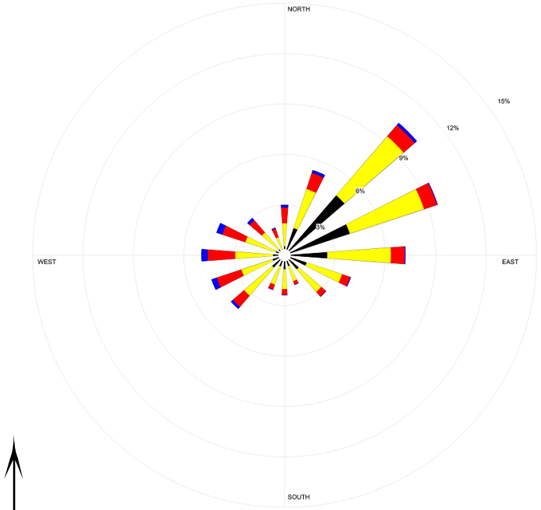
Holston River

Legend

- Approximate Property Boundary
- Burn Pan Unit
- 1000-Foot Radius

WIND SPEED (m/s)

- >11.06
- 8.49 - 11.06
- 5.40 - 8.49
- 3.34 - 5.40
- 1.80 - 3.34
- 0.51 - 1.80



SOURCE OF WINDSPEED DATA IS THE
STATION #13877 - BRISTOL/TRI CITY AIRPORT, TN,

0 1,000 2,000 FEET

1 " = 2,000 '
1:24,000

HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TENNESSEE

FIGURE 2-1
LOCATION MAP

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CHECKED BY:	M GEHRING		AS NOTED	FILE NO.	Fig 2_1 Location Map.mxd
APPROVED BY:	M GEHRING	DATE PRINTED:			
DATE:	August 2020		*8/25/2020*		

Coterie ENVIRONMENTAL
1150 First Ave., Ste 501
King of Prussia, PA 19406

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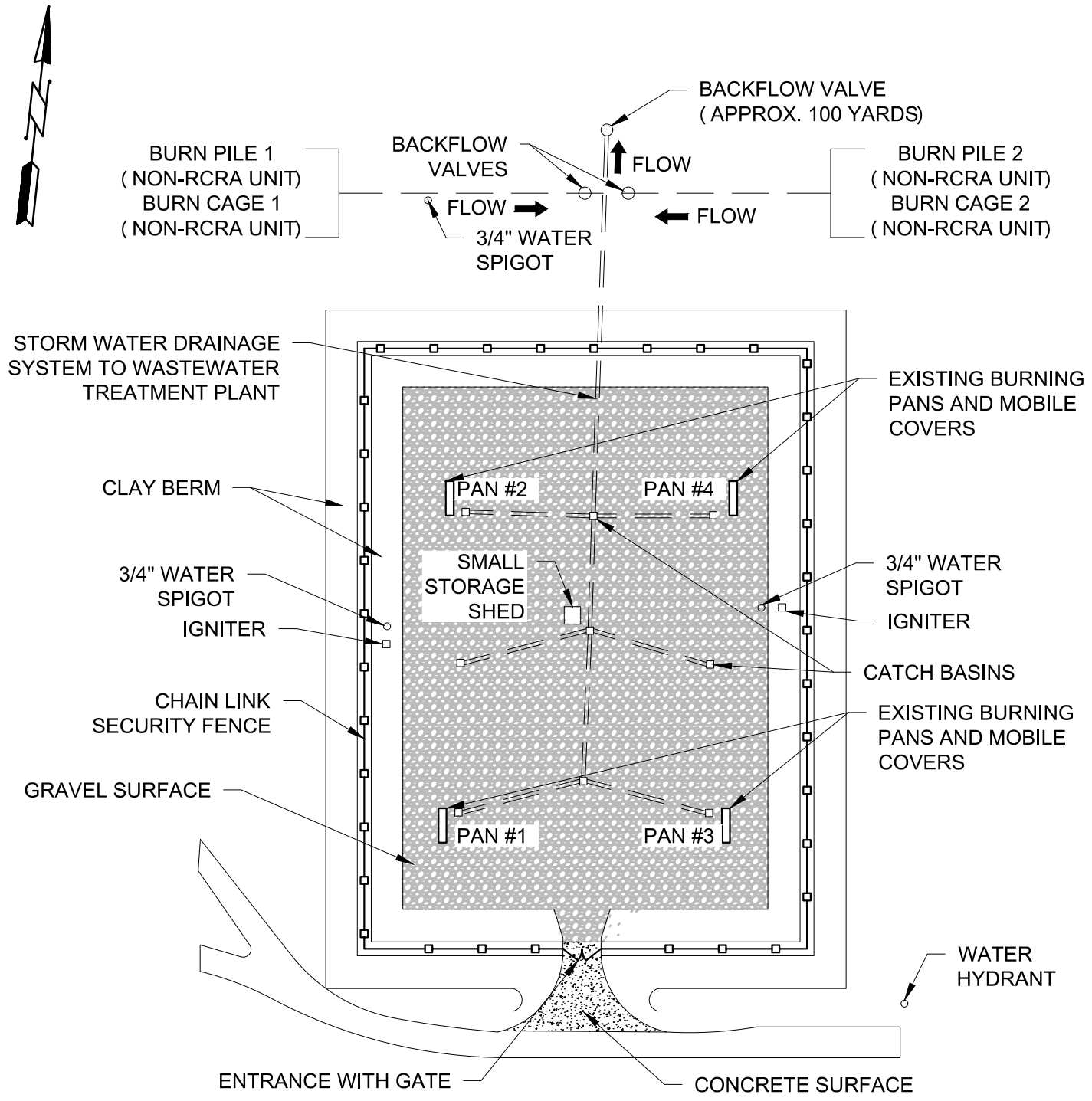


GRAPHIC SCALE

80 0 40 80 160

(IN FEET)

1" = 80'

SOURCE: COPY FROM ORIGINAL EXHIBIT

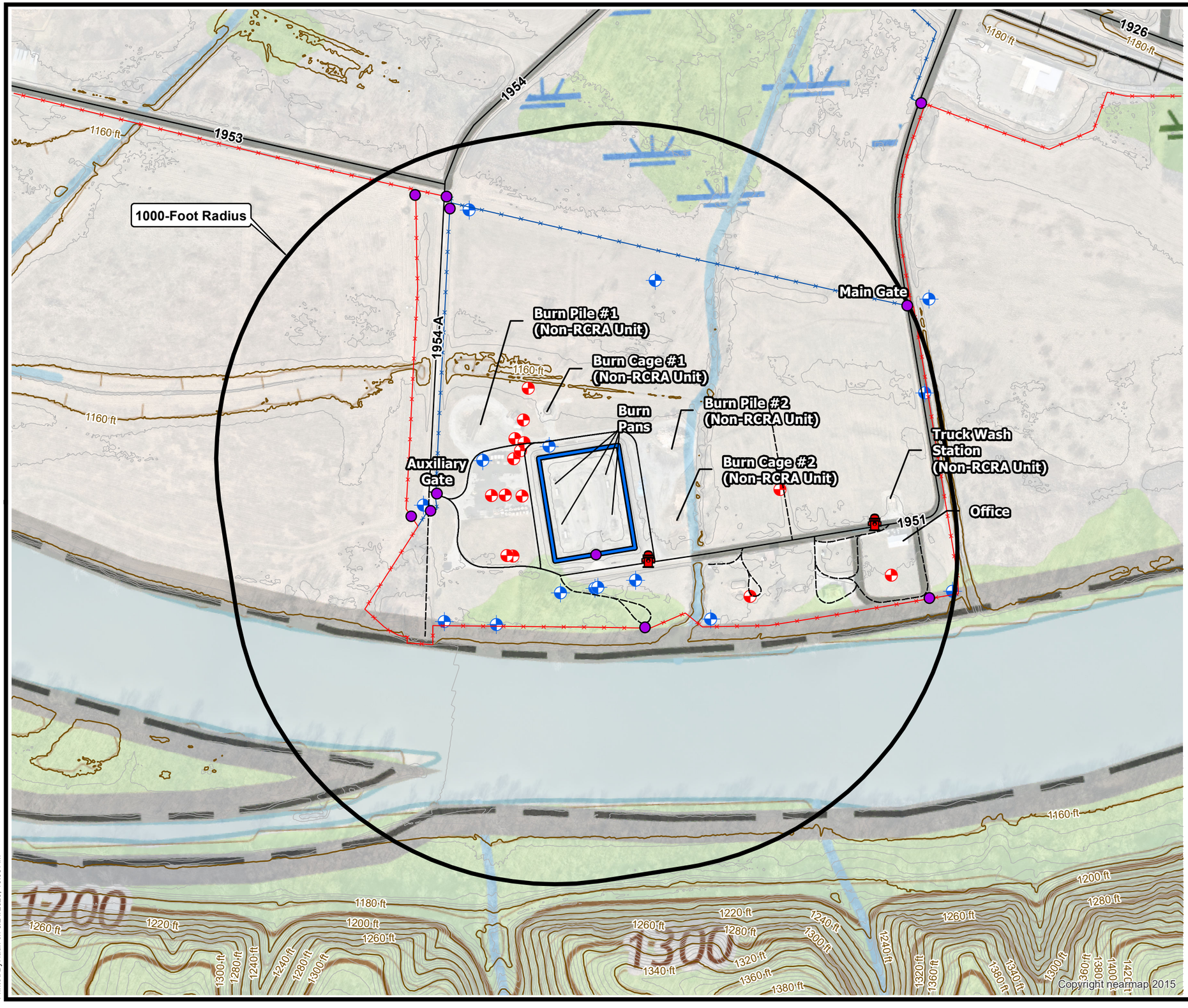
PROJECT NO.	DATE
15242	MAY 2020
FILE NAME	
HOLSTON	

HOLSTON ARMY AMMUNITION PLANT
SUBPART X PERMIT

LAYOUT OF BURN PAN UNIT

THOMPSON & LITTON

FIGURE
2-2

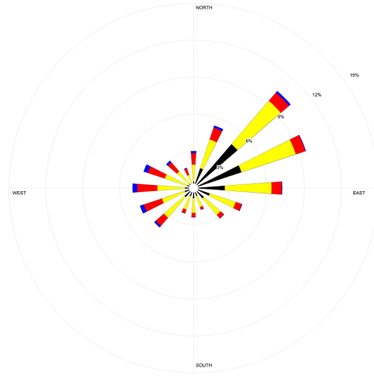


Legend

- Burn Pan Unit
- Gates
- Interior Fence
- Perimeter Fence
- Primary Road
- Secondary Road
- Fire Hydrant
- Groundwater Monitoring Well (Open)
- Groundwater Monitoring Well (Closed)
- 1000-Foot Radius

WIND SPEED (m/s)

- >11.06
- 8.49 - 11.06
- 5.40 - 8.49
- 3.34 - 5.40
- 1.80 - 3.34
- 0.51 - 1.80



N

0 150 300
FEET

1 " = 300 '
1:3,600

HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TENNESSEE

FIGURE 2-3
TOPOGRAPHIC MAP

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CHECKED BY:	M GEHRING	AS NOTED	FILE NO. Fig 2_3 Topographic Map.mxd
APPROVED BY:	M GEHRING	DATE PRINTED:	
DATE:	August 2020	*8/24/2020*	

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King of Prussia, PA 19406

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1953

1954-A

1951

1160.ft

1160 ft

Burn Pile #1
(Non-RCRA Unit)

Burn Cage #1
(Non-RCRA Unit)

Burn Pile #2
(Non-RCRA Unit)

Burn
Pans

Burn Cage #2
(Non-RCRA Unit)

Truck Wash
Station
(Non-RCRA Unit)

Main Gate

Auxiliary
Gate

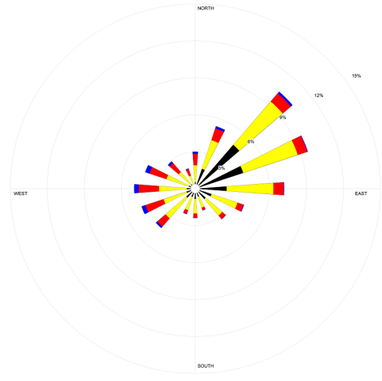
Office

Legend

- Burn Pan Unit
- Gates
- Interior Fence
- Perimeter Fence
- Primary Road
- Secondary Road
- Fire Hydrant
- Groundwater Monitoring Well (Open)
- Groundwater Monitoring Well (Closed)

WIND SPEED (m/s)

- >11.06
- 8.49 - 11.06
- 5.40 - 8.49
- 3.34 - 5.40
- 1.80 - 3.34
- 0.51 - 1.80



N

0 100 200
FEET

1 " = 200 '
1:2,400

HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TENNESSEE

FIGURE 2-4
ZOOMED TOPOGRAPHIC MAP

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APPROVED BY: M GEHRING	DATE PRINTED:		
DATE: August 2020	*8/24/2020*		

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J:\Prj\Holston Army Ammunition\RCRA 2020\Fig 2_4 Topographic Map 1_200.mxd
Printed By: lauri on 8/24/2020, 10:08 AM

Legend

- Burn Pan Unit
- Sewer Drainage Line
- Stormwater Channel
- Backflow Prevention Valve
- Surface Flow Direction
- Groundwater Monitoring Well (Open)
- Groundwater Monitoring Well (Closed)

N

0 90 180
FEET

1 " = 180 '
1:2,160

HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TENNESSEE

FIGURE 2-5
SURFACE WATER FLOW

DRAWN BY:	SSW	SCALE:	PROJ. NO. RCRA 2020
CHECKED BY:	M GEHRING	AS NOTED	FILE NO Fig 2_5 Surface Water Flow.mxd
APPROVED BY:	M GEHRING	DATE PRINTED:	
DATE:	August 2020	*8/25/2020*	

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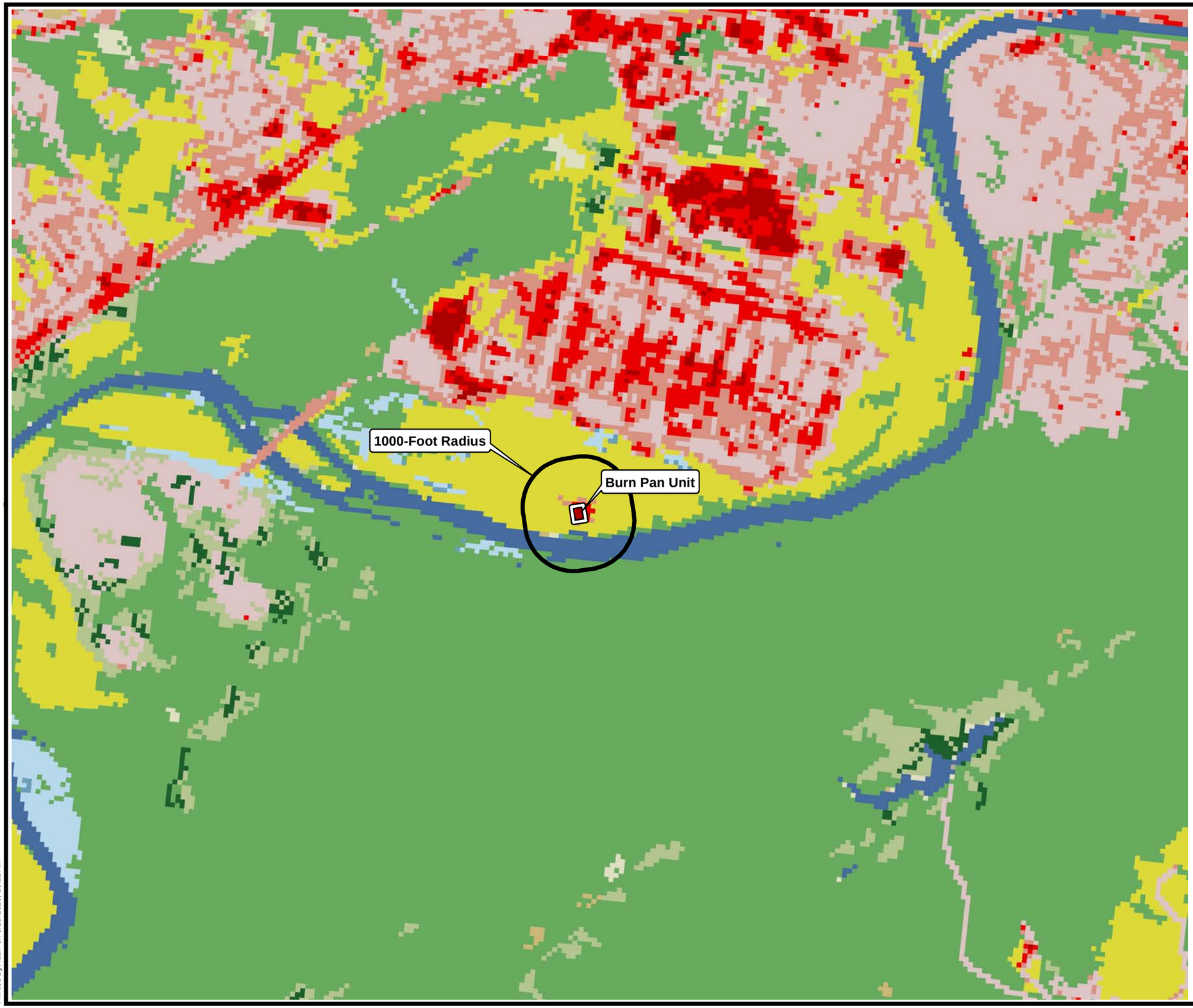
J:\Prj\Holston Army Ammunition\RCRA 2020\Fig 2_5 Surface Water Flow.mxd
Printed By: lauri on 8/25/2020, 07:36 AM



Legend

- Burn Pan Unit
- 1000-Foot Radius

NLCD Land Cover Classification, 2016

- 11 Open Water
- 21 Developed, Open Space
- 22 Developed, Low Intensity
- 23 Developed, Medium Intensity
- 24 Developed, High Intensity
- 31 Barren Land (Rock/Sand/Clay)
- 41 Deciduous Forest
- 42 Evergreen Forest
- 43 Mixed Forest
- 52 Shrub/Scrub
- 71 Grassland/Herbaceous
- 81 Pasture/Hay
- 90 Woody Wetlands
- 95 Emergent Herbaceous Wetlands

N

0 1,000 2,000 FEET

1 " = 2,000 '
1:24,000

HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TENNESSEE

FIGURE 2-6
LANDUSE MAP

DRAWN BY:	SSW	SCALE:		PROJ. NO.	RCRA 2020
CHECKED BY:	M GEHRING	AS NOTED		FILE NO.	Fig 2_6 Landuse.mxd
APPROVED BY:	M GEHRING	DATE PRINTED:			
DATE:	August 2020	*8/20/2020*			

Colerie ENVIRONMENTAL
1150 First Ave., Ste 501
King of Prussia, PA 19406

J:\Prj\Holston Army Ammunition\RCRA 2020\Fig 2_6 Landuse.mxd
Printed By: lauri on 8/20/2020, 10:11 AM

Figure 2-7. 100-Year Floodplain and Floodway Boundary - Vicinity

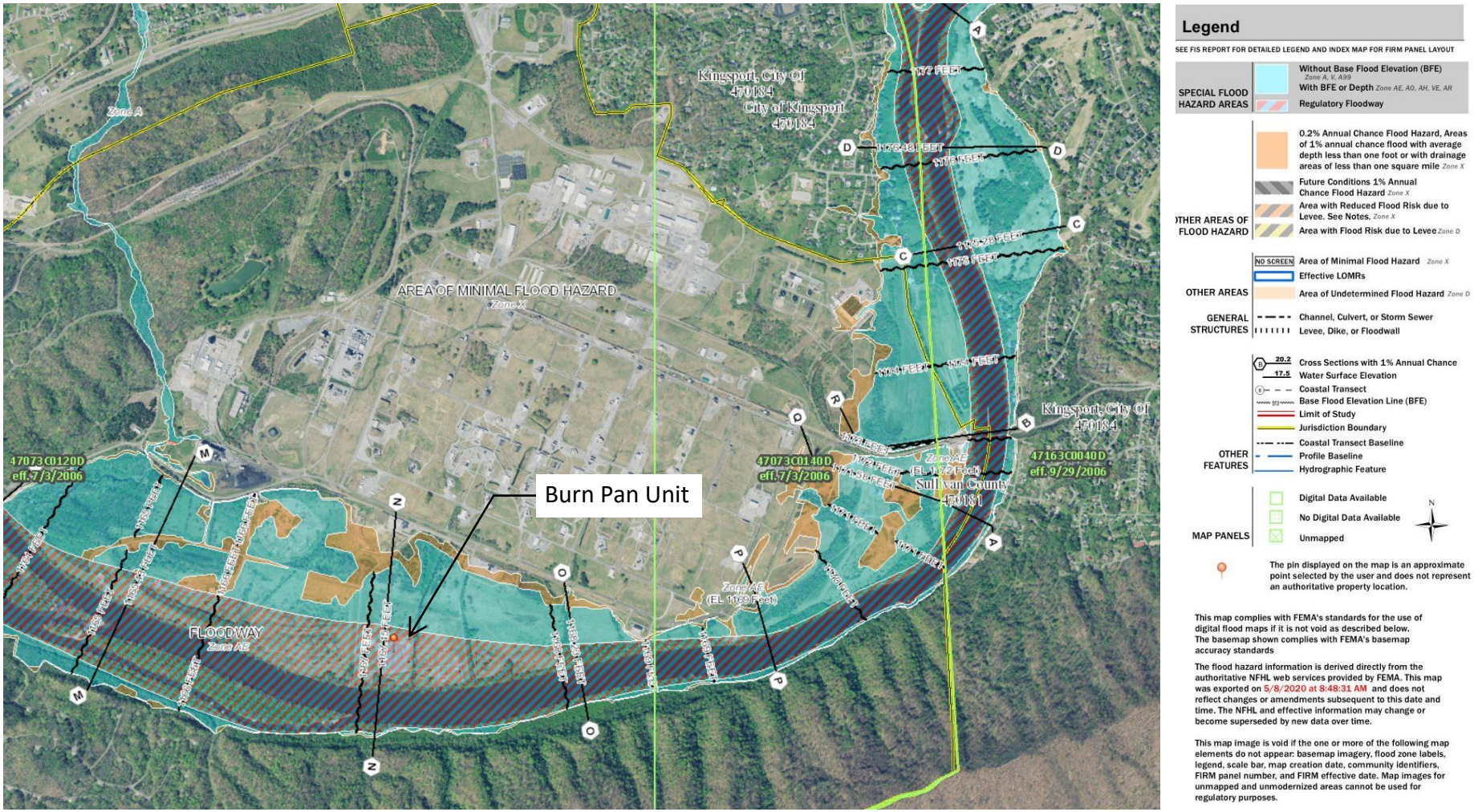
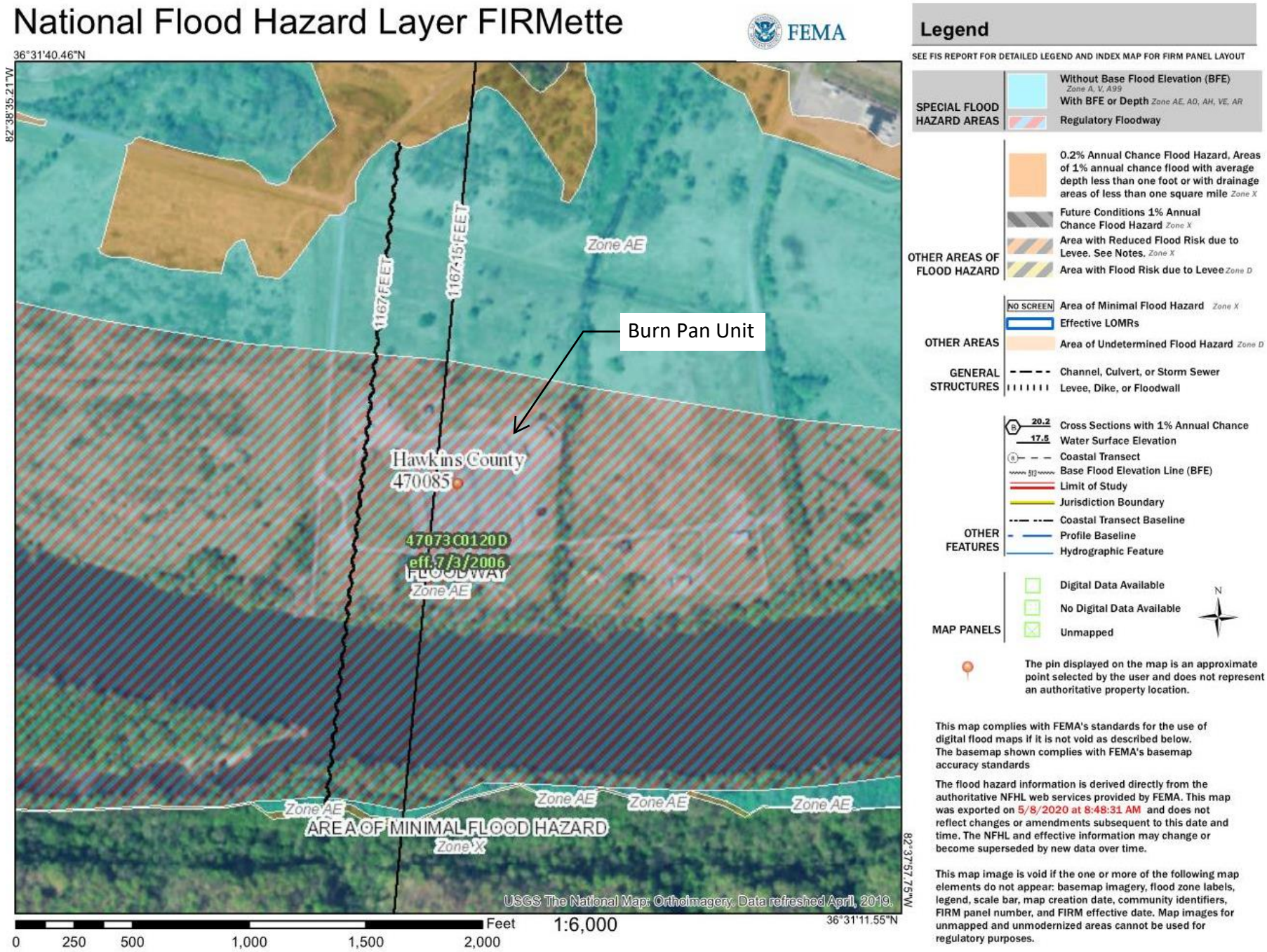
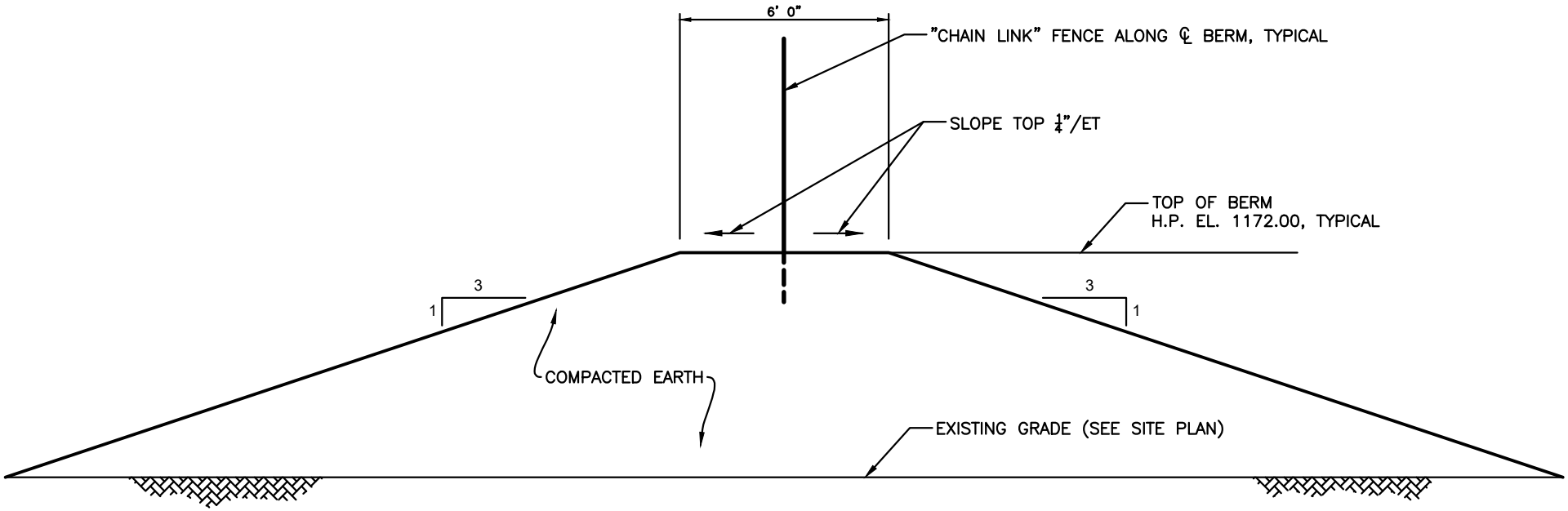


Figure 2-8. 100-Year Floodplain and Floodway Boundary - Local





N.T.S.

HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TENNESSEE

FIGURE 2-9
TYPICAL BERM SECTION AT BURNING PAN AREA

DRAWN BY: SSW	SCALE:	PROJ. RCRA 2020
CHECKED BY: M GEHRING	See bar scale	FILE NO. Typical Berm Section.dwg
APPROVED BY: M GEHRING	DATE PRINTED:	
DATE: August 18, 2020		

Coterie ENVIRONMENTAL
1150 First Ave., Ste 501
King of Prussia, PA 19406

Attachment 2-2: FLOOD DATA

TENNESSEE VALLEY AUTHORITY
KNOXVILLE TENNESSEE 37902

October 10, 1975

Mr. David Stinson
Post Office Box 749
Kingsport, Tennessee 37662

Dear Mr. Stinson

This is in reply to your oral request to John Rozek for the 100- and 200-year flood elevations along Holston River from miles 137 to 142 and along South Fork Holston River from miles 0 to 8. The requested information is given on the two enclosed profile drawings.

The 200-year flood on Holston River from mile 137 to the mouth of the South Fork at mile 142.2 approximates the 100,000 cubic feet per second natural profile marked in red on the Holston River drawing. The 100-year flood for this reach would be approximately 2 feet below the 200-year flood profile. The August 14, 1940, flood profile on the South Fork Holston River drawing is approximately equal to the 200-year flood from about mile 1.3 to mile 8.18 along South Fork Holston River. The maximum known flood (1901), regulated, approximates the 100-year flood for this same reach.

Please note that the backwater effect from the Holston River floods extends up the South Fork approximately 1.3 miles and should be considered the controlling elevation up to that point All of the above defined profiles assume existing upstream regulation This profile information is based on available data which were developed for conditions prior to 1960.

If we can be of further service please let us know.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

Edward H. Lesesne,
Director of Water Management

Enclosures

FU 133-61.02
ajg

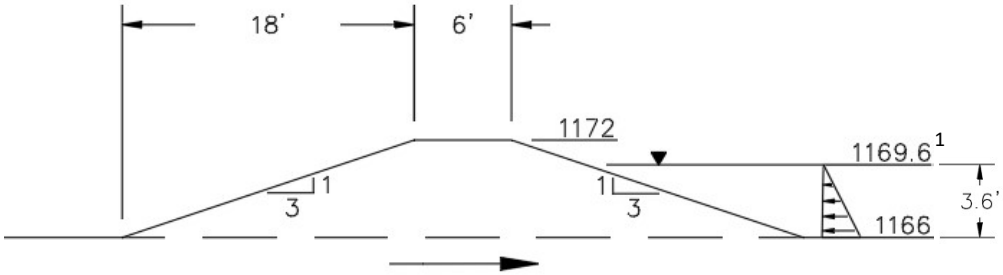
AMY, PLEASE INSERT THE ORIGINAL MAP FROM THE EXISTING PERMIT IN A MAP POCKET HERE.

Attachment 2-3: BERM CALCULATIONS

Static Stability Calculations:

Overturning: Kinematically unlikely; no need to evaluate

Sliding: Kinematically possible, but high factors of safety clearly exist. Perform simplified calculation to estimate F.S.



$$F.S. = \frac{Resisting\ Forces}{Driving\ Forces}$$

Short-term (undrained) conditions are assumed to exist. Most likely failure plane exists at base of berm. Assume berm exists of relatively homogeneous cohesive materials; gravel layer mentioned in text assumed not to extend through berm. No shear strength data available, assume S_U = 250 psf (Very soft – soft clay).

$$Resisting\ Force = (18' \times 2 + 6')(250\ psf) = (42')(250\ psf) = 10{,}500\frac{lb}{ft}$$

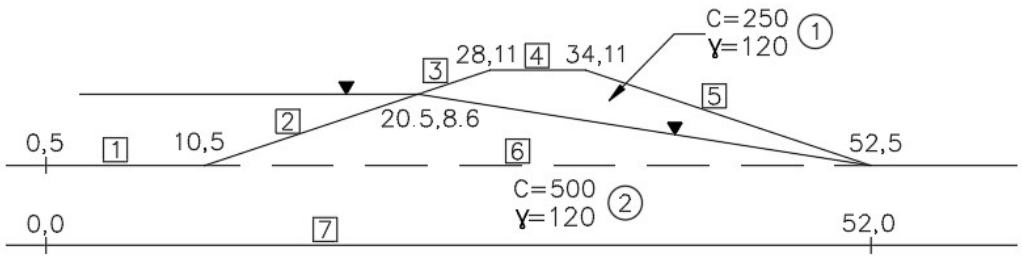
$$Driving\ Force = \frac{3.6'(62.4\ pcf)}{2} \times 3.6' = 404\frac{lb}{ft}$$

$$F.S. = \frac{10{,}500}{404} = 26$$

Very safe in sliding

[1] 200-year flood elevation as provided by TVA. The 100-year flood elevation provided by TVA is 1167.6. Since the current 100-year flood elevation according to FEMA (using NAVD 1988) is 1167.4, the original elevations from TVA (using NGVD 1929) were used for conservativity.

Slope Stability: This is expected to be most critical. Since the occurrence of a design earthquake and 100-year flood together is extremely unlikely, only examine static case. Examine stability using PCSTABL. Computer run attached.



Steady-state seepage has been assumed, although the low permeability material and relatively short time duration would probably preclude this from developing. The analysis is, therefore, somewhat conservative in this regard, although in this instance, the model is probably not very sensitive to selection of phreatic surface.

$$F.S. \approx 5.0$$

Very high factor of safety. Safety factors for structure are higher than recommended minimums.

$$F.S. \approx 4.2 \; if \; piezometric \; surface \; ignored.$$

** PCSTABL5M **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date: 9-21-92
Time of Run: 4:02 PM
Run By: P J FLOOD
Input Data Filename: A:HOSTONS.DAT
Output Filename: A:HOSTONS.OUT

PROBLEM DESCRIPTION SLOPE STABILITY ANALYSIS FOR BURN PAN BE
RM, STATIC ANALYSIS, STEADY STATE

BOUNDARY COORDINATES

5 Top Boundaries
6 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	5.00	10.00	5.00	2
2	10.00	5.00	20.50	8.60	1
3	20.50	8.60	28.00	11.00	1
4	28.00	11.00	34.00	11.00	1
5	34.00	11.00	52.00	5.00	1
6	10.00	5.00	52.00	5.00	2

ISOTROPIC SOIL PARAMETERS

2 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	110.0	120.0	250.0	.0	.00	.0	1
2	110.0	120.0	500.0	.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 3 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	8.60
2	20.50	8.60
3	52.00	5.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = .00 ft.
and X = 20.00 ft.

Each Surface Terminates Between X = 29.00 ft.
and X = 36.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = .00 ft.

3.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation. The Angle Has Been Restricted Between The Angles Of -45.0 And 13.0 deg.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	13.33	6.14
2	16.27	5.52
3	19.26	5.24
4	22.25	5.33
5	25.22	5.76
6	28.12	6.54
7	30.90	7.66
8	33.54	9.10
9	35.50	10.50

Circle Center At X = 20.1 ; Y = 30.6 and Radius, 25.4

*** 5.050 ***

Individual data on the 12 slices

Slice No.	Width Ft(m)	Weight Lbs(kg)	Water Force Top Lbs(kg)	Water Force Bot Lbs(kg)	Tie Force Norm Lbs(kg)	Tie Force Tan Lbs(kg)	Earthquake Force Hor Lbs(kg)	Earthquake Force Ver Lbs(kg)	Surcharge Load Lbs(kg)
1	2.9	287.1	378.2	518.4	.0	.0	.0	.0	.0
2	3.0	817.3	185.0	602.5	.0	.0	.0	.0	.0
3	1.2	466.7	17.5	259.4	.0	.0	.0	.0	.0
4	1.8	746.5	.0	348.0	.0	.0	.0	.0	.0
5	3.0	1416.1	.0	499.9	.0	.0	.0	.0	.0
6	2.8	1399.5	.0	315.2	.0	.0	.0	.0	.0
7	.1	60.1	.0	9.3	.0	.0	.0	.0	.0
8	2.3	1025.9	.0	91.4	.0	.0	.0	.0	.0
9	.5	181.9	.0	.0	.0	.0	.0	.0	.0
10	2.6	759.0	.0	.0	.0	.0	.0	.0	.0
11	.5	88.7	.0	.0	.0	.0	.0	.0	.0
12	1.5	129.9	.0	.0	.0	.0	.0	.0	.0

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	13.33	6.14
2	16.21	5.29
3	19.19	4.91
4	22.19	5.01
5	25.13	5.59
6	27.95	6.62
7	30.56	8.09
8	32.91	9.96
9	33.85	11.00

Circle Center At X = 20.1 ; Y = 23.7 and Radius, 18.8

*** 5.354 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	15.56	6.90
2	18.46	6.15
3	21.44	5.82
4	24.44	5.93
5	27.39	6.48
6	30.23	7.44
7	32.90	8.81
8	35.35	10.55
9	35.35	10.55

Circle Center At X = 22.2 ; Y = 26.5 and Radius, 20.6

*** 5.435 ***

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	17.78	7.67
2	20.43	6.26
3	23.42	5.97
4	26.29	6.82
5	28.64	8.69
6	29.94	11.00

Circle Center At X = 22.7 ; Y = 13.7 and Radius, 7.7

*** 5.691 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	11.11	5.38
2	14.11	5.24

3	17.11	5.29
4	20.10	5.54
5	23.06	5.99
6	25.99	6.63
7	28.88	7.46
8	31.70	8.48
9	34.44	9.69
10	35.81	10.40

Circle Center At X = 14.8 ; Y = 50.5 and Radius, 45.2

*** 5.784 ***

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	17.78	7.67
2	20.52	6.44
3	23.51	6.33
4	26.34	7.34
5	28.58	9.33
6	29.41	11.00

Circle Center At X = 22.3 ; Y = 14.0 and Radius, 7.7

*** 5.933 ***

Failure Surface Specified By 9 Coordinate Points

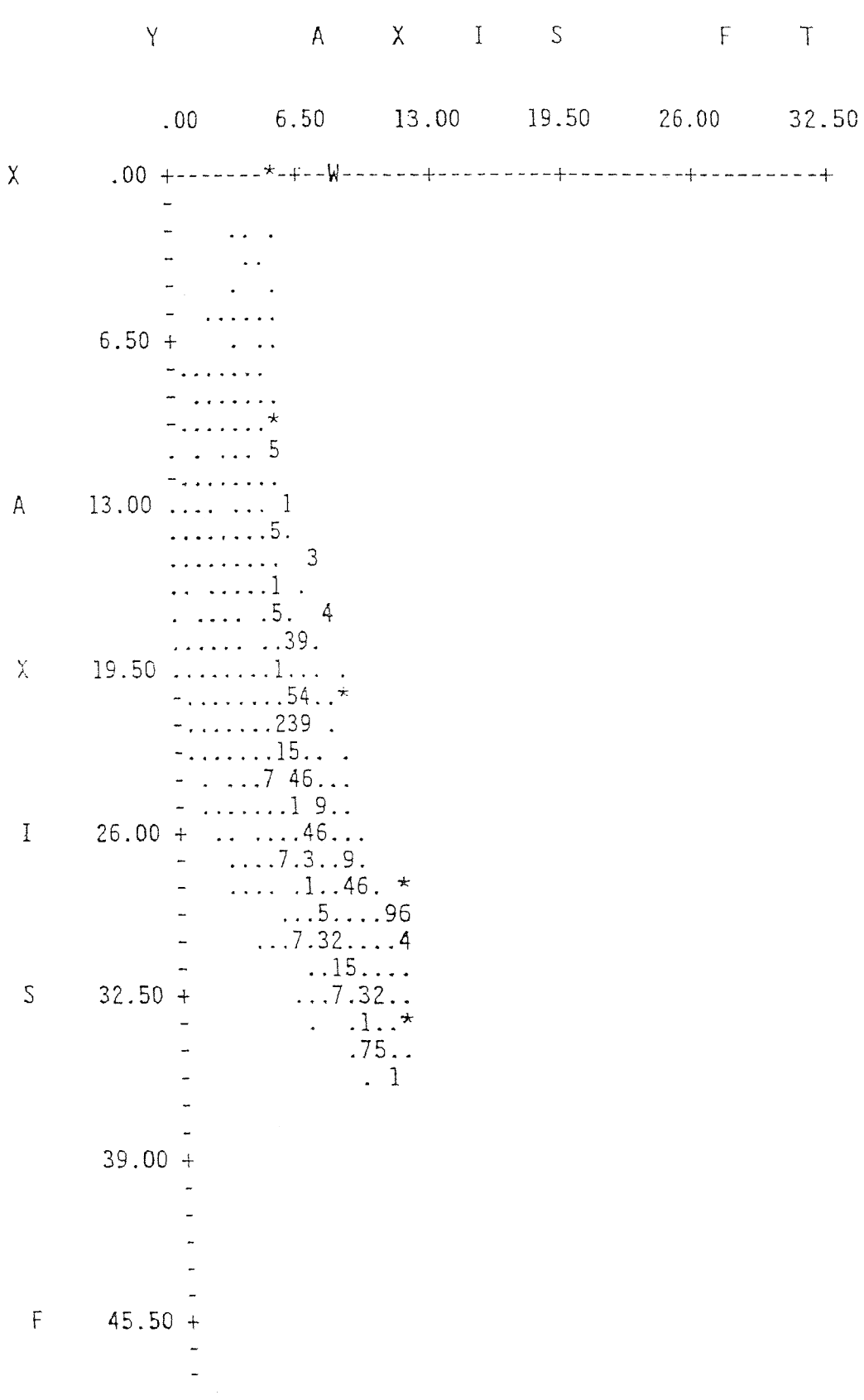
Point No.	X-Surf (ft)	Y-Surf (ft)
1	15.56	6.90
2	18.30	5.68
3	21.21	4.98
4	24.21	4.81
5	27.18	5.19
6	30.04	6.11
7	32.68	7.53
8	35.02	9.40
9	35.87	10.38

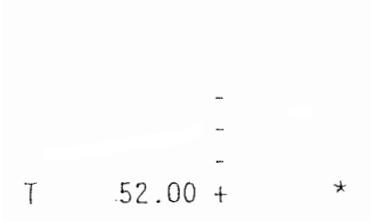
Circle Center At X = 23.6 ; Y = 21.3 and Radius, 16.5

*** 5.952 ***

Circle Center At X = 19.6 ; Y = 21.2 and Radius, 14.9

*** 6.114 ***

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20.5 8.6 28.0 11.0 1
28.0 11.0 34.0 11.0 1
34.0 11.0 52.0 5.0 1
10.0 5.0 52.0 5.0 2
SOIL
2
110.0 120.0 250.0 0.0 0.0 0.0 1
110.0 120.0 500.0 0.0 0.0 0.0 1
WATER
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3
0.0 8.6
20.5 8.6
52.0 5.0
CIRCL2
10 10
0.0 20.0 29.0 36.0
0.0 3.0 13.0 -45.0
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** PCSTABL5M **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	9-21-92
Time of Run:	4:41 PM
Run By:	P J FLOOD
Input Data Filename:	A:HNOPIEZ.DAT
Output Filename:	A:HNOPIEZ.OUT

PROBLEM DESCRIPTION SLOPE STABILITY ANALYSIS FOR BURN PAN BERM, STATIC ANALYSIS, NO PIEZ. SURF.

BOUNDARY COORDINATES

5 Top Boundaries
6 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	5.00	10.00	5.00	2
2	10.00	5.00	20.50	8.60	1
3	20.50	8.60	28.00	11.00	1
4	28.00	11.00	34.00	11.00	1
5	34.00	11.00	52.00	5.00	1
6	10.00	5.00	52.00	5.00	2

ISOTROPIC SOIL PARAMETERS

2 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	110.0	120.0	250.0	.0	.00	.0	1
2	110.0	120.0	500.0	.0	.00	.0	1

A Critical Failure Surface Searching Method, Using A Random

Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = .00 ft.
and X = 20.00 ft.

Each Surface Terminates Between X = 29.00 ft.
and X = 36.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = .00 ft.

3.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of -45.0
And 13.0 deg.

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	13.33	6.14
2	16.27	5.52
3	19.26	5.24
4	22.25	5.33
5	25.22	5.76
6	28.12	6.54
7	30.90	7.66
8	33.54	9.10
9	35.50	10.50

Circle Center At X = 20.1 ; Y = 30.6 and Radius, 25.4

*** 4.171 ***

Individual data on the 11 slices

Slice No.	Width Ft(m)	Weight Lbs(kg)	Water Force Top Lbs(kg)	Water Force Bot Lbs(kg)	Tie Force Norm Lbs(kg)	Tie Force Tan Lbs(kg)	Earthquake Force Hor Lbs(kg)	Earthquake Force Ver Lbs(kg)	Surcharge Load Lbs(kg)
1	2.9	263.2	.0	.0	.0	.0	.0	.0	.0
2	3.0	749.2	.0	.0	.0	.0	.0	.0	.0
3	1.2	427.8	.0	.0	.0	.0	.0	.0	.0
4	1.8	690.7	.0	.0	.0	.0	.0	.0	.0
5	3.0	1336.8	.0	.0	.0	.0	.0	.0	.0
6	2.8	1350.7	.0	.0	.0	.0	.0	.0	.0
7	.1	58.7	.0	.0	.0	.0	.0	.0	.0
8	2.8	1194.2	.0	.0	.0	.0	.0	.0	.0
9	2.6	759.0	.0	.0	.0	.0	.0	.0	.0
10	.5	88.7	.0	.0	.0	.0	.0	.0	.0
11	1.5	129.9	.0	.0	.0	.0	.0	.0	.0

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	13.33	6.14
2	16.21	5.29
3	19.19	4.91
4	22.19	5.01
5	25.13	5.59
6	27.95	6.62
7	30.56	8.09
8	32.91	9.96
9	33.85	11.00

Circle Center At X = 20.1 ; Y = 23.7 and Radius, 18.8

*** 4.386 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	6.67	5.00
2	8.98	3.09
3	11.61	1.64
4	14.46	.70
5	17.43	.30
6	20.43	.46
7	23.34	1.17
8	26.08	2.41

9	28.54	4.12
10	30.64	6.26
11	32.31	8.76
12	33.27	11.00

Circle Center At X = 18.1 ; Y = 16.4 and Radius, 16.1

*** 4.479 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	8.89	5.00
2	11.24	3.13
3	13.90	1.75
4	16.78	.90
5	19.76	.63
6	22.75	.93
7	25.62	1.79
8	28.27	3.20
9	30.61	5.08
10	32.54	7.38
11	33.99	10.00
12	34.28	10.91

Circle Center At X = 19.7 ; Y = 16.1 and Radius, 15.5

*** 4.526 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	11.11	5.38
2	14.11	5.24
3	17.11	5.29
4	20.10	5.54
5	23.06	5.99
6	25.99	6.63
7	28.88	7.46
8	31.70	8.48
9	34.44	9.69
10	35.81	10.40

Circle Center At X = 14.8 ; Y = 50.5 and Radius, 45.2

*** 4.591 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	8.89	5.00
2	11.08	2.95
3	13.66	1.42
4	16.51	.50
5	19.50	.22
6	22.48	.61
7	25.29	1.64
8	27.82	3.26
9	29.92	5.40
10	31.51	7.94
11	32.50	10.77
12	32.53	11.00

Circle Center At X = 19.2 ; Y = 13.8 and Radius, 13.6

*** 4.630 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	6.67	5.00
2	9.32	3.60
3	12.15	2.60
4	15.09	2.00
5	18.08	1.84
6	21.07	2.11
7	23.99	2.80
8	26.78	3.90
9	29.39	5.38
10	31.75	7.23
11	33.83	9.40
12	34.79	10.74

Circle Center At X = 17.7 ; Y = 22.7 and Radius, 20.8

*** 4.666 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	8.89	5.00
2	11.47	3.47
3	14.30	2.46
4	17.26	2.02
5	20.26	2.16
6	23.17	2.87
7	25.89	4.14
8	28.32	5.90
9	30.36	8.10
10	31.94	10.65
11	32.08	11.00

Circle Center At X = 18.0 ; Y = 17.5 and Radius, 15.5

*** 4.670 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	4.44	5.00
2	6.74	3.07
3	9.36	1.60
4	12.20	.64
5	15.17	.23
6	18.17	.37
7	21.09	1.07
8	23.82	2.30
9	26.28	4.01
10	28.38	6.16
11	30.05	8.65
12	31.05	11.00

Circle Center At X = 15.9 ; Y = 16.3 and Radius, 16.1

*** 4.720 ***

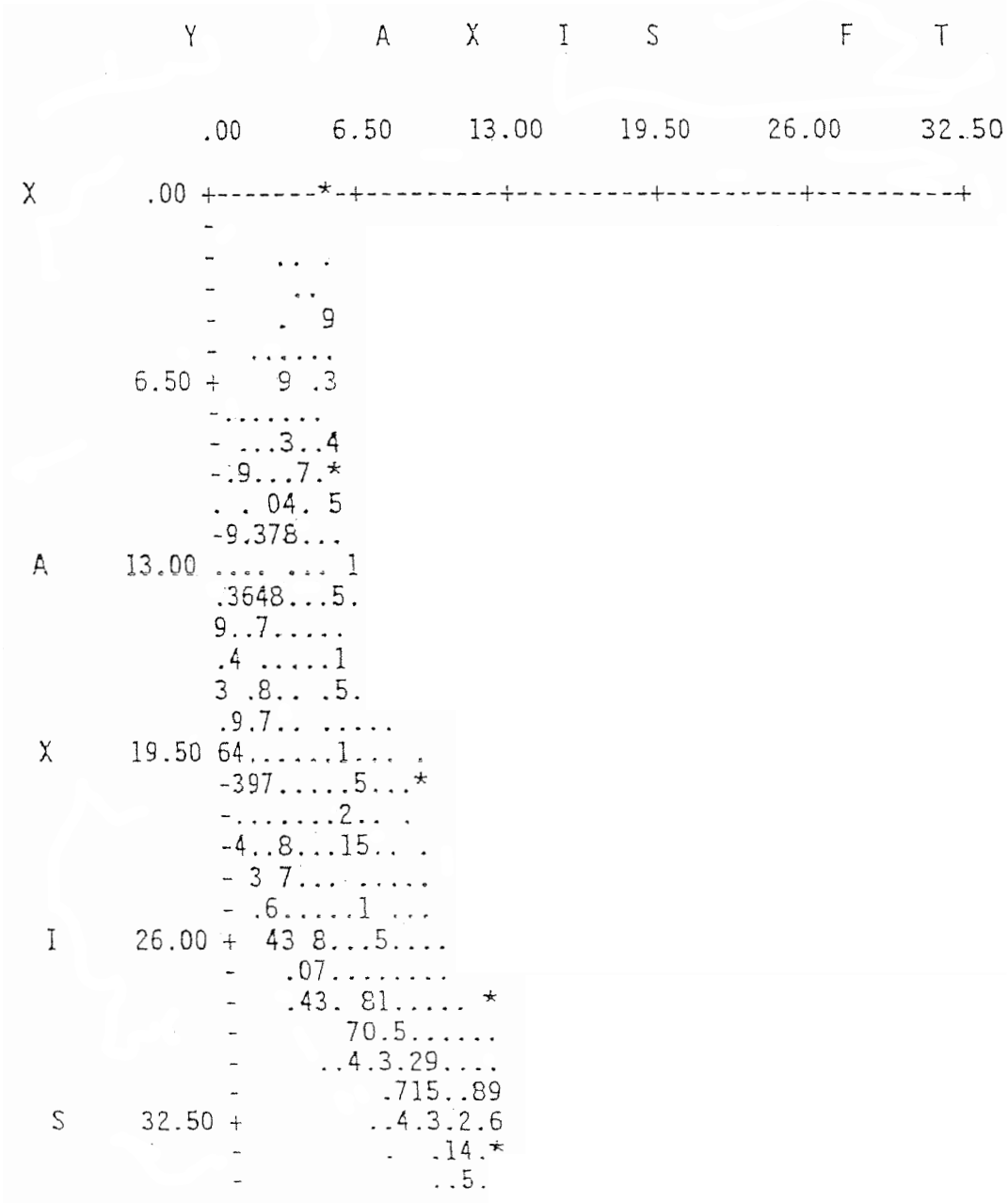
Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)

1	8.89	5.00
2	11.02	2.88
3	13.57	1.32
4	16.43	.39
5	19.42	.14
6	22.38	.60
7	25.16	1.73
8	27.60	3.47
9	29.57	5.73
10	30.97	8.39
11	31.63	11.00

Circle Center At X = 19.0 ; Y = 13.0 and Radius, 12.9

*** 4.722 ***



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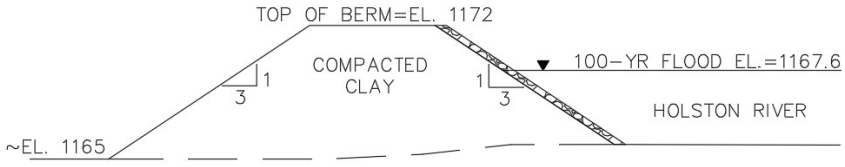
PROFIL
SLOPE STABILITY ANALYSIS FOR BURN PAN   BERM, STATIC ANALYSIS, NO PIEZ. SURF.
6 5
0.0 5.0 10.0 5.0 2
10.0 5.0 20.5 8.6 1
20.5 8.6 28.0 11.0 1
28.0 11.0 34.0 11.0 1
34.0 11.0 52.0 5.0 1
10.0 5.0 52.0 5.0 2
SOIL
2
110.0 120.0 250.0 0.0 0.0 0.0 1
110.0 120.0 500.0 0.0 0.0 0.0 1
CIRCL2
10 10
0.0 20.0 29.0 36.0
0.0 3.0 13.0 -45.0
```

HYDRODYNAMIC FORCE CALCULATIONS

Holston Army Ammunition Plant
Burn Pan Containment Berm Evaluation
6/11/2020
Calculated by: RMW
Checked by: MAM

Hydrodynamic Force Calculations:

Dike currently has 6-inch diameter cobbles at a depth of approximately 12 inches.



Obtained flow and velocity data from TVA – Carrie Williamson, P.E., CFM:

100-year flood: 79,000 cfs
Velocity at river mile 139.08 = 5.2 fps (mean)

Determine adequacy of existing erosion protection:

Using Corps of Engineers Hydraulic Design Criteria:

$$V = C\left[2g\left(\frac{\gamma_S - \gamma_W}{\gamma_W}\right)\right]^{\frac{1}{2}}(D)^{\frac{1}{2}}$$

Where,

$V = Velocity\ (fps)$
$C = 0.86$
$g = acceleration\ of\ gravity\ \left(32.2\frac{ft}{s^2}\right)$
$\gamma_S = Specific\ weight\ of\ stone, use\ 135\ lb/ft^3$
$\gamma_W = Specific\ weight\ of\ water, 62.4\ lb/ft^3$
$D = Stone\ diameter\ (ft)$

Using existing 0.5 ft diameter stone size:

$$V = 0.86\left[2(32.2)\left(\frac{135 - 62.4}{62.4}\right)\right]^{\frac{1}{2}}(0.5)^{\frac{1}{2}}$$

$$\boldsymbol{V = 5.3\ fps}$$

$\boldsymbol{5.3 > 5.2\ fps\ provided\ by\ TVA, so\ existing\ erosion\ protection\ is\ adequate.}$

Note: Berm was inspected on 04/23/2020 by Thompson & Litton and determined to be structurally sound.

HYDRAULIC DESIGN CRITERIA

SHEET 712-1

STONE STABILITY

VELOCITY VS STONE DIAMETER

1. Purpose. Hydraulic Design Chart 712-1 can be used as a guide for the selection of rock sizes for riprap for channel bottom and side slopes downstream from stilling basins and for rock sizes for river closures. Recommended stone gradation for stilling basin riprap is given in paragraph 6.

2. Background. In 1885 Wilfred Airy[1] showed that the capacity of a stream to move material along its bed by sliding is a function of the sixth power of the velocity of the water.[1] Henry Law applied this concept to the overturning of a cube,[2] and in 1896 Hooker[2] illustrated its application to spheres. In 1932 and 1936 Isbash published coefficients for the stability of rounded stones dropped in flowing water.[3,4] The design curves given in Chart 712-1 have been computed using Airy's law and the experimental coefficients for rounded stones published by Isbash.

3. Theory. According to Isbash the basic equation for the movement of stone in flowing water can be written as:

$$V = C \left[2g \left(\frac{\gamma_s - \gamma_w}{\gamma_w} \right) \right]^{1/2} (D)^{1/2} \qquad (1)$$

where

V = velocity, fps

C = a coefficient

g = acceleration of gravity, ft/sec^2

γ_s = specific weight of stone, lb/ft^3

γ_w = specific weight of water, lb/ft^3

D = stone diameter, ft

The diameter of a spherical stone in terms of its weight W is

$$D = \left(\frac{6W}{\pi \gamma_s} \right)^{1/3} \qquad (2)$$

Substituting for D in equation 1 results in

$$V = C\left[2g\left(\frac{\gamma_s - \gamma_w}{\gamma_w}\right)\right]^{1/2}\left(\frac{6W}{\pi\gamma_s}\right)^{1/6}$$

which describes Airy's law stated in paragraph 2.

4. Experimental Results. Experimental data on stone movement in flowing water from the early (1786) work of DuBuat[5] to the more recent Bonneville Hydraulic Laboratory tests[6] have been shown to confirm Airy's law and Isbash's stability coefficients.[7] The published experimental data are generally defined in terms of bottom velocities. However, some are in terms of average flow velocities and some are not specified. The Isbash coefficients are from tests with essentially no boundary layer development and the average flow velocities are representative of the velocity against stone. When the stone movement resulted by sliding, a coefficient of 0.86 was obtained. When movement was effected by rolling or overturning, a coefficient of 1.20 resulted. Extensive U. S. Army Engineer Waterways Experiment Station laboratory testing for the design of riprap below stilling basins indicates that the coefficient of 0.86 should be used with the average flow velocity over the end sill for sizing stilling basin riprap because of the excessively high turbulence level in the flow. For impact-type stilling basins, the Bureau of Reclamation[8] has adopted a riprap design curve based on field and laboratory experience and on a study by Mavis and Laushey.[9] The Bureau curve specifies rock weighing 165 lb/ft^3 and is very close to the Isbash curve for similar rock using a stability coefficient of 0.86.

5. Application. The curves given in Chart 712-1 are applicable to specific stone weights of 135 to 205 lb/ft^3. The use of the average flow velocity is desirable for conservative design. The solid-line curves are recommended for stilling basin riprap design and other high-level turbulence conditions. The dashed line curves are recommended for river closures and similar low-level turbulence conditions. Riprap bank and bed protection in natural and artificial flood-control channels should be designed in accordance with reference 10.

6. Stilling Basin Riprap.

a. Size. The W_{50} stone weight and the D_{50} stone diameter for establishing riprap size for stilling basins can be obtained using Chart 712-1 in the manner indicated by the heavy arrows thereon. The effect of specific weight of the rock on the required size is indicated by the vertical spread of the solid line curves.

b. Gradation. The following size criteria should serve as guidelines for stilling basin riprap gradation.

(1) The lower limit of W_{50} stone should not be less than the weight of stone determined using the appropriate "Stilling Basins" curve in Chart 712-1.

(2) The upper limit of W_{50} stone should not exceed the weight that can be obtained economically from the quarry or the size that will satisfy layer thickness requirements as specified in paragraph 6c.

(3) The lower limit of W_{100} stone should not be less than two times the lower limit of W_{50} stone.

(4) The upper limit of W_{100} stone should not be more than five times the lower limit of W_{50} stone, nor exceed the size that can be obtained economically from the quarry, nor exceed the size that will satisfy layer thickness requirements as specified in paragraph 6c.

(5) The lower limit of W_{15} stone should not be less than one-sixteenth the upper limit of W_{100} stone.

(6) The upper limit of W_{15} stone should be less than the upper limit of W_{50} stone as required to satisfy criteria for graded stone filters specified in EM 1110-2-1901.

(7) The bulk volume of stone lighter than the W_{15} stone should not exceed the volume of voids in the revetment without this lighter stone.

(8) W_0 to W_{25} stone may be used instead of W_{15} stone in criteria (5), (6), and (7) if desirable to better utilize available stone sizes.

c. Thickness. The thickness of the riprap protection should be $2D_{50\ max}$ or $1.5D_{100\ max}$, whichever results in the greater thickness.

d. Extent. Riprap protection should extend downstream to where nonerosive channel velocities are established and should be placed sufficiently high on the adjacent bank to provide protection from wave wash during maximum discharge. The required riprap thickness is determined by substituting values for these relations in equation 2.

7. References.

(1) Shelford, W., "On rivers flowing into tideless seas, illustrated by the river Tiber." Proceedings, Institute of Civil Engineers, vol 82 (1885).

(2) Hooker, E. H., "The suspension of solids in flowing water." Transactions, American Society of Civil Engineers, vol 36 (1896), pp 239-340.

(3) Isbash, S. V., Construction of Dams by Dumping Stones in Flowing

Water, Leningrad, 1932. Translated by A. Dorijikov, U. S. Army Engineer District, Eastport, CE, Maine, 1935.

(4) _____, "Construction of dams by depositing rock in running water." Transactions, Second Congress on Large Dams, vol 5 (1936), pp 123-136.

(5) DuBuat, P. L. G., Traite d'Hydraulique. Paris, France, 1786.

(6) U. S. Army Engineer District, Portland, CE, McNary Dam - Second Step Cofferdam Closure. Bonneville Hydraulic Laboratory Report No. 51-1, 1956.

(7) U. S. Army Engineer Waterways Experiment Station, CE, Velocity Force on Submerged Rocks. Miscellaneous Paper No. 2-265, Vicksburg, Miss. April 1958.

(8) U. S. Bureau of Reclamation, Stilling Basin Performance; An Aid in Determining Riprap Sizes, by A. J. Peterka. Hydraulic Laboratory Report No. HYD-409, Denver, Colo., 1956.

(9) Mavis, F. T. and Laushey, L. M., "A reappraisal of the beginning of bed movement - competent velocity." Second Meeting, International Association for Hydraulic Structure Research, Stockholm, Sweden, 1948. See also Civil Engineering, vol 19 (January 1949), pp 38, 39 and 72.

(10) U. S. Army, Office, Chief of Engineers, Engineering and Design; Hydraulic Design of Flood Control Channels. EM 1110-2-1601, Washington, D. C., 1 July 1970.

FAX COVER

Send To:

Name: TERRY DARRAGH

Company: SEC DONOHUE

Address: GREENVILLE, SC

Fax Number: 803-234-3069 Number of Pages: 4

Verification Number: 803-234-3054

Subject: HOLSTON RIVER M 139.08 IUFO

From: Tennessee Valley Authority

Name: JIM CRAWFORD

Organization: FLOOD PROTECTION

Address: KNOXVILLE, TN

Fax Number: 615-632-7032

Telephone Number: 615-632-6850

Special Instructions:

Important! If you do not [illegible] all pages, Call us back immediately.

TVA 15536 (IS-CRM 6/91)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
HOLSTON RIVER								
A	0	650	11,883	6.6	1141.8	1141 8	1142.7	0 9
B	1390	770	13,707	5 8	1142 8	1142 8	1143 7	0 9
C	5650	1100	14,867	5 3	1144.6	1144 6	1145 3	0 7
D	10,025	980	13,998	5 6	1146 2	1146 2	1147 2	1 0
E	14,075	820	12,322	6.4	1148 1	1148.1	1149 1	1 0
F	19,375	450[2]	9407	8 4	1152 1	1152 1	1152.7	0 6
G	24,545	490	9933	8 0	1155.7	1155 7	1156 6	0 9
H	27,330	440	9858	8 0	1157.5	1157.5	1158 4	0 9
I	30,080	360	8744	9 0	1158.9	1158 9	1159 8	0 9
J	33,095	460	9435	8 4	1160 9	1160 9	1161.9	1 0
K	35,390	1000	20,390	3 9	1163 1	1163 1	1164 1	1 0
L	36,235	1400	16,129	4 9	1164 0	1164 0	1164.9	0 9
M	38,664	1450	15,945	5 0	1166 0	1166.0	1166 8	0 8
N	42,466	1550	15,279	5 2	1167 7	1167 7	1168 7	1 0
O	45,634	850	13,139	6 0	1168.8	1168 8	1169.8	1 0
P	48,432	470	9999	7 9	1170 0	1170 0	1170 9	0 9
Q	52,022	540[3]	9857	8.0	1172 0	1172 0	1172 7	0 7
R	53,184	540[3]	10,685	7 4	1173.5	1173 5	1174.2	0 7

Hi 139.08

[1]FEET ABOVE RIVER MILE 13L21
[2]WIDTH PERPENDICULAR TO FLOW
[3]THIS WIDTH EXTENDS BEYOND COUNTY BOUNDARY

TABLE

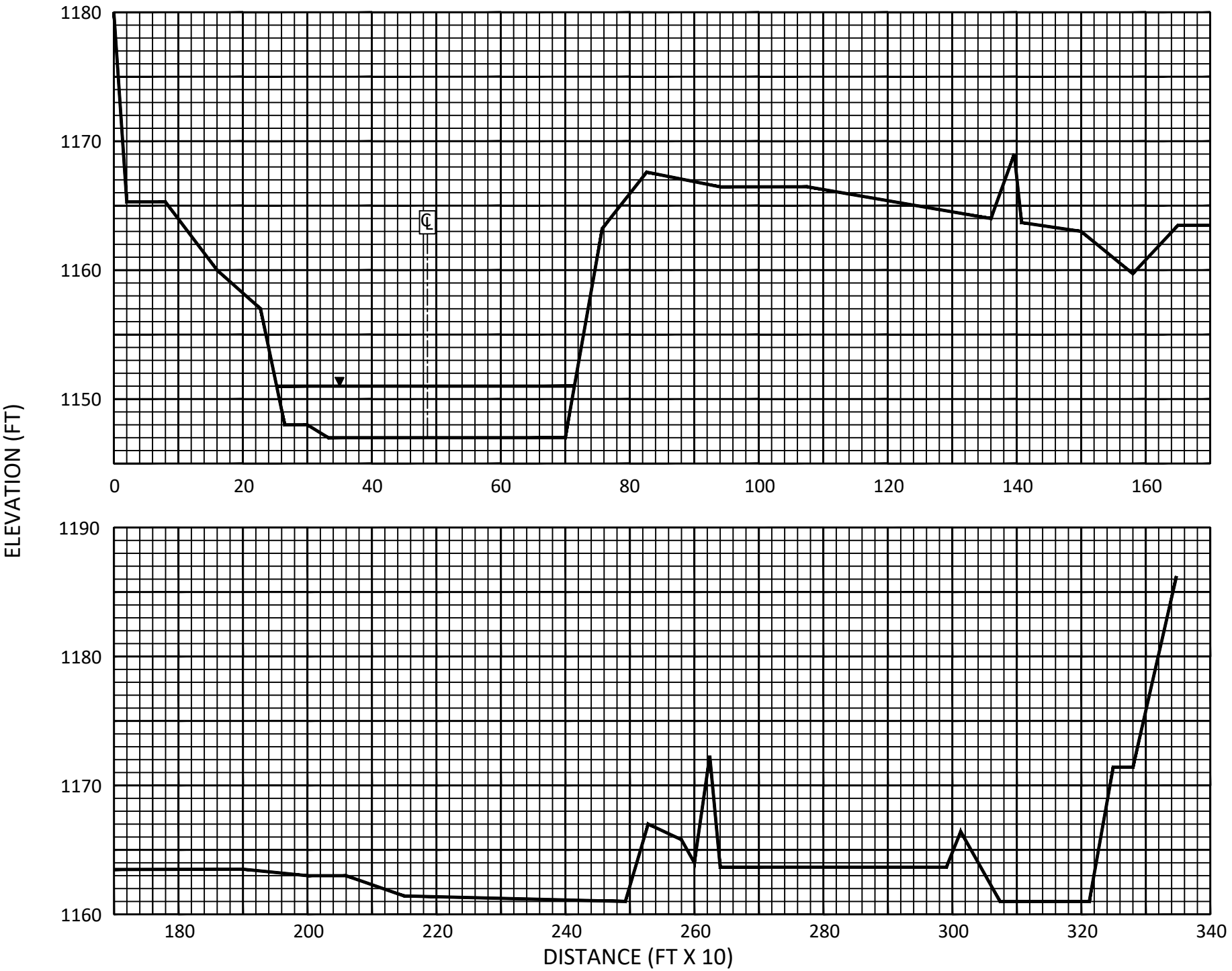
FEDERAL EMERGENCY MANAGEMENT AGENCY

HAWKINS COUNTY, TN
(UNINCORPORATED AREAS)

FLOODWAY DATA

HOLSTON RIVER

HOLSTON RIVER - SECTION 3 MILE 139.08



Note: Figure has been recreated from original permit for clarity.

Subject: FW: BAE HSAAP Subpart X
From: "Williamson, Carrie C" <ccwilliamson@tva.gov>
Date: 6/17/2020, 8:44 PM
To: Reece Williams <rwilliams@t-l.com>, Bill King <bking@t-l.com>

Hello Mr. Williams,

Your May 15 email must have gone to my Spam folder and got deleted by accident. I apologize.

Based on the aerial you provided, the Burn Pan is located at about Holston River Mile 139.1, right descending bank, in Hawkins County, Tennessee. TVA computed flood elevations on this reach of the Holston River in 1987 and the results were incorporated into the 1991-ish Hawkins County Flood Insurance Study. The Watershed IV Alliance updated the Hawkins County FIS in 2006; however, it appears the Holston River H&H modeling was brought forward from the prior study and adjusted to NAVD 1988.

The 100- and 500-year flood elevations at Holston River Mile 139.1 would be 1167.7 and 1170.8 feet, respectively, referenced to NGVD 1929.

I do not have velocity data for this river mile; however, I attached the two HEC-2 input files and you should be able to import them into HEC-RAS and get velocities through RAS. That said, I cannot guarantee that these files contain the current effective model data, but I feel pretty good that they are.

If you plan activity within the 100-year floodplain (that area below elevation 1167.7 NGVD29), you may need a TVA Section 26a permit. Please see TVA's Section 26a web page (https://www.tva.com/environment/shoreline-construction-permits) and TVA's Section 26a Interpretive Rule for more information (https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/default-document-library/site-content/environment/shoreline-construction-26a/federal-register_vol-81-no-169_wednesday-august-31-2016.pdf?sfvrsn=8d976e49_0), and also feel free to contact TVA's Public Lands Information Center at 800-882-5263 for assistance.

Sorry it took so long to respond. Please feel free to contact me if you have further questions or need additional information. Now that I have sent you emails, your emails to me should survive my Spam filter.

Thank you,

Carrie Williamson, P.E., CFM
Program Manager, Flood Risk
River Management

Tennessee Valley Authority
400 W. Summit Hill Drive, Mail Stop 10C-K
Knoxville, TN 37902

(865) 621-0483 (mobile)
(865) 632-2234 (work)
ccwilliamson@tva.gov

From: Reece Williams <rwilliams@t-l.com>
Sent: Wednesday, June 17, 2020 2:41 PM
To: Williamson, Carrie C <ccwilliamson@tva.gov>
Subject: Fwd: BAE HSAAP Subpart X

Carrie,

I've forwarded you the first email that was sent on May 15th. This includes the information that we were told we needed to complete the request for flood elevations and velocities. If you could just provide me with an update on the time frame for fulfilling this request, that would be greatly appreciated.

Thank you!
Reece

-------- Forwarded Message --------
Subject: BAE HSAAP Subpart X
Date: Fri, 15 May 2020 09:36:36 -0400
From: Reece Williams <rwilliams@t-l.com>
To: ccwilliamson@tva.gov
CC: amy.crawford@baesystems.com, laura.peters8.civ@mail.mil, Michele.Gehring@coterie-env.com, Andrew Monk P.E. <amonk@t-l.com>, Bill King <bking@t-l.com>

Good morning Carrie,

Per TVA's request, I've attached a screenshot of the Burn Pan Unit with an outline of the berm system. We have found the location of this unit to be at mile 139 of the Holston River. If you need anything else, please let me know.

Thank you and have a great weekend.
--
Reece Williams, EIT
Design Engineer

THOMPSON & LITTON
100 Fifth Street
Suite 400
Bristol, Tennessee 37620

tel: 423.989.9491
fax: 423.989.9010

Federal HUBZone and Small Business Certified / Virginia SWaM Certified

www.T-L.com

Attachments:

Burn Pan Aerial View.pdf	8.0 MB
Holstus.dat	32.2 KB
holstusf.dat	33.9 KB

Subject: RE: BAE HSAAP Flood Elevations
From: "Williamson, Carrie C" <ccwilliamson@tva.gov>
Date: 6/22/2020, 12:59 PM
To: Reece Williams <rwilliams@t-l.com>

Hello Reece,

Unfortunately, TVA does not have a 100-year flood elevation map or a shapefile for the Burn Pan Unit area.

Here is some additional information.

Hawkins County Flood Insurance Study/Rate Map Cross Section N, Holston River Mile 139.08:

100-year flood elevation, TVA records, NGVD 1929 = 1167.7 ft
100-year flood elevation, 2006 Flood Ins Study/Rate Map, NAVD 1988 = 1167.15 ft

I went to NOAA's conversion tool website (https://vdatum.noaa.gov/vdatumweb/vdatumweb?a=124303620200622) and input the lat/long coordinates at Cross Section N.

Converting NAVD 88 1167.15 to NGVD 1929 returns an elevation of 1167.58 NGVD 1929.
Converting NGVD 29 1167.7 to NAVD 1988 returns an elevation of 1167.3 NAVD 1988.

TVA's elevation as stored in our database is higher than the 2006 Flood Insurance Study by 0.1 foot, which I believe is not significant. I believe the existing elevations and FIRM accurately represent the flood elevations and floodplain at the Burn Pan Unit site and can be used without modification.

If construction activities are planned at this location, please check TVA's website for Section 26a permit requirements, or call TVA's Public Lands Information Center at 800-882-5263 for additional information.

If you have further questions, please feel free to contact me.

Thank you,

Carrie Williamson, P.E., CFM
Program Manager, Flood Risk
River Management

Tennessee Valley Authority
400 W. Summit Hill Drive, Mail Stop 10C-K
Knoxville, TN 37902

(865) 621-0483 (mobile)
(865) 632-2234 (work)
ccwilliamson@tva.gov

From: Reece Williams <rwilliams@t-l.com>
Sent: Friday, June 19, 2020 4:18 PM
To: Williamson, Carrie C <ccwilliamson@tva.gov>
Cc: amy.crawford@baesystems.com; laura.peters8.civ@mail.mil; Michele.Gehring@coterie-env.com; Andrew Monk P.E. <amonk@t-l.com>; Bill King <bking@t-l.com>
Subject: BAE HSAAP Flood Elevations

Good evening Carrie,

We have a request for a 100-year flood elevation map for the "Burn Pan Unit" area of the Holston Army Ammunition plant. Is this something you would be able to provide? If not, would it be possible to generate a shape file or something we could import into a drawing that includes the 100-year flood elevation boundary?

If you need any clarification or have any other questions, please let

Thank you and have a great weekend!
--
Reece Williams, EIT
Design Engineer

THOMPSON & LITTON
100 Fifth Street
Suite 400
Bristol, Tennessee 37620

tel: 423.989.9491
fax: 423.989.9010

Federal HUBZone and Small Business Certified / Virginia SWaM Certified

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Attachments:

Burn Pan Unit FIRMette.pdf 942 KB

Section 3. WASTE CHARACTERISTICS

This section presents a description of the waste handled at the site and is being provided pursuant to the general Part B permitting requirements specified in 40 CFR Part 270 Subpart B, Part 264, and Part 268 and the associated TCRR provisions.

3.1 WASTE GENERATION AND MINIMIZATION

[§270.14(b)(2), §264.73(b)(9), TCRR 0400-12-01-.07(5)(a)1(ii), and TCRR 0400-12-01-.06(5)(d)(ix)]

In general, four different types of waste are treated at the Burn Pan Unit: manufacturing waste, off-specification product waste, laboratory waste, and research and development waste. Each of these waste streams are directly associated with the explosive waste production operations at the HSAAP. In addition, a fifth waste stream, classified as treatment residues, is generated from the operation of the Burn Pan Unit; this waste stream reflects the non-combustible fraction of the wastes that are treated by open burning.

Waste minimization is always a priority due to the inherent inefficiencies represented by excessive waste generation. HSAAP's waste minimization program is designed to help reduce the volume and toxicity of hazardous waste generated at the facility, as practicable from the standpoint of economics and safety. However, waste generation is a standard component in all manufacturing operations. Therefore, to the degree that waste minimization efforts cannot prevent the generation of these wastes, HSAAP will properly characterize the wastes and will provide analysis via process knowledge or laboratory techniques in accordance with the waste analysis plan described herein. Annually, HSAAP will provide a certification as to their waste minimization activities in accordance with 40 CFR §264.73(b) and TCRR 0400-12-01-.06(5)(d)(ix), indicating that a program is in place at HSAAP to reduce the volume and toxicity of hazardous waste generated to the degree determined to be practicable from the standpoint of economics and safety. The certification will also include a statement that treatment by open burning is the only safe and viable method currently available to minimize present and future threats to human health and the environment.

3.2 CHEMICAL AND PHYSICAL ANALYSES OF MANAGED WASTES

[§270.14(b)(2), §264.13(a), TCRR 0400-12-01-.07(5)(a)1(ii), and TCRR 0400-12-01-.06(2)(d)(i)]

As required by 40 CFR §270.14(b)(2), 40 CFR §264.13(a), and the associated TCRR sections, HSAAP conducts periodic chemical and physical analysis of the hazardous waste and hazardous debris handled at the facility. This section provides information on the chemical and physical characteristics of the hazardous wastes treated by open burning at the Burn Pan Unit and provides a sampling and analytical protocol for the wastes that are treated and the residues that are generated from their treatment.

The Burn Pan Unit is used to treat reactive and ignitable hazardous wastes received from the manufacturing area, the magazines, the laboratory, and the research and development facilities. HSAAP uses a combination of process knowledge and analysis to characterize these wastes. The chemical and physical information for these wastes is provided in the following sections. Table 3-1 presents a list of the hazardous waste codes that may be associated with each waste type treated at the Burn Pan Unit. Not all wastes will carry all of the codes specified, but any waste may carry one or more of the codes identified for that group.

TABLE 3-1
HAZARDOUS WASTE CODES TREATED AT BURN PAN UNIT

WASTE	APPLICABLE WASTE CODES	
Manufacturing Waste	D001	Ignitability
	D003	Reactivity
	D007	Toxic for chromium
	D018	Toxic for benzene
	D030	Toxic for 2,4-Dinitrotoluene
	D035	Toxic for methyl ethyl ketone
	K044	Wastewater treatment sludges from manufacturing explosives
	K045	Spent Carbon from treatment of wastewater containing explosives
Off-Specification Product Waste	D001	Ignitability
	D003	Reactivity
	D030	Toxic for 2,4-Dinitrotoluene
Laboratory Waste	D001	Ignitability
	D003	Reactivity
	D018	Toxic for benzene
	D022	Toxic for chloroform
	D030	Toxic for 2,4-Dinitrotoluene
	D035	Toxic for methyl ethyl ketone
	D038	Toxic for pyridine
	K044	Wastewater treatment sludges from manufacturing explosives
	K045	Spent Carbon from treatment of wastewater containing explosives
Research and Development Laboratory and Pilot Plant Waste	D001	Ignitability
	D003	Reactivity
	D018	Toxic for benzene
	D022	Toxic for chloroform
	D030	Toxic for 2,4-Dinitrotoluene
	D035	Toxic for methyl ethyl ketone
	D038	Toxic for pyridine
	K044	Wastewater treatment sludges from manufacturing explosives
	K045	Spent Carbon from treatment of wastewater containing explosives
Treatment Residue	D003	Reactivity [1]

[1] Prior to disposal, HSAAP verifies that the treatment residues are not reactive via the test methods described herein. However, it is possible that some of the residues in the pans may exhibit this characteristic. In this case, the residues are ignited and thermally treated to destroy any remaining energetic material in the pan.

3.2.1 MANUFACTURING WASTE

Hazardous energetic wastes are generated as part of the explosive and explosive formulation manufacturing operations at HSAAP. These include:

- Energetic wastes from filtering operations;
- Energetic wastes from settling tanks;
- Energetic wastes from building clean-ups;
- Off-specification energetic waste product; and
- Energetic wastes from production area concrete sumps referred to as catch basins that collect process wastewater from explosives handling buildings and provide a mechanism for settling out of the explosive solids before the wastewater is sent to the industrial sewer.

These energetic wastes are all hazardous due to their ignitability and/or reactivity and may also be hazardous due to toxicity characteristics and/or listings for specific industry sectors. In addition to the explosive compounds that make the wastes reactive, these energetic wastes contain various production intermediates and non-explosive additives, such as waxes and lecithin, that do not contribute to the hazardous waste classification of the waste streams.

Each of the explosives manufactured at HSAAP are produced to very strict specifications. Information is known about the materials that go into the formulation of the explosives, the solvents that are used in the explosive manufacturing process, and the materials of construction used in the explosive manufacturing equipment. These strict product manufacturing codes allow HSAAP to determine the hazardous waste classification of these wastes using process knowledge. While small deviations in composition and/or physical properties can result in the material being classified as off-specification, most off-specification materials are classified as such due to foreign object debris (FOD), such as glass or rust, which can increase the sensitivity of the explosive material. In addition, materials may be present in the wastes due to leaching of process materials (*e.g.,* chromium from stainless steel piping).

3.2.2 OFF-SPECIFICATION PRODUCT WASTE

Finished explosive products manufactured at HSAAP are stored in earth-covered, concrete magazines. Occasionally, the manufactured explosives stored in these buildings are removed from the explosive product inventory because they are no longer needed, they cannot be reworked, recycled, or sold, or their stabilizer levels have declined such that they present a storage hazard. In these cases, the explosive products are removed from the magazine, classified as a hazardous waste, and treated by open burning at the Burn Pan Unit.

These wastes may be hazardous due to their ignitability, reactivity, or presence of chemicals for which a toxicity characteristic threshold has been established. In all cases the chemical and physical characteristics of the stored explosive formulations are very clearly defined by the

military specifications from which they were manufactured. Therefore, process knowledge can be used to assign the hazardous waste classifications to them. No secondary sampling and analysis is necessary to characterize them for compliance.

3.2.3 LABORATORY WASTES

HSAAP operates a laboratory that conducts quality control testing of formulated product and research for new explosives or process ingredients. In the analysis process, hazardous wastes may be generated as analyses are conducted or samples are discarded. As these samples may originate from end-product formulations or manufacturing wastes and residues, they will carry the same hazardous waste classifications as those wastes. In addition, the wastes may be toxic for one of several solvents used in the analytical processes. Unless a separate contaminant is intentionally introduced at the laboratory, the laboratory wastes will be assigned the same hazardous waste classifications as the generating area. If one of the toxic solvents is included in the extraction, digestion, or analysis of the sample, the code for that solvent will also be included. No additional sampling and analysis will be performed.

3.2.4 RESEARCH AND DEVELOPMENT LABORATORY AND PILOT PLANT WASTE

The HSAAP research and development (R&D) team conducts both laboratory-scale and pilot plant evaluations of manufacturing processes and techniques for existing or new explosive formulations. Energetic waste and catch basin waste from these R&D studies is disposed at the Burn Pan Unit. As the formulations and ingredients used in the R&D evaluations may vary significantly, waste codes are assigned to each waste as it is designated for disposal. These wastes may be hazardous for ignitability, reactivity, or any combination of toxicity codes specified previously. Process knowledge will be used in assigning these codes based upon the tests being conducted and the ingredients used. No separate sampling and analysis of the wastes will be performed.

3.2.5 TREATMENT RESIDUE

Open burning of explosives at the Burn Pan Unit generates small amounts of treatment residue (ash) from the non-combustible components in the treated wastes. The physical form of the treatment residue is distinctly different from the unburned explosives. The treatment residue is a dark, coarse-grained material, consisting primarily of dirt, glass, and inert material that was entrained in the waste explosives.

Each batch of treatment residue is sampled and analyzed prior to it being shipped off-site or sent to the on-site landfill. Based on historical results from this sampling and analysis, the treatment residue does not typically display any ignitability, reactivity, or toxicity characteristics. Should the residue display a reactivity characteristic, it is reburned and retested prior to being removed from the pan and disposed.

3.3 WASTE ANALYSIS PLAN

[§270.14(b)(3), §§264.13(b) and (c), TCRR 0400-12-01-.07(5)(a)(iii), TCRR 0400-12-01-.06(2)(d)(2) and (3)]

A waste analysis plan (WAP) is required pursuant to 40 CFR §270.14(b)(3), 40 CFR §§264.13(b) and (c), and the associated TCRR sections. The WAP specifies the procedures that are used to obtain the required chemical and physical analyses of the hazardous waste. The plan also includes the parameters for which each waste will be analyzed, the methods that will be used to sample and test for the parameters, and the frequency of analyses. Additionally, for those HSAAP-generated materials arriving back at the HSAAP facility from off-site locations, 40 CFR §264.13(c) requires that the WAP describe the procedures used to inspect and, if necessary, analyze the waste shipments to confirm the wastes' identity.

3.3.1 PARAMETERS AND RATIONALE

[§270.14(b)(3), §264.13(b)(1), TCRR 0400-12-01-.07(5)(a)(iii), and TCRR 0400-12-01-.06(2)(d)2(i)]

This section specifies the parameters for which the waste is analyzed to ensure compliance with the applicable requirements and the rationale for determination of those parameters.

3.3.1.1 WASTES TREATED AT THE BURN PAN UNIT

Process knowledge and product specifications are used to obtain the necessary chemical and physical data for the wastes that are treated at the Burn Pan Unit. Each process building has a defined set of documented production processes, which include input and output materials, as well as residuals. This information is used with internal waste manifest records to characterize wastes that are sent to the Burn Pan Unit, whether they originate from the manufacturing processes, the on-site laboratory, the R&D pilot plant, or the magazines.

3.3.1.2 TREATMENT RESIDUES

On an annual basis, the treatment residues are sampled and analyzed for reactivity and the toxicity characteristic for metals and 2,4-dinitrotoluene. Prior to disposal, this analysis is expanded to include analysis for additional underlying hazardous constituents (UHCs) specified in 40 CFR §268.48 and TCRR 0400-12-01-.10(3)(i) to evaluate compliance with the land disposal regulations (LDR). Treatment residues remain in the burn pan until the results of the reactivity test are available. If necessary, the residues may be removed from the plans and placed in a separate, labeled, covered container (*e.g.,* roll-off dumpster covered with plastic) while awaiting on additional sample results prior to disposal. A complete list of the analytical parameters evaluated for the treatment residues is provided in Table 3-2.

TABLE 3-2
PARAMETERS AND RATIONALE FOR TREATMENT RESIDUE ANALYSES

PARAMETERS	RATIONALE
Reactivity	Hazardous waste classification and LDR compliance.
TCLP Arsenic	Hazardous waste classification and LDR compliance.
TCLP Barium	Hazardous waste classification and LDR compliance.
TCLP Cadmium	Hazardous waste classification and LDR compliance.
TCLP Chromium	Hazardous waste classification and LDR compliance.
TCLP Lead	Hazardous waste classification and LDR compliance.
TCLP Mercury	Hazardous waste classification and LDR compliance.
TCLP Selenium	Hazardous waste classification and LDR compliance.
TCLP Silver	Hazardous waste classification and LDR compliance.
TCLP 2,4-Dinitrotoluene	Hazardous waste classification and LDR compliance.
TCLP and Total Semivolatile Organics	LDR compliance.
TCLP and Total Volatile Organics	LDR compliance.

3.3.2 SAMPLING METHODS

[§270.14(b)(3), §264.13(b)(3), TCRR 0400-12-01-.07(5)(a)(iii), and TCRR 0400-12-01-.06(2)(d)2(iii)]

The sampling methods used to collect representative samples of each waste stream are discussed in this section. The methods themselves are described, along with the sample handling practices and preservation techniques.

3.3.2.1 WASTES TREATED AT THE BURN PAN UNIT

In general, the wastes treated at the Burn Pan Unit are not sampled and analyzed. Process knowledge and product specifications are used to characterize them. In the event that it became necessary to sample the wastes due to a unique situation in the generating process, an unexpected treatment residue result, or some other reason, different methods would be employed depending on the physical matrix of the waste material. This would likely involve a combination of either a dipper or scoop technique. The sampling technique can be summarized as follows:

- A dipper/scoop will be used to collect waste from the waste storage container.
- Any free water will be drained from the scoop, and the remaining solid sample will be transfer into a sample basket.
- Where composite samples are created from individual grab samples, the collected grab samples will be combined in the sample basket and will be used to form a 1-pound composite sample.

The resulting composite samples (or individual grab sample if no composite exists) will be placed in one-liter Nalgene bottles and will be sent to the laboratory for analysis.

3.3.2.2 *Treatment Residues*

Treatment residue is sampled prior to the residue being removed from the pan only after the burn pan has cooled to ambient temperature. To collect the residue sample, the following procedure is used:

1. The pan is divided into six to eight equally distanced sampling grids along the length of the pan.
2. From within each grid, approximately three equal grab samples are obtained using a non-sparking scoop that has been cleaned using a laboratory-grade soap or that is a new disposable scoop from stores.
3. The collected grab samples are placed into a non-sparking bowl and are homogenized by mixing with the scoop.
4. The homogenized sample is then placed into new or cleaned sample containers provided by the laboratory. Adequate sample is collected to provide for both the required on-site and off-site analyses that may be required (*e.g.,* TCLP analysis).
5. Each sample is labeled and the appropriate chain-of-custody documentation is completed.

To provide an additional quality assurance and quality control (QA/QC) assessment of the field sampling procedure, a field duplicate is created from the samples collected at a frequency of at least once per year.

3.3.3 Analytical Test Methods

[§270.14(b)(3), §264.13(b)(2), TCRR 0400-12-01-.07(5)(a)(iii), and TCRR 0400-12-01-.06(2)(d)2(ii)]

40 CFR §264.13(b)(2) and TCRR 0400-12-01-.06(2)(d)2(ii) require that the WAP indicate the procedures that will be used to determine each analytical parameter specified in Section 3.3.1. This section specifies the methods that will be used.

3.3.3.1 *Wastes Treated at the Burn Pan Unit*

The wastes treated at the Burn Pan Unit are characterized using process knowledge and product specifications. The primary means of documenting this information is on internal manifests or explosives disposition records (EDRs) used by the production and storage areas. The production areas document their waste information on an Explosives Waste Disposition Record (EWDR), and the magazines document their waste information on an Explosives Removal Request (ERR). Both forms provide general information regarding the waste including:

- The name of the waste material;
- The location from which the waste originated;

- The quantity of waste contained in the shipment; and,
- The reason that the waste material must be destroyed.

In addition, the forms provide detailed information to assist with the tracking and safe handling of the waste, including:

- The type of waste (catch basin, off-specification material, *etc*.);
- The applicable hazardous waste classification codes;
- The generating building number;
- The number of containers in the shipment;
- The gross weight of the shipment; and,
- The net explosive weight (NEW) of the shipment.

Prior to picking up the material from the generating building, the material handler (truck driver) verifies that the shipment description provided on the form matches the material being loaded into the truck. The Burning Ground Attendant documents when the material is received at the Burning Ground (Burn Pan Unit) and records the time and date that the waste explosives were treated.

3.3.3.2 TREATMENT RESIDUES

Analytical methods utilized for the treatment residues are shown in Table 3-3. Analytical procedures are from the latest version of USEPA's *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods* (SW-846) that is incorporated into the contract laboratory's procedures, with the exception of the impact sensitivity test, which is a HSAAP site-specific method. That test is performed according to the latest approved method at HSAAP. The laboratory analyzing the treatment residues will operate in conformance with a QA/QC plan that meets the requirements described in Chapter 1 of SW-846 or the latest TDEC-approved method.

TABLE 3-3
TEST METHODS FOR ANALYSIS OF BURN PAN UNIT TREATMENT RESIDUES

PARAMETER	ANALYSIS TYPE [1]	METHOD NUMBER [2]
Reactivity	Impact Sensitivity Test	Holston ASM P-4
Toxicity characteristics	TCLP preparation	SW-846 Method 1311
TCLP Arsenic	ICP-AES	SW-846 Method 6010B
TCLP Barium	ICP-AES	SW-846 Method 6010B
TCLP Cadmium	ICP-AES	SW-846 Method 6010B
TCLP Chromium	ICP-AES	SW-846 Method 6010B
TCLP Lead	ICP-AES	SW-846 Method 6010B
TCLP Mercury	CVAA	SW-846 Method 7470A
TCLP Selenium	ICP-AES	SW-846 Method 6010B
TCLP Silver	ICP-AES	SW-846 Method 6010B
TCLP 2,4-DNT	GC/MS	SW-846 Method 8270C
TCLP and Total VOCs	GC/MS, GC	SW-846 Method 8260B and 8015 (modified)
TCLP and Total SVOCs	GC/MS	SW-846 Method 8270C

[1] Where SW-846 methods are referenced, the latest update that has been incorporated to the laboratory's procedures will be used.

[2] ICP-AES = Inductively coupled plasma – atomic emission spectrometry. CVAA = Cold Vapor Atomic Absorption. GC/MS = Gas chromatography/mass spectrometry.

3.3.4 FREQUENCY OF ANALYSES

[§270.14(b)(3), §264.13(b)(4), TCRR 0400-12-01-.07(5)(a)(iii), and TCRR 0400-12-01-.06(2)(d)2(iv)]

Pursuant to 40 CFR §264.13(b)(4) and TCRR 0400-12-01-.06(2)(2)2(iv), the facility has established a frequency with which the initial analysis of the waste will be reviewed or repeated to ensure that the analysis is accurate and up to date.

3.3.4.1 WASTES TREATED

Process knowledge is used to determine the chemical and physical characteristics of wastes prior to every treatment. Each waste load sent to the Burn Pan Unit is characterized on the EDR described previously. Hazardous waste classifications are assigned to the waste at that time by the generating area and are reviewed by the Environmental Department or a designated representative. The overall list of applicable waste codes for each type of waste processed at the Burn Pan Unit is evaluated annually or if any of the generating processes change.

3.3.4.2 TREATMENT RESIDUES

Treatment residue from the Burn Pan Unit is analyzed at a minimum once per year to verify the appropriate hazardous waste classifications for the residues. However, analyses may be conducted on a more frequent basis if it is necessary to remove the

residues from the pan or to replace the clay liner in a burn pan. In this case, the materials are also analyzed for additional UHCs specified in 40 CFR §268.48 and TCRR 0400-12-01-.10(3)(i) as necessary to evaluate compliance with the land disposal regulations (LDR). If a complete analysis for disposal is conducted in a given year, this analysis may be used to satisfy the annual analysis for characterization.

3.3.5 ADDITIONAL REQUIREMENTS FOR WASTES GENERATED OFF-SITE

[§270.13(b)(3), §§264.13(a)(3) and (a)(4), §264.13(b)(5), §264.13(c), §264.73(b), TCRR 0400-12-01-.07(5)(a)(iii), TCRR 0400-12-01-.06(2)(d)2(v), and TCRR 0400-12-01-.06(5)(d)2]

Currently, HSAAP treats only wastes that are generated on-site; however, the facility may, under limited circumstances, receive explosive materials that originated in whole or part at the HSAAP back for on-site treatment. Such situations may include returned product that cannot be otherwise disposed, or HSAAP material that was being shipped and that encountered some sort of incident in route to its final destination. In no event, shall any more than 10 percent of the wastes treated in any annual period be received from off-site facilities. This is below the level for classification as a commercial facility as defined in TCRR 0400-12-02-.01(2)(a). If any hazardous wastes are received from off-site and treated at the Burn Pan Unit at HSAAP, the information necessary to comply with the waste analysis requirements described herein and the associated environmental performance standards will be obtained prior to treatment.

3.3.5.1 INFORMATION FROM WASTE GENERATORS

[§270.13(b)(3), §264.13(b)(5), TCRR 0400-12-01-.07(5)(a)1(iii), and TCRR 0400-12-01-.06(2)(d)2(v)]

HSAAP would only accept off-site generated wastes for treatment in the Burn Pan Unit if that material originated from HSAAP, originated from facilities that manufacture the same types of explosives as manufactured by HSAAP, or originated from facilities that use similar manufacturing processes for explosive production. Any waste being received from off-site will be characterized by the generator prior to shipment and this characterization will be reviewed by HSAAP prior to accepting the waste. Generators will be required to use process knowledge, product specifications, or waste analysis to obtain the necessary chemical and physical data on the wastes being shipped to HSAAP. For each new waste stream that is a candidate for management by the facility, the generator will be required to provide a hazardous waste manifest and associated Department of Defense (DoD) shipping papers. On or with the manifest, the generator must include:

- The applicable hazardous waste classifications for the waste stream;
- Information necessary to document conformance with the land disposal restrictions (LDR) as specified in 40 CFR §268.7(a); and,
- Other supporting documentation, including information such as Safety Data Sheets, product ingredients, analytical data, *etc*., that is used to substantiate the information specified on the waste manifest.

3.3.5.2 *INSPECTION AND EVALUATION OF WASTE SHIPMENTS*

[§270.13(b)(3), §§264.13(a)(3) and (a)(4), §264.13(c), TCRR 0400-12-01-.05(a)1(iii), TCRR 0400-12-01-.06(2)(d)1(iii) and 1(iv), and TCRR 0400-12-01-.06(2)(d)3]

Each shipment of wastes received from off-site for treatment at the Burn Pan Unit will be visually examined by the Burning Ground Attendant to assure that items listed on the hazardous waste manifest and the DoD shipping papers are consistent with the items that are received. Such information may include the size, weight, shape and color of the waste and the containers, and/or the markings stamped or stenciled on the shipping container.

Shipments received damaged and/or with a quantity discrepancy will be separated from other lots in storage and placarded with a tag/label. The lot will remain placarded until the discrepancy is resolved. Shipments received without documentation will be rejected or held in a conditionally exempt magazine until the information is obtained.

Should a discrepancy with the waste manifest be identified or should the generator of the waste inform HSAAP that the generating process has changed, HSAAP will work with the generator to reevaluate the waste stream and determine an appropriate waste profile for it pursuant to 40 CFR §264.13(a)(3) and TCRR 0400-12-01-.06(2)(d)1(iii). This reprofiling of the waste stream may include laboratory analysis or process knowledge investigations, depending upon the change and/or discrepancy that occurs.

For re-evaluation resulting from process changes, the re-evaluation process may consist of a paperwork review rather than a new laboratory analysis. Such a review would consist of an evaluation of whether the existing analytical data is accurate and current and confirmation that the information provided is sufficient to properly manage the waste as intended. This will involve comparing the current waste profile to the available results of routine inspection, sampling, and analysis obtained upon receipt of an incoming load of the waste stream. To augment this review, if existing analytical data is not sufficient, the generator may be asked to review the current waste profile, to supply a new profile, and/or submit a sample for analysis.

Should it become necessary to store wastes during the process of this re-evaluation, such storage would take place in conditionally exempt magazines. These magazines meet the DDESB requirements listed in 40 CFR §266.205(a)(1) and TCRR 0400-12-01-.09(13)(f) for exemption from Resource Conservation and Recovery Act (RCRA) requirements. Storage of any rejected wastes would also take place in these conditionally exempt magazines. If it is necessary to store wastes in non-regulated units, HSAAP will notify the Commissioner as required in 40 CFR §266.205(a)(1)(iv) and TCRR 0400-12-01-.09(13)(f)1(i)(IV) and will meet the other requirements listed in 40 CFR §266.205(a)(1) and TCRR 0400-12-01-.09(13)(f) for maintenance of the conditional exemption for storage.

3.3.5.3 WASTE TRACKING AND RECORDKEEPING REQUIREMENTS

[§270.13(b)(3), §264.73(b), TCRR 0400-12-01-.07(5)(a)1(iii), and TCRR 0400-12-01-.06(5)(d)2]

For any off-site wastes that are treated at the Burn Pan Unit, HSAAP will satisfy the requirements of 40 CFR §264.73(b) and TCRR 0400-12-01-.06(5)(d)2 for tracking and documenting the waste movement and treatment within the facility. The specific procedures used by HSAAP to track off-site hazardous waste is described below.

INITIATION OF PROCESS

After a need is identified for HSAAP to accept waste from an off-site facility, contact will be initiated between HSAAP and the generating facility. During this process, information will be shared regarding the type of waste that will be shipped and the logistics with which it will be transported to HSAAP. HSAAP will also confirm their ability to receive the wastes and will make sure that the designated shipment will not exceed the 10 percent off-site waste threshold provided in TCRR 0400-12-02-.01(2)(a).

RECEIPT OF WASTE

Upon arrival of the waste shipment at HSAAP, the safety and security personnel will inspect the vehicle, contents, and shipping paper manifests. If all paperwork is complete and accurate, the transfer vehicle will be escorted to the designated offloading point or transfer point, or a specified explosives magazine storage location. Should discrepancies be identified in the shipping papers, the transfer vehicle will then be held in the suspect yard until any discrepancies are resolved.

Transfer to the Burn Pan Unit will happen via a variety of mechanisms:

- Waste may be offloaded into a storage area temporarily and then loaded into an in-plant truck for transport to the Burn Pan Unit;
- Waste may be offloaded directly into an in-plant truck for transport to the Burn Pan Unit; or,
- If the shipment transfer vehicle is suitable, the waste may be offloaded directly onto burn pans at the Burn Pan Unit.

If significant discrepancies are not resolved within 15 days, a letter indicating the discrepancies and the attempts to resolve them, together with a copy of the manifest or shipping document, will be sent to the regulatory agencies involved.

TREATMENT OF OFF-SITE WASTE

Once the wastes are sent to the Burn Pan Unit for treatment, they will be unloaded from the transport vehicle and placed onto the burn pans. If necessary, a few days are allowed for water to evaporate from energetic material on the burn pans to facilitate a proper open burn. At that point, the off-site site wastes will then treated by open burning per the same procedure as listed for on-site wastes.

GENERATOR AND REGULATORY AGENCY NOTIFICATION

Pursuant to 40 CFR §264.71(a)(2) and TCRR 0400-12-01-.06(5)(b)1(ii), the manifest will be signed, dated, and any discrepancies will be noted upon receipt of the waste. At least one copy of the manifest will immediately be given to the transporter and, within 30 days of delivery, a second copy will be sent to the generator. In addition, within 30 days of delivery, the manifest will be submitted to USEPA and TDEC in accordance with the procedures in 40 CFR §264.71(a)(2)(v) and TCRR 0400-12-01-.06(5)(b)1(ii)(V). Additional internal paperwork will be completed as necessary to document proper treatment of the wastes. All copies of shipping papers and hazardous waste manifests will be maintained for at least five years from the date of receipt.

3.3.6 ADDITIONAL REQUIREMENTS FOR IGNITABLE, REACTIVE, OR INCOMPATIBLE WASTES

[§270.14(b)(3), §264.13(b)(6), §264.17, TCRR 0400-12-01-.07(5)(a)(iii), TCRR 0400-12-01-.06(2)(d)2(vi), and TCRR 0400-12-01-.06(2)(h)]

The wastes treated at the Burn Pan Unit are all reactive wastes and some of them are also ignitable. Therefore, the facility complies with the additional requirements in 40 CFR §264.13(b)(6) and TCRR 0400-12-01-.06(2)(d)2(vi) for facilities managing ignitable, reactive, or incompatible wastes.

The hazards that can be generated from management, handling, and treatment of the wastes treated at the Burn Pan Unit are well documented via the DoD specifications for production of explosive wastes and the safety data sheets for the products that are manufactured at HSAAP. Hazards that have been evaluated include:

- The potential for the wastes to generate extreme heat or pressure, cause fire or explosions, or other violent reactions during storage, transfer, or treatment.
- The potential for the wastes to produce uncontrolled toxic mists, fumes, dusts, or gases in sufficient quantities to threaten human health or the environment during storage, transfer, or treatment;
- The potential for the wastes to damage the structural integrity of the facility; and
- The potential for the wastes, through other like means to threaten human health or the environment.

No further waste analysis is required to evaluate these hazards or determine mitigation plans for them.

3.4 WASTE ANALYSIS PERTAINING TO LAND DISPOSAL RESTRICTIONS

[§270.14(a), §262.10, §264.13, §264.73, §268, TCRR 0400-12-01-.07(5), TCRR 0400-12-01-.03(1)(a), TCRR 0400-12-01-.06(2)(d), TCRR 0400-12-01-.06(5)(d), and TCRR 0400-12-01-.10]

The ultimate disposition of the treatment residue generated from the treatment of hazardous waste at the Burn Pan Unit is the on-site Class II landfill. Therefore, the facility must conduct evaluation of the residues as required by 40 CFR Part 268 and TCRR 0400-12-01-.10 to ensure compliance with the Land Disposal Restrictions (LDR) and to make sure that these restrictions are met by the waste treatment at the Burn Pan Unit. HSAAP conducts analyses of the treatment residues to demonstrate compliance with the standards identified in Table 3-4.

TABLE 3-4
LAND DISPOSAL REQUIREMENTS FOR BURN PAN UNIT TREATMENT RESIDUES

WASTE CODE	WASTE DESCRIPTION AND TREATMENT/ REGULATORY SUBCATEGORY	TREATMENT STANDARD [TCRR 0400-12-01-.10(3)(a)]
D003	Explosives subcategory per TCRR 0400-12-01- .02(3)(d)1(vi), (vii) and (viii)	DEACT and satisfy standards under TCRR 0400-12-01-.10(3)(i)[1]
D018	Wastes that are TC for benzene based on the TCLP result from SW-846 Method 1311	10 mg/kg and meet -.10(3)(i) standards
D035	Wastes that are TC for methyl ethyl ketone based on the TCLP result from SW-846 Method 1311	36 mg/kg and meet -.10(3)(i) standards
D030	Wastes that are TC for 2,4-dinitrotoluene based on the TCLP result from SW-846 Method 1311.	140 mg/kg and meet -.10(3)(i) standards
K044	Wastewater treatment sludges from the manufacturing and processing of explosives	DEACT
K045	Spent carbon from the treatment of wastewater containing explosives	DEACT

Rule 0400-12-01-0.10(3)(i) lists the Universal Treatment Standards for Hazardous Constituents .

In addition, all new waste streams will be reviewed to determine the potential presence of UHCs that could have applicable standards under the LDR. If any UHC may be present, the Burn Pan Unit treatment residue will also be analyzed for that constituent to determine whether the appropriate treatment standard has been met.

3.4.1 WASTE ANALYSIS

[§270.14(a), §264.13(a)(1), §268, TCRR 0400-12-01-.07(5), TCRR 0400-12-01-.06(2)(d)1(i), and TCRR 0400-12-01-.10]

The analytical methods utilized to evaluate LDR compliance for the treatment residues were specified in Section 3.3.2.2.

3.4.2 NOTIFICATION, CERTIFICATION, AND RECORDKEEPING REQUIREMENTS

[§270.14(a), §264.13, §264.73, §268.7, §268.9(d) TCRR 0400-12-01-.07(5), TCRR 0400-12-01-.06(2)(d), TCRR 0400-12-01-.06(5)(d), TCRR 0400-12-.10(1)(g), and TCRR 0400-12-01-.10(1)(i)4]

Because the treatment residues from the Burn Pan Unit are land-disposed, HSAAP satisfies all applicable requirements under 40 CFR §268.7(b) and TCRR 0400-12-01-.10(1)(g)2 for these residues. In addition to the sampling and analysis described above, HSAAP meets all of the associated notification, certification, and recordkeeping requirements as specified in this section.

3.4.2.1 RETENTION OF GENERATOR NOTICES AND CERTIFICATIONS

[§270.14(a), §264.13, §268.7(a), TCRR 0400-12-01-.07(5), TCRR 0400-12-01-.06(2)(d), and TCRR 0400-12-01-.10(1)(g)1]

Currently, the treatment residues are disposed in the on-site Class II landfill. However, should the residues be sent off-site for disposal, any notices and certifications developed by HSAAP in accordance with the LDR will be retained on-site for at least three years from the date that the waste was last sent off-site for disposal in accordance with 40 CFR §268.7(a)(8) and TCRR 0400-12-01-.10(1)(g)1(viii).

3.4.2.2 NOTIFICATION AND CERTIFICATION REQUIREMENTS FOR TREATMENT FACILITIES

[§270.14(a), §264.13, §268.9(d), TCRR 0400-12-01-.07(5), TCRR 0400-12-01-.06(2)(d), and TCRR 0400-12-01-.10(1)(i)4]

Currently, the on-site Class II solid waste disposal facility at HSAAP is used to dispose of the treatment residue generated from treatment at the Burn Pan Unit. To permit on-site land-disposal of these wastes, HSAAP has prepared a one-time notification and certification pursuant to 40 CFR §268.9(d) and TCRR 0400-12-01-.10(1)(i)4 and maintains that notification in the site operating records. This notification specifies:

- The name and address of the nonhazardous solid waste landfill; and,
- A description of the waste as initially generated including applicable waste codes and treatability groups.

Because all UHCs in the residues are destroyed via treatment at the Burn Pan Unit, there is no associated documentation on them included in the notification.

Anytime the generating processes are modified such that the characteristics of the generated waste changes, the LDR notification will be updated. The certification will be signed by a responsible official and state the language found in §268.7(b)(4)(v) and TCRR 0400-12-01-.10(1)(g)2(iv)(V).

Section 4. PROCESS INFORMATION

This section presents information on the design and operation of the HSAAP Burn Pan Unit and is being provided pursuant to the general Part B permitting requirements of 40 CFR Part 270, 40 CFR Part 264, Subpart X and TCRR 0400-12-01-.07(5)(b)9. This section also includes a summary of operating conditions and allowable meteorological conditions during which treatment can be conducted.

The Burn Pan Unit is classified as a RCRA Subpart X Miscellaneous Unit. The Unit includes not only the open burning pans in which treatment occurs, but also the associated clay-lined berms and liner, the stormwater management system, and the Burning Ground Office, which functions as operation control center for the Burn Pan Unit. Descriptions are provided in this section for the burn pans, the burn pan mobile covers, the berms surrounding the burn pans, and the underlying compacted clay layer between the berms. The following design drawings for the Burn Pan Unit are provided in Attachment 4-1:

- Figure 4-1: General Location of the Burn Pan Unit
- Figure 4-2: Layout of the Burn Pan Unit
- Figure 4-3: Burn Pan Unit Details
- Figure 4-4: Burning Pan and Cover Assembly
- Figure 4-5: Typical Berm Design for the Burn Pan Unit

Note that at this time, there are no permitted storage container areas provided within the confines of the Burn Pan Unit or elsewhere at the HSAAP. Manufacturing, lab, and research and development wastes are collected in satellite accumulation areas in the generating buildings and are transferred directly to the Burn Pan Unit for treatment. All of the magazines meet the requirements of 40 CFR §266.205(a)(1) and TCRR 0400-12-01-.09(13)(f) for conditional exemption from RCRA storage requirements for permitted facilities. These facilities also meet the DDESB explosive storage requirements. Should one of the storage magazines be required to store materials after they have been declared a hazardous waste, HSAAP will request a temporary authorization for storage of military munitions in non-regulated areas pursuant to 40 CFR §266.205(a)(iv) and TCRR 0400-12-01-.09(13)(f)(1)(i)(IV).

4.1 BURN PAN UNIT DESCRIPTION

[§270.23(a)(1), §264.600, TCRR 0400-12-.07(9)(i)(I), and TCRR 0400-12-.06(27)]

The thermal treatment of hazardous waste explosives is performed in four burn pans located at the Burn Pan Unit. Figure 4-1 provides information on the general location of the Burn Pan Unit. The layout and engineering design details of each of the burn pans and the associated covers are shown in Figures 4-2 through 4-4. Operations at the Burn Pan Unit are directed from the Burning Ground Office, which is located at the East end of the burning ground as shown on Figure 4-2.

As shown in Figure 4-4, each 1-foot, 5/8-inch deep burn pan is constructed of 3/8-inch-thick, seam-welded steel and is 5 feet, 1 inch wide by 20 feet 1-5/8 inches long. All four burn pans are identical in construction with beveled sides and gussets for support. Each burn pan is lined with 8 to 9.5 inches of compacted clay. The primary function of the clay is to reflect and dissipate heat generated during each burn, minimizing structural damage to the burning pans. The clay also serves as a containment layer, minimizing water leakage or spills from the pan.

Each burn pan is supported on 7-inch-wide by 16-inch-high I-beams conforming to the American Society for Testing and Materials (ASTM) A36 specifications. The support structure is designed to elevate the bottom of each pan approximately one-foot above the gravel surface. The pans are placed on top of concrete parking bumpers to permit visual inspection of the sides and bottom of the pans.

HSAAP utilizes mobile covers to protect each pan. The details of each cover are shown in Figure 4-4. These covers are used to prevent rainfall from collecting in the burn pan and to prevent wind dispersion of treatment residue. The burn pan covers are manufactured with an aluminum super-structure and are mounted on four wheels. The roof of each structure has a 2-2/3-inch pitch from side to side to shed water. The covers can be moved by one person as necessary, whether to perform a burn, cover the residues for the evening, or protect the pans from inclement weather. To prevent the mobile covers from being blown around, the covers can be secured to the burn pans.

The burn pans themselves are located within an area that is approximately 250 feet wide by 325 feet long as shown on Figure 4-3. The pans are completely surrounded by a berm system that serves to protect the area from a 100-year flood event as described in Section 2.3.3. Figure 4-5 provides information on the general construction of these berms. Both the berms and the ground that underlies the burn pans are lined with a compacted clay liner to prevent water movement through them. Any water that does collect in the bermed area is removed through a stormwater system that discharges to the site's industrial wastewater treatment plant.

4.2 BURN PAN UNIT OPERATIONS

[§270.23(a)(2), §264.600, TCRR 0400-12-.07(5)(b)(9)(i)(II), and TCRR 0400-12-.06(27)]

The treatment of hazardous explosive wastes at the Burn Pan Unit can take place only under certain meteorological conditions between the hours of 1200 and 1600, Monday through Friday. Treatment is not allowed to take place during meteorological conditions that would inhibit burning (*e.g.*, precipitation), would present a safety hazard from premature ignition (*e.g.,* lightning), or that would prevent efficient dispersion of the combustion products. Open burning is not conducted during the following conditions:

- Electrical storms or thunderstorms
- Wind speeds over 15 miles per hour (mph)
- Visibility less than one mile

- Other meteorological conditions (*i.e.,* air quality alerts, ozone action days, or temperature inversions) that could limit the ability to safely treat the wastes.

Verification of proper meteorological conditions is included as part of the pre-burn inspections conducted by the operators described in Section 6.2.

Once wastes have been designated for a burn and transferred to the Burn Pan Unit, the operators place a waterproof plastic sheet into the burn pan and then unload the explosive waste into the pan. This waterproof plastic sheet prevents any liquid present in the energetic wastes (*e.g.,* water used to make the wastes safe for handling) from getting onto the clay liner of the burn pan. After being loaded into the pan, the plastic bags that contain the wastes are cut open, and the material is spread out in a continuous train to a maximum depth of 3 inches inside the burn pan. Up to 1,500 pounds of waste are placed on a pan at any given time, and not more than 5,000 pounds of waste can be processed on any combination of pans during any given burn. The wetter reactive hazardous wastes are placed on the bottom of the waste load, and the drier explosives are placed on the top to aid in igniting the explosives and to enhance the combustion process. Waste will not be placed in a burn pan that has not been provided ample time between burns to cool or that has not been wet down and inspected to ensure that it has cooled sufficiently.

In the event that the unloaded waste is too wet to burn, the wastes are allowed to sit in the pan during daylight hours to dry. In the evening or during precipitation events, the pan is covered with a roll-away mobile cover to protect from rainfall infiltration. Depending on the moisture content and weather conditions, the material may require several days to dry.

Prior to igniting the waste, the mobile covers are rolled at least 20 feet away from the pan(s) to protect them from the heat that radiates from the burn operation. After confirming that no unauthorized personnel are present in the Burn Pan Unit, the operators place an excelsior streamer into the waste and attach an approved ignition device on the free end of the excelsior stream that extends away from the pan. After securing the area, the operators move to the remote ignition area located within the Burning Ground Office. The ignition system includes two locked metal boxes with individual ignition circuits. To activate the ignition system, one person at each box must depress and hold a manual switch. Ignition normally takes approximately three minutes.

Once the pan is ignited, the manual switches are released and the burn is monitored by closed-circuit television from the Burning Ground Office. No person is allowed to enter the active burn pan area until at least 30 minutes after there is no visible flame observed on the closed-circuit television. If ignition is not successful, personnel wait 30 minutes prior to entering the Burn Pan Unit to examine the cause of an ignition failure.

After each treatment event, the area surrounding the burn pans will be inspected for the presence of ejected material as detailed in Section 6.2. All ejected material will be collected using non-sparking spill cleanup equipment and will be placed back into the burn pan for treatment in the next burn. Following

this inspection, the Explosives Waste Log is updated to document key parameters related to the burn event, including:

- The date of the burn;
- The total number of pounds burned;
- The hazardous waste classification and treatment codes associated with the treated waste;
- The time ignition was achieved and the length of burning time; and,
- The names of the operator and attendant that supervised the burn.

Copies of the completed Explosive Waste Log and the EDR for the treated wastes, as well as any other manifest records, are maintained as required in the facility operating log.

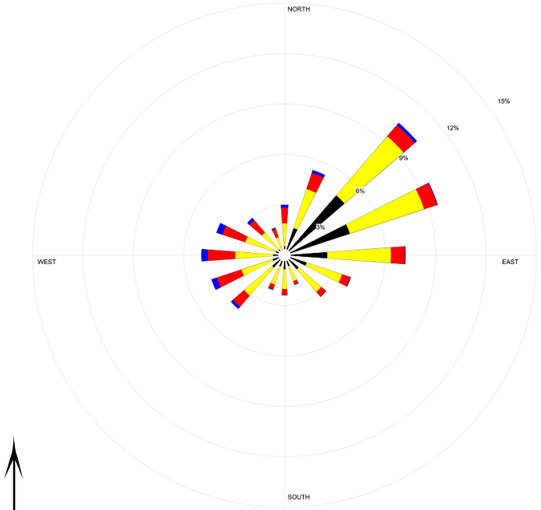
Attachment 4-1: DRAWINGS OF THE BURN PAN UNIT

Legend

- Approximate Property Boundary
- Burn Pan Unit
- 1000-Foot Radius

WIND SPEED (m/s)

- >11.06
- 8.49 - 11.06
- 5.40 - 8.49
- 3.34 - 5.40
- 1.80 - 3.34
- 0.51 - 1.80



SOURCE OF WINDSPEED DATA IS THE
STATION #13877 - BRISTOL/TRI CITY AIRPORT, TN,

0 1,000 2,000 FEET

1 " = 2,000 '
1:24,000

HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TENNESSEE

FIGURE 4-1
GENERAL LOCATION OF THE BURN PAN UNIT

DRAWN BY:	SSW	SCALE:		PROJ. NO.	RCRA 2020
CHECKED BY:	M GEHRING		AS NOTED	FILE NO.	Fig 2_1 Location Map.mxd
APPROVED BY:	M GEHRING	DATE PRINTED:			
DATE:	August 2020		*8/25/2020*		

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J:\Prj\Holston Army Ammunition\RCRA 2020\Fig 2_1 Location Map.mxd
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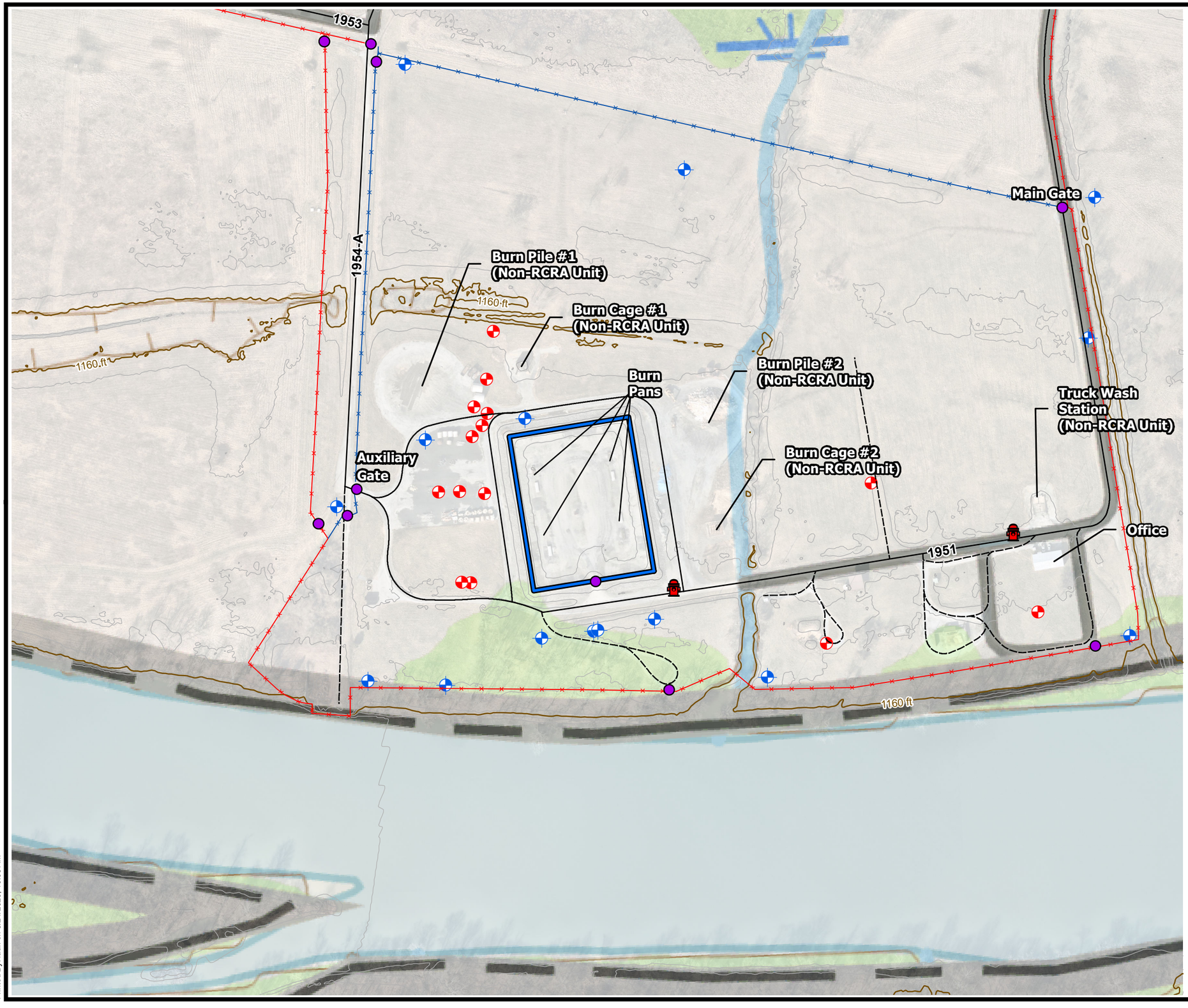
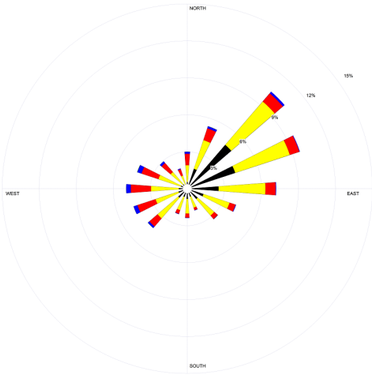


Legend

- Burn Pan Unit
- Gates
- Interior Fence
- Perimeter Fence
- Primary Road
- Secondary Road
- Fire Hydrant
- Groundwater Monitoring Well (Open)
- Groundwater Monitoring Well (Closed)

WIND SPEED (m/s)

- >11.06
- 8.49 - 11.06
- 5.40 - 8.49
- 3.34 - 5.40
- 1.80 - 3.34
- 0.51 - 1.80



N

0 100 200
FEET

1 " = 200 '
1:2,400

HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TENNESSEE

FIGURE 4-2
LAYOUT OF THE BURN PAN UNIT

DRAWN BY:	SSW	SCALE:		PROJ. NO.	RCRA 2020
CHECKED BY:	M GEHRING		AS NOTED	FILENO.	Fig 2_4 Topographic Map 1_200.mxd
APPROVED BY:	M GEHRING	DATE PRINTED:			
DATE:	August 2020		*8/24/2020*		

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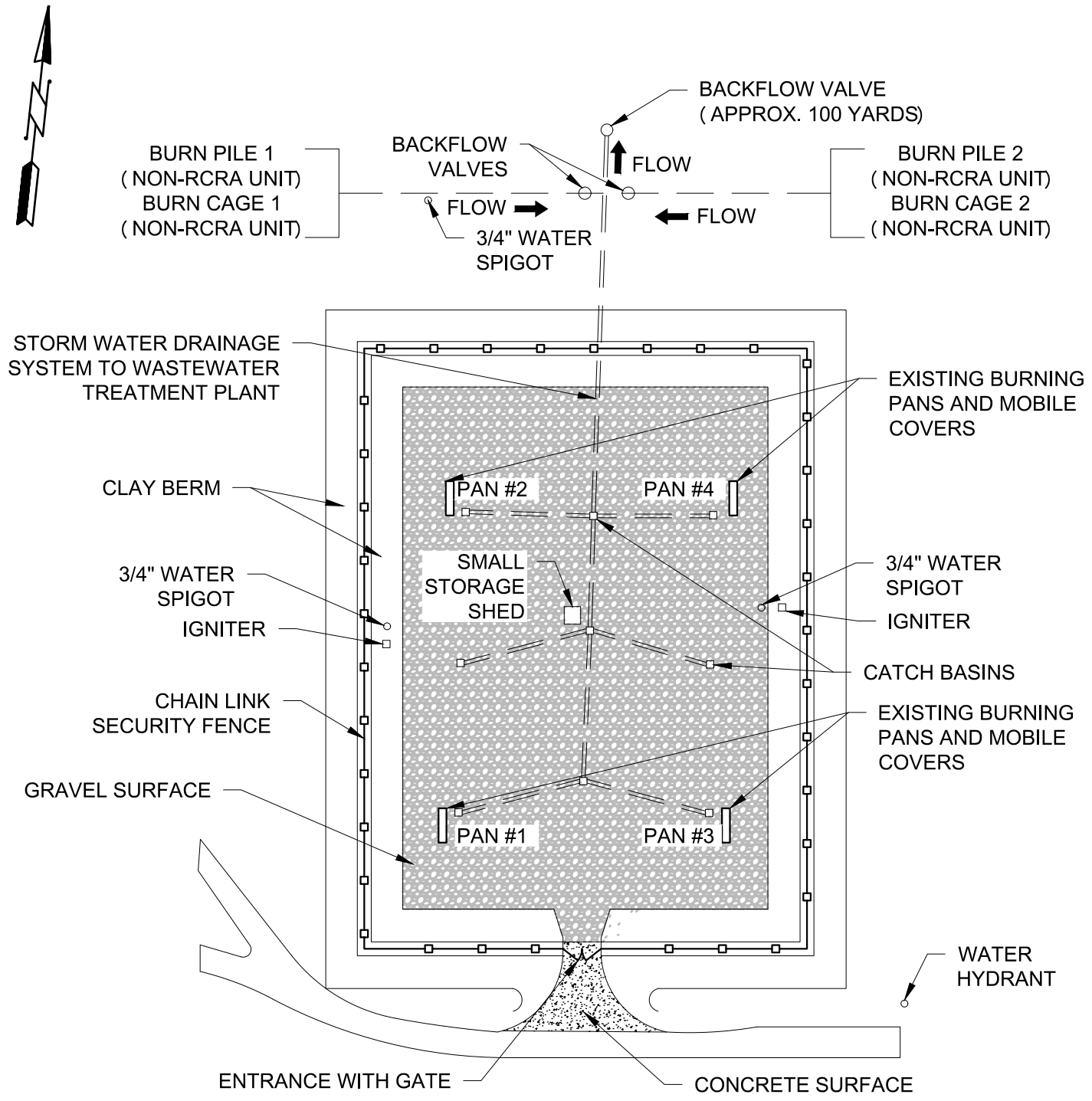
J:\Prj\Holston Army Ammunition\RCRA 2020\Fig 2_4 Topographic Map 1_200.mxd
Printed By: lauri on 8/24/2020, 10:08 AM



GRAPHIC SCALE

80 0 40 80 160

(IN FEET)

1" = 80'

SOURCE: COPY FROM ORIGINAL EXHIBIT

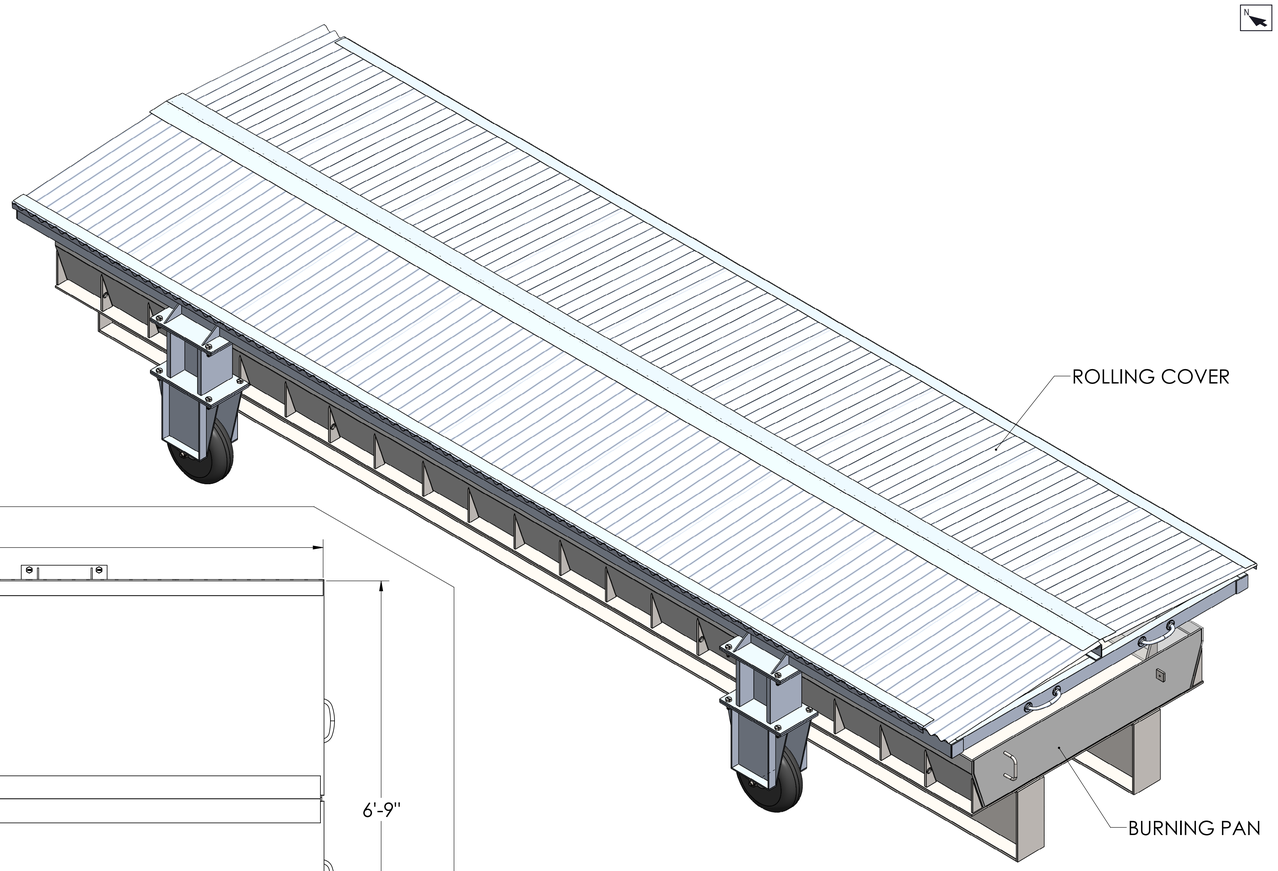
PROJECT NO.	DATE
15242	MAY 2020
FILE NAME	
HOLSTON	

HOLSTON ARMY AMMUNITION PLANT
SUBPART X PERMIT

BURN PAN UNIT DETAILS

THOMPSON & LITTON

FIGURE
4-3



NW ISOMETRIC VIEW
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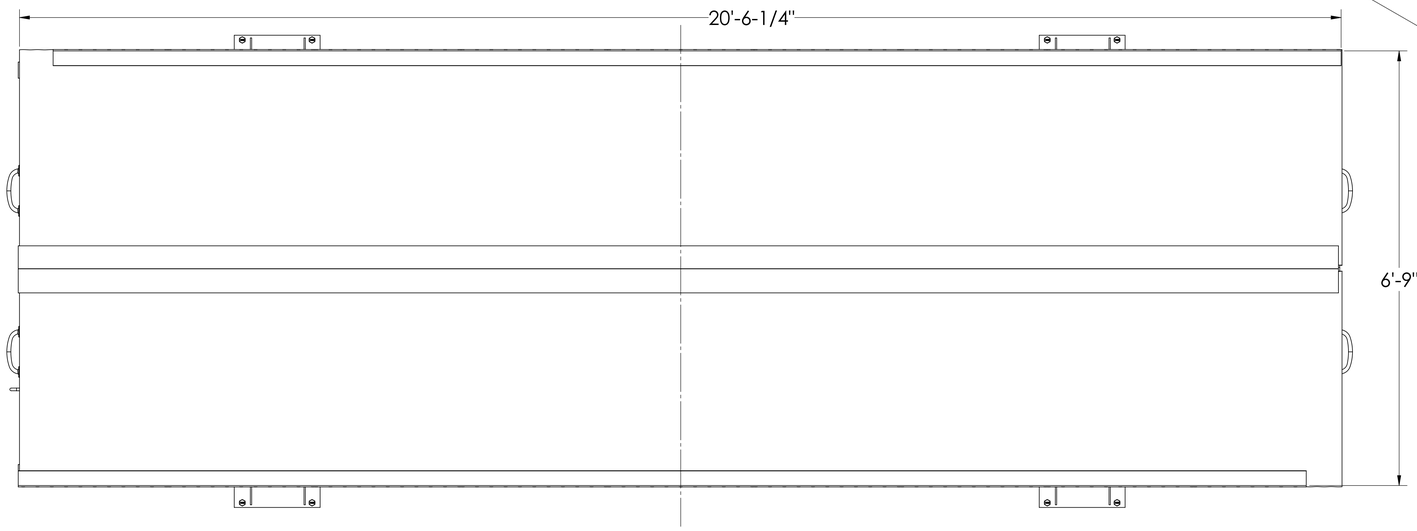
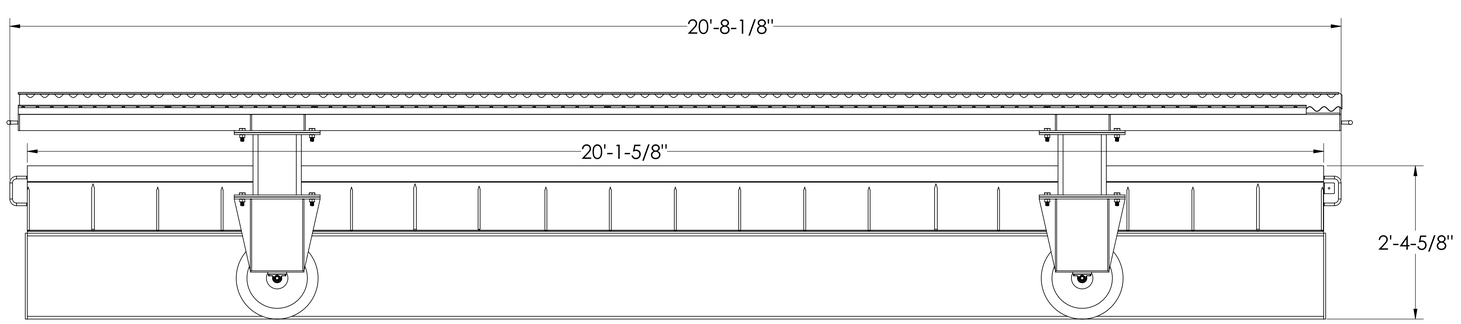


TOP
SCALE: 1" = 1FT.



SIDE VIEW
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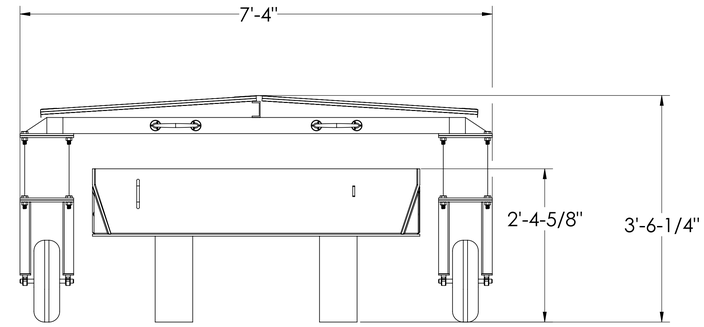


FRONT VIEW
SCALE: 1" = 1 FT.

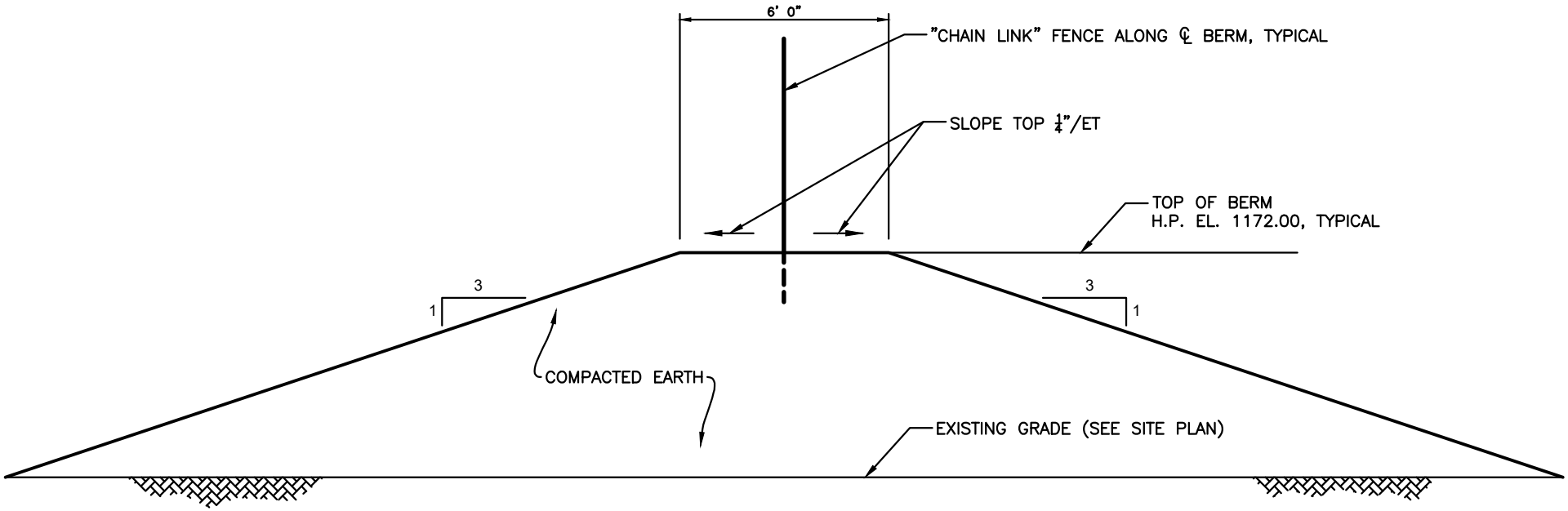
						HSAAP ACO:		ENGINEERING DIRECTOR: DEREK WOLFE	9/27/2019
						HSAAP ENGR:		ENGINEERING MANAGER: DAVID SUTHERLAND	9/27/2019
						HSAAP SAFETY:		MECHANICAL ENGINEER: TYLER ZIMMERMAN	9/27/2019
								ENGINEERING OPERATIONS MANAGER: MICHELLE BAILEY	9/27/2019
								DESIGN: STEPHEN GARRITY	9/27/2019
						OSI SAFETY:		DRAWN: STEPHEN GARRITY	9/27/2019
						APPROVED	DATE	APPROVED	DATE
REFERENCE DRAWINGS (7651-)		REV	JOB	DESCRIPTION	DATE APPROVED	0 DRAWING REVISION			

BAE SYSTEMS

ORDNANCE SYSTEMS INC.
HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TENNESSEE

FIGURE 4-4
BURNING PAN AND ASSEMBLY

BLDG. NO.: PLANT	SCALE: AS NOTED	DRAWING NUMBER	REV.
AREA: B	FRACTIONAL TOL.: +/- 1/8"	7651-1089.0013	1
CLASS: SE, PE	DECIMAL TOL.: +/- .125"		
DO NOT SCALE	REVISE ON CADD ONLY		



N.T.S.

HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TENNESSEE

FIGURE 4-5
TYPICAL BERM SECTION AT BURNING PAN AREA

DRAWN BY: SSW	SCALE:	PROJ. RCRA 2020
CHECKED BY: M GEHRING	See bar scale	FILE NO. Typical Berm Section.dwg
APPROVED BY: M GEHRING	DATE PRINTED:	
DATE: August 18, 2020		

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King of Prussia, PA 19406

Section 5. GROUNDWATER MONITORING

[§270.14(c), §264.601(a), TCRR 0400-12-01-.07-(5)(c), and TCRR 0400-12-01-.06(27)(b)1]

40 CFR §264.601(a) and TCRR 0400-12-01-.06(27)(b)1 require the permittee to prevent any release that may have adverse effects on human health or environment due to migration of waste constituents in the groundwater or subsurface environment. Compliance with this requirement is often demonstrated via groundwater monitoring. However, HSAAP submitted a request to waive this monitoring requirement under TCRR 0400-12-01-.06(1)(d). In accordance with this provision, any requirement may be waived by the Commissioner if the owner or operator can demonstrate to the satisfaction of the Commissioner that the standard is inapplicable, inappropriate, or unnecessary to his facility, or that it is equaled in effect by other procedures or mechanisms utilized at the facility.

To support the waiver request, HSAAP conducted a two-year groundwater monitoring study in and around the Burn Pan Unit. That study demonstrated that no impact had been made on the groundwater. Furthermore, HSAAP documented that the unit's proximity to the Holston River, the thickness of the residuum to the groundwater, and the tight clays in the underlying soil would impede the vertical movement of any contamination into and from the groundwater in the future. After reviewing this request and considering the design and operating practices of the Burn Pan Unit, TDEC concluded that the waiver request was justified and determined that no future groundwater monitoring would be included as part of this Permit. A copy of the approval letter provided with renewal of the waiver in 2016 is provided in Attachment 5-1.

As a condition the waiver, TDEC instituted the following requirements for the Burn Pan Unit:

- HSAAP was required to institute a soil monitoring program at the Burn Pan Unit to detect any contamination in the compacted clay liner that underlies the Unit; and,
- HSAAP was directed to periodically review the results from the adjacent, site-wide groundwater monitoring well installed under the facility's Corrective Action Permit, to provide preliminary indication of any potential issues.

Note that in regard to the Corrective Action monitoring well, contamination found during the course of that monitoring well's operation is not necessarily indicative of leaching of contaminants from the Burn Pan Unit. However, it should serve as an initiation step for review of the site operations, other potential sources of contamination, and comparison with soil monitoring results, to help evaluate if the Burn Pan Unit is further impacting the environment.

HSAAP requests that this waiver be continued for the duration of the renewed permit period. However, HSAAP is requesting to change the required sampling frequency to annually instead of semi-annually based on the historical results obtained thus far under the soil sampling program. With the exception of the change of the sampling period, HSAAP will continue to meet all of the requirements stipulated by TDEC as a condition of the waiver and will provide the results of the soil monitoring and Corrective

Action activities to TDEC as required. Should this waiver request again be approved, soil sampling will be conducted as follows:

- Annually, HSAAP will collect soil samples from the surface of the compacted clay liner underlying the Burn Pan Unit following the soil sampling plan provided in Attachment 5-2.
- HSAAP will analyze the collected samples for RDX and HMX, the primary explosive components in the wastes treated at the Burn Pan Unit.
- Should any of the key explosive constituents be detected in these surface samples above the action level for soils at industrial sites provided by USEPA's current *Regional Screening Levels for Chemical Contaminants at Superfund Sites*, HSAAP will collect samples from the subsurface layer of the compacted clay liner.
- If contamination is noted in either the surface or subsurface levels of the liner, the sampling frequency will be increased to semiannually and additional samples will be collected from the native soil layers as discussed in Attachment 5-2.
- Once two consecutive semiannual samples are found to have no contamination present above the action levels, the sampling will revert to an annual frequency.

Provided each of these requirements are satisfied, no additional sampling or analysis will be performed to demonstrate compliance with the groundwater monitoring requirements provided in 40 CFR §270.14(c) and TCRR 0400-12-01-.07-(5)(c).

Attachment 5-1: APPROVAL OF GROUNDWATER MONITORING WAIVER

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
Division of Solid Waste Management
William R. Snodgrass Tennessee Tower
312 Rosa L. Parks Avenue, 14th Floor
Nashville, Tennessee 37243

January 29, 2016

CERTIFIED MAIL # 7015 0640 0003 9613 0209
RETURN RECEIPT REQUESTED

Mr. Robert E. Winstead, Director, EHSS
BAE SYSTEMS Ordnance Systems, Inc.
4509 West Stone Drive
Kingsport, TN 37660

RE: Approval for Groundwater Monitoring Waiver Renewal
Holston Army Ammunition Plant (HSAAP)
EPA ID Number TN5210020421
Hazardous Waste Permit Number TNHW-148

Dear Mr. Winstead,

The Division has reviewed your request to renew the five-year groundwater monitoring waiver that was granted on March 31, 2011 as part of the issuance of permit TNHW-148. In lieu of groundwater monitoring for the facility's hazardous waste open burn unit, the permit requires HSAAP to visually monitor and cleanup all materials expelled after each burn event. The facility must then follow-up with semi-annual soil sampling around the burn pans and removal of any contaminated media.

Based on review of the information submitted as part of the waiver request application and the on-site meeting on December 15, 2015, the Division approves the renewal of the groundwater monitoring waiver. The groundwater monitoring waiver is granted pursuant to the facility's procedures meeting the environmental performance standards of Tennessee Rule 0400-12-01-.06(27)(b) and in accordance with the waiver authority in Rule 0400-12-01-.06(6)(a)2. The waiver will expire in conjunction with permit TNHW-148.

If you have any questions or comments, please contact Mr. Clayton Bullington at (615) 532-0859 or by email to clayton.bullington@tn.gov.

Sincerely,

Patrick J. Flood, PE
Director

cc: William Krispin, Manager, Hazardous Waste Program
Roger Donovan, Hazardous Waste Permitting
Al Frakes, Hazardous Waste Permitting
Jamie Burroughs, Manager, Hazardous Waste Permitting
Rick Whitson, Manager, Johnson City Environmental Field Office
Mike Norman, Chief, RCRA Branch, EPA, Region 4
Hazardous Waste File 20

Attachment 5-2: SOIL SAMPLING PLAN

BAE SYSTEMS

HOLSTON ARMY AMMUNITION PLANT

KINGSPORT, TENNESSEE

ATTACHMENT 5-2
SOIL SAMPLING PLAN
FOR THE HSAAP BURN PAN UNIT

SEPTEMBER 2020

Coterie ENVIRONMENTAL

1150 FIRST AVENUE, SUITE 501 • KING OF PRUSSIA, PA 19406

610.945.1777 • WWW.COTERIE-ENV.COM

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1.0 INTRODUCTION

The Holston Army Ammunition Plant (HSAAP) treats explosive wastes on-site via open burning at the Burn Pan Unit. The major components of these explosive wastes include cyclotrimethylene trinitramine (RDX) and cyclotetramethylene tetranitramine (HMX). During the treatment process, the potential exists for explosive materials to be ejected from the burn pan and to land on the ground surface surrounding the burn pans. If this were to occur, these deposited materials could potentially infiltrate into the groundwater underlying the Burn Pan Unit. To prevent material from infiltrating through the native soil into the groundwater, a six to eight-inch compacted clay liner was applied over the native soil surface that underlies the unit. This liner serves as an impediment to groundwater infiltration.

In order to provide early warning of potential contamination issues, HSAAP has instituted a robust soil sampling program (SSP) for the Burn Pan Unit. This SSP is designed to identify if explosive contaminants have been deposited onto the clay liner and to allow removal and replacement of those portions of the liner that have been contaminated prior to those contaminants infiltrating through the liner to the underlying soil and groundwater. This plan provides a description of the sampling program design, the locations that are sampled, the sampling procedures that are used, the quality assurance and quality control (QA/QC) measures that are employed, and the documentation that is provided to properly log the sampling event, the transport of samples, and the review and reporting of sample results.

2.0 SOIL SAMPLING PROGRAM DESIGN

As stated previously, this SSP has been designed to provide early detection of possible soil contamination resulting from operation of the Burn Pan Unit. This program has been employed to satisfy the conditions of a groundwater monitoring waiver granted under TCRR 0400-12-01-.06(1)(d).

The objective of the SSP is to provide an "early warning" of potential contamination of the soil that could, eventually, infiltrate to the underlying groundwater. This objective will be attained by conducting annual sampling of the compacted clay liner that underlies the Burn Pan Unit. Collected samples will be analyzed for the two primary components in the HSAAP explosive formulations: RDX and HMX. "Contamination" of the sampled layer will be defined as any RDX or HMX concentration exceeding the current USEPA screening levels for industrial soil specified in *Regional Screening Levels for Chemical Contaminants at Superfund Sites* and available at the following website maintained by USEPA: https://www.epa.gov/risk/regional-screening-levels-rsls.

The sampling program will be instituted in the phases shown in Figure 2-1 to allow HSAAP to first identify any potential contamination and then to secondly determine the horizontal and vertical extent of any contamination that is identified. Once the extent of contamination is determined, the contaminated liner and soil segments will be removed and replaced with clean fill to prevent it from contaminating the underlying native soil and groundwater.

2.1 PHASE I SAMPLING

Phase I is the initial sampling phase for all of the annual soil sampling activities. In Phase I, surface samples will be collected from the surface of the compacted clay liner. Surface samples are defined as those collected within the first two inches of the liner's surface. These samples will be analyzed for RDX and HMX. If analysis indicates that the surface of the compacted clay liner is not contaminated, then no deeper sampling will be conducted. However, if the results from the surface samples indicate the surface of the compacted clay liner is contaminated, then Phase II sampling will be conducted.

2.2 PHASE II SAMPLING

Phase II sampling is conducted when and where the initial surface sampling indicates that the surface of the compacted clay liner has been contaminated. In Phase II, subsurface samples of the compacted clay liner will be collected and analyzed for RDX and HMX. The liner's subsurface area is defined as that portion of the liner located 4 to 6 inches below the liner's surface. If no explosive contamination is found in these samples, no further vertical sampling will be conducted. However, if the results from the subsurface samples indicate that this region has been contaminated, then Phase III sampling will be conducted.

In addition to the subsurface sampling, Phase II will also include additional surface level sampling extending out from the initial detection in all four directions in zero to six-foot horizontal increments. Should contamination be detected in this extended horizontal area, another round of Phase II sampling will be initiated. This sampling will include subsurface sampling under the newly identified surface contamination and horizontal surface sampling extending out from the contaminated area.

2.3 PHASE III SAMPLING

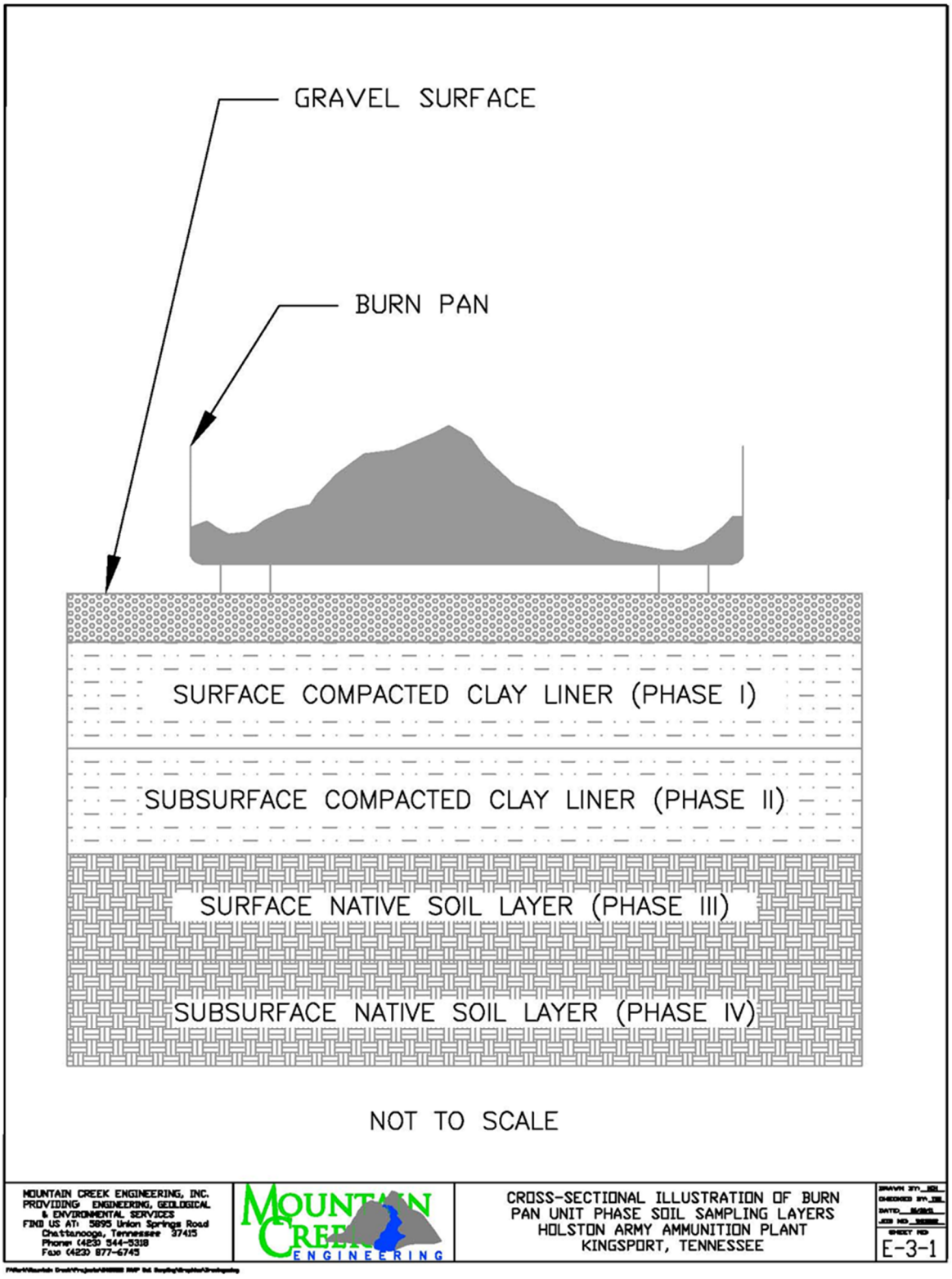
If the results of the subsurface sampling conducted in Phase II indicate that the contamination has extended into the subsurface layer, then Phase III sampling will be initiated. In Phase III, the initial layer of native soils that underlie the compacted clay liner will be sampled. This initial soil layer encompasses that soil layer located in the first zero to 2 inches of native soil. If no explosive contamination is found in these samples, no further vertical sampling will be conducted. However, if the results from the initial soil sampling indicate that this region has been contaminated, then Phase IV sampling will be conducted.

In addition to the native soil surface sampling, Phase III will also include additional subsurface sampling extending out from the detections in Phase II in all four directions in zero to six-foot horizontal increments. Should contamination be detected in this extended horizontal area, another round of Phase III sampling will be initiated. This sampling will include native soil sampling under the newly identified subsurface contamination and horizontal subsurface sampling extending out from the contaminated area.

2.4 PHASE IV SAMPLING

If the initial native soil sampling conducted in Phase III shows evidence of contamination, then Phase IV of the sampling effort will be initiated. In Phase IV, the native soil's subsurface will be sampled. The subsurface level of the native soil is defined as that portion of the soil extending from two inches to one foot below the soil's surface. Sampling will continue in increments of one-foot until no further contamination is found or until the groundwater table is reached. Should the later condition exist, HSAAP will enter discussions with the Tennessee Department of Environment and Conservation (TDEC) on how to proceed. Phase IV will also include horizontal increment sampling similar to that described for Phases II and III, extending out from the contaminated native soil surface locations in all four directions in zero to six-foot horizontal increments.

FIGURE 2-1
CROSS SECTIONAL ILLUSTRATION OF BURN PAN UNIT PHASED SAMPLING APPROACH



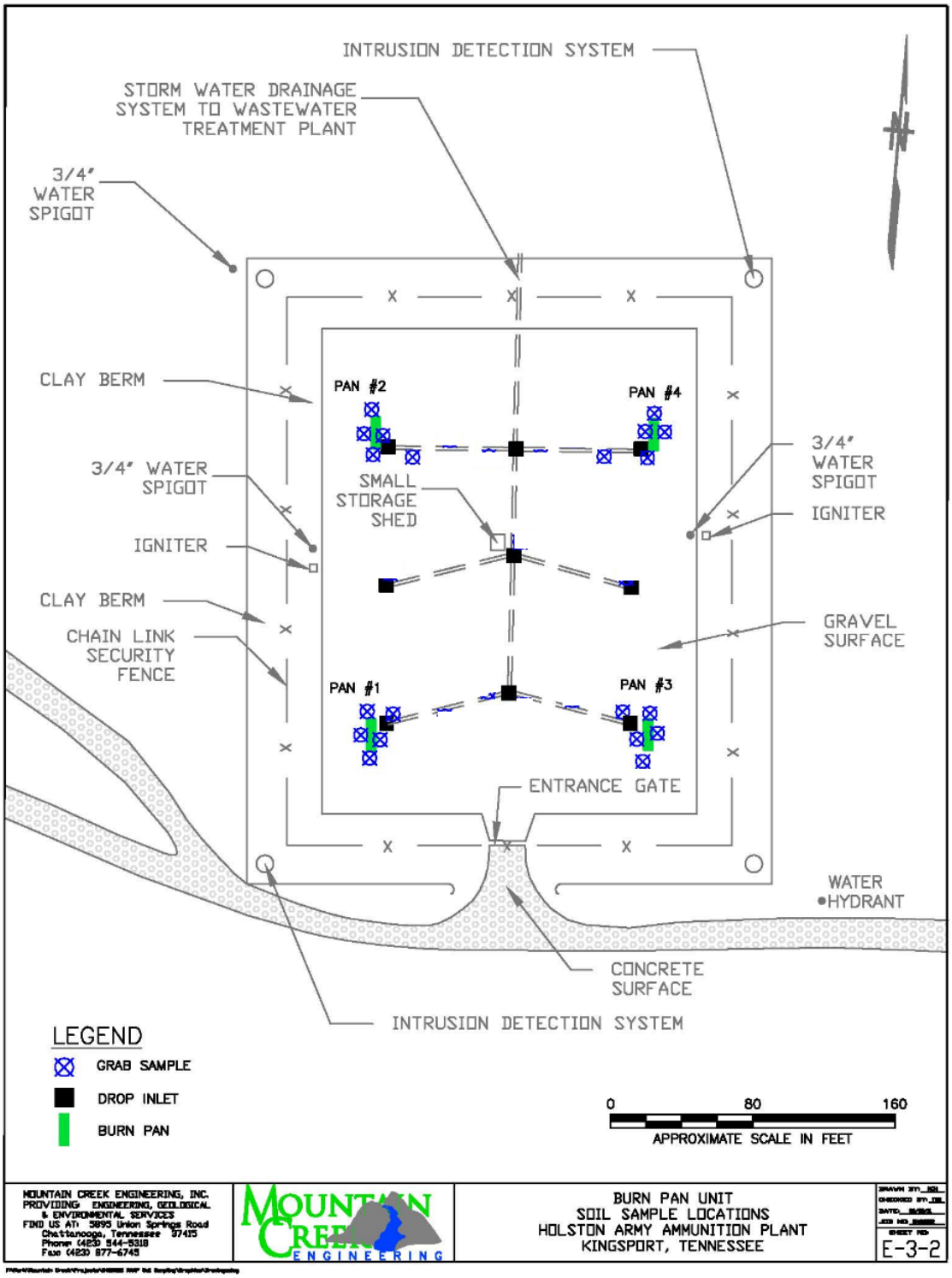
3.0 SAMPLING LOCATIONS

The phased sampling approach described in Section 2 will be implemented at the locations throughout the Burn Pan Unit shown in Figure 3-1. A total of 20 locations will be sampled during each annual sampling event as follows:

- 16 grab samples will be taken from around each of the four burn pans, with four samples being collected around each burn pan.
- 4 grab samples will be collected along the stormwater drainage sewer inlet for each burn pan.

Each of the sample locations will be shifted slightly during subsequent sampling events so that the same exact location is not sampled repeatedly.

FIGURE 3-1
BURN PAN UNIT SOIL SAMPLE LOCATIONS



4.0 SAMPLING METHODS

Different sampling methods will be employed depending upon the depth of the sample being collected. This section provides a description of the techniques that will be employed in each sampling phase and provides procedures for packaging the collected samples for shipping.

4.1 PHASE I SURFACE LINER SAMPLING

Samples from the surface of the compacted clay liner will be collected using precleaned or decontaminated stainless-steel spoons, scoops, and bowls, and, where necessary, a hand auger or spade. The following procedure will be employed to collect the samples:

1. Place plastic sheeting on the ground around the sampling location to prevent cross-contamination from other areas.
2. Gently brush aside the upper portion of the gravel layer and any organic material that is covering the clay surface.
3. Collect at least 8 ounces of clay from the first two inches of the clay liner into a stainless-steel bowl with a spade or other appropriate sampling tool.
4. Transfer four ounces of the sample into a glass sample bottle obtained from the laboratory.
5. Secure the cap of the bottle tightly.
6. Label the sample bottle with the appropriate sample label, carefully and clearly completing all portions of the label.
7. Place all filled sample containers on ice immediately, cooling the samples to at least 4 degrees Celsius (°C).
8. Complete all chain of custody (COC) documents and record the necessary information in the field logbook as described in Section 5.
9. Prepare samples for shipment as described in Section 4.3.
10. Return any unused sample back to the location sampled and replace any missing clay from the sampling location with clean clay from the on-site borrow area, being sure to compact the replaced clay to maintain the integrity of the liner.

4.2 PHASE II SUBSURFACE COMPACTED CLAY LINER AND PHASE III AND IV NATIVE SOIL SAMPLING

Subsurface compacted clay and native soil samples will be collected at locations determined via Phases II through IV of the sampling program. Samples will be collected using precleaned or decontaminated, stainless-steel hand augers, spoons, or scoops. The following procedures will be used to collect these samples:

1. Place plastic sheeting on the ground around the sampling location to prevent cross-contamination from other areas.

2. Clear the area to be sampled of any surface debris (gravel, twigs, rocks, litter).
3. Begin hand augering to the desired depth, periodically removing accumulated materials from the outside of the auger to prevent accidentally brushing loose material into the borehole when removing the auger.
4. After reaching desired depth, slowly and carefully remove auger from boring.
5. Using a lab spoon, scoop, or another appropriate sampling tool, transfer the sample from the auger into a 4-ounce glass sample bottle obtained from the laboratory.
6. Secure the cap of the bottle tightly.
7. Label the sample bottle with the appropriate sample label, carefully and clearly completing all portions of the label.
8. Place all filled sample containers on ice immediately, cooling the samples to at 4°C.
9. Complete all COC documents and record the necessary information in the field logbook as described in Section 5.
10. Prepare samples for shipment as described in Section 4.3.
11. Return any unused sample back to the location sampled and replace any missing clay or soil from the sampling location with clean clay or soil from the on-site borrow area, being sure to compact the replaced clay to maintain the integrity of the liner.

4.3 SAMPLE PACKAGING AND SHIPPING

Following collection of the samples, prepare the samples for shipping using the following procedures:

1. Double-check that all sample labels have been completed and place the samples into polyethylene bags (*e.g.,* Ziploc® freezer bags).
2. Place the bagged samples into a strong outside container, such as a picnic cooler, lined with a polyethylene bag.
3. Place cushioning material in and around samples to help prevent breakage during shipment.
4. Place ice in the coolers on top of and around the bagged sample containers.
5. Place a copy of the completed COC in a polyethylene bag and tape it to the inside lid of the cooler.
6. Apply strapping tape and COC labels on and around the outside of the cooler, being sure to cover all COC labels with at least one layer of tape.
7. Properly mark the outside of the shipping container with the proper shipping name, category of hazardous materials, United Nations (UN) or North America (NA) number, proper label (*e.g.*, "Laboratory Samples"), and "This End Up" with upward pointing arrows on all four sides. In addition, label the container with the appropriate receiving address and return address.
8. Complete shipping documenting and place it on the top of the cooler for delivery to the shipper.

5.0 SAMPLING DOCUMENTATION

Documentation is required to properly document the sampling effort and to demonstrate proper chain-of-custody of the collected samples. This section provides a description of the documentation that is required.

5.1 FIELD LOGBOOK

All pertinent information regarding the site and sampling procedures will be documented in a field logbook. A bound logbook with numbered and water-resistant pages will be used for all records, with a new page being started at the beginning of each day's sampling activities. All information entered into the logbooks shall be done legibly, with indelible ink. The field logbooks will be maintained on-site in between sampling events in the HSAAP Environmental Office. Logbooks are controlled documents and are to be maintained as part of the project file. The documents are not to be destroyed or thrown away, even if they are illegible or contain inaccuracies.

When completing a sampling effort, the following information shall be documented in the field logbook for each sample that is collected:

1. Name and exact location of site of investigation (*e.g.*, burn pan number and location, drop Inlet number, or grid location).
2. Name of person keeping log and names of all persons involved in the sampling effort.
3. Location of sampling point, including justification of the location chosen, the number of samples taken, and the volume of samples taken.
4. Method of sample collection and any factors that may affect sample quality. Note, if a method other than one described in this sampling plan is utilized, the record shall also include justifying information for the alternative method.
5. Date and time of sample collection.
6. Name of sample collector.
7. All sample identification numbers and a description of each sample.
8. Weather conditions on the day of sampling,
9. Sketch of grab sample location in relation to the burn pan or more permanent points in the Burn Pan Unit.
10. Geographic positioning system (GPS) coordinates of each sample location as determined by HSAAP personnel using a hand-held GPS unit. If the GPS unit is unavailable on the day of sampling, measurements will be taken of each sample location relative to a permanent point in the Burn Pan Unit. These measurements will be recorded in the logbook and will later be converted to coordinates.

5.2 CHAIN OF CUSTODY

Proper custody of the samples will be maintained at all times and will be documented via COC forms. The COC documentation is initiated at the sampling event and transfers with the sample through receipt at the laboratory. The COC will bear the name of the person assuming responsibility for the samples at each stage of the sampling effort. The named persons are tasked with ensuring secure and appropriate handling of the samples while they are in their custody or stored in a designated secure area. At a minimum, proper COC documentation will include the signature of the following individuals:

- The person collecting the sample;
- The person packaging the sample for shipment; and
- The laboratory technician receiving the samples at the laboratory.

The COC form will be completed at each incident of sample transfer and will be kept with the samples at all times. To help prevent damage to the COC form, it will be kept inside a plastic bag.

6.0 SAMPLE ANALYSIS

Each sample will be analyzed for RDX and HMX using USEPA SW-846 Method 8330 or an approved equivalent method. All results will be reported in milligrams per kilogram (mg/kg) on a dry-weight basis.

In addition to analyzing the collected samples, the laboratory will also analyze all QA/QC samples required by the method. Assessments of analytical precision and accuracy will be made by the laboratory based on the results of these QA/QC samples. Should data qualifiers be required, they will be documented along with the sample results in the laboratory report.

7.0 SAMPLING QUALITY ASSURANCE/QUALITY CONTROL

In addition to the QA/QC samples that are utilized by the laboratory, several QA/QC samples will be collected to document proper field sampling technique and to evaluate potential field contamination of the samples. These sampling QA/QC samples include field duplicate samples and equipment blanks.

7.1 FIELD DUPLICATES

Field duplicates are defined as secondary samples collected independently at a sampling location. Field duplicates are used to assess the consisting of the sampling procedure and also serve as an indicator of the precision of the analysis. A minimum of one field duplicate will be collected for every 20 samples (5 percent) that are obtained during an individual sampling effort. The first field duplicate will be obtained at a randomly selected sample location adjacent to one of the burn pans. The second field duplicate will be obtained at a randomly selected sample location along the Burn Pan Unit drainage path.

7.2 EQUIPMENT BLANKS

Equipment blanks are samples of analyte-free water that are collected by rinsing the decontaminated sampling equipment. Also known as “rinsate” blanks, these samples are used to assess the effectiveness of the decontamination procedures and indicate the potential for sample cross-contamination from sampling equipment or sample containers. One equipment blank will be obtained for each day of sampling.

8.0 NOTIFICATION AND REPORTING REQUIREMENTS

Prior to and following each sampling event, HSAAP will provide notifications and reports to TDEC. The following notifications and reports will be provided:

- At least 5 business days prior to each sampling event, HSAAP will notify TDEC to provide them the opportunity to witness the sampling.
- Following each sampling event, HSAAP will report the results of the sample analysis to TDEC's Division of Solid and Hazardous Waste Management. All results will be accompanied by any necessary discussion of the results and planned remediation activities.

Section 6. PROCEDURES TO PREVENT HAZARDS

This section presents a description of the procedures employed to prevent hazards and is being provided pursuant to 40 CFR Part 270 Subpart B, 40 CFR Part 264 Subpart C, TCRR 0400-12-01-.07(5), and TCRR 0400-12-01-.06(3).

The HSAAP operations are designed and operated to minimize the potential for the hazardous wastes managed on-site to cause harm to human health or the environment. Exposure potential is minimized and safe operations are maximized through proper equipment selection, facility design, and operating procedures. The general procedures used to prevent the threat of hazardous occurrences in the Burn Pan Unit are described herein. The information provided either identifies the process or system in effect to deter hazards or references prepared documents (*e.g.*, facility inspection procedures) that are devised to meet regulatory requirements for secure operation at the facility.

6.1 SECURITY

[§270.14(b)(4), §264.14, TCRR 0400-12-01-.07(5)(a)1(iv), and TCRR 0400-12-01-.06(2)(e)]

HSAAP is a secured, limited-access government facility. Entrances are staffed 24 hours per day, 7 days per week (24/7) by HSAAP security personnel. Specific security measures for the Burn Pan Unit are provided in the subsections that follow.

6.1.1 24-HOUR SURVEILLANCE SYSTEM

[§264.14(b)(1) and TCRR 0400-12-01-.06(2)(e)2(i)]

In addition to providing 24/7 limited access to the site, HSAAP provides additional security through roving security teams and closed-circuit television systems. Roving security officers check all gates within the burning ground area, including the Burn Pan Unit, twice during each 12-hour shift. When the unit is in operation, the closed-circuit television system at the Burn Pan Unit also provides continuous monitoring of all entrances and exits from the Unit.

6.1.2 BARRIER

[§264.14(b)(2)(i)] and TCRR 0400-12-01-.06(2)(e)2(ii)(I)]

The burning ground area and Burn Pan Unit are located in HSAAP Area B, which is surrounded in its entirety by a 6-foot high, chain-link fence with top guard (3 strands of barbed wire). Beyond that, the burning ground area is surrounded by a second, 6-foot high chain link fence with top guard, and the berms that surround the Burn Pan Unit are topped with a third, 6-foot high, chain-link fence. The combination of Area B fencing, burning ground area fencing, and Burn Pan Unit fencing provides for a redundant barrier system to protect entry into the Burn Pan Unit.

6.1.3 MEANS TO CONTROL ENTRY

[§264.14(b)(2)(ii) and TCRR 0400-12-01-.06(2)(e)2(ii)(II)]

Access into Area B is controlled via pass-through gates that are manned by security officers on a 24-hour basis. Access to the burning ground area is provided via gates on the western and eastern sides of the burning ground that remain locked when the Burning Ground Attendant is not present, or when a burn is in progress. Once inside this second level of barrier, entrants are restricted from access into the Burn Pan Unit itself via one 15-foot wide gate in the fence on the southern side of the unit. A paved 45-foot ramp follows the contour of the berm up to the fence and then down into the unit. Keys for the burning ground area and the Burn Pan Unit gate locks are controlled by a sign-in/out procedure that is managed by the Burning Ground Attendant.

To prevent unauthorized access from the Holston River, the property boundaries at the river are monitored by Security Dispatch via closed circuit television.

6.1.4 WARNING SIGNS

[§264.14(c) and TCRR 0400-12-01-.06(2)(e)3]

Warning signs that state "Danger - Unauthorized Personnel Keep Out" are posted on the 15-foot wide entrance gate to the Burn Pan Unit. These signs are legible from a distance of at least 25 feet, and are in English, the predominant language in the area.

For those traveling on the Holston River, warning signs are posted where the river crosses the HSAAP property boundaries. The signs on the river state the following: "Except in cases of extreme emergency all vessels other than those owned or controlled by the US Government and any activity involving persons in the water are prohibited from entering this area."

6.1.5 SECURITY COMMUNICATIONS

[§264.32 and TCRR 0400-12-01-.06(3)(c)]

All personnel working at the Burn Pan Unit have a hand-held, two-way radio on their person at all times. A land-line telephone system is also available in the Burning Ground Office. Cell phones are also typically available to personnel while in the office or in company vehicles but are not a mandated means in which the operators stay in contact with the security and operations team.

Any calls to the security department from the two-way radios or the telephone system are received by an emergency response dispatcher, who is on duty 24 hours a day at the central HSAAP Security Dispatch. Any requirements to investigate intruder or other concerns will be relayed from this dispatch to the appropriate response personnel as required.

6.2 INSPECTION SCHEDULES

[§270.14(b)(5), §270.23, §264.15, §264.602, TCRR 0400-12-01-.07(5)(a)1(v), TCRR 0400-12-01-.07(5)(a)9, TCRR 0400-12-01-.06(2)(f), and TCRR 0400-12-01-.06(27)(c)]

The facility implements a regular schedule of inspections at the Burn Pan Unit to maintain the burning ground equipment and facilities and to ensure protection of human health and the environment. No specific inspections relative to Subpart X units are provided in 40 CFR §264.602 or TCRR 0400-12-01-.06(27)(c).

Inspections are conducted as specified on the schedules in Attachment 6-1 and are documented on the inspection log, which is maintained at the Burning Ground Office. All information shown on the form, including the types of problems inspector's should look for during the inspection, the required frequency of each inspection, and the status, observations, and corrective actions associated with the inspection must be completed as applicable. For each item, the inspector is required to indicate whether any condition is satisfactory or unsatisfactory and must follow up on unsatisfactory notations with the date and nature of corrective actions.

All inspections are performed by the HSAAP Burning Ground Attendant and are signed and dated, and the time of the inspection is noted. All inspection records will be maintained at the Burning Ground Office for at least 3 years from the date of the inspection.

6.2.1 TYPES OF PROBLEMS

[§264.15(b)(3) and TCRR 0400-12-01-.06(2)(f)2(iii)]

The inspection schedules provided in Attachment 6-1 identify typical problems that could be encountered during the inspection process. Items examined include the security and communication equipment, Burn Pan Unit and burn pan condition, emergency equipment, weather monitoring equipment, and other miscellaneous items.

6.2.2 FREQUENCY OF INSPECTIONS

[§264.15(b)(4) and TCRR 0400-12-01-.06(2)(f)2(iv)]

The inspection schedules provided in Attachment 6-1 specify the frequency of each inspection that is performed. Frequencies range from before and after use, to daily, or with each waste delivery. In addition to these items, non-routine inspections are performed as required.

6.2.3 REMEDIAL ACTION OR MAINTENANCE

[§264.15(c) and TCRR 0400-12-01-.06(2)(f)3]

Any deterioration or malfunction of equipment or structures noted during an inspection will be remedied. The Burning Ground Attendant is authorized to initiate corrective action of any unacceptable conditions discovered during an inspection. The Burning Ground Attendant is also responsible for ensuring proper and timely action (emergency or otherwise) is taken in response to the identified deficiency. In the event that a deficiency is discovered during an inspection that presents significant environmental hazard and that deficiency cannot be immediately

repaired and/or corrected, waste treatment will be suspended on the affected pan(s) until repairs can be made.

6.3 DOCUMENTATION OF PREPAREDNESS AND PREVENTION

[§270.14(b)(6), §264.30, TCRR 0400-12-01-.07(5)(a)1(vi), and TCRR 0400-12-01-.06(3)(a)]

The facility does not wish to request a waiver of the preparedness and prevention requirements under 40 CFR Part 264 Subpart C and TCRR 0400-12-01-.06(3). Documentation of facility preparedness and prevention is described herein.

6.3.1 EQUIPMENT FOR PREVENTION OR MITIGATION OF HAZARDS

[§270.14(b), §264.32, TCRR 0400-12-01-.07(5)(a)1, and TCRR 0400-12-01-.06(3)(c)]

The facility meets the equipment requirements for preparedness and prevention by maintaining communication, emergency response, and spill cleanup equipment as specified in the sections that follow.

6.3.1.1 INTERNAL COMMUNICATIONS

[§270.14(b), §264.32(a), §264.34, TCRR 0400-12-01-.07(5)(a)1, TCRR 0400-12-01-.06(3)(c)1, and TCRR 0400-12-01-.06(3)(e)]

All personnel working at the Burn Pan Unit have a hand-held, two-way radio on their person at all times, allowing ready access to communication systems as required in 40 CFR §264.34 and TCRR 0400-120-1-.06(3)(e). A land-line telephone system is also available in the Burning Ground Office. While cellular phones are typically available to personnel while in the office or in company vehicles, they are not a mandated requirement and are therefore not used to satisfy the requirement for internal communication systems.

6.3.1.2 EXTERNAL COMMUNICATIONS

[§270.14(b), §264.32(b), TCRR 0400-12-01-.07(5)(a)1, and TCRR 0400-12-01-.06(3)(c)2]

Only HSAAP emergency personnel are allowed into the burning ground area to respond to emergency events. Outside emergency personnel will serve as backup to HSAAP personnel. If communication with external agencies is required, these communications will be initiated by the Security Dispatch, as requested by the Incident Commander or Emergency Coordinator.

6.3.1.3 EMERGENCY EQUIPMENT

[§270.14(b), §264.32(c), TCRR 0400-12-01-.07(5)(a)1, and TCRR 0400-12-01-.06(3)(c)3]

Emergency equipment located at the burning ground area includes portable fire extinguishers and spill control and cleanup equipment. This equipment is inspected in accordance with the inspection schedules provided in Attachment 6-1 and is available for any emergencies occurring in the burning ground area. The equipment is located at various locations throughout the Burn Pan Unit and elsewhere throughout the facility as shown in Figure 6-1. Note that while this equipment is maintained as specified, any fire

that involves explosives is allowed to burn to ensure protection of the HSAAP emergency responders. Procedures for responding to these emergencies are provided in the Contingency Plan in Section 7.

The HSAAP Fire Department has additional emergency response equipment (on trucks and at the Fire Department) that is available in the event of emergencies. The RCRA Contingency Plan provided in Section 7 includes further information on the types of emergency equipment maintained by the HSAAP Fire Department and provides details on plant emergency response procedures. This equipment is inspected and maintained as necessary per plant-specific protocols to ensure its functionality and reliability.

6.3.1.4 WATER AND FIRE CONTROL

[§270.14(b), §264.32(d), TCRR 0400-12-01-.07(5)(a)1, and TCRR 0400-12-01-.06(3)(c)4]

The Burn Pan Unit is kept free of vegetation and combustible material to minimize the potential for a spread of a fire from a pan to the surrounding area. Should a fire occur, water for fire control at the Burn Pan Unit is available from water hydrants at the burning ground as shown on Figure 6-1.

6.3.1.5 TESTING AND MAINTENANCE OF EQUIPMENT

[§270.14(b), §264.33, TCRR 0400-12-01-.07(5)(a)1, and TCRR 0400-12-01-.06(3)(d)]

All required equipment specified above is tested and maintained as necessary to ensure its continued proper operation. This equipment is tested as specified on the inspection schedule provided in Attachment 6-1. Maintenance will be performed on the equipment as specified below:

- Communication systems will be tested as specified. Maintenance activities will generally consist of the repair or replacement of damaged parts, depending on the extent of malfunction. HSAAP performs most maintenance functions on communication equipment in-house and uses contract maintenance as backup.
- Spill control equipment is maintained by replenishing supplies as warranted or replacing defective or damaged equipment. Any deficiencies that are detected will result in replacement of the item.
- The drainage system and vegetation control are checked as specified. Maintenance activities will generally consist of repair of the drainage system components and/or removal of unwanted vegetation.
- Fire control systems are tested by the Fire Department as specified. Volume and pressure testing of spigots and hydrants, and repair or replacement of damaged parts will be conducted by the Fire Department. Maintenance activities (*i.e.,* repair and replacement of damaged parts) will be conducted as needed.

6.3.2 DOCUMENTATION OF ARRANGEMENTS

[§270.14(b), §264.37, TCRR 0400-12-01-.07(5)(a)1, and TCRR 0400-12-01-.06(3)(h)]

Emergency response arrangements are detailed in the Contingency Plan included in Attachment 7-1. Copies of the arrangements are provided as an attachment to that Plan.

6.4 PREVENTIVE PROCEDURES, STRUCTURES, AND EQUIPMENT

[§270.14(b)(8) and TCRR 0400-12-01-.07(5)(a)1(viii)]

The facility uses the appropriate procedures, structures, and equipment to prevent the occurrence of adverse conditions in the Burn Pan Unit.

6.4.1 PREVENTION OF HAZARDS WHILE UNLOADING WASTES

[§270.14(b)(8)(i) and TCRR 0400-12-01-.07(5)(a)1(viii)(I)]

Waste explosives containers are collected from various generation points and are loaded directly (by hand) into a specially designed transport vehicle, are transferred to the Burn Pan Unit, and are unloaded by hand at the specified burn pan according to the schedule for treatment that day. To help reduce the risk of spills from the pan and protect the integrity of the clay liner, a layer of plastic is placed in the burn pan prior to loading the explosives into the pan. The following additional precautions are employed when transferring and unloading wastes at the Burn Pan Unit:

- No explosive material may be loaded or unloaded while the motor of the transport vehicle is running;
- Explosive containers may not be thrown, rolled, dragged, or pushed; and
- The contents of explosives containers are carefully placed in the burn pans.

6.4.2 PREVENTION OF RUN-OFF FROM WASTE AREAS

[§270.14(b)(8)(ii) and TCRR 0400-12-01-.07(5)(a)1(viii)(II)]

All precipitation falling onto the Burn Pan Unit is contained within it. Precipitation is collected by the drainage system and is conveyed to the HSAAP industrial wastewater treatment plant. Further details on this stormwater collection and management system is provided in Section 2.3.3. Therefore, there is no potential for run-off to exit the Burn Pan Unit. In addition, there is no run-on that can occur into the Unit because of the berms that surround it.

6.4.3 PREVENTION OF WATER SUPPLY CONTAMINATION

[§270.14(b)(8)(iii) and TCRR 0400-12-01-.07()5)(a)1(viii)(III)]

The water supply in and around the HSAAP Burn Pan Unit is protected from contamination via four different mechanisms. These include:

1. All burning takes place within burn pans that are designed to retain residual liquids that may be present in the energetic wastes (*e.g.,* water that is added to some waste streams to make

them safe to handle). Within each pan there is a clay layer that prevents liquids from leaving the pan.

2. The construction of the compacted clay lined berms and underlying clay liner in the Burn Pan Unit minimizes any potential infiltration of surface waters from the Unit into the groundwater.
3. All precipitation falling into the Burn Pan Unit flows over the clay liner and then into drains, which connect to the on-site wastewater treatment system.
4. The burn pan mobile covers prevent precipitation from entering the burn pans when they are not being used for an active burn or to dry or unfreeze wet wastes that have been loaded onto the pans for treatment.

6.4.4 Mitigation of Impacts from Equipment and Power Failure

[§270.14(b)(8)(iv) and TCRR 0400-12-01-.07()5)(a)1(viii)(IV)]

Power failure at the facility will not result in a release to the environment, as no power is used while the burn is progressing. Electric power is used only for the initiation of the burns in the pans and for the cameras that monitor the progress of the burns. If a power outage occurs prior to the initiation of the burn, the materials will be kept in the burn pans until power is restored and treatment can take place. Should a power failure take place before the truck is unloaded, loading of the wastes may be delayed unless the wastes require drying prior to treatment. Power failures affecting security monitoring devices will not affect the physical barriers, which are the primary security devices to prevent unauthorized access to the Burn Pan Unit.

6.4.5 Protection Against Personnel Exposure

[§270.14(b)(8)(v) and TCRR 0400-12-01-.07(5)(a)1(viii)(V)]

Personnel engaged in the handling of waste explosives must do so in a manner that minimizes contact with the waste. Three main mechanisms are used to assist in this effort: personal protective equipment (PPE), administrative controls, and personnel training. The personnel training program is discussed in detail in Section 8.1, and the administrative controls that are in place pertain primarily to the loading, ignition, and access control limitations discussed elsewhere in this section. PPE is required for all personnel that manage the hazardous wastes and that participate in any element of the Burn Pan Unit operations. Minimum PPE requirements for this area include work gloves, safety glasses with side shields, and safety toe shoes.

6.4.6 Minimizing Unplanned Releases to the Atmosphere

[§270.14(b)(8)(vi) and TCRR 0400-12-01-.07(5)(a)1(viii)(VI)]

By nature, operation of the Burn Pan Unit results in releases of combustion products to the atmosphere. Unplanned releases from the unit could occur due to emergencies such as unplanned explosions or fires involving the wastes either in or out of the pans, or fugitive

releases of treatment residues from the pans. The latter of these, fugitive releases from the pans, are largely minimized by the implementation of the mobile pan covers. These covers remain in place over the plans at all times except for when an active burn is occurring, when wastes are being left on the pan to dry, or when the pans are cooling immediately after a burn. Restrictions regarding wind speeds help prevent air releases of treatment residues during these periods. Releases from unplanned emergencies, such as fires or explosions, are minimized to the extent practicable while protecting personnel actively involved in fighting the emergency. Management of operations during these periods is discussed in detail in the Contingency Plan in Section 7.

6.5 PREVENTING ACCIDENTAL IGNITION OR REACTION OF IGNITABLE, REACTIVE, OR INCOMPATIBLE WASTE

[§270.14(b)(9), §264.17, TCRR 0400-12-01-.07(5)(a)1(ix), and TCRR 0400-12-01-.06(2)(h)]

HSAAP has in place the measures identified in the sections that follow to prevent the accidental ignition or reaction of those wastes managed at the Burn Pan Unit.

6.5.1 PRECAUTIONS TO PREVENT IGNITION OR REACTION OF IGNITABLE OR REACTIVE WASTE

[§270.14(b)(9), §264.17, TCRR 0400-12-01-.07(5)(a)1(ix), and TCRR 0400-12-01-.06(2)(h)]

All wastes treated at the Burn Pan Unit exhibit the RCRA reactivity and/or ignitability characteristics. Therefore, all procedures used in the treatment process are designed to avoid accidental ignition or reaction of the waste materials. General safety precautions to be followed when operating the Burn Pan Unit to prevent accidental ignition or reaction of the wastes are included in Section 4.2. Additional precautions include:

- Motor vehicles used to transport explosive wastes or other materials to the Burn Pan Unit must meet safety requirements for the transportation of explosives.
- No smoking, matches, lighters, or other unauthorized ignition sources are permitted in the Burn Pan Unit, absent those materials used specifically for ignition of the waste in the burn pans.
- No cutting, welding, or other activities involving hot surfaces, frictional heat, radiant heat, or other heat-producing activities are permitted in the Burn Pan Unit when explosive wastes are present.
- Spark-producing equipment and tools are prohibited from use within 15 feet of reactive materials. Inspections are performed on hand tools and mechanical devices to ensure integrity for use.
- Containers of reactive wastes are handled carefully at all times. They are not thrown, pushed, or dumped from the truck to the ground. If a truck is not equipped with an elevator-type tailgate, the individual containers are lifted and placed in the burn pan by hand, one at a time.

- Burning Ground Attendants who work in the Burn Pan Unit and material handlers that may assist the attendants are trained in handling wastes treated by open burning.

6.5.2 PRECAUTIONS TO PREVENT REACTIONS OF INCOMPATIBLE WASTES

[§270.14(b)(9), §264.17, TCRR 0400-12-01-.07(5)(a)1(ix), and TCRR 0400-12-01-.06(2)(h)]

The only materials that would be incompatible with the wastes treated at the Burn Pan Unit are certain strong oxidizers or other materials demonstrated to cause reactions with the treated wastes. In addition to the procedures outlined in Section 4.2, the following precautions are used to prevent reactions from occurring between these incompatible wastes and the treated wastes:

- Incompatible materials are not accepted at the Burn Pan Unit. All wastes at the facility are accompanied by an EDR that identifies the waste material and the generating location. Materials that would not be compatible with th Burn Pan Unit wastes are redirected to other treatment and disposal options.
- Prior to placement or spreading of waste material for burning, the burn pans are carefully inspected to ensure against the presence of heat retained in embers, sparks, or residual material from previously treated materials.
- All nearby explosives, whether in a vehicle or not, are placed at a safe distance from the Burn Pan Unit operations and are protected from flying embers, fragments, or sparks.

Legend

- Approximate Property Boundary
- Burn Pan Unit
- Fire Hydrant
- Emergency Equipment Locations

1	Bldg 140, Safety, Security Dispatch & Emergency OPS CTR
2	Bldg 155, Auxiliary Emergency OPS CTR
3	Bldg 163, Fire Station

N

0 500 1,000 FEET

1 " = 1,000 '
1:12,000

HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TENNESSEE

FIGURE 6-1
LOCATION OF EMERGENCY EQUIPMENT

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Attachment 6-1: INSPECTION SCHEDULES

BURNING GROUND SURVEILLANCE INSPECTION LIST
BURNING OF EXPLOSIVE WASTE

1. Tennessee Air Pollution Control Board permit present? ……
2. "Open Burning of Explosive Waste" permit present? ……
3. SOP 1930-9600 present? ……
4. 5,000 pound explosive load limit posted at Burning Ground? ……
5. Pan Numbers 1, 2, 3, and 4 load limits are 1,500 pounds? ……
6. Pan total load limit is 5,000 pounds? ……
7. Number of pounds burned? ……
8. Burn pan integrity acceptable? ……
9. Empty Pans Covered? ……
10. Parallel pans of explosives separated by not less than 150 feet? ……
11. Documentation to ensure authorization for burning? ……
12. Explosive material in closed containers? ……
13. No explosive material changed from one container to another inside truck? ……
14. Explosive containers not to be handled roughly, thrown, tumbled, rolled, or "walked over" the ground, floors, or other containers; the dragged or pushed along the ground or floor or dropped from the vehicle……
15. Waterproof plastic sheet placed in the burning pan? ……
16. Explosives to be spread in the burning pan no deeper than 3 inches……
17. Wind speed no more than 15 MPH average; no precipitation; no electrical or thunderstorms; no air quality alerts not an ozone action day; no temperature inversions; visibility greater than one mile……
18. Temperature……
19. Wind direction and speed……
20. Relative humidity……
21. Barometric Pressure……
22. Minimum of 2 personnel present for a burn; personnel to remain at the burning ground office……
23. Field No. 4 locked? ……
24. Burning grounds closed to all traffic during the burn? ……
25. 30-minute waiting period when an ignition failure occurs? ……
26. Burning pans to have a 12-hour cooling period and inspection before reuse……
27. Explosives Waste log completed? ……
28. HH Form 3561 completed and filed? ……

Remarks:

*** N/A TO THIS BURN**

Burning Ground Attendant _____ Date _____

Surveillance Inspector _____ Date _____

HH-4088 (Rev. 12/05)

EXAMPLE ONLY

ACTUAL FORM MAY VARY FROM THAT SHOWN BUT WILL COVER THE SAME TYPES OF INSPECTIONS

ORDNANCE SYSTEMS INC.

BURNING GROUND/ Inspection Checklist

Inspection Items	Type(s) of Problems	Frequency of Check	Status Satisfactory	Status Unsatisfactory	*Observations, Recommendations
BERMED AREA					
Fences	Integrity	Daily			
Gates	Operating	Daily			
Lock	Operating	Daily			
Sign	Present& Legible	Daily			
COMMUNICATION DEVICES					
Security Camera	Operating	Daily			
2-Way Radio	Operating	Daily			
Telephone	Operating	Daily			
BURN PAN UNIT					
Berms	Conditions, etc.	Daily			
Compacted Clay Liner	Conditions, etc.	Daily			
Collection Drains	Any Obstructions	Daily			
Vegetation on Berms/Clay	Presence of	Daily			
Standing Water	Presence of	Daily			
Spill	Presence of	Daily			
Storage Shed	Integrity	Daily			
Drop Inlets for Storm Water	Presence of	Daily			
Storm Water Drainage System	Pooling of water and or observation with drainage system	Daily			
Gravel Surface	Condition, etc.	Daily			
Firing Station	Operating	Daily			
Resistance Heater Igniter/Electrical Cords	Operating	Before Use			
BURN PANS					
Integrity	Conditions, etc.	Daily			
Freeboard	Less than 6”	Before Use			
Untreated Explosives	Presence of	After Use			
Ejected Waste Material	Presence of	After Burn			
Spill while unloading	Presence of	Each Delivery			
Pan Covers	Conditions, etc.	Daily			
Hot –spots	Presence of	After Use			
Explosives	Wet	Daily		Continue Treatment ☐	
EMERGENCY EQUIPMENT					
Fire Extinguisher (3 in burning ground office)	Present – in-Date	Daily			
Water Spigots	Operational	Daily			
Shovels (2), Scoops	Presence	Daily			
MISCELLANEOUS					
Weather Station	Operating	Daily			**Calibration Date:**
Flood Valves	Operational	Heavy Rain Events			
Inspection for debris from Piles around Cooling Water Channel	Presence of	Daily			
VEHICLES					
Documentation	Present	Each Delivery			
Additional Comments:					

Inspector:_____ **Date:**_____ **Time:**_____

EXAMPLE ONLY

ACTUAL FORM MAY VARY FROM THAT SHOWN BUT WILL COVER THE SAME TYPES OF INSPECTIONS

Section 7. RCRA CONTINGENCY PLAN

This section describes the facility's Contingency Plan and is being provided pursuant to the requirements specified in 40 CFR Part 270 Subpart B, 40 CFR Part 264 Subparts C, D, and J, TCRR 0400-12-01-.07(4), and TCRR 0400-12-01-.06(3), (4), and (10). The actual contingency plan is provided as a stand-alone document in Attachment 7-1 to facilitate distribution of the plan to local authorities.

7.1 GENERAL INFORMATION

[§270.14(b)(7) and TCRR 0400-12-01-.07(5)(a)1(vii)]

Section 1.0 of the Contingency Plan in Attachment 7-1 provides general information that may be required for emergency responders to respond to events within HSAAP. Information is provided on the location of the facility and the Burn Pan Unit, the Unit operations, the wastes managed, and potential emergency situations that could arise.

7.2 EMERGENCY COORDINATORS

[§270.14(b)(7), §264.52(d), §264.55 and TCRR 0400-12-01-.07(5)(a)1(vii), TCRR 0400-12-01-.06(4)(c)4, and TCRR 0400-12-01-.06(4)(f)]

An emergency coordinator list is provided in Table 2-1 of the Contingency Plan for all positions at the HSAAP that are authorized to act as primary and alternate Emergency Coordinators. In order to enhance the protection of defense services and defense articles and to protect the unauthorized export of defense information under the International Traffic in Arms Regulations (ITAR), promulgated in 22 CFR §§120-130, the actual contact information of individual persons or contractors in the employ of HSAAP have been withheld from this Permit. This information is readily available for review and inspection at the facility upon request. The relevant data is also readily available to plant security and supervision to respond to an emergency.

7.3 IMPLEMENTATION

[§270.14(b)(7), §264.52(a), §264.56(d), TCRR 0400-12-01-.07(5)(a)1(vii), TCRR 0400-12-01-.06(4)(c)1, and TCRR 0400-12-01-.06(4)(g)4]

The provisions of the Contingency Plan in Attachment 7-1 will be carried out immediately whenever there is a fire, explosion, or release of hazardous waste or hazardous waste constituents that could threaten human health or the environment.

7.4 EMERGENCY ACTIONS

[§270.14(b)(7), §264.56, TCRR 0400-12-01-.07(5)(a)1(vii), and TCRR 0400-12-01-.06(4)(g)]

The actions that will be taken in case of an emergency at the Burn Pan Unit are detailed in Section 3.0 of the Contingency Plan in Attachment 7-1.

7.5 EMERGENCY EQUIPMENT

[§270.14(b)(7), §264.52(e), TCRR 0400-12-01-.07(5)(a)1(vii), and TCRR 0400-12-01-.06(4)(c)5]

Section 4.0 of the Contingency Plan in Attachment 7-1 identifies the emergency response equipment in the proximity of the Burn Pan Unit and provides a graphical depiction of where such equipment is located.

7.6 ARRANGEMENTS WITH LOCAL AUTHORITIES

[§270.14(b)(7), §264.37, §264.52(c), TCRR 0400-12-01-.07(5)(a)1(vii), TCRR 0400-12-01-.06(3)(h), and TCRR 0400-12-01-.06(4)(c)3]

Arrangements with local authorities are described in Section 5.0 of the Contingency Plan in Attachment 7-1. A copy of the arrangements with local authorities is included as Appendix A to the Plan.

7.7 EVACUATION PLAN FOR FACILITY PERSONNEL

[§270.14(b)(7), §264.52(f), TCRR 0400-12-01-.07(5)(a)1(vii), and TCRR 0400-12-01-.06(4)(c)6]

The evacuation plan is described in Section 6.0 of the Contingency Plan in Attachment 7-1.

7.8 REQUIRED REPORT PROCEDURES FOR RECORDKEEPING AND REPORTING TO FEDERAL AUTHORITY

[§270.14(b)(7), §264.56(i), TCRR 0400-12-01-.07(5)(a)1(vii), and TCRR 0400-12-01-.06(4)(g)9]

Recordkeeping and reporting procedures are described in Section 7.0 of the Contingency Plan in Attachment 7-1.

7.9 LOCATION AND DISTRIBUTION OF CONTINGENCY PLAN

[§270.14(b)(7), §264.53, TCRR 0400-12-01-.07(5)(a)1(vii), and TCRR 0400-12-01-.06(4)(d)]

The locations of and distribution list for the Contingency Plan are described in Section 8.0 of the Contingency Plan in Attachment 7-1.

Attachment 7-1: RCRA CONTINGENCY PLAN

BAE SYSTEMS

HOLSTON ARMY AMMUNITION PLANT

KINGSPORT, TENNESSEE

HAZARDOUS WASTE CONTINGENCY PLAN FOR THE HSAAP BURN PAN UNIT

SEPTEMBER 2020

Coterie ENVIRONMENTAL

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Appendix A: Coordination Agreements

1.0 GENERAL INFORMATION

This Contingency Plan has been prepared for the Burn Pan Unit operated at the Holston Army Ammunition Plant (HSAAP) in Kingsport, Tennessee, to satisfy the requirements of 40 CFR Part 270 Subpart B, 40 CFR Part 264 Subparts C, D, and J, TCRR 0400-12-01-.07(4) and TCRR 0400-12-01-.06(3), (4) and (10). This stand-alone plan has been prepared to facilitate distribution to the various agencies that may assist with emergency response activities. Administratively, the Contingency Plan resides in Section 7 of the facility's RCRA Part B permit application.

The objective of this Contingency Plan is to minimize hazards to human health and the environment from fires, explosions, or any unplanned sudden or non-sudden release of hazardous waste or hazardous waste constituents to the air, soil, or surface water. This plan defines the actions to be taken in the event of Burn Pan Unit emergency that could threaten human health or the environment.

The Burn Pan Unit at the HSAAP is used to thermally treat explosive waste material. Treatment operations at the Burn Pan Unit are performed in four burn pans that are evenly spaced 150 feet apart. The pans are positioned in the northeast, southeast, southwest, and northwest corners of the Burn Pan Unit, facing lengthwise north to south. Operations of the Unit are monitored from the Burning Ground Office, which is located east of the Burn Pan Unit.

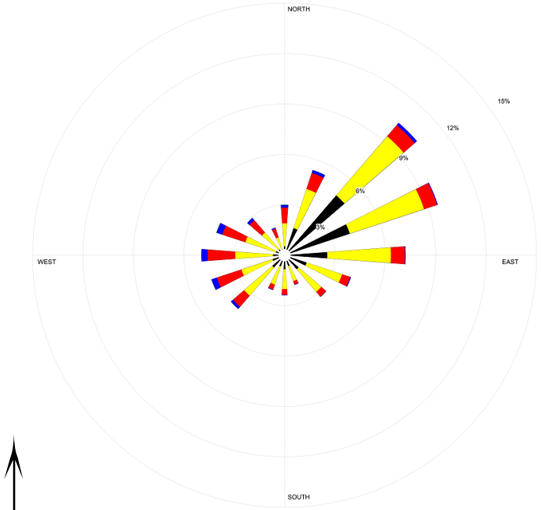
The Burn Pan Unit is located in the extreme southern portion of HSAAP's Area B as shown on Figure 1-1. HSAAP is located in Hawkins and Sullivan Counties in northeastern Tennessee. The site is located within the 100-year flood plain but controls have been put in place to help prevent the wash-out of hazardous wastes.

Legend

- Approximate Property Boundary
- Burn Pan Unit
- 1000-Foot Radius

WIND SPEED (m/s)

- >11.06
- 8.49 - 11.06
- 5.40 - 8.49
- 3.34 - 5.40
- 1.80 - 3.34
- 0.51 - 1.80



SOURCE OF WINDSPEED DATA IS THE
STATION #13877 - BRISTOL/TRI CITY AIRPORT, TN,

0 1,000 2,000 FEET

1 " = 2,000 '
1:24,000

HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TENNESSEE

FIGURE 1-1
LOCATION MAP

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2.0 EMERGENCY COORDINATORS

[§264.52(d) and §264.55, TCRR 0400-12-01-.06(4)(c)4 and TCRR 0400-12-01-.06(4)(f)]

The Emergency Coordinator (EC) has the responsibility for coordinating all emergency incidents at the Burn Pan Unit. In accordance with 40 CFR §264.55 and TCRR 0400-12-01-.06(4)(f), the EC is familiar with this Contingency Plan, the layout and operation of the facility, and with the location and characteristics of hazardous wastes and hazardous waste operations at the facility. The EC also has the authority to commit the necessary resources to carry out the Contingency Plan.

In the event of an emergency, the EC and their designees are responsible for providing all necessary internal and external notifications, assisting with the characterization, management, and mitigation of the emergency and associated releases, performing all post-incident notifications, and ensuring for proper handling and disposal of all hazardous wastes and other materials generated during the emergency response effort.

An emergency contact list, including phone numbers for key emergency contact points, is provided in Table 2-1. Names and addresses of personnel identified in this table are protected for security reasons. This information is maintained on-site and is readily accessible by the security and human resource departments.

TABLE 2-1
HSAAP EMERGENCY CONTACT INFORMATION

EMERGENCY CONTACT	POSITION	24- HOUR PHONE NUMBER
HSAAP Security Dispatch	Primary initial contact with both on-site and on-call personnel	Off-Site Phone: 423-578-6318, or 423-245-9119 (emergencies only) On-Site Phone: 911
BAE Emergency Coordinator	Plant manager and primary EC	Contact HSAAP Security Dispatch [1]
US Army Emergency Coordinator (Alternate EC)	Owner's representative and secondary EC	Contact HSAAP Security Dispatch [1]
Environmental Representative (Alternate EC)	Plant health, safety, and environmental director and alternate EC	Contact HSAAP Security Dispatch [1]
Safety Representative (Alternate EC)	Plant safety representative and alternate EC	Contact HSAAP Security Dispatch [1]

[1] In order to enhance the protection of defense services and articles and to protect the unauthorized export of defense information under the International Traffic in Arms Regulations (ITAR), promulgated in 22 CFR Parts 120 through 130, the actual contact information of individual persons or contractors in the employ of HSAAP have been withheld from this Permit. This information is readily available for review and inspection at the facility upon request. The relevant data is also readily available to plant security and supervision to respond to an emergency.

3.0 IMPLEMENTATION AND EMERGENCY ACTIONS

[§264.52(a) and §264.56, TCRR 0400-12-01-.06(4)(c)1 and TCRR 0400-12-01-.06(4)

The provisions of this Contingency Plan shall be immediately implemented whenever there is a fire, explosion, or release of hazardous waste or hazardous waste constituents from the Burn Pan Unit that could threaten human health or the environment.

3.1 TYPES AND IMPACTS OF EMERGENCIES

The Burn Pan Unit location, types of wastes treated, facility design, and operating practices were evaluated for potential hazards to determine emergency events that should be addressed in this Contingency Plan. The primary hazards associated with the management and handling of hazardous waste at the Burn Pan Unit are fire and explosion. A discussion of each of these types of events is provided below. Note that a spill at the Burn Pan Unit does not constitute an emergency event requiring implementation of the Contingency Plan, as the potential for impacts to human health and the environment do not exist. The solid portion of any spill occurring within the Burn Pan Unit will be cleaned up with hand tools such as shovels and scoops and placed into a burn pan. Any free liquids that are present in the wastes (*e.g.,* water used to ensure the materials are safe to handle) will flow over the compacted-clay liner to the drainage system, which conveys the liquids to the HSAAP industrial wastewater treatment plant (IWWTP). The IWWTP is capable of treating explosives in water.

3.1.1 EXPLOSIONS

Explosions at the Burn Pan Unit can occur due to the nature of the wastes being treated. However, the potential impact from an explosion is minimized due to the location of the Burn Pan Unit relative to adjacent production areas and property. The maximum quantity of explosives that are present at any one time at the Burn Pan Unit is 5,000 pounds, and the unit itself is located approximately 4,500 feet from the nearest HSAAP boundary. US Army quantity-distance requirements contained in Army Material Command Regulation (AMCR) 385-10 require that this quantity of Class 1.1. explosives be located at least 1,250 feet from the boundary of the facility. USEPA interim status regulations pertaining to open burning of explosives (40 CFR §265.382) require that at least 1,730 feet be provided between an explosive quantity of 5,000 pounds and the property of others. Maintaining at least this level of separation between the explosives and adjacent boundaries helps to prevent off-site impacts due to explosions.

3.1.2 FIRES

Fires can occur due to the ejection of burning wastes from the burn pans and initiation of nearby vegetation or structures. The potential for such fires is minimized due to the design of the waste ignition system, the operating procedures for a burn, and maintenance procedures that are designed to minimize fuel for fires.

Waste explosives are electrically ignited remotely from within the Burning Ground Office using an approved ignition device and excelsior strips. The ignition process and subsequent burn is observed by the Burning Ground Attendant via a video monitor in the Burning Ground Office. After the burn is complete, the area surrounding the burn pans is visually inspected for the presence of ejected material. Any ejected material is collected by use of small hand tools such as scoops and shovels and placed back into the burn pan for treatment in the next burn. The treatment residue remaining in the pans is also assessed to make sure no untreated waste remains after each burn. The Burn Pan Unit area is also kept free of vegetation to minimize the potential impact of a fire within the unit should these other preventative measures fail to protect against the ejection of materials from the pans.

3.2 IMPLEMENTATION OF THE CONTINGENCY PLAN

In the event that an emergency does occur that could impact human health or the environment, the procedures specified in this Contingency Plan will be implemented. Each such emergency response effort will be directed by the EC. The EC may, as permitted under the hazardous waste regulations, designate persons to assist in the emergency response effort. Such designations may include:

- The Security Dispatcher, who will be responsible for establishing and maintaining communications.
- The Fire Chief of the HSAAP Fire Department, who will be responsible for directing firefighting and paramedic services. Emergency medical services, including ambulance services, will be provided or arranged for by the on-site Emergency Medical Technician (EMT) on duty.
- The Incident Commander, who will be responsible for assessing the emergency, directing emergency notifications through the Security Dispatcher, ensuring adequate traffic control and other safety measures are taken, coordinating the termination of operations, accounting for personnel, coordinating with Environmental Affairs, requesting the activation of the Emergency Operations Center (EOC), and advising the EOC if further assistance is needed to respond to the incident.
- Material Handlers, who will have the responsibility for removing and isolating the waste materials from the area in the event of an emergency incident.

3.2.1 ON-SITE NOTIFICATIONS

HSAAP utilizes an internal 9-1-1 system for on-site emergency notification. The first person to discover the incident will dial 9-1-1 on a plant telephone or the Security Dispatch emergency line from an external phone, such as a cellular phone. In the event of a phone service interruption, radio-equipped locations or vehicles can be used to report the emergency to Security Dispatch. This notification will include the following:

- Location of the emergency;
- Nature of the emergency (fire, explosion, injury); and
- The types of waste materials present.

The Security Dispatcher will then notify the following personnel by phone or radio:

- The EC or their designee;
- The Security Department;
- The Fire Department; and,
- Any additional personnel notifications as directed by the EC or their designee.

As soon as practical after notifying the EC of their designee, the Security Dispatcher will communicate to general plant personnel that an emergency exists in the plant. When an emergency is reported, the Security Dispatcher will make an announcement stating that an emergency exists, specifying the nature of the emergency, and directing plant personnel to limit unnecessary radio traffic on the Security and Maintenance radio networks.

3.2.2 Assessment of Hazards

The ECs or their designees will assess the hazards of the emergency situation based on the following information:

- The type and quantity of waste present at the Burn Pan Unit, as well as the formulation of the explosive constituents;
- The location of truck(s) transporting explosives to the Burn Pan Unit;
- The stage of the waste treatment process (unloading, drying, excelsior strip attached/unattached, etc.);
- The nature (fire, explosion, personnel injury) and location of the emergency within the Burn Pan Unit; and,
- The current and predicted weather conditions.

3.2.3 Off-Site Notifications

The ECs or their designees will immediately report any potential off-site consequences to the following regulatory agencies:

- Tennessee Emergency Management Agency (800-262-3300) and/or
- National Response Center (800-424-8802)

The notification will include:

- The name and phone number of the reporter;
- The name and address of the facility;
- The time and type of incident (fire, explosion, etc.);
- The name and quantity of material(s) involved (to the extent known);
- The extent of injuries, if any; and
- The possible hazards to human health, or the environment outside the facility.

3.2.4 CONTROL MEASURES

During an emergency event, the following measures will be taken to mitigate the potential hazard and impact of the emergency:

- The EC or their designee will initiate evacuation of personnel from the area. In the event of an explosion, an initial search will be conducted for injured personnel by assigned emergency personnel.
- Any injured personnel will be evaluated initially by the on-site EMT. The on-site EMT will provide initial first aid and will arrange for transportation to a medical facility, if necessary.
- Security will prevent any non-emergency personnel from entering the burning ground area until the area has been secured and assessed. All shipments of explosive materials to the Burn Pan Unit will stop.
- Any fire involving explosive material within the Burn Pan Unit will allowed to burn to avoid risk to fire-fighting personnel.
- The on-site senior Fire Department representative and the EC will jointly assess proper control measures to be taken regarding fires outside the Burn Pan Unit.
- Fire watches will be established and maintained after the fire is extinguished to ensure that the fire is completely out.
- When determined safe by the EC or their designee, a search will be conducted of the Burn Pan Unit and the area surrounding the Burn Pan Unit for any ejected explosive material. Any such material will be removed by appropriate means, placed into a container, and taken back to a burn pan for future treatment. If the EC determines that the explosive material is unsafe to move, it will be burned in-place by attaching an excelsior strip to the explosive material and igniting the strip.
- Any explosives already placed in burn pans will not be removed. Potential impacts from these materials will be considered by the EC or their designee in their assessment of the hazard and response procedures to the emergency.

3.2.5 POST-EMERGENCY ACTIONS

Once the emergency incident is under control and the site is determined to be safe, the EC or their designee will:

- Arrange for treatment, storage, or disposal of recovered waste, contaminated soil, or any other contaminated material. Specific requirements for each type of material are as follows:
  - Any released material will be removed and placed in an approved container or the Burn Pan Unit for treatment during the next scheduled burn.
  - Explosive material from the Burn Pan Unit will be placed into a burn pan for treatment.
  - If a pan is not available and the material is safe for transport, the contained material will be transported to an appropriate storage magazine until such time that thermal treatment can be conducted.
  - Residues determined by analytical testing to be non-hazardous will be placed into containers and taken to the on-site landfill.

- Residues determined to be hazardous will either be treated in one of the burn pans to deactivate them or will be containerized and shipped to an appropriate off-site disposal facility.
- Any waste or materials that may be incompatible with the released material will be treated, stored, or disposed of until cleanup procedures are completed.

- Assure the proper decontamination, disposal, replacement, and repair to emergency and other facility equipment, as appropriate.

Before waste treatment operations resume, the EC or their designee will:

- Assure that all emergency equipment listed in the Contingency Plan is cleaned and fit for its intended use; and,
- Confirm that, after decontamination activities are complete, the standard pre-burn inspection procedures are completed prior to the resumption of treatment operations.

4.0 EMERGENCY EQUIPMENT

[§264.52(e), TCRR 0400-12-01-.07(5)(a)1(vii) and TCRR 0400-12-01-.06(4)(c)5]

Various types of emergency equipment, such as fire extinguishing systems, spill control equipment, communication and alarm systems, may be used in the response to emergency situations at the Burn Pan Unit. A description of each type of equipment is provided in this section. The location of each type of equipment is shown on Figure 4-1.

4.1 PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment (PPE) is maintained by the Fire Department and Safety Department to respond to emergencies if the Contingency Plan is implemented. Each department is responsible for maintaining the PPE for its personnel. The following protective gear is maintained and available:

- Fire Department
  - Firefighter helmet with face shield
  - Rubber boots with steel toes
  - Firefighter gloves
  - Turn-out gear (fire-resistant coats and pants)
  - Self-contained breathing apparatus
  - Hard hats with face shield
  - Water supply truck
  - Clean-up equipment
- Safety Department
  - Gloves
  - Safety shoes
  - Safety goggles
  - Hard hats with face shield
  - Decontamination equipment

4.2 FIRST AID EQUIPMENT

Emergency first-aid equipment and medical supplies are available at the Fire Hall. EMTs are on duty 24 hours per day at the Fire Hall for responding to emergencies.

4.3 Spill Control Equipment

Spill control equipment, such as shovels, scoops, and absorption materials, are maintained at the Burn Pan Unit. If necessary, equipment for decontaminating the spill cleanup equipment can be obtained from the Safety Department.

4.4 Emergency Response Protection Equipment

PPE is transported to the scene of the incident by emergency responders. The EC or their designee determines what safety procedures and protective clothing should be used depending on the nature of the incident. The EC is also responsible for coordinating the inspection and supply of safety equipment during an emergency.

4.5 Decontamination Equipment

Decontamination equipment may include items such as rags, wipes, or brushes, that can be used to remove residue from the emergency equipment, clean them, and prepare them for future use. This equipment is located in a storage trailer near the HSAAP Fire Department.

4.6 Water for Fire Control

The HSAAP Fire Department has a 1,000-gallon-per-minute (gpm) pumper capable of carrying 750 gallons of water and a 1,200-gallon tanker truck that is maintained on standby duty at the Fire Hall to respond to the burning ground area. Response time from the Fire Hall to the Burn Pan Unit is less than 5 minutes. Additional water for fire control is available from water hydrants located in the Burn Pan Unit.

4.7 Emergency Communications and Alarm System

Emergency communications are made using hand-held, battery powered two-way radios, mobile telephones and landline telephones. In addition, a plant-wide emergency warning system is available to easily notify all personnel on the facility of emergencies at the Burn Pan Unit.

Legend

- Approximate Property Boundary
- Burn Pan Unit
- Fire Hydrant
- Emergency Equipment Locations

1	Bldg 140, Safety, Security Dispatch & Emergency OPS CTR
2	Bldg 155, Auxiliary Emergency OPS CTR
3	Bldg 163, Fire Station

N

0 500 1,000 FEET

1 " = 1,000 '
1:12,000

HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TENNESSEE

FIGURE 4-1
LOCATION OF EMERGENCY EQUIPMENT

DRAWN BY: SSW	SCALE:	PROJ. NO.	RCRA 2020
CHECKED BY: M GEHRING	AS NOTED	FILE NO.	Fig 6_1 Emergency Equipment.mxd
APPROVED BY: M GEHRING	DATE PRINTED:		
DATE: August 2020	*8/25/2020*		

Colerie ENVIRONMENTAL
1150 First Ave., Ste 501
King of Prussia, PA 19406

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5.0 ARRANGEMENTS WITH LOCAL AUTHORITIES

[264.37, §264.52(c), TCRR 0400-12-01-.06(3)(h) and TCRR 0400-12-01-.06(4)(c)3]

5.1 FIRE DEPARTMENT AND EMERGENCY RESPONSE TEAMS

Outside Fire Department and emergency management agencies will not directly participate in any emergency actions at the Burn Pan Unit due to the potential presence of explosive material. However, outside emergency management agencies are supplied with a copy of this Contingency Plan for informational purposes.

5.2 EMERGENCY RESPONSE TEAMS AND LOCAL HOSPITALS

The Hawkins County Emergency Medical Service provides emergency ambulance services to the local community. Should it be necessary to pick up injured personnel at the Burn Pan Unit, the Hawkins County Emergency Medical Service staff will be escorted by HSAAP staff from the gate to the Unit.

Off-site treatment of medical emergencies is provided by Holston Valley Medical Center and Hospital. There is no coordination agreement with either the Hawkins Country Emergency Medical Service or the Holston Valley Medical Center and Hospital as the services provided are in accordance with their standard services.

6.0 EVACUATION PLAN FOR FACILITY PERSONNEL

[§264.52(f) and TCRR 0400-12-01-.06(4)(c)6]

The EC or their designee is responsible for initiating evacuation of the Burn Pan Unit whenever emergencies occur at the Unit that present a danger to human health. In an instance where evacuation is necessary, the evacuation signal(s) will be given verbally with the assistance of bullhorns, if available, or by two-way radio. If evacuation is required, other plant personnel will be notified by two-way radio or by telephone. Figure 6-1 shows the evacuation routes from the Burn Pan Unit.

Legend

- Burn Pan Unit
- Primary Evacuation Route
- Secondary Evacuation Route

N

0 75 150 FEET

1 " = 150 '
1:1,800

HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TENNESSEE

FIGURE 6-1
EVACUATION ROUTES

DRAWN BY: SSW	SCALE:	PROJ. NO.	RCRA 2020
CHECKED BY: M GEHRING	AS NOTED	FILE NO.	Fig Evacuation Routes.mxd
APPROVED BY: M GEHRING	DATE PRINTED:		
DATE: August 2020	*8/30/2020*		

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7.0 REPORTING REQUIREMENTS

[§264.56(i) and TCRR 0400-12-01-.06(4)(g)9]

The EC or their designee will note in the operating record the time, date, and details of any incident that requires implementation of the Contingency Plan for the Burn Pan Unit. Within 15 days after the incident, the EC will submit a written report on the incident to the Tennessee Department of Environment and Conservation (TDEC) Commissioner. The report will include:

- Name, address, and telephone number of the owner or operator;
- Name, address, and telephone number of the facility;
- Date, time, and type of incident (i.e., fire, explosion);
- Name and quantity of material(s) involved;
- The extent of injuries, if any;
- An assessment of actual or potential hazards to human health or the environment, where this is applicable; and
- Estimated quantity and disposition of recovered material that resulted from the incident.

8.0 AMENDMENT OF THE CONTINGENCY PLAN

[§264.53, TCRR 0400-12-01-.06(4)(d)]

The Contingency Plan for the Burn Pan Unit will be reviewed and amended, if necessary, whenever any of the following occurs:

- The facility permit is revised;
- The plan fails during an emergency;
- The facility changes in its design, construction, operation, maintenance, or other circumstances in a way that materially increases the potential for fires, explosions, or releases of hazardous waste or hazardous waste constituents, or changes the response necessary in an emergency;
- The list of emergency coordinators or contact points changes; or
- The list of emergency equipment changes.

Appendix A:
COORDINATION AGREEMENTS

BAE SYSTEMS

MEMORANDUM OF UNDERSTANDING BETWEEN
U.S. DEPARTMENT OF THE ARMY
BAE SYSTEMS ORDNANACE SYSTEMS, INC.
CITY OF KINGSPORT, DIVISION OF FIRE

Gentlemen/Ladies:

In order to provide effective use of available fire fighting resources for control of a major emergency at Holston Army Ammunition Plant, (HSAAP), or in the City of Kingsport, the following proposals are submitted for your consideration.

That portion of Holston Army Ammunition Plant, (Area A), lying within the boundary of the City of Kingsport will receive the same fire protection as the other parts of the city. In addition, it is intended to provide theses services to that area outside of the city limits in Hawkins County, Tennessee, known as Area B.

It is understood that the City of Kingsport will in no case be called upon to fight fires in structures which contain hazardous or explosives materials. Calls for City assistance will be made by HSAAP Commanding Officer, or designated representative, or the Ordnance Systems, Inc., (OSI), Emergency Control Center or the OSI Command Post.

Any request on the part of the City of Kingsport will be made directly by the Mayor, the City Manager, the Fire Chief or Deputy Fire Chief. Request for assistance on the part of the City of Kingsport must be approved by the Commanding Officer, (HSAAP), the OSI General Manager or Senior Fire Services Officer.

It is further understood that the City of Kingsport and HSAAP propose to render mutual assistance to each other whenever practical to do so but they do not guarantee to answer every call made. The City and HSAAP may choose not to render assistance in civil disturbance situations where there is a significant danger of physical harm to fire fighters. Assistance may be withdrawn if the plant or city officials fail to provide adequate protection to fire fighters. Fire fighting equipment will not be used for riot control.

The Senior Officer of each department in charge of fire fighting equipment shall for reasons of safety be authorized to withhold or withdraw any fire fighting equipment needed inside the City or HSAAP limits. In such event, neither will be held responsible to respond to the call of the other. All responding personnel and equipment will be under the supervision of the Senior Fire Officer in charge of such equipment.

BAE SYSTEMS

In consideration of the mutual benefits obtained by each party by this agreement, each party waives all claims of any kind or nature against the other for compensation or reimbursement for any loss, damage, personal injury or death occurring as a consequence of the performance of this agreement.

Subject to the above restrictions, the parties will assist each other when called upon in Fighting Fire, Hazmat, Technical Rescue, Emergency Medical Services and CBRNE at specified locations on their respective properties by furnishing such fire fighting, hazmat, technical rescue, emergency medical services and CBRNE equipment, and personnel as compatible with the security and safety of the City of Kingsport and HSAAP.

It is agreed that each party will pay the other five hundred dollars ($500.00) per hour or fraction thereof for each piece of apparatus, (including operating personnel), which is utilized to contain the emergency. It is understood between the parties that either party has right to terminate this agreement upon a thirty (30) day written notice by registered or certified mail.

CITY OF KINGSPORT, TENNESSEE

BY: John Clark _____ 7/25/18
Mayor Date

ATTEST: Angela Marshall
City Recorder

APPROVED AS TO FORM: J. Michael Ray Billingsley
City Attorney

KINGSPORT FIRE DEPARTMENT

BY: Scott A Boyd _____ 7/27/18
Fire Chief Date

U.S. DEPARTEMNT OF THE ARMY
HOLSTON ARMY AMMUNITION PLANT

BY: Joseph L Kennedy _____ 16 July 2018
Commanding Officer Date

BAE SYSTEMS

BAE SYSTEMS, ORDNANCE SYSTEMS INC.

BY: _____ 16 July 2018
General Manager/Operations Date

Centerra Group LLC. agrees to provide the necessary support of the Mutual Aid Plan in accordance with current contract guidelines.

BY: _____ 16 July 2018
Project Manager Date

ISO 9001:2000

QMI REGISTERED

NSF-ISR

ENVIRONMENTAL MANAGEMENT SYSTEM REGISTERED TO ISO 14001:2004

Section 8. PERSONNEL TRAINING

This section presents a description of the training program for HSAAP personnel involved in the operation of the Burn Pan Unit and is being provided pursuant to the requirements specified in 40 CFR Part 270 Subpart B, 40 CFR Part 264 Subpart B, TCRR 0400-12-01-.07(5), and TCRR 0400-12-01-.06(2).

8.1 OUTLINE OF PERSONNEL TRAINING PROGRAM

[§270.14(b)(12), §264.16, TCRR 0400-12-01-.07(5)(a)1(xii), and TCRR 0400-12-01-.06(2)(g)]

The facility has established a personnel training program designed to provide employees with the information necessary to perform their job function in a safe and effective manner. The training program is updated and revised as necessary to comply with the established guidelines of 40 CFR §264.16 and TCRR 0400-12-01-.06(2)(g). The goal of the training program is to provide employees with the knowledge to ensure the facility's compliance with this Permit and the ability to respond effectively to hazardous waste emergencies. The sections that follow describe the individuals that are included in the training program, the topics that are addressed, and the frequency with which training is completed.

8.1.1 JOB TITLE/JOB DESCRIPTION

[§270.14(b)(12), §264.16(d), TCRR 0400-12-01-.07(5)(a)1(xii), and TCRR 0400-12-01-.06(2)(g)4]

The following personnel positions perform tasks associated with proper operation and/or function of the Burn Pan Unit:

- Material Handler – The material handler(s) are responsible for the transportation of the waste from the point of generation to the Burn Pan Unit. The material handler may also help the burning ground attendant place waste on the pans or may assist with ignition of the loaded pans. This position is responsible for reporting spills of explosive waste that occur during transportation.
- Burning Ground Attendant – The Burning Ground Attendant is responsible for all operations at the Burn Pan Unit, including receipt, loading, and preparation of explosive wastes for burning, preparation and ignition of the burn, management of burn pan treatment residues, inspection of burn pans, completion of treatment records, and cleanup of waste spills within the Unit.
- Environmental Affairs (EA) Representative – The EA Representative is responsible for maintaining compliance with all hazardous waste permit conditions, submitting required reports to TDEC, and directing RCRA training.
- Emergency Coordinator – The site Emergency Coordinators are responsible for directing facility operations in the event of a hazardous waste or other site emergency. This individual is authorized to commit financial resources required to respond to the emergency and mitigate impacts to human health or the environment. The EC may designate others to assist with on-site management of the incident at the site, while maintaining overall responsibility and communicative authority for site operations.

- Incident Commander – The site Incident Commanders are responsible for implementing emergency procedures and assisting in hazard assessment and response during emergencies as designated by the acting Emergency Coordinator.
- Safety Manager/Safety Technologists – Supervise Safety personnel serving as Burning Ground Attendants and/or Incident Commanders.

Full job descriptions including minimum qualifications and the names of those employees fulfilling roles of each of the pertinent functions are maintained in the HSAAP operating record.

8.1.2 TRAINING CONTENT AND TECHNIQUES

[§270.14(b)(12), §§264.16(a) and (c), TCRR 0400-12-01-.07(5)(a)1(xii), and TCRR 0400-12-01-.06(2)(g)1 and 3]

Employees are trained to learn how to perform their duties in a way that ensures the facility's safe compliance with all applicable hazardous waste regulations. The training that is provided covers, at a minimum, the following topics:

- Identification and response to hazards from hazardous waste;
- Communication of and response to spills and leaks of hazardous waste;
- Operation and safe shutdown of equipment and units related to their job function;
- Inspection, use, and repair of emergency response and monitoring equipment; and,
- Response to hazards waste emergencies, including fires, explosions, or other releases

The training provided to each individual is commensurate with their job duties and is a combination of classroom (in person or virtual) training and on-the-job training (OJT). For most positions, this training consists of some level of Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) training. Table 8-1 details the training requirements for each job description specified herein. The sections that follow provide more detailed descriptions of the content of each training course.

TABLE 8-1
GENERAL TRAINING TOPICS REQUIRED FOR POSITIONS
WITH BURN PAN UNIT RESPONSIBILITIES

JOB TITLE	RCRA HAZARDOUS WASTE MANAGEMENT TRAINING [1]	OSHA HAZWOPER TRAINING (29 CFR §1910.120) [1]
Material Handler	Plant-specific initial and annual refresher	24-hour HAZWOPER and 8-hour annual refresher
Burning Ground Attendant	Plant-specific initial and annual refresher	40-hour HAZWOPER and 8-hour annual refresher
EA Representative	Initial RCRA Hazardous Materials Management from certified training program Annual RCRA refresher from certified training program	24-hour HAZWOPER and 8-hour annual refresher
Emergency Coordinator	Plant-specific initial and annual refresher	On-site emergency response training (initial training and training drills)
Incident Commander	Plant-specific initial and annual refresher	40-hour HAZWOPER and 8-hour annual refresher
Safety Manager/ Safety Technologist	Plant-specific initial and annual refresher	40-hour HAZWOPER, 8-hour HAZWOPER Supervisor, and 8-hour annual refresher

[1] The Environmental Affairs Department Representative is responsible for directing RCRA training to all other individuals identified herein and/or confirming completion of an online training course. Their training to exercise this responsibility is provided by an outside training source.

[2] The referenced 24-hour and 8-hour HAZWOPER training courses are either provided by a representative of the HSAAP safety department or an outside contractor. All 40-hour HAZWOPER training is provided by an outside contractor.

8.1.2.1 HAZARDOUS WASTE MANAGEMENT TRAINING CONTENT

[§270.14(b)(12), §264.16(a), TCRR 0400-12-01-.07(5)(a)1(xii), and TCRR 0400-12-01-.06(2)(g)1]

The Introductory Hazardous Waste Management training course is designed to provide each worker at the Burn Pan Unit with an understanding of the hazardous waste requirements applicable to the open burning of hazardous waste explosives in the burn pans and to their job functions. This course will be reviewed periodically and updated, as required, based on permit conditions, changes in hazardous waste regulations, and applicable operating practices. This course covers the following subjects:

- Waste receipt and verification procedures
- Hazardous characteristics of the wastes treated in the burn pans
- Spill cleanup procedures
- Permit conditions relative to operation of Burn Pan Unit, including allowable meteorological conditions for treatment
- Inspection requirements, including inspections of emergency response equipment

- Emergency response procedures, including shutdown of operations in response to emergencies
- Recordkeeping requirements for the Burn Pan Unit
- Safety Requirements for management and treatment of hazardous waste

The annual refresher will review each of the topics covered in the introductory training with expanded emphasis on changes that have occurred.

8.1.2.2 OSHA HAZWOPER TRAINING CONTENT

[§270.14(b)(12), §264.16(a), TCRR 0400-12-01-.07(5)(a)1(xii), and TCRR 0400-12-01-.06(2)(g)1]

Depending upon the position, HSAAP employees involved in Burn Pan Unit operations receive either 24-hour or 40-hour HAZWOPER training and the associated 8-hour refresher training. In addition, certain employees also take the 8-hour HAZWOPER supervisor training. The content of each of these training courses is defined in 29 CFR §1910.120. As specified in 40 CFR §264.16(a)(4) and TCRR 0400-12-01-.06(2)(g)1(iv), this training satisfies all of the requirements for emergency response training specified under 40 CFR §264.16(a)(3) and TCRR 0400-12-01-.06(2)(g)1(iii). This content may be covered either via in-face or virtual classroom instruction.

8.1.2.3 ON THE JOB TRAINING CONTENT

[§270.14(b)(12), §264.16(a), TCRR 0400-12-01-.07(5)(a)1(xii), and TCRR 0400-12-01-.06(2)(g)1]

During the OJT training, the trainee will conduct each of the job functions required for their position under the direct supervision of a trained employee. The amount of time for OJT will vary depending on the previous experience of the employee being trained and the job function. Specific activities that may be included in OJT based on the position being trained are as follows:

- Transport of hazardous wastes to Burn Pan Unit
- Receiving hazardous wastes at the Burn Pan unit
- Loading of hazardous wastes into the pans
- Preparation of pans for burning and ignition
- Ignition and observation of burns
- Inspections and recordkeeping

Completion of the OJT is evaluated by the employee's supervisor, once that supervisor determines that the employee has demonstrated sufficient ability to perform the tasks unassisted as required. Following completion, the employee, trainer, and supervisor sign a certification form to document the training.

8.1.3 TRAINING FREQUENCY

[§270.14(b)(12), §§264.16(b) and (c), TCRR 0400-12-01-.07(5)(a)1(xii), and TCRR 0400-12-01-.06(2)(g)2 and 3]

OJT and classroom training are provided initially to all new employees involved in hazardous waste transportation and Burn Pan Unit operations within the first six months of assignment to their position. New or newly assigned workers will not work unsupervised during the transportation of wastes or in Burn Pan Unit operations until all classroom training is complete and the individual's supervisor has documented successful completion of all OJT.

8.1.4 TRAINING ADMINISTRATION

[§270.14(b)(12), §264.16(a)(2), TCRR 0400-12-01-.07(5)(a)1(xii), and TCRR 0400-12-01-.06(2)(g)1(ii)]

Classroom training is administered by an EA or Safety Representative or an outside contractor. OJT training is provided in a worker setting by an experienced operator or the employee's supervisor.

8.2 MAINTENANCE OF TRAINING RECORDS

[§270.14(b)(12), §§264.16(b), (d), and (e), TCRR 0400-12-01-.07(5)(a)1(xii), TCRR 0400-12-01-.06(2)(g)2, 4, and 5]

Records documenting employees' completion of the required training are maintained by the individual department to which the worker reports, as part of an individual's employment history. Training records are maintained for 3 years after an individual leaves HSAAP or until closure of the Burn Pan Unit.

Section 9. CLOSURE

This section presents information on the facility's Closure Plan and is being provided pursuant to the requirements of 40 CFR Part 270 Subpart B, 40 CFR Part 264, TCRR 0400-12-01-.07(4), and TCRR 0400-12-01-.06.

9.1 CLOSURE PLAN REQUIREMENTS

[§270.14(b)(13), §264.112, §264.603, TCRR 0400-12-01-.07(5)(a)1(xiii), TCRR 0400-12-01-.06(7)(c), and TCRR 0400-12-01-.06(27)(d)]

Owners and operators of hazardous waste management facilities are required by 40 CFR §264.112 and TCRR 0400-12-01-.06(7)(c) to develop a written closure plan that identifies the necessary steps for partially or completely closing the facility at any point during its active life. The purpose of this plan is to ensure that the HSAAP Burn Pan Unit will be closed in a manner that minimizes the need for future maintenance of the site, and controls, minimizes, or eliminates post-closure escape of hazardous waste and hazardous constituents as necessary to protect human health and the environment.

HSAAP will amend the closure plan whenever:

- Changes in the operating plan or facility design affect the closure procedures;
- There is a change in the expected year of facility closure; and/or
- Modifications to the plan become necessary due to partial or final closure activities.

Any proposed changes will be promptly submitted to TDEC for approval in accordance with 40 CFR §264.112(c) and TCRR 0400-12-01-.06(7)(c)2.

A current copy of the closure plan and all plan revisions will be maintained at HSAAP until certification of closure completeness has been submitted to and approved by TDEC.

9.2 CLOSURE PERFORMANCE STANDARD

[§270.14(b)(13), §264.111, §264.112, TCRR 0400-12-01-.07(5)(a)1(xiii), TCRR 0400-12-01-.06(7)(b), and TCRR 0400-12-01-.06(7)(c)]

When appropriate, HSAAP intends to close the Burn Pan Unit as required by 40 CFR §264.111 and TCRR 0400-12-01-.06(7)(b). Pursuant to the closure performance standard provided in 40 CFR §264.112 and TCRR 0400-12-01-.06(7)(c), such closure will be designed to:

- Minimize the need for further maintenance;
- Eliminate the potential for any post-closure escape of hazardous waste or hazardous constituents to the environment; and
- Comply with the requirements in 40 CFR Part 264 Subpart G and TCRR 0400-12-01-.06(7) and unit-specific closure standards specified in 40 CFR Part 264 Subpart X and TCRR 0400-01-.06(27).

9.3 MAXIMUM WASTE INVENTORY

[§270.14(b)(13), §264.112(b)(3), TCRR 0400-12-01-.07(5)(a)1(xiii), and TCRR 0400-12-01-.06(7)(c)2(iii)]

There is no permitted storage for hazardous wastes at the Burn Pan Unit. The maximum inventory of wastes present at one time in the Burn Pan Unit is the explosive load limit or 5,000 pounds net explosive weight (NEW). Should the unit be closed, however, all waste will be treated prior to initiating closure activities. Therefore, the maximum untreated waste inventory at the Burn Pan Unit at the time of closure is zero. However, some treatment residues may be present at the site when closure is initiated. Therefore, for purposes of determining the necessary procedures for closure of the unit, a maximum waste inventory has been established based on the maximum amount of treatment residue that may be present in the pans at any time and the amount of clay underlying the residue in the pans. For estimation purposes, it is assumed that up to 20 cubic feet of treatment residue could remain in the pans (5 cubic feet per pan) and up to 100 cubic feet of contaminated clay could exist below that residue in the pans, with 25 cubic feet per pan.

9.4 TIME AND ACTIVITIES REQUIRED FOR CLOSURE

[§270.14(b)(13), §§264.112(b)(1) thru (b)(7), TCRR 0400-12-01-.07(5)(a)1(xiii), and TCRR 0400-12-01-.06(7)(c)2(i) thru 2(vii)]

The closure plan has been designed to ensure that the HSAAP Burn Pan Unit will be closed pursuant to 40 CFR Part 264 Subpart G and TCRR 0400-12-01-.06(7). The procedures established for closing the unit and the time period allotted for it have been developed based on this design.

9.4.1 CLOSURE PROCEDURES

[§270.14(b)(13), §264.112, §264.114, TCRR 0400-12-01-.07(5)(a)1(xiii), TCRR 0400-12-01-.06(7)(c), and TCRR 0400-12-01-.06(7)(e)]

Procedures have been established to close or partially close the Burn Pan Unit for which this Permit has been established. However, the entire Burn Pan Unit is expected to remain in service throughout the active life of the facility. From time to time, one or more of the burn pans may be taken out of service for repair or replacement. However, this is not considered a closure or partial closure activity; instead such activity is considered necessary and routine repair and replacement. The only type of partial closure that may be considered for the unit would be a reduction from normal to emergency or limited operations based on the installation of an alternative treatment technology at the facility. Should such a unit be installed, HSAAP will provide a plan for partial closure of the Burn Plan Unit based on the capabilities of the alternative treatment technology.

Closure of the Burn Pan Unit will be a multi-step process, consisting of the following:

- Inventory removal;
- Disposal and/or decontamination of Unit equipment; and
- Evaluation of post-closure care requirements.

The sections that follow describe the process of inventory removal and equipment decontamination/disposal. Evaluation of post-closure care requirements is discussed later in this Closure Plan.

9.4.1.1 INVENTORY REMOVAL

[§270.14(b)(13), §264.112(b)(3), TCRR 0400-12-01-.07(5)(a)1(xiii), and TCRR 0400-12-01-.06(7)(c)2(iii)]

Prior to closure of the Burn Pan Unit, all remaining hazardous waste will be treated during normal unit operations and all treatment residues and the clay liners will be verified to be non-reactive. After treatment of the final volume of wastes and any reactive treatment residues, the burn pans will contain non-reactive treatment residue and the clay liners. Once closure is initiated and both the treatment residues and clay liners have passed the reactivity test, these materials will be managed as follows:

1. The treatment residues and clay liners will be analyzed for site-specific toxicity characteristics or underlying hazardous constituents (UHCs) from 40 CFR §268.48, as appropriate.
2. If the treatment residue or clay liner analytical results exceed the regulatory thresholds for any constituent analyzed, the residue and/or liner will be placed into appropriate containers and shipped for disposal to an appropriately regulated off-site hazardous waste landfill.
3. If the treatment residue or clay liner analytical results are below the regulatory thresholds for all constituents analyzed, the treatment residue and/or liner will be sent to the on-site Class II landfill for disposal.

9.4.1.2 DISPOSAL OR DECONTAMINATION PROCEDURES

[§270.14(b)(13), §264.112(b)(4), §264.114, TCRR 0400-12-01-.07(5)(a)1(xiii), TCRR 0400-12-01-.06(7)(c)2(iv), and TCRR 0400-12-01-.06(7)(e)]

Procedures used for decontamination of the Burn Pan Unit equipment and for disposing of decontamination materials will be accomplished in several stages, from equipment decontamination and removal, through soil sampling and excavation. The steps associated with each of these stages are described below. All wastes generated during closure will be properly manifested, labeled, and shipped as required by hazardous waste management and Department of Transportation (DOT) regulations.

EQUIPMENT DECONTAMINATION AND REMOVAL

The equipment at the Burn Pan Unit consists of the burn pans and covers, the remote ignition system, and the stormwater drainage system. The following steps will be taken to decontaminate and remove these systems:

- The ignition system will be made inoperative and the above-ground portions of the system will be removed. It is not expected that this system will have been contaminated during unit operation.

- The drainage system will be flushed with water from the fire hydrants to the HSAAP industrial wastewater treatment plant to remove any accumulated solids.
- The burn pans and aluminum lids will be thermally decontaminated, inspected, certified as explosive-free, and sold for recycle as metallic scrap or sent to the on-site Class II landfill for disposal. Procedures and criteria specified in DoD Instruction 4140.62 will be used to guide this process. Per site safety procedures, after thermal decontamination, the concrete rail pan supports will be sent to the exempt area of the on-site Class II landfill for disposal as a non-hazardous solid waste.

Once the initial decontamination activities are complete and any necessary soil excavation has been completed, the equipment used in the closure process will be decontaminated as follows:

- Small excavation equipment, such as shovels and rakes, will be decontaminated by steam cleaning with a high-pressure washer.
- Vehicles and heavy equipment, such as trucks, backhoes, and bulldozers, will be decontaminated on the decontamination pad prior to leaving the site using steam cleaning with a high-pressure washer.
- Contaminated protective clothing and decontamination equipment will be decontaminated following its use or will be managed as hazardous waste.

Assessment of equipment decontamination will be made to determine the effectiveness of cleaning. This assessment may include visual inspections or sampling and analysis for the reactivity characteristic, site-specific toxicity characteristics or underlying hazardous constituents (UHCs) from 40 CFR §268.48 and TCRR 0400-12-01-.10(3)(i), or assessment of the material according to DoD Instruction 4140.62, as appropriate.

During the decontamination phase, a decontamination pad will be constructed on a graded and compacted earthen foundation and surrounded by berms. The berms and the pad will be overlain by a liner (at least 30 millimeters thick) so that decontamination fluids are retained. The liner will be protected from tearing by material such as sand or plywood. Ramps will be positioned at the entrance and exit of the pad to allow vehicles to pass over the berms. The pad will be sloped so that decontamination fluid will flow to a low point to be collected. After decontamination activities are finished, the decontamination pad liner will be steam cleaned and the rinsate will be collected and containerized. The liner will then be properly disposed.

SOIL AND LINER SAMPLING AND EXCAVATION

Once the burn pans have been removed, the compacted clay liner and underlying soil within the Burn Pan Unit will be sampled in phases to determine the extent of horizontal and vertical contamination, if any, within the Burn Pan Unit. The liner and soil samples

will be analyzed for reactivity and toxicity characteristics, and select UHCs from 40 CFR §268.48 and TCRR 0400-12-01-.10(3)(i), as appropriate.

Based upon the analytical results of the soil sampling, any contaminated soil will be excavated and properly disposed. Removal will continue until clean closure is achieved or until the area has been decontaminated to a restricted-use standard and placed in monitored status. During any excavation, contaminated clay and native soils will be removed from the unit and brought to a temporary staging area to be prepared for shipment. The staging area will be located within or adjacent to the Burn Pan Unit and will consist of a graded, compacted, earthen foundation surrounded by earthen berms or temporary concrete berms. The foundation and berms of the staging area will be overlain by a 30-millimeter thick liner of sufficient durability to withstand sorting activities. Plywood or a similar material will be laid on top of the liner to prevent tearing. To control run-off from the area, the staging area will be covered in a manner that prevents accumulation of precipitation while allowing work to continue.

9.4.2 SCHEDULE FOR CLOSURE

[§270.14(b)(13), §§264.112(b)(6) and (d), TCRR 0400-12-01-.07(5)(a)1(xiii), and TCRR 0400-12-01-.06(7)(c)2(vi) and (c)4]

At present, there is no immediate plan for closure of the Burn Pan Unit. When such a closure date is established, HSAAP will notify TDEC according to the requirements provided in 40 CFR §264.112(d) and TCRR 0400-12-01-.06(7)(c)4 at least 45 days prior to the date closure activities are expected to initiate. Complete closure of the Burn Pan Unit will be performed within the timeframes set forth in 40 CFR §264.113 and TCRR 0400-12-01-.06(7)(d) and outlined in Table 9-1 below.

TABLE 9-1
SCHEDULE FOR BURN PAN UNIT FACILITY CLOSURE

STEP	DESCRIPTION	TIME (DAYS) [1]
1	Notify Department	-45
2	Receipt of final volume of hazardous waste	0
3	Treat final volume of hazardous waste, sample residuals and clay liners for reactivity characteristic and applicable UHCs, and reburn if necessary.	0 - 7
4	Remove residuals and clay liners from burn pans and store in roll-offs until verified non-reactive. Reburn if necessary.	7 – 21
5	Disassemble, clean, decontaminate ignition system, burn pans and covers, and dispose of residuals and clay liners in on-site landfill or off-site facility based on evaluation of analytical results.	21 – 90
6	Flush stormwater drainage system	50 – 60
7	Site investigation (identify sampling locations, complete analysis of all samples, and identify areas for further action)	60 – 120 [2]
8	Site remediation and soil removal (if necessary)	120 – 180 [2]
9	Complete closure activities	180 [2]
10	U.S. Army certification that closure is completed in accordance with plan	240
11	Certification by independent, registered professional engineer that closure has been completed in accordance with plan	240

[1] Time from the date upon which closure begins.

[2] Longer, as approved, if large quantities of contaminated soil are encountered during closure.

If during closure it becomes apparent that an extension to the closure period will be necessary, an application for extension will be made to TDEC in accordance with 40 CFR §264.113(c) and TCRR 0400-12-01-.06(7)(d)3. Any request for an extension of the closure period will be made, at the latest, 30 days prior to expiration of the 180-day time period allowed for closure.

9.5 POST-CLOSURE PLANS

[§270.14(b)(13) and TCRR 0400-12-01-.07(5)(a)1(xiii)]

It is the intent of HSAAP to close the Burn Pan Unit such that there is unrestricted future land use of the area or limited restrictions to the land use based on contamination from prior activities (*e.g.,* restriction to industrial land use only). As clean closure is the ultimate goal, no specific provisions for site monitoring, land restrictions, *etc*., have been included in this Closure Plan. Should the results of the closure-period soil sampling necessitate a change in the closure approach or should limited land use restrictions be required, post-closure care and monitoring may be warranted. If necessary, details of such activities will be developed in a future amendment to the Closure Plan.

9.6 CLOSURE COST ESTIMATE AND FINANCIAL ASSURANCE REQUIREMENTS (*not applicable*)

[§270.14(b)(15), §264.142 thru §264.146, TCRR 0400-12-01-.07(5)(a)1(xv) and TCRR 0400-12-01-.06(8)]

Federal facilities are exempted from financial requirements, including those requirements for developing a closure cost estimate, documenting financial assurance mechanisms, and liability requirements. HSAAP is a federal facility and therefore these requirements are not applicable.

Section 10. CORRECTIVE ACTION FOR SOLID WASTE MANAGEMENT UNITS

[§270.14(d) and TCRR 0400-12-01-.07(5)(e)]

There are several active SWMUs located in the vicinity of the burning ground area, which, itself, is classified as SWMU 43 and is designated for no further action. The active SWMUs include:

- SWMU 44 – The former burning pads, which are located directly under the existing burn pans;
- SWMU 45 – The existing Burn Pan Unit;
- SWMU 46 – Burn cages used for destruction of non-hazardous, energetic contaminated waste; and
- SWMU 47 – Burn piles used for destruction of non-hazardous, energetic contaminated waste.

However, absent the soil monitoring and cleanup program discussed in this Permit, the corrective action efforts for each of these SWMUs is covered under the Cleanup Program managed by the US Army under Corrective Action Order (CAO) 03-HCA003 rather than in this Permit. Corrective action for the underlying groundwater is being addressed as part of a separate site-wide groundwater area of concern (AOC-GW).

Section 11. ADDITIONAL PART B REQUIREMENTS FOR MISCELLANEOUS UNITS

[§270.23(c), §264.601, TCRR 0400-12-01-.07(5)(b)9, and TCRR 0400-12-01-.06(27)(b)]

40 CFR Part 264, Subpart X and TCRR 0400-12-01-.06(27)(b) provide additional requirements for Miscellaneous Units that must be satisfied in the hazardous waste management application. These requirements include the identification of potential pathways of exposure and the demonstration of treatment effectiveness.

11.1 POTENTIAL PATHWAYS OF EXPOSURE

[§270.23(c), §264.601, TCRR 0400-12-.07(5)(b)(9)(iii), and TCRR 0400-12-.06(27)(b)]

HSAAP completed a human health and ecological risk assessment for the Burn Pan Unit in 2012 as part of the initial permitting effort for the unit. Since that time, conditions at the site, unit throughput requirements, and waste constituents have not seen any substantial changes. Based on that, HSAAP is proposing to utilize this risk assessment to meet the human health and environmental protection obligations under the requirements for RCRA Subpart X Miscellaneous Units. A copy of that risk assessment report is provided as Attachment 11-1.

11.1.1 HUMAN HEALTH EXPOSURES

[§270.23(c), §264.601, TCRR 0400-12-.07(5)(b)(9)(iii), and TCRR 0400-12-.06(27)(b)]

In Section 2.2.1 of the risk assessment report, the following potential pathways of exposure were identified for each of the assessed receptors:

- Operators involved in on-site operation of the Burn Pan Unit:
  - Incidental ingestion of burn pan wastes during handling; and,
  - Incidental ingestion of contaminated surface soils during spill cleanup operations;
- Construction workers participating in short term, intermittent site work at the Burn Pan Unit:
  - Incidental ingestion of contaminated surface and subsurface soil; and,
  - Inhalation of particulates containing contaminated surface and subsurface soils;
- Off-site residents, including those at the closest public residence to the HSAAP:
  - Inhalation of airborne contaminants from waste treatment operations; and,
- Students from the eight elementary and high schools located within 10 kilometers of HSAAP:
  - Inhalation of airborne contaminants from waste treatment operations.

For each of the identified pathways of exposure, the risk assessment evaluated the potential risks resulting from exposure to the Burn Pan Unit operations. For the air exposure pathways, modeled air concentrations were compared to USEPA risk screening criteria and ambient air risk-based concentrations. For the soil exposure pathways, a detailed fate and transport assessment was conducted.

No instances were found in which the modeled exposures resulted in non-carcinogenic hazards in excess of USEPA targets. The carcinogenic reasonable maximum exposure (RME) estimate for the on-site worker slightly exceeded USEPA targets, with a risk of 1.6×10^{-6}, but all other risks were below the 1×10^{-6} target by approximately an order of magnitude.

11.1.2 ECOLOGICAL EXPOSURES

[§270.23(c), §264.601, TCRR 0400-12-.07(5)(b)(9)(iii), and TCRR 0400-12-.06(27)(b)]

In Section 3.1 of the risk assessment report, the transport of analytes via air and consequential deposition of those analytes to the ground was determined to be the only operative transport mechanism to the surrounding terrestrial and aquatic, floral and faunal species. Exposure mechanism included direct contact of the target organisms with the constituents that were deposited onto the surface soils and surface waters.

The assessment of risk to the ecological receptors indicated a nominal additive risk, with a hazard index slightly greater than 1.0, to ecological receptors in contact with those exposed to air-transported constituents deposited onto soils. For surface water deposits, the assessment found no significant or unacceptable risk to ecological receptors in contact with the surface water.

11.2 DEMONSTRATION OF TREATMENT EFFECTIVENESS

[§270.23(d), §264.600, TCRR 0400-12-.07(5)(b)(9)(iv), and TCRR 0400-12-.06(27)(a)]

The intent of the Burn Pan Unit treatment process is to destroy the ignitable and reactive components of the hazardous wastes and render their treatment residues safe for subsequent disposal. The effectiveness of this treatment process is measured by analysis of the treatment residues. As explained in Section 3, the burn pan treatment residue is sampled and analyzed for reactivity, the toxicity characteristic for metals, and UHCs that have the potential to be present in the residues based on chemicals used in the manufacturing processes. The reactivity analysis is intended to provide the required demonstration of treatment effectiveness for this process. Should any of the treatment residues demonstrate the reactivity characteristic, they will be re-processed through the Burn Pan Unit until no evidence of the reactivity characteristic remains.

Attachment 11-1: HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT REPORT

HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT
HOLSTON ARMY AMMUNITION FACILITY
BURN PAN UNIT
KINGSPORT, TENNESSEE

S&ME Project No. 1437-11-347

Prepared for:
BAE Systems Ordnance Systems Inc.
4509 West Stone Drive
Kingsport, Tennessee 37660

Prepared by:
S&ME, Inc.
1413 Topside Road
Louisville, Tennessee 37777

March 27, 2012

March 27, 2012

BAE Systems Ordnance Systems Inc.
4509 West Stone Drive
Kingsport, Tennessee 37660

Attention: Ms. Amy Crawford

Reference: **Human Health and Ecological Risk Assessment**
Holston Army Ammunition Plant
Burn Pan Unit
Kingsport, Tennessee
S&ME Project No. 1437-11-347

Dear Ms. Crawford:

S&ME, Inc. (S&ME) has prepared a Human Health and Ecological Risk Assessment to demonstrate whether releases from the Holston Army Ammunition Plant (HSAAP) Burn Pan Unit pose unacceptable risks to human health or the environment. The Risk Assessment was developed in accordance with S&ME's Risk Assessment Plan, which was submitted to BAE Systems Ordnance Systems Inc. (OSI) on November 30, 2011, and approved by Ms. Amy Crawford via e-mail on December 7, 2011. The Risk Assessment was also prepared in accordance with BAE Systems Ordnance Systems Inc. (OSI) Request for Proposal (RFP) JAE-092011-02 dated September 2, 2011 and S&ME Proposal No. 3711392.

Thank you for the opportunity to be of service to you on this project. If you should have any questions, or need any further information, please do not hesitate to contact us.

Respectfully submitted,

S&ME, Inc.

Leira S. Douthat
Environmental Scientist and Risk Assessor

Ashley Sapyta
Senior Risk Assessor

Point of Contact: Carol Goldinger Ford (cford@smeinc.com)

S: 2011 Projects/347 Holston Army Ammunition Risk Assessment/Holston Army Ammunition HH and Eco Risk Assessment

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Ecological Risk Assessment Site Visit Checklist

1.0 INTRODUCTION

The Holston Army Ammunition Plant (HSAAP) holds a Resource Conservation and Recovery Act (RCRA) Part B Permit (EPA Identification Number TN5210020421, Permit Number TNHW-148) to treat waste explosives (RCRA codes D003, D030, and K044) by open burning in four (4) burn pans which are classified as Subpart X Open Burn Miscellaneous Treatment Burn Pan Units. The HSAAP facility is located at 4509 West Stone Drive in Kingsport, Tennessee (Figure 1, Appendix I). The RCRA permit was issued by the Tennessee Department of Environment and Conservation (TDEC) Division of Hazardous Waste Management and became effective on March 31, 2011. A requirement of HSAAP's permit is to conduct a risk assessment (RA) to demonstrate that releases from the Burn Pan Unit will not pose unacceptable risks to human health or the environment during the life of the permit. The primary goal of the RA is to provide a means to communicate the risk caused by the operation of the burn pans during the permit life (March 31, 2021) of the unit.

This combined HSAAP Human Health and Ecological RA was prepared in accordance with S&ME's Risk Assessment Plan, which was submitted to BAE Systems Ordnance Systems Inc. (OSI) on November 30, 2011 and approved by Ms. Amy Crawford via e-mail on December 7, 2011. As stated in the Plan, the RA was developed in accordance with the EPA's Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A) Interim Final December 1989 and Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, Interim Final June 5, 1997.

The following documents were included in HSAAP's January 2002 RCRA Permit application and were used in support of this RA:

- *Screening Ecological Risk Assessment* prepared by Tetra Tech in 2000/2002 (Section E-2 of the application)
- *Air Pathway Assessment* prepared by Brown and Root in 1997 (Section E-4 of the application)
- *Hazard Assessment* prepared by Sirrine in 1994 (Section L of the application).

2.0 HUMAN HEALTH RISK ASSESSMENT

The HHRA presented herein was performed as a review and update of previous assessments. The HHRA report includes the following information:

- Background – description of the Site including relevant history and geographical information;
- Exposure scenarios – description of receptor groups and an analysis of exposure pathways;
- Data evaluation – description of data sources and details of data treatment; determination of chemicals of potential concern (COPCs);
- Exposure assessment – description of exposure parameters and methodology for calculating exposures; presentation of resulting exposures;

- Toxicity assessment – presentation of noncarcinogenic and carcinogenic toxicity criteria; discussion of human health effects associated with the defined COPCs;
- Risk characterization – description of methodologies for characterizing risks; presentation of calculated noncarcinogenic hazards and carcinogenic risks;
- Uncertainties – qualitative and quantitative assessments of key uncertainties and data gaps; description of the impacts of uncertainties on resulting risk and hazard estimates;
- Conclusions; and,
- References (which will be combined with the references for the ecological section)

Supporting information used in the calculation of risks and hazards is provided in appendices.

2.1 Background

2.1.1 Holston Army Ammunition Plant

2.1.1.1 Description

The HSAAP is a government-owned, contractor-operated facility used for the manufacturing of explosive compounds and explosive formulations. Since 1942, the facility has performed manufacturing operations in two (2) distinct areas, Area A and Area B. Area A is located at the intersection of State Routes 93 and 93A in Sullivan County, Tennessee while Area B is located on U.S. Route 11W in Hawkins County, Tennessee. Areas A and B are linked by an interplant railroad and pipeline corridor. The entire HSAAP is a secured, limited-access facility. Entrances to the HSAAP facility are staffed 24 hours a day, seven (7) days a week by HSAAP security personnel. Area A, Area B and the corridor are each surrounded by a six (6)-foot, chain-link fence with top guard (3 strands of barbed wire). Both Area A and Area B may be accessed only by pass-through gates that are manned by security guards on a 24-hour basis.

The plant also maintains explosive material storage magazines, industrial landfills, a wastewater treatment plant, and several office buildings that provide administrative, environmental, health and safety, and security support services. Area A manufacturing operations consist of refining and concentrating acetic acid and producing acetic anhydride. These materials are then sent to Area B for use in manufacturing explosives.

Area B manufacturing operations consist of the production of an ammonium nitrate and nitric acid mix for the manufacturing of explosive compounds, the production of explosives, the blending of explosive compounds, and the recovery of acetic acid. Explosive wastes are generated only in Area B. There are a total of ten (10) explosives production lines in Area B. The principal explosives manufactured at HSAAP Area B are cyclotrimethylene trinitramine (RDX), cyclotetramethylene tetranitramine (HMX), NTO (3-nitro-1,2,4-triazol-5-one), and DNAN (2,4-dinitroanisole). Other explosives, such as trinitrotoluene (TNT), triamino-trinitrobenzene (TATB), and nitrocellulose (NC) are brought from off-site and used as raw materials to produce other explosive compounds. The end products manufactured and formulated at HSAAP also contain

non-explosive additives such as waxes and lecithin. HSAAP does not use any RCRA metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, or silver) in the manufacturing of the explosives, and these metals are not present in either the primary raw materials or the various additives. Open burning of waste explosive material is conducted at the Burn Pan Unit in Area B.

2.1.1.2 Environmental Setting

The terrain immediately surrounding HSAAP ranges from gently rolling hills on the west and east to very hilly terrain to the north and south. The topography in the vicinity of the Burn Pan Unit is relatively flat with terrain rising gradually to the west, north, and east. The terrain rises more abruptly immediately south of the Burn Pan Unit, just across the Holston River where the Holston River Mountains extend southwest to northeast along the southern boundary of HSAAP. The base elevation at the Site is 1,165 feet mean sea level (msl). Terrain to the west and east rises to elevations of 1,400 to 1,500 feet msl. Immediately south, elevations reach about 2,200 feet msl in the Holston River Mountains. The land within a 3-kilometer distance of the Burn Pan Unit is comprised of either undeveloped woodlands, Area B manufacturing facilities, or the explosive magazine storage area. Most of this area is owned by HSAAP and is not available for development or growth.

2.1.1.3 Surrounding Land Use

The HSAAP Area B is encompassed by U.S. Highway 11W to the north and by the Holston River on the remaining sides. Land use across Highway 11W is predominantly commercial and residential (Figure 1, Appendix I). To the east, primarily single-family residential land lies across the river. A small, multi-family residential area is adjacent to the western boundary of Area B. The area immediately adjacent to the Burn Pan Unit is primarily industrial, mixed forest and/or barren (Figure 2, Appendix I). The Holston River flows near the southern boundary of the Site. Figure 2, Appendix I depicts the location of potential wetlands, ponds and drainage features located near the Site.

2.1.2 Burn Pan Unit

2.1.2.1 Physical Description

From 1942 to 1984, all explosive wastes generated by HSAAP were burned on the ground on burn pads in the area of the existing Burn Pan Unit. Since 1984, off-specification explosives and waste explosive residues have been open burned in four (4) burn pans located at the Burn Pan Unit. In 1986, HSAAP installed a new six (6) to eight (8) inch clay base (design permeability of 1.0E-7 cm/sec or less) covered by three (3) to four (4) inch gravel layer within the Burn Pan Unit to prevent infiltration of stormwater and a berm with side slopes to protect against floods and run-on/run-off and to direct precipitation into the stormwater drainage system. A12-inch layer of rock material (rip rap) was placed on top of the berm's clay base to prevent erosion. Stormwater collected from the Burn Pan Unit was routed to HSAAP's industrial wastewater treatment facility which was designed to treat explosives and discharges to the Holston River per a National Pollutant Discharge Elimination System (NPDES) permit.

Within the Site, there are the four (4) burn pan units, a small storage shed, a resistance heater igniter assembly, two (2) 3/4-inch water spigots and the stormwater drainage system. As shown in Figure 4, Appendix I, the pans are positioned in the northeast, southeast, southwest, and northwest quadrants, near the four (4) corners of the Site, approximately 150 feet away from each other. Each burn pan measures four (4) feet ten (10) inches wide by 20 feet long by one (1) foot deep, is made of quarter-inch-thick seam-welded steel, and contains a clay liner. Each burn pan has a mobile cover that covers the entire pan area. These pan covers are used to prevent precipitation from infiltrating into the pans.

The Burn Pan Unit is located within the 100-year floodplain of the Holston River but the berm surrounding it was designed to prevent floodwaters from entering the Unit. The top-of-berm elevation is 4.4 feet higher than the 100-year flood elevation. The permit states that in the event of a flood, HSAAP would receive 12 to 24 hours of advanced warning from the National Weather Service and the backflow prevention valves on the stormwater drainage lines would be closed to prevent any backflow of floodwaters into the Burn Pan Unit through the drainage lines. Any wastes in the pans awaiting treatment would be treated if conditions allowed. If the material could not be treated, it would be removed and stored in existing product storage igloos located at the Explosive Storage Magazine Area, which is located above the 100-year floodplain.

A 7-foot-high, chain-link fence with top guard (3 strands of barbed wire) installed at the top of the berm establishes the bounds of the Burn Pan Unit (the Site) and protects the Site from unauthorized access. The Site measures approximately 250 feet by 325 feet. Vicinity and aerial maps of the Site are depicted on Figures 1 through 4 of Appendix I. Figure 5, Appendix I presents the layout of the Burn Pan Unit, which is included in the RCRA Permit (Figure 1-1-2 of the Permit). A paved, 45-foot ramp follows the contour of the southern side of the berm up to a 15-foot wide gate in the fence and then down into the Site. Signs stating “Danger Unauthorized Personnel Keep Out” are posted on the Burn Pan Unit gate. The Site is also protected by a closed-circuit television security system that can detect intruders and monitor burning activities from a safe vantage point.

2.1.2.2 Process Description

Hazardous reactive wastes received from the manufacturing catch basins, the product storage area and the laboratory are placed on the clay liner within the burn pans to a thickness of three (3) inches or less and then treated by open burning. Manufacturing process wastes received at the Site typically contain moisture and may be too wet to burn. In these cases, the roll-away mobile cover(s) are left off during the day when it is not raining and if the wind speed is less than 15 miles per hour. This will allow the excess moisture to evaporate. Depending on the moisture content and weather conditions the material may require several days to dry. Pans are covered at dusk.

Open burning treatment takes place during daylight hours after 1200 hours and before 1600 hours, local times, Monday through Friday. In accordance with the permit, open burning does not occur when any of the following meteorological conditions are present or reasonably expected to occur during thermal treatment:

- Precipitation, thunderstorms, or lightning.
- Additional meteorological conditions (air pollution episodes, inversions, overcast sky).
- Restricted visibly (dense fog, blowing snow, or dust).
- Low, overcast sky.
- Air pollution stagnant advisories.
- Ozone advisory alert.
- Wind speeds greater than 15 miles per hour (mph).

Prior to igniting the waste, the mobile covers are rolled at least 20 feet away from the pan(s). An excelsior streamer is placed into the reactive hazardous waste. The free end of the excelsior streamer extends toward the igniter. The Safety Department Representative checks to ensure that there are no personnel in the Site before continuing with ignition procedures. The gate to the Site is locked and personnel move to the remote ignition area inside Building 20 (Figure 3, Appendix I), which is located approximately 800 feet east of the Site. The ignition device uses a heating element consisting of an electrical resistance charcoal heater that ignites the excelsior streamer. Ignition and burning are monitored by closed circuit TV. No person shall enter the Site for at least 30 minutes after there is no visible flame observed on the closed circuit TV. After an appropriate time has elapsed after burning, the mobile covers are moved over the burn pans. Burn pans normally remain covered, especially during inclement weather to prevent rainwater from accumulating in the burn pans.

Each pan is limited to a maximum of 1,500 pounds of net explosive with a Site limit of 5,000 pounds net explosive. The total net explosive treated is not to exceed the 5,000 pound daily limit with a maximum of one (1) burn per day. According to Ms. Amy Crawford of OSI, open burning does not normally occur daily, but typically averages once or twice per week. According to Ms. Crawford, HSAAP burns an average of 3,000 to 3,700 pounds of waste in 2 to 3 pans per burn event.

The solid portion of any spill occurring within the Site is cleaned up by shovels and scoops and placed into a burn pan. If any free liquids are present, they will flow over the compacted-clay liner to the drainage system and be conveyed to the HSAAP NPDES-permitted wastewater treatment plant.

Open burning of explosives in the burn pans at the Site generates very small amounts of ash (treatment residue). The physical form of the treatment residue is distinctly different from the unburned explosive. The treatment residue is a dark, coarse-grained material consisting primarily of dirt, glass, and inert material that was entrained in the waste explosives, whereas the explosives are light colored and have a physical form such as powder, granules or paste depending on the waste being treated. The primary hazard associated with the treatment residue after thermal treatment is the possibility of trace amounts of reactive materials that failed to combust. After sampling and analyses allows for classification of the ash as non-hazardous, ash generated from burn activities is transported and disposed of in the facility's on-Site landfill.

2.1.2.3 Process Emissions

The only releases to the atmosphere associated with open burning, other than water vapor, take place during the actual thermal treatment process. There are no releases to the atmosphere prior to thermal treatment because the wastes do not contain any volatile substances (other than water) and materials are placed in pans and covered except during treatment. Following the cool-down period, no releases take place because there are no volatiles present and treatment residues remain in the covered pans until the next treatment.

The emissions from the open burning of explosives at HSAAP have not been tested because of the need for specialized facilities and equipment for the sampling and analyzing of open burning treatment emissions plumes. However, the Army has conducted an extensive testing program to determine the contents of emissions from the open burning and open detonation of military munitions. The tests were conducted in a specially designed test chamber located at the Dugway Proving Grounds in Utah. The U.S. Environmental Protection Agency (EPA) assisted in the design of the experimental program and in oversight during the test program.

To date, tests have been conducted on more than 20 military munitions items. Several of the munitions tested are bulk explosives and explosive formulations, which were similar to, or the same as, explosives and explosive formulations manufactured by HSAAP and treated in the Burn Pan Unit. These include the following:

- Amatol (50% TNT, 50% Ammonium Nitrate)
- Composition B (RDX/TNT/wax)
- Double Base
- HBX (RDX/TNT/AI/wax)
- M1 (85% NC)
- M6 (85% NC)
- RDX
- TNT
- Triple Base

The 1997 Brown and Root *Air Pathway Assessment*, which is provided in Appendix III, contains a summary of the organic emission constituents and emission factors for each organic emission constituent as determined in the Dugway test program. These emission factors are stated as pounds of emission constituent per pound of explosive material stated as net explosive weight. Data are also included for products of complete combustion, such as carbon dioxide, and products of incomplete combustion (PICs), such as carbon monoxide and benzene.

2.2 Exposure Scenarios for the Site

The exposure scenarios evaluated for human health were determined to be complete based on the continued use of the Site as an industrial facility. A conceptual site model (CSM) has been prepared, which summarizes the potential exposure pathways and receptor populations that were considered. The following sections discuss the selection

of exposure pathways and receptor groups that were evaluated and provide the rationale for exclusion of exposure pathways and receptor groups that were not evaluated.

2.2.1 Exposure Pathways

Exposure pathways were evaluated to determine whether or not they are complete. To be considered complete, an exposure pathway must contain the following elements (USEPA 1989):

- Source and mechanism of release;
- Retention or transport medium;
- Point of potential contact with the affected medium; and,
- Exposure route at the contact point.

If any of these elements was determined to be missing, the exposure pathway was determined to be incomplete. Only complete exposure pathways were evaluated.

2.2.1.1 Sources, Transport, and Contaminated Media

The CSM developed for the Site describes the source, release, distribution, and transport of chemical constituents to potential receptor populations. As such, the CSM was used as the basis for the development of complete exposure pathways for the Site. The CSM was prepared based on current Site data and is presented in Appendix IV.

Past operation of the burn pans has resulted in the release of chemicals to soil, air and groundwater at the Site. Release into groundwater most likely occurred before the clay liner was installed at the Site to prevent precipitation infiltration. Future operation is anticipated to result in the release of chemicals to soil and air. These chemicals have and will be transported in the environment by a variety of mechanisms and may reach potential human receptors who contact contaminated media.

Chemicals in soil will be directly contacted by persons working at the Site. In addition, constituents that are sorbed to soils can be transported to air via wind erosion or due to other physical disturbances of the soil (e.g., vehicle traffic, excavation). Once in air, the soil-sorbed chemicals (i.e., particulates) can be transported to potential receptors both on and off the Site. The burning of explosive materials in the burn pans produces residuals that will also be released into the air and transported to potential receptors either on or off the Site.

Residential use of groundwater was not evaluated in the RA because groundwater is not used as a potable source. Chemicals detected in groundwater could be discharged into the Holston River, thereby transporting contaminants to fish. Although off-site residents could potentially be exposed to contaminants through direct exposure to water in the river or ingestion of fish, these pathways have been determined to be insignificant because the impacted portion of the Holston River has not been associated with recreational swimming or subsistence fishing.

2.2.1.2 Exposure Routes

Receptors can be exposed to chemicals in contaminated media by the following exposure routes:

- Ingestion - soils and treatment residues
- Dermal contact - soils and treatment residues
- Inhalation - particulate matter in ambient air from soils and treatment residues or as released during operation of the burn pans

2.2.2 Potential Receptor Populations

Potential receptor populations were identified based on current and extended future land use in the vicinity of the HSAAP. The primary receptor populations that could be exposed to chemicals at the Site were determined to be current and future on-Site workers. Future on-Site construction workers would also have the potential to be exposed to on-Site chemicals. Trespassers at the Site were determined to be unlikely due to the high level of security; therefore, that population was not evaluated. The principal off-site receptors were determined to be nearby workers and residents. Exposures to off-site workers would be lower than those to on-Site workers (due to fewer exposure routes and lower exposure concentrations); therefore, risks to off-site workers were not evaluated. Because off-site residents constitute a receptor population different from on-Site workers, they were evaluated in the HHRA.

2.2.2.1 On-Site Worker

The on-Site worker was defined as a current and future long-term, full-time employee who spends most of the day working in the vicinity of the Site. This receptor was assumed to be the material handler who collects containers (usually plastic bags) of waste explosives from various generation points, loads them directly (by hand) into a pickup truck, transfers them to the Site and then unloads them, by hand, onto the burn pan(s) for open burn treatment. The material handler would use a shovel to clean up the solid portion of any spill occurring within the Site placing the material onto a burn pan. This receptor may also participate in the removal of unwanted vegetation within 200 feet from the burn pans to prevent fire hazards. The Site is covered by three (3) to four (4) inches of gravel so frequency of this activity is minimal.

Personnel engaged in the handling of waste explosives and treatment residue wear protective clothing, including white cotton coveralls, gloves, safety glasses with side shields, and non-sparking safety shoes. Therefore, dermal exposure was determined to be an insignificant exposure pathway and was not evaluated.

Waste material treated at the Site is in solid, granular form, and the vapor pressure of the energetics is negligible. Additionally, the relatively high moisture content of the materials greatly reduces the chance of windblown emissions. As a result, inhalation of volatiles and particulates during waste transport and loading was determined to be an incomplete pathway. Inhalation of emissions during burning was considered insignificant because the worker is required to evacuate the Site and observe the burning

events from within a building that is located 800 feet east of the Site. Inhalation and incidental ingestion of treatment residues by the on-Site worker were considered insignificant due to the small amount of ash residue that is generated during treatment and the fact that only trace amounts of reactive materials remain. Because the pans containing the treatment residue are covered at all times unless the moist waste material is being treated or is still moist, the potential for on-Site workers to be exposed to windblown treatment residue was also determined to be insignificant.

The evaluation of the on-Site worker was, therefore, limited to incidental ingestion of burn pan wastes during handling and contaminated surface soils while cleaning up spills and removing vegetation.

2.2.2.2 Construction Worker

Future construction workers would be expected to participate in shorter term, intermittent work at the Site. Activities may include repairing and replacing the Burn Pan Unit structure, which would involve on-Site exposures to surface and subsurface soils containing hazardous waste constituents. Workers were assumed to have the potential for direct contact with soil to a depth of ten (10) ft below ground surface (bgs). Inhalation of particulates also may occur. Dermal contact was not considered a complete exposure pathway since it was assumed that HSAAP would require similar PPE as for the on-Site worker. Exposure to emissions during burning was determined to be incomplete because the construction worker will not be onsite during burning operations. The construction worker was determined not to be exposed to treatment wastes because the pans are covered between treatments.

Potentially complete exposure pathways evaluated for the construction worker were:

- Incidental ingestion of contaminated surface and subsurface soil, and;
- Inhalation of particulates containing contaminated surface and subsurface soils

2.2.2.3 Off-site Resident

The off-site resident was assumed to spend a portion of their time outdoors and a portion of their time inside the residence. Exposure to treatment residues that could potentially become windborne was determined to be limited because the burn pans containing the residues are covered between treatments. Mobility of contaminated soils by wind erosion is reduced by the presence of the berm that surrounds the Site and a gravel layer that covers the clay liner below the burn pans. Inhalation of waste emissions dispersed in air during waste treatment is, therefore, the only potentially complete exposure pathway for the off-Site resident. This exposure pathway was evaluated using information from the 1997 Brown and Root *Air Pathway Assessment*. The exposure populations that were evaluated under this assessment included the residents in the closest public residence to the HSAAP and students attending the eight (8) elementary and high schools located within ten (10) kilometers of HSAAP. The air pathway assessment, which is provided in Appendix III, presents the quantitative evaluation for this pathway. The pathway assessment remains a valid representation of current conditions at the site. Therefore, an update or revision to the existing air pathway assessment is not required.

2.2.3 Data Evaluation

This section describes the types of analytical data that were used for the HHRA as well as the proposed procedures that were used to evaluate the usability of the data.

2.2.3.1 Data Types

A list of site-related chemicals (SRCs) manufactured and potentially treated at the Site by HSAAP is provided in the RCRA Permit (OSI 2011). Hazardous wastes that are treated at the Site are not tested prior to treatment. Therefore, analytical data for hazardous wastes treated at the Burn Pan Unit were not available for use in the HHRA. Historically, chemical and physical characteristics of the waste materials to be burned have been assumed based on process knowledge and product specifications.

On November 8, 2011, Ms. Amy Crawford of OSI provided analytical reports for historical groundwater samples collected from the site and analytical reports for historical treatment residue samples collected from the burn pans on November 11, 2011.

A review of groundwater data collected between 2001 and 2011 from five (5) monitoring wells revealed detected concentrations of RMX and HMX in the monitoring wells. Nitrotoluene and nitrobenzene constituents were not detected in the groundwater samples. Although the data indicates contaminant transfer to groundwater has occurred, the groundwater exposure pathway was not evaluated in the HHRA since it was determine to be incomplete for all receptor populations.

Treatment residue TCLP analytical data collected from the burn pans between 2006 and 2011 was also reviewed. The analytical reports revealed detections of barium and arsenic, but no other constituents. As with groundwater, the treatment residue data were not evaluated because exposures to treatment residue were determined to be insignificant or incomplete.

On January 27, 2012, Ms. Carol Ford of S&ME provided the *Soil Sampling, Fall 2011* report. The purpose of the soil sampling was to define the horizontal and vertical extent of contamination around the four (4) burn pans. Soil samples were analyzed for the primary constituents of concern including RDX, HMX and TNT. Table 1, Appendix II provides a summary of the analytical data. No other historical soil data were available. The 2011 soil analytical data were reviewed for usability.

Samples to determine the concentrations of SRCs in air have not been collected. Air dispersion modeling was conducted to estimate maximum ambient concentrations of SRCs and other pollutants resulting from combustion as well as the deposition of particulate matter. This modeling was completed using the Open Detonation/Open Burning (ODOM) model and results were reported in Brown and Root's *Air Pathway Assessment* prepared for Burn Pan Unit in 1997 (Brown and Root Environmental 1997). The report and supporting documentation were reviewed to determine the usability of the modeling results in this HHRA.

2.2.3.2 Data Review and Selection

The primary objective of the data review was to ensure that they were of acceptable quality and quantity for use in the RA.

The primary sources of analytical data for this RA included:

- 2011 Burn Pan Unit soil sampling data collected by S&ME
- Heat content values and emissions factor of the energetic materials and combustion products (pollutants) presented in the 1997 Brown and Root *Air Pathway Assessment*

The soil data collected in 2011 were reviewed to confirm whether the data adequately represented the Site spatially (locations sampled) and statistically (sufficient number of values available to have an acceptable level of confidence in the data set). Sampling locations were biased toward impacted areas on the Site, which resulted in a good representation of the maximum concentrations of the constituents of concern. Procedures used in the field to collect the samples were in accordance with the procedures set forth in the 2011 *Soil Sampling Plan* prepared by Mountain Creek Engineering, Inc. The number of samples collected was determined to provide an adequate dataset for competent statistical evaluation.

EPA's *Guidance for Data Usability in Risk Assessment* (EPA 1992) was used to evaluate the analytical data to determine its reliability for use in the RA. Analytical methods used by the analytical laboratory were equivalent to those approved by the USEPA. Analytical methods were chosen to ensure sufficient analytical sensitivity to detect potentially harmful analytes at concentrations below the levels of concern. Data qualifiers were reviewed and treated in accordance with EPA guidance. According to ESC's *Quality Assurance Manual* the laboratory's routine quality checks are incorporated into the analytical methods to generate definitive data and to document issues that might adversely affect the quality or usability of the data, such as instrument malfunctions, bias during analysis, or cross contamination. Analytical results were documented in a data summary report that discussed overall data quality. No limitations were reported for the use of the data.

The air data presented in the 1997 Brown and Root *Air Pathway Assessment* were derived from the application of an air dispersion model, approved by the USEPA for open detonation and open burning, the ODOM model. The model was used to calculate short term and long term concentrations for pollutants having either a National Ambient Air Quality Standard (NAAQS) or associated risk-based air screening level. The model inputs source dimensions, heat content values of the energetic materials, and combustion products. All information regarding the Site source release parameters was obtained from facility drawings, HSAAP personnel, the POLU13L Combustion Products Model and a database of heat content and emissions factors derived from open burning emissions tests conducted at Dugway Proving Grounds.

The Composition B, RDX, and TNT tested at Dugway are similar to the Composition B, RDX, and TNT manufactured at HSAAP. The open detonation emission factors were used, because data were not available for the emissions resulting from the open burning

of explosive compounds (HMX, RDX, and TNT). Use of detonation emission factors as surrogates for emission constituents and emission quantities for Burn Pan Unit treatments is conservative, because open detonation reportedly results in greater emissions. The constituents evaluated in the pathway assessment were the same as those that HSAAP currently uses in its manufacturing process. The source release information, heat content values and meteorological data used in the model represent the most current data available. As a result, it was determined not to be necessary to rerun the air dispersion model. Emissions factor data from the air dispersion modeling conducted in 1997 were determined to provide a reasonable prediction of the dispersion of pollutants resulting from the operation of the burn pans under a worst-case scenario.

2.2.3.3 Data Processing

Data were evaluated based on data usability. Data determined to be of sufficient quality to support the HHRA were compiled in a database to support the exposure and risk calculations. The universe of relevant sampling data for the Site included detected and non-detected values, duplicate samples, and split samples. The treatment of these different data types followed EPA guidance. Detected data that were deemed appropriate for use in the RA by the data usability evaluation were used at the full reported value. Non-detected results that were considered appropriate for use in the HHRA were also included in the dataset. For non-detected results, the sample detection limit was reported.

During the 2011 soil sampling, three (3) duplicates and three (3) rinseate samples were collected and submitted to ESC laboratory for analysis of RDX, HMX and TNT. None of these constituents were detected in the rinseate samples, thereby confirming that the sampling equipment was adequately cleaned to prevent cross-contamination. The concentrations detected in the duplicate samples were not comparable with the Site samples. Table 1, Appendix II shows the variability between the duplicates and their respective Site samples. Therefore the duplicates were treated as independent samples and results were carried forward in the quantitative characterization of SRCs. Uncertainties associated with the choice of the first sample will be tracked in the RA and discussed in the uncertainty section.

2.2.4 Selection of HHRA COPCs

To focus the HHRA on those SRCs that were most important in defining potential risks and hazards, an initial screening was applied to the data to select the particular SRCs to be considered in the HHRA. The SRCs selected for evaluation in the RA were defined as the chemicals of potential concern (COPCs). The risk-based screening assessment consisted of a comparison of the maximum detected Site concentration to the Oak Ridge National Laboratory (ORNL) 2011 Industrial Soil Regional Screening Levels (RSLs). Chemicals for which the maximum detected Site concentrations exceeded their respective RSLs were retained as COPCs for further risk analysis.

2.2.4.1 Selection of Air COPCs

As stated previously, the emissions factors from the 1997 Brown and Root *Air Pathway Assessment* air dispersion model were used to calculate long-term air concentrations for combustion pollutants. Long-term annual average air concentrations were calculated by

OBODM using the 5 years of hourly meteorological data assuming that treatment is conducted 5 days per week, 50 weeks per year for one (1) hour. This exposure frequency is considered to be overly conservative since HSAAP's historical records indicate that burn events occur an average of zero (0) to two (2) times a week. HSAAP has occasionally burned three (3) to four (4) times a week n the last three (3) years, which still averages less than three (3) times a week on an annual basis. These air concentrations and EPA's Region III 1997 Risk-based (RBC) Ambient Air concentrations were used to calculate the carcinogenic and noncarcinogenic risks for each off-Site receptor population. The assessment was updated in 2001 using the same air concentrations and EPA Region III Ambient Air RBCs. None of the individual carcinogenic and noncarcinogenic risks exceeded the EPA's risk criteria of 1E-06 for carcinogenic risk or noncarcinogenic hazard quotient of 1 in either evaluation. The individual carcinogenic and noncarcinogenic risks were summed in the 1997 and 2001 assessment to evaluate total risks for each off-Site receptor. The total carcinogenic risk and noncarcinogenic hazards did not exceed the EPA's risk criteria.

To further update the air pathway assessment, the November 2011 ORNL Residential Air RSLs were used to compare against the off-Site resident average annual air concentrations. A summary of the comparison is provided in Table 2, Appendix II. None of the air concentrations exceeded their respective Residential Air RSLs. It should be noted that Residential Air RSLs were not available for 23 constituents, including RDX and HMX. Ambient Air RBCs were available for these 23 constituents at the time of the 1997 and 2001 assessments. These assessments demonstrated that the individual carcinogenic or noncarcinogenic risks calculated for these constituents were below the EPA risk criteria. These concentrations were also below their respective Ambient Air RBCs. Therefore, none of the chemicals evaluated in the air pathway assessment were identified as COPCs for further evaluation in the RA.

2.2.4.2 Selection of Soil COPCs

Three (3) phases of soil sampling were conducted at the Site in 2011 in order to delineate the horizontal and vertical extent of contamination around the burn pans. The sampling was conducted as required by the RCRA Permit and in accordance with the July 2011 *Soil Sampling Plan* prepared by Mountain Creek Engineering, Inc. Two (2) rounds of soil sampling were conducted under the Phase I sampling protocol to delineate the horizontal extent of contamination at the Site. The first round of sampling occurred on September 19, 2011. The results are summarized in Table 1, Appendix II. Soil sample locations are depicted on Figure 4, Appendix I. The analytical results indicated the following:

- RDX was detected in 20 of the 31 samples;
- The concentration of RDX exceeded the ORNL Industrial Soil RSL in eight (8) of the 31 samples;
- HMX was detected in 30 of the 31 samples;
- None of the concentrations of HMX exceeded the ORNL Industrial Soil RLS in the 31 samples; and
- TNT was not detected in any of the 31 samples.

To further define the horizontal extent of contamination, the second round of Phase I sampling included the collection of an additional 24 soil samples from three (3) locations on a five (5)-foot radius around the original eight (8) sample locations where RDX exceeded its ORNL Industrial Soil RSL. The analytical results (Table 1, Appendix II) indicated the following:

- RDX was detected in 23 of 24 samples;
- HMX was detected in 24 of 24 samples;
- TNT was detected in only one (1) of 24 samples; and
- None of concentrations of RDX, HMX or TNT exceeded their respective ORNL Industrial Soil RSLs.

The Phase II and III sampling events were conducted to delineate the vertical extent of contamination in the vicinity of the burn pan. During the Phase II event, samples were collected from a depth of four (4) to six (6) inches below the top of the compacted clay liner at the eight (8) locations where RDX concentrations detected in the Phase I soil samples exceeded the ORNL Industrial Soil RSL. The analytical results (Table 1, Appendix II) indicated the following:

- TNT was detected in one (1) of the eight (8) samples;
- RDX and HMX were detected in all eight (8) samples;
- Concentrations of RDX detected in three (3) samples exceeded its ORNL Industrial Soil RSL; and
- HMX and TNT concentrations did not exceed their respective ORNL Industrial Soil RSLs.

To further delineate the vertical extent of contamination, three (3) soil samples were collected from the upper layer of the residual soils beneath the compacted clay liner as part of the Phase III soil sampling. The samples were collected from a depth of 10 to 12 inches below the top of the clay liner into residual soils at the three (3) locations where Phase II soil samples exhibited RDX concentrations exceeding the ORNL Industrial Soil RSL. The analytical results (Table 1, Appendix II) indicated the following:

- RDX and HMX were detected in two (2) of the three (3) samples but concentrations did not exceed their respective ORNL Industrial Soil RSLs; and
- TNT was not detected in any of the sample.

Since RDX was the only constituent detected during the 2011 sampling events at concentrations exceeding its Industrial Soil RSL, it was identified as the only COPC in soil and was retained for further risk analysis.

2.3 Exposure Assessment

The magnitude of exposure for any given receptor is a function of the chemical concentrations in the exposure medium and the frequency, intensity, and duration of contact with that medium. This section presents an overview of the assumptions that were used to calculate potential exposures as part of the HHRA.

2.3.1 General Approaches to Exposure Calculations

Oral and dermal exposures are expressed in terms of intake (i.e., milligram chemical per kilogram body weight per day – mg/kg day), whereas inhalation exposure are expressed in terms of an exposure concentration (EC) in air (e.g. gram chemical per cubic meter air - g/m^3). These different expressions of exposure correspond with the toxicity criteria that are available to calculate risks for each type of exposure. EPA guidance recommends that two (2) types of exposure estimates be calculated. The reasonable maximum exposure (RME) is defined as the highest exposure that could reasonably be expected to occur for a given exposure pathway at a site. The RME is intended to account for both uncertainty of the contaminant concentration and variability in exposure parameters. EPA also recommends that an average estimate of exposure, termed "central tendency exposure" (CTE), be presented. Both RME and CTE estimates were calculated for the HHRA.

2.3.2 Exposure Point Concentrations

Exposure Point Concentrations (EPCs) were based on measured concentrations of chemicals in environmental media or estimated concentrations based on air dispersion modeling. Both RME and CTE EPCs were derived.

Soil EPCs were calculated to estimate direct contact exposure for the on-Site worker and construction worker. EPCs from soil were derived using analytical data from soil samples collected within the Site. Representative EPCs were based on the potential exposure depth interval for each receptor. For receptors exposed to surface soil (e.g., on-Site workers), data from the top two (2) inches of soil was used since the site is covered with a three (3) to four (4)-inch gravel layer and the likelihood of the on-Site worker removing spills or vegetation beyond two (2) inches below the gravel is unlikely.

For the construction worker data from the surface to a depth of 12 inches were used. Soil samples below 12 inches were not collected since the vertical extent of contamination of the site was delineated to this depth. However, the dataset provides representative maximum exposure potential for the construction worker.

To estimate exposures that are representative of upper end exposures, EPA recommends using the 95th upper confidence limit (UCL) of the arithmetic mean concentration. For each COPC, the sample size, frequency of detection, and data distribution were evaluated in order to select the appropriate method for computing a UCL. One-half the detection limit for non-detected results was not used when computing the 95th UCL because a nonparametric method (i.e., Kaplan-Meier) was used to calculate the UCL. The USEPA ProUCL 4.1 software (USEPA 2012) was used to calculate the UCLs using RDX data from samples collected from depths of zero (0) to two (2) inches to represent the RME for the on-Site worker and from zero (0) to 12 inches to represent the RME for the construction worker. The arithmetic mean concentrations were also calculated for each data set to represent the CTEs. RME and CTE values calculated for both receptors are presented in Table 3, Appendix II.

2.3.3 General Intake Assumptions

The specific equations and assumptions used to estimate exposure varied based on the exposure routes that were evaluated. Site specific and default EPA guidance values were used as the exposure factors for ingestion rate (IR), fraction ingested (FI), exposure duration (ED), exposure frequency (EF), body weight (BW) and averaging time (AT). Table 3, Appendix II, presents the general exposure factor assumptions that were used for the on-Site worker and construction worker.

2.3.3.1 Ingestion Rate

As stated previously, the exposure for the on-Site worker is limited to incidental ingestion of burn pan wastes during handling and contaminated surface soils while cleaning up spills, and removing vegetation. The EPA recommends an IR of 100 mg/day for an outdoor worker (USEPA 2002). This ingestion rate is based on an outdoor worker who spends most of the workday conducting maintenance activities such as moderate digging and landscaping. The HSAAP outdoor worker does not perform daily maintenance activities that require digging and landscaping. The worker spends a short amount of time on the Site transporting wastes from containers to the burn pans, cleaning up spills with shovels, and occasionally removing sparse vegetation from the Site. Also, the contaminated soils are located below a three (3) to four (4)-inch gravel layer so exposure to soils would be occasional rather than routine. Therefore, an ingestion rate of 50 mg/day was selected rather than the EPA recommended rate. This IR was adopted for the RME and CTE cases. The EPA-recommended construction worker IR of 330 mg/day was adopted for the construction worker RME and CTE cases.

2.3.3.2 Exposure Duration

The EPA-recommended RME worker ED of 25 years (USEPA 2002) was adopted for this HHRA. The average, or CTE, value for occupational ED was assumed to be seven (7) years, which is the median occupational tenure of the working population (USEPA 1997b). Based on best professional judgment, one (1) year was used as the RME ED for the construction worker and of value of six (6) months was used as the CTE value.

2.3.3.3 Exposure Frequency

An RME EF of 150 days/year was adopted for outdoor workers. This frequency assumes HSAAP conducts burn events 3 days a week for 50 weeks a year. As stated in Section 2.2.4.1, burn events occur an average of zero to two (2) times a week. HSAAP has occasionally burned three (3) or four (4) times a week in the last three (3) years, which still averages less than three (3) times a week on an annual basis. This EF was adopted for the CTE case. Based on best professional judgment, a value of 250 days/year was used for both the RME and CTE EF for the construction worker.

2.3.3.4 Body Weight

The EPA recommended BW of 70 kg (USEPA 2002) was used for all RME and CTE worker scenarios.

2.3.3.5 Averaging Time

In accordance with EPA guidance, the AT for carcinogenic risks was established as a 70 year lifetime (25,550 days) (USEPA 2002). The AT for noncarcinogenic effects was calculated as the scenario-specific ED converted to days.

2.3.4 Intake Equations

2.3.4.1 Incidental Ingestion of Soils

Ingestion of COPCs in soil by the on-Site worker and construction worker was estimated by the following equation:

$$\text{Intake (mg/kg-day)} = \frac{CS \times IR \times CF \times EF \times ED}{BW \times AT}$$

Where:
CS = Chemical concentration in Soil (mg/kg) (chemical specific)
IR = Ingestion Rate (mg soil/day)
CF = Conversion Factor (10^{-6} kg/mg)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT = Averaging Time (period over which exposure is averaged – days)

2.3.4.2 Inhalation of Particulates

The inhaled dose of COPCs in soil particulates by the construction worker was estimated by the following equation:

$$\text{Intake (mg/kg)} = \frac{CA \times ET \times EF \times ED}{AT}$$

CA = Concentration of COPC in air ($\mu g/m^3$)
ET = Exposure Time (hours/day)
EF = Exposure frequency (days/year)
ED = Exposure Duration (years)
AT = Averaging Time (days)

The concentrations of COPCs in air were calculated as follows:

$$Ca = \frac{Cs}{PEF}$$

where:
Ca = constituent concentration in air (mg/m^3, calculated)
Cs = constituent concentration in soil (mg/kg)
PEF = particulate emission factor (m^3/kg)

EPA derived a model for estimating a dust particulate emission factor (EPA 2002) as follows:

$$PEF = Q/C \times \frac{3{,}600 \text{ seconds/hour}}{0.036 \times (1\text{-}Fv) \times (U_m/U_t)^3 \times F(x)}$$

where:
PEF = particulate emission factor (m^3/kg, calculated)
Q/C = inverse of the mean concentration at center of square source
3600 seconds/hour
Fv = fraction of surface covered with vegetation (0.1, unitless, assumed)
U_m = mean annual wind speed (default, 4.69 m/second)
U_t = equivalent threshold value of wind speed at 7 m (default, 11.32 m/second)
F(x) = function dependent on Um/Ut (default, 0.194)

2.4 Toxicity Assessment

Toxicity factors are numerical expressions of dose and response, and vary based on factors such as the route of exposure (e.g., oral or inhalation) and duration of exposure (e.g., subchronic or chronic). Because RDX was determined to be the only COPC, the purpose of the toxicity assessment was to summarize health effects that may be associated with exposure to RDX and to identify doses that may be associated with those effects. The focus of the toxicity assessment was on effects associated with repeated long-term exposures to the RDX concentrations detected in soil based on the exposure pathways determined complete for the Site.

Standard EPA procedures were followed to identify and assess toxicity factors and other relevant toxicity information, such as the weight of evidence (WOE) category for carcinogenic potential. As recommended in the EPA memorandum, *Human Health Toxicity Values in Superfund Risk Assessments* (USEPA 2003), the primary sources that were consulted for toxicity values were, in order of priority, EPA's Integrated Risk Information System (IRIS; USEPA 2011b) and EPA's provisional peer reviewed toxicity values (PPRTVs) from the National Center for Environmental Assessment/Superfund Health Risk Technical Support Center (USEPA 2011c). Where neither IRIS toxicity values nor PPRTVs were available, other documented sources, including EPA's Health Effects Assessment Summary Tables (HEAST; USEPA 1997), the Agency for Toxic Substances and Disease Registry (ATSDR) minimal risk levels (MRLs; ATSDR 2011), and Oak Ridge National Laboratory's Risk Assessment Information System (ORNL, RAIS; USDOE 2011) were reviewed. Uncertainties associated with the toxicity assessment are discussed in the uncertainty section.

2.4.1 Noncarcinogenic Effects from Chemical Exposures

IRIS reported a chronic oral reference dose (RfD) of 3.0E-03 mg/kg-day for RDX. The No-Observed Adverse Effect Level (NOAEL) dose rate (0.3 mg/kg/day) and an uncertainty factor of 100 were applied to extrapolate animal effects to human effect to derive the oral RfD.

An inhalation reference concentration (RfC) was not identified for RDX, nor was a surrogate identified for the inhalation pathway.

2.4.2 Carcinogenic Effects from Chemical Exposure

IRIS identified RDX as a Class C carcinogen with an oral slope factor of 1.1E-01 mg/kg-day. The animal study dose was divided by the ratio of the human weight (70 kg) to the mouse weight (0.040 kg) raised to the 1/3 power.

An inhalation unit risk (IUR) value was not identified for RDX nor was a surrogate identified for the inhalation pathway.

2.5 Risk Characterization

The goal of risk characterization was to present and interpret the key findings of the HHRA, along with their limitations and uncertainties, for use in risk management decision making. The quantitative estimates of exposure and toxicity were compared to yield estimates of potential carcinogenic risk and noncarcinogenic hazard. Carcinogenic risks and noncarcinogenic hazards were estimated separately because of differences in calculation methods. This section describes the methods that were used for quantifying and interpreting carcinogenic risks and noncarcinogenic hazards and for characterizing uncertainties associated with these calculations.

2.5.1 Noncarcinogenic Hazards from Chemical Exposures

Health risks other than cancer were characterized as the increased likelihood that an individual will suffer adverse health effects as a result of chemical exposure. To evaluate these noncarcinogenic hazards, the ratio of the exposure term (i.e., average daily intake or EC) to the corresponding noncarcinogenic toxicity reference value (i.e., reference dose - RfD or reference concentration - RfC) was calculated. This ratio is referred to as the hazard quotient (HQ):

$$HQ = \frac{I}{RfD}$$

where:
HQ = hazard quotient
I = average daily intake (mg/kg-day)
RfD = Reference Dose

The chemical-specific HQs were summed for each individual receptor to calculate the hazard index (HI). The HQ for the inhalation of particulates exposure pathway under the construction worker scenario could not be calculated since an inhalation RfC value was not available for RDX. Therefore, the HI was calculated based on only one (1) exposure pathway, incidental ingestion of soils, for both the on-Site worker and construction worker scenarios. The noncarcinogenic HIs calculated for the two (2) receptors are presented below.

On-Site Worker		Construction Worker	
CTE HI	RME HI	CTE HI	RME HI
0.008	0.03	0.08	0.26

The CTE and RME noncarcinogenic hazards for the on-Site worker and construction worker were each less than the EPA target HI of 1.

2.5.2 Carcinogenic Risks from Chemical Exposures

The carcinogenic risk estimates derived using standard RA methods were characterized as the incremental probability that an individual will develop cancer during his or her lifetime due to exposure to SRCs resulting from the specific exposure scenarios that were evaluated. The term "incremental" reflects the fact that the calculated carcinogenic risk associated with Site-related exposure is in addition to the background risk of cancer experienced by all individuals in the course of daily life. Incremental lifetime cancer risks were calculated as the product of the exposure term (i.e., lifetime average daily intake or EC) and the expression of the carcinogenic potency of chemicals (i.e., slope factor - SF or inhalation unit risk - IUR).

$$Risk = Intake \times SF$$

where:
Risk = a unitless probability of an individual developing cancer over a lifetime
Intake = average daily intake (mg/kg-day)
SF = slope factor, expressed in $(mg/kg\text{-}day)^{-1}$

Individual carcinogenic risk values were summed across pathways to calculate a total carcinogenic risk for each receptor. The carcinogenic risk for the inhalation of particulates was not calculated because an IUR value was not identified for RDX. Therefore, only one (1) exposure pathway, the incidental ingestion of soils, was included in the calculation of individual carcinogenic risks under the onsite worker and construction worker scenarios. The carcinogenic risks that were calculated for both receptors are presented below.

Onsite Worker		Construction Worker	
CTE Cancer Risk	RME Cancer Risk	CTE Cancer Risk	RME Cancer Risk
1.1E-07	1.6E-06	1.3E-07	8.5E-07

The RME carcinogenic risk for the on-Site worker slightly exceeded the EPA's target carcinogenic risk of 1E-06 but the CTE carcinogenic risk did not exceed the target level. Neither the RME nor the CTE carcinogenic risks for the construction worker exceeded the target level.

2.6 Uncertainty Evaluation for HHRA

An important element of the HHRA is an assessment of the uncertainty in the estimated noncarcinogenic hazards and carcinogenic risks. Uncertainty is inherent in many aspects of the RA process. The following factors were identified as the primary areas of

uncertainty for this HHRA:

- future site use;
- toxicity factors;
- exposure factors; and
- exposure point concentrations

2.6.1 Future Site Use

The RA assumed that the current industrial uses of the Site will not change in the future. A future change in land use of the Site is possible, but not expected. The RCRA Permit provides requirements for minimizing risks to human health and the environment should the permittee close the facility. An assessment of risks associated with closure activities would be required, thereby reducing the uncertainties associated with potential changes in land use.

2.6.2 Toxicity Factors

The uncertainties specific to the toxicity assessment are associated with:

- the toxicity studies that form the basis for the toxicity values recommended by USEPA and
- the lack of sufficient toxicity data to develop toxicity values for certain constituents.

2.6.2.1 Toxicological Studies

The toxicity assessment relies upon the use of toxicity values (carcinogenic SF or IUR, non-carcinogenic RfDs or RfCs) developed by USEPA to evaluate potential chronic toxicity of COPCs. These toxicity values may be estimated from human data, but the process is largely dependent upon laboratory animal data generated from a variety of toxicology and safety testing studies conducted on constituents. Epidemiological studies of munitions workers exposed to RDX have not been conducted. Therefore, the toxicity values were derived from laboratory studies using laboratory animals. IRIS indicated a high confidence level in both the SF and RfD values.

The carcinogenic toxicity values, SFs, are derived from cancer bioassay or epidemiologic dose-response data to estimate carcinogenic risk at constituent concentrations that may be several orders of magnitude lower than the given dose or estimated exposure observed in the studies that form the basis of the assessment. Thus, extrapolations are made in projecting potential effects at low doses from data on effects at high doses, thereby adding to the uncertainty. In the case of RDX the high-dose data was not used in the slope factor calculation since it was lowered from 175 mg/kg/day to 100 mg/kg/day during week 11 due to low survival.

Toxicity values derived to estimate chronic dosages that may induce non-carcinogenic adverse effects also have a number of limitations. Unlike carcinogenic risk assessment, by convention noncarcinogenic adverse effects are assumed to occur in a dose-response manner only after a threshold dose has been exceeded. This assumption is the basis for the use of the RfD in estimating the HI. If this ratio is greater than 1.0, such exposures may be considered hazardous. The HI can only be used to qualitatively rank the

possibility of adverse noncarcinogenic effects occurring. The HI used to describe noncarcinogenic health hazards has an inherent uncertainty. For example, RfDs are derived from No-Observed Adverse Effect Level (NOAEL) or Lowest Observed Adverse Effect Level (LOAEL) dose rates determined from animal studies or human exposure investigations. Depending on the quality of the available data, the NOAEL or LOAEL is divided by an uncertainty factor ranging from one (1) to 10,000. In the case of RDX, the NOAEL dose rate was used for the noncarcinogenic toxicity value, and an uncertainty factor of 100 was used to extrapolate animal effects to human effect. This uncertainty factor may over-estimate noncarcinogenic hazard.

2.6.2.2 Insufficient Toxicological Data

In some cases, toxicological data is not available for constituents. Therefore, risks cannot be fully evaluated. For example, inhalation toxicity values for RDX were not identified by the sources used to derive toxicity values. Therefore, carcinogenic risks and noncarcinogenic hazards for the construction worker were not quantitatively assessed for the inhalation pathway, and the total carcinogenic risk and noncarcinogenic hazard for the Site may have been underestimated. Residential Air RSLs were not available for some constituents evaluated in the Air COPC evaluation. However, the Ambient Air RBCs were available during the 1997 Air Pathway Assessment, and the 2001 update for the assessment. Therefore, the risks to the offsite resident were not underestimated.

The primary sources of toxicological data identified in Section 2.4 were reviewed to derive qualitative information regarding RDX inhalation toxicity. ATSDR was the only source that provided data from animal and human studies. According to the ATSDR *Toxicological Profile for RDX*, January 2012 (ATSDR 2012), there is no inhalation MRLs due to the limited data available on the toxicity of RDX following inhalation exposure. Several studies reported convulsions in humans acutely exposed to unspecified amounts of RDX. Nausea and vomiting have also been reported in humans; however, these individuals may have been exposed to RDX via inhalation and ingestion. Deaths due to bronchopneumonia, pneumonia, or pulmonary congestion were observed in rabbits and guinea pigs exposed to an unspecified concentration of RDX.

Four (4) studies were located regarding systemic effects in humans after inhalation exposure to RDX alone. The available studies have reported adverse gastrointestinal, hematological, hepatic, and renal effects in workers exposed to C-4 (an explosive composed of 91% RDX) or RDX dusts via inhalation. No studies were located regarding respiratory, cardiovascular, musculoskeletal, dermal, ocular, or other systemic effects in humans after inhalation exposure to RDX. Only one (1) study is available regarding systemic effects in animals after inhalation exposure to RDX. This study is limited by insufficient numbers of animals tested, no controls, and no data on exposure levels.

Workers at an Army ammunition plant who were exposed to an average of 0.28 mg/m^3 of RDX dusts for an unknown period of time showed no significant differences in a test for antinuclear antibodies as compared to nonexposed workers. The results of this test provide no evidence of autoimmune disease. No other immunological function tests were performed. Convulsions and unconsciousness, accompanied by headache, dizziness, and

vomiting, were noted in five (5) out of 26 workers who were exposed to unknown levels of RDX dust in the air. Similar findings, such as convulsions, muscle twitching, and confusion, have been reported in five (5) case studies of men exposed to C-4 fumes (91% RDX) when it was used as a cooking fuel and in a worker hand-sieving RDX. The workers recovered a few days after they were removed from the source of exposure. In a study of workers at an RDX facility, no increases in the occurrence of subjective symptoms were reported. Significant differences in performance on tests of memory retention and block design were found in workers exposed to 0.407 or 0.672 mg/m^3, as compared to controls; however, no other differences were found between the two (2) exposed groups. No studies were located regarding neurological effects in animals after inhalation exposure to RDX.

2.6.3 Exposure Factors

Selected exposure parameters are generally designed to be conservative so that no actual exposed population will receive greater exposures than those estimated. Exposure parameters were used to bound the upper and best estimate levels of reasonable maximum exposures. Potential exposure pathways were evaluated for all identified potential receptors. All pathways except for the inhalation pathway under the construction worker scenario were evaluated quantitatively for their potential to be associated with adverse health effects.

Under the standard approach to exposure assessment recommended by the USEPA, where a COPC was identified, it was generally assumed that exposure to that substance will occur. Although efforts were made to apply Site-specific and receptor-specific exposure factors, some USEPA default values were used. These recommended default values are based on limited data and are chosen to represent conservative estimates. For example, in construction worker exposure pathway for incidental soil ingestion, it was assumed that 100 percent of the ingested COPCs were absorbed for 250 days per year for one year under the RME exposure. This assumption may overestimate the incidental ingestion exposure pathway since construction-related projects at the Site are unlikely to require this extent of time. The RME and CTE exposure frequency for the on-Site worker is also overly conservative since there are some weeks that burning does not actually occur at the Site. The RME default ingestion rates for the on-Site worker is overly conservative since waste spills are handled with shovels and removal of vegetation is limited since the site is covered with a three (3) to four (4) inch gravel layer. Under the Air Pathway Assessment it is assumed that the offsite residents could be exposed to the maximum levels of emissions from Site on a daily basis. As noted previously, burn events do not occur daily. Therefore, there is a high degree of certainty that total exposures are not underestimated for any actual exposed population.

2.6.4 Exposure Point Concentrations

Uncertainty can exist in data collection, data analysis and validation, statistical analysis of the data, and screening of the data. Samples were collected from known and suspected areas of contamination (i.e., biased sampling), to delineate the nature and extent of contamination. Although this sampling methodology provided a reasonable estimation of

the level of contamination at known or suspected contaminated areas, the possibility exists that the data set formed by these samples did not accurately represent the level of contamination and instead overestimated the concentrations to which receptors could be exposed. The exposure point concentrations used in the exposure assessment for the RME receptors are based on 95 percent UCLs of the mean. These UCL values provide a conservative estimate of the true average concentration, and, therefore, they tend to overestimate the potential exposure.

The exposure point concentration calculated for the on-Site worker and construction worker scenarios were based only on the 2011 soil analytical data. Soils were analyzed for RDX, HMX and TNT because these are the primary explosives manufactured and treated at the Site, and represents the worst-case chemical exposure potential. The HHRA also assumes the on-Site worker would have daily exposure to the top two (2) inches of soils. This is overly conservative since the Site is covered by three (3) to four (4) inches of gravel. In reality, the on-Site worker will only be exposed to potential spills on top of the gravel.

The incidental exposure pathway evaluations for the on-Site worker and construction worker were limited to exposure to concentrations of RDX, HMX and TNT concentrations based on the previous risk evaluations at the Site. RDX was the only chemical identified as a COPC and quantitatively evaluated under the on-Site worker and construction worker scenarios. However, the risks to HMX and TNT were conservatively considered by comparing the maximum concentration against ORNL Industrial Soil RSLs.

Representative air samples were not collected from the Site. However, data collected from the Dugway test program used to model the air pathway assessment are representative of constituent air emissions at the Site. The exposure assessment assumed the maximum exposure potential and may have overestimated the potential risk to off-Site receptors.

2.7 Presentation and Interpretation of HHRA Findings

The HHRA was based on soil data collected at the Site in 2011 as part of the scope for delineating the horizontal and vertical extent of contamination at the Site and air concentrations predicted through modeling of the emissions of the open burning process. Soils were analyzed for RDX, HMX and TNT because these are the primary explosives manufactured and treated at the Site, and represent the worst-case chemical exposure potential. Of these three (3) chemicals, RDX was identified as the only COPC for the Site because RDX was the only chemical detected in soil at a concentration exceeding the ORNL Industrial Soil RSL. No COPCs were identified in air based on screening the modeled air concentrations against the ORNL Air RSLs.

The HHRA identified three (3) complete exposure pathways:

- an on-Site worker;
- a construction worker; and,
- an off-Site resident.

Carcinogenic risks and noncarcinogenic hazards were calculated for exposure to RDX in soil for both the on-Site worker and construction worker under both RME and CTE scenarios. For both the on-Site worker and the construction worker exposure pathway for incidental soil ingestion, it was assumed that 100 percent of the ingested RME concentrations of RDX were absorbed at default RME ingestion rates for 150 days and 250 days per year, respectively, under the RME and CTE exposure cases. The ingestion rates of RME concentrations are overly conservative for both receptors since soil samples were collected from known and suspected areas of contamination (i.e., biased sampling) and overestimate the concentrations to which receptors could actually be exposed. The exposure frequency for both receptors is also overly conservative since there are some weeks that burning events do not actually occur at the Site. The HHRA also assumed the on-Site worker would have daily exposure to the top 2 inches of soils. This assumption is overly conservative since waste spills are handled with shovels and removal of vegetation is limited since the site is covered with a three (3) to four (4) inch gravel layer. In reality, the on-Site worker will only be exposed to potential spills on top of the gravel.

The off-Site resident was assumed to be exposed to chemicals transported through the air during open burning. The 1997 air pathway assessment for the offsite resident assumed treatment was conducted 5 days per week, 50 weeks per year for one (1) hour. As noted previously, burn events do not occur this frequently. Carcinogenic risks and noncarcinogenic hazards were not calculated for the off-Site resident because no COPCs were identified for air.

In addition to incidental ingestion, the construction worker was assumed to be exposed to RDX in soil through the inhalation of soil particles. Carcinogenic risk and noncarcinogenic hazard associated with the inhalation of particulates could not be quantitatively evaluated for the construction worker because inhalation toxicity values were not available for RDX. As indicated in the ATSDR *Toxicological Profile for RDX* (ATSDR 2012), inhalation toxicity values are not available because few studies have been conducted to determine toxicological effects to humans or animals after RDX inhalation exposure. A few studies revealed acute effects humans and animals, but none of the studies provided conclusive systemic or carcinogenic data that could be used to adequately assess the risk for the inhalation exposure pathway. The construction worker is not expected to have long-term exposure contaminated soils by inhalation because construction activities will most likely be much less than the RME and CTE exposure duration assumptions (i.e., 1 year and 6 months, respectively) used in the HHRA. Also, the HHRA assumes the construction worker would be exposed only to contaminated soils in the vicinity of the burn pans. In reality, construction activities could occur elsewhere on the Site. Therefore, exposure to contaminated soils by inhalation could be less than what is assumed in the HHRA.

The HHRA resulted in the following conclusions:

On-Site Worker

- Both the calculated CTE and RME noncarcinogenic hazards for the on-Site worker were less than the EPA's target HI of 1.

- The CTE carcinogenic risk for the onsite worker was less than the EPA's target risk of 1.0E-06.
- The RME carcinogenic risk (1.6E-06) slightly exceeded the EPA's target risk level of 1.0E-06.

Construction Worker

- Both the calculated CTE and RME noncarcinogenic hazards associated with incidental ingestion of soil by the construction worker were less than the EPA's target HI of 1.
- Both the CTE and RME carcinogenic risks associated with incidental ingestion of soil by the construction worker were less than the target risk.

Off-Site Resident

- No COPCs were identified associated with the off-Site resident.

The carcinogenic risks and noncarcinogenic hazards identified at the Site are not anticipated to increase, assuming HSAAP continues to maintain the procedures established in the RCRA Permit for protecting human health.

3.0 ECOLOGICAL RISK ASSESSMENT

This ecological risk assessment (ERA) of the Site was conducted in accordance with the USEPA (1997) stepwise approach consisting of Steps 1 and 2 of the process. These two (2) Steps comprise the Screening-Level portion of the ERA process (SLERA). The completion of Step 2 represents the first Scientific/Management Decision Point (SMDP) in the ERA Process. At that point, in consultation with HSAAP, OSI, and TDEC, a decision can be made as to whether a full ecological risk assessment is warranted. These Steps and their functional components are:

Step 1

- Site Visit & Description
- Problem Formulation
- Toxicity Evaluation

Step 2

- Exposure Estimate
- Risk Calculation

A SLERA for the Site was performed previously (Tetra Tech 2000) {Appendix V}. Within the context of the Steps noted above, the SLERA presented herein was performed as a review and update, where applicable, of the previous SLERA.

3.1 Screening Level – Step 1

Site Visit

The Checklist attached herein under Appendix VI was completed during the site reconnaissance that was performed in January 2012.

Problem Formulation

- *Environmental Setting*
  The environmental setting and Site description presented by Tetra Tech (2000) remained accurate and applicable with no updates required.

- *Selection of Site-Related Contaminants*
  The ecological contaminants of potential concern (eco-COPCs) selection presented by Tetra Tech (2000) remained accurate and applicable with no updates required.

- *Contaminant Fate and Transport Mechanisms*
  The physicochemical characteristics of the eco-COPCs presented by Tetra Tech (2000) remained accurate and applicable with no updates required.
- *Contaminant-Associated Ecotoxicity Mechanisms and Likely Receptor Categories*
  The most-recent survey of Protected Species at HSAAP (USACOE 2001)was reviewed. The ecotoxicity mechanisms and generally-recognized potential receptors of those eco-COPCs presented by Tetra Tech (2000) remained accurate and applicable with no updates required. Biomagnification upward through the food web trophic structure was confirmed to not be an issue due to the lack of expectation for biomagnification by the analytes identified as eco-COPCs.

- *Complete Exposure Pathways*
  A Conceptual Site Exposure Model-Ecological ($CSEM_e$) was developed to identify, review and confirm the operable exposure routes and pathways for uptake of the analytes by terrestrial and aquatic, floral and faunal species (Appendix 4). Transport of analytes originating from burn events via air, thence deposition, was confirmed to be the only plausible, operative transport mechanism. Potential deposition onto surface soil and surface water and organisms contact in those media by direct mechanisms were identified as the plausible exposure mechanisms. Accordingly, the air-related transport/deposition and direct contact mechanisms comprised the plausible exposure pathways.

- *Assessment and Measurement Endpoint Selection*
  Balanced, indigenous aquatic and terrestrial, floral and faunal populations with proper structure and function the same or similar to an unimpacted area is the intent of protection. Evaluation of site-related eco-COPCs against protective Toxicity Reference Values (TRVs) was adopted as a reasonable measurement for this assessment endpoint by the previous SLERA (Tetra Tech 2000). That approach remained accurate and applicable with no updates required.

No habitat supportive of ecological colonization or transit was present on the Site, as the entire Site is underlain by surge stone. This stone also covers the berms that contain the Burn Pan Unit. The Site is fenced. Accordingly, no observations for indicators of on-Site ecological impacts were realistic. Visual observations during reconnaissance of the area immediately surrounding the Site did not present any indicators of ecological impact.

Toxicity Evaluation

- Selection of Preferred Toxicity Data
  The analyte-specific EPCs for each eco-COPC were screened against appropriate TRVs published by USEPA Region 4 (Tetra Tech 2000). No adjustments to this previous analysis were required.

- Eco-COPC Dataset Analysis
  No new analytical data have been acquired from areas where plausible ecological receptors may reside or transit. The air dispersion modeling reported in the previous SLERA (Tetra Tech 2000) was reviewed and found to remain applicable with no updates required.

3.2 Screening Level – Step 2

Exposure Estimate -- Bioconcentration and Bioaccumulation

- The exposure point estimates for the eco-COPCs developed previously (Tetra Tech 2000) were reviewed and found to remain applicable with no updates required.

Exposure Estimate -- Biomagnification

- This process was not evaluated herein or in the previous SLERA because the types of analytes comprising the eco-COPCs were not expected to undergo biomagnifications.

Risk Calculation

- The calculated risk from the eco-COPCs presented in the previous SLERA (Tetra Tech 2000) was reviewed within the context of the previous noted sections. The calculated risks reported in 2000 were found to remain applicable with no updates required.

3.3 Uncertainties

Elements of uncertainties inherent to any risk assessment, and applicable to this site-specific assessment, were duly presented and discussed in the previous SLERA (Tetra Tech 2000). No additions or edits otherwise were determined to be applicable.

3.4 Summary

The conclusions presented in the previous SLERA were:

- Analyte transport by air resulting from burn events and subsequent deposition of those analytes was the only operable transport pathway
- Risks to ecological receptors in contact with soil and/or surface water were expected to be negligible
    - The calculated Hazard Index for soil-related contaminants exhibited a value of slightly greater than one (1.0), indicating a nominal additive risk to ecological receptors in contact with that medium within the area(s) of air-transported analyte deposition.
    - The calculated Hazard Index for surface water-related contaminants exhibited a value of less than one (1.0), indicating no significant or unacceptable risk to ecological receptors in contact with that medium within the area(s) of air-transported analyte deposition.

This SLERA presented herein found these conclusions to remain accurate and operative for the Site. No final contaminants of concern for ecological receptors were identified.

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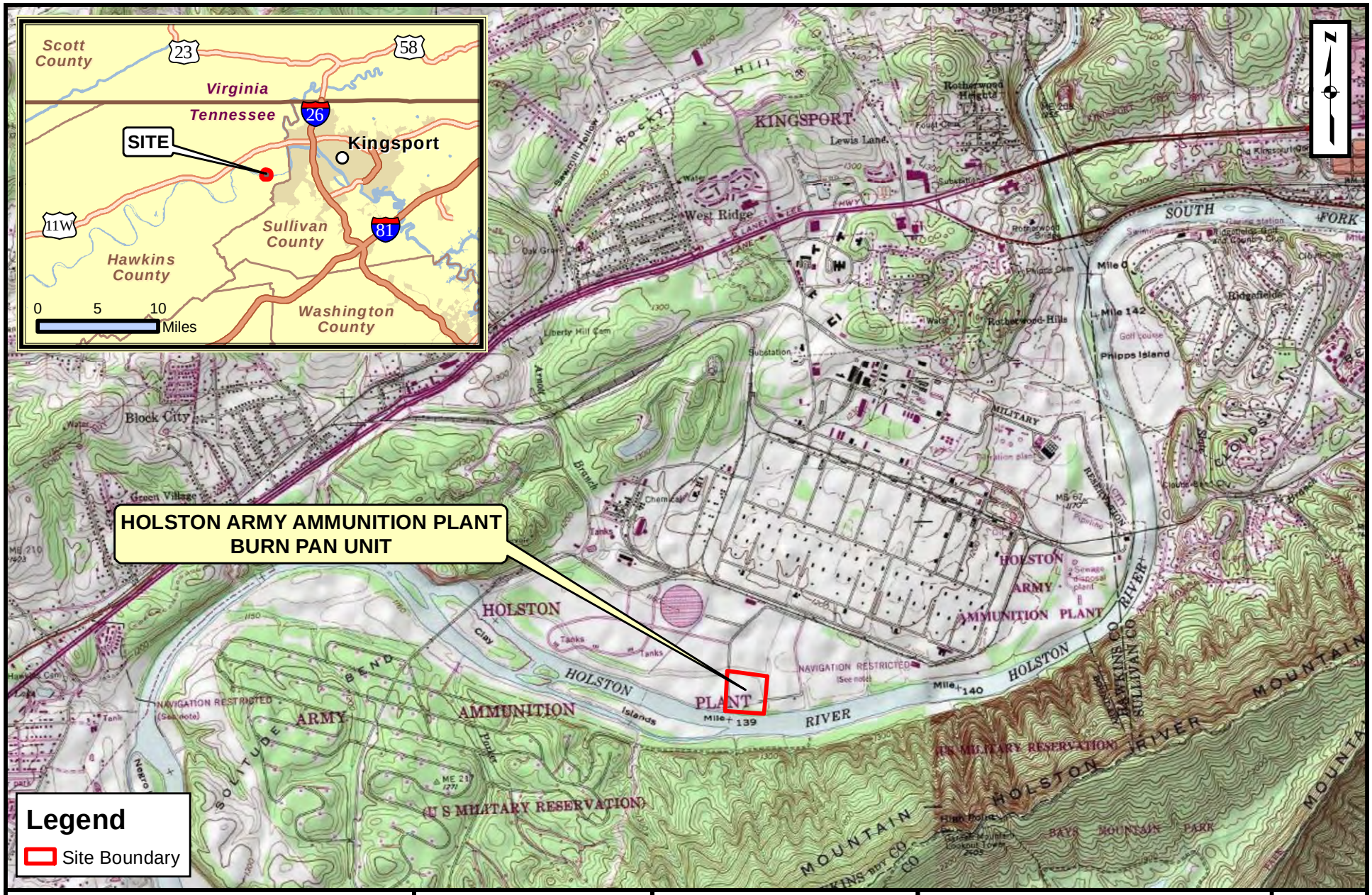
APPENDIX I

Figure 1 Site Vicinity Map
Figure 2 Land Use Map
Figure 3 Burn Pan Unit Aerial Map
Figure 4 Sampling Locations Map
Figure 5 Burn Pan Unit Sketch



USGS topographic and street basemap provided by ©2011 Microsoft Corporation and its data suppliers. USGS topographic quadrangle reference: Church Hill and Kingsport, Tennessee.

0 0.5 1 Miles

SCALE:	AS SHOWN
CHECKED:	EMP
DRAWN:	SAS
DATE:	11/15/11

S&ME

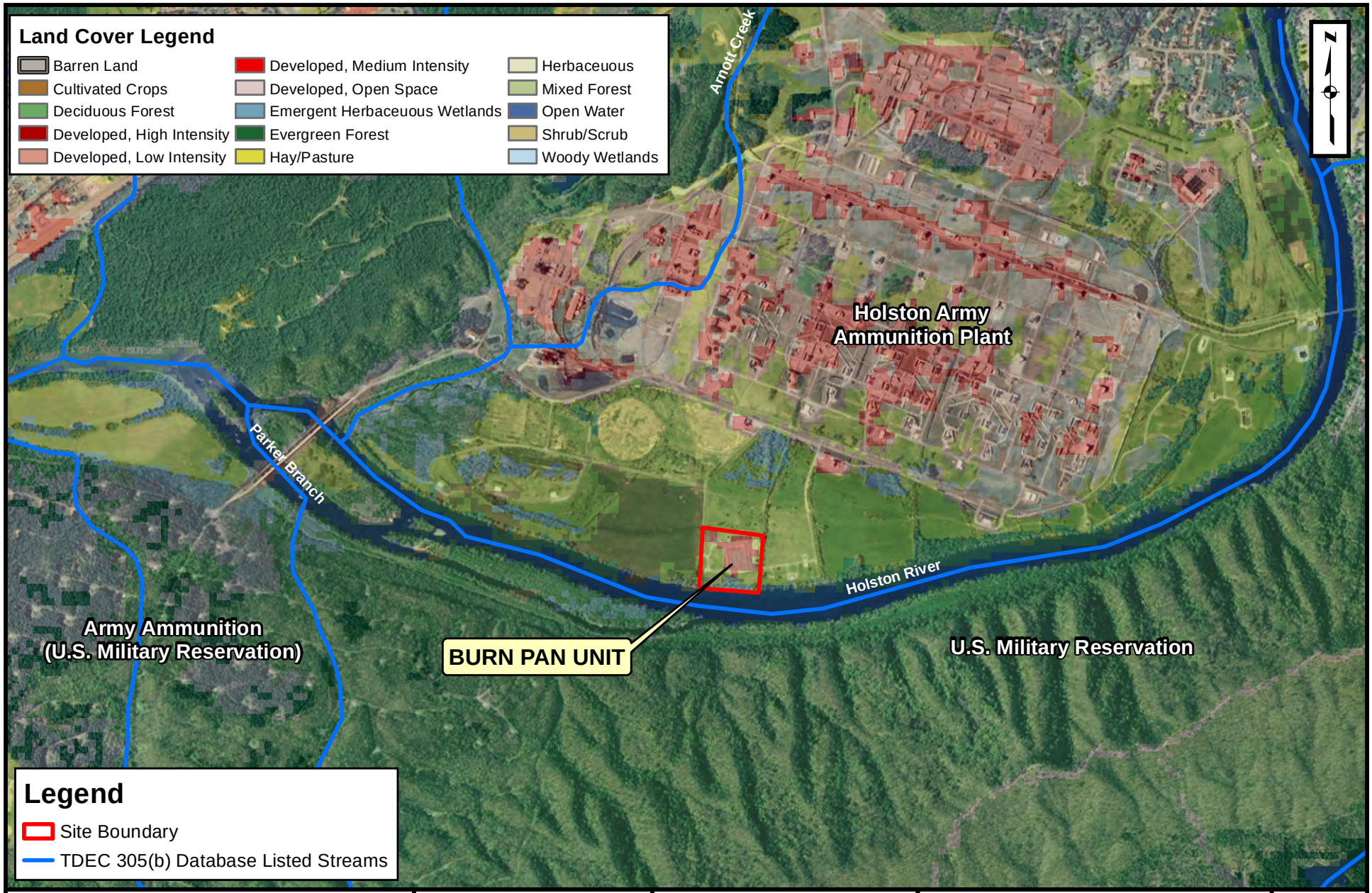
Site Vicinity Map

Risk Assessment
Holston Army Ammunition Plant
Burn Pan Unit
Kingsport, Tennessee

Project No: 1437-11-347

FIGURE NO:

1



Aerial photograph basemap provided by ©2011 Microsoft Corporation and its data suppliers. Land use basemap provided by the Tennessee Spatial Data Server.

0 2,000 4,000 Feet

SCALE:	AS SHOWN
CHECKED:	EMP
DRAWN:	SAS
DATE:	11/15/11

S&ME

Land Use Map

Risk Assessment
Holston Army Ammunition Plant
Burn Pan Unit
Kingsport, Tennessee

Project No: 1437-11-347

FIGURE NO:

2

Aerial photograph basemap provided by ©2012 Microsoft Corporation and its data suppliers.

0 200 400 Feet

SCALE:	AS SHOWN
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DRAWN:	SAS
DATE:	3/2/12

S&ME

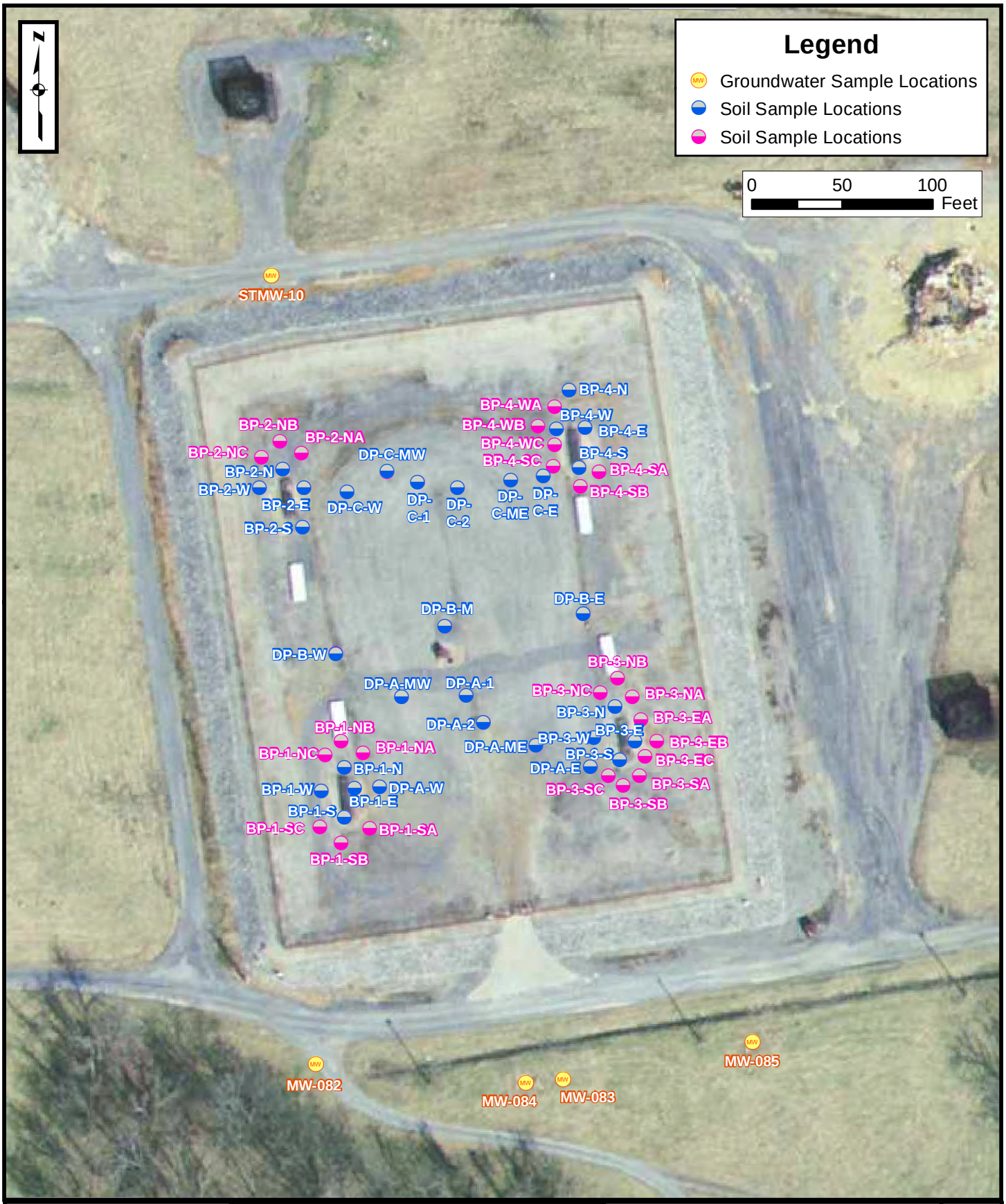
Burn Pan Unit Aerial Map

Risk Assessment
Holston Army Ammunition Plant
Kingsport, Tennessee

Project No: 1437-11-347

FIGURE NO:

3



SCALE: AS SHOWN	S&ME	Sampling Locations Map **Risk Assessment** **Holston Army Ammunition Plant** Kingsport, Tennessee	FIGURE NO: **4**
CHECKED: EMP			
DRAWN: SAS	Aerial photograph basemap provided by: NRCS NAIP. Flight Date: 2010.	**Project No:** 1437-11-347	
DATE: 11/15/11			

Figure 1.1-2 (Layout of Burn Pan Unit)

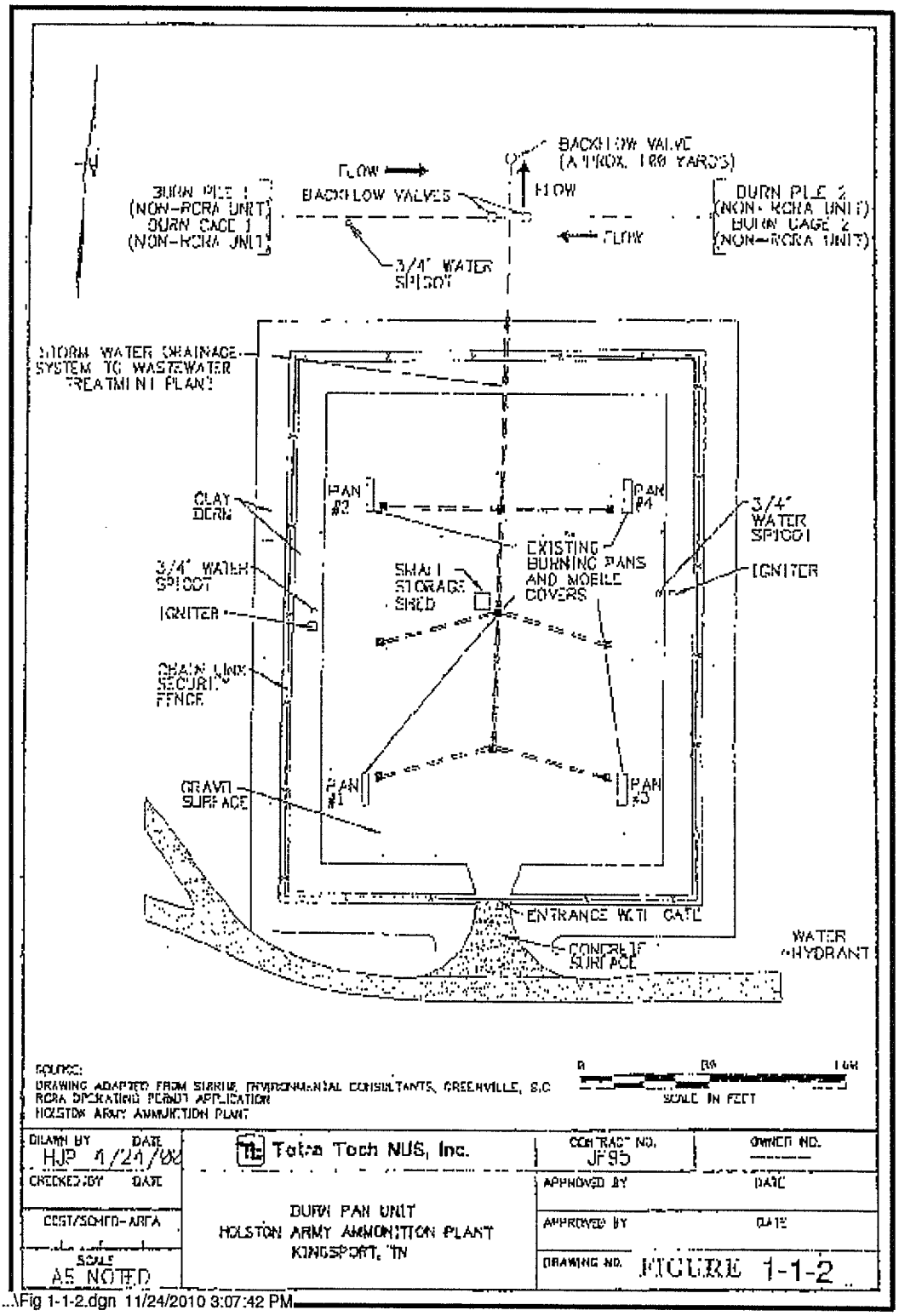


FIGURE 5
Burn Pan Sketch

APPENDIX II

Table 1 2011 Burn Pan Unit Soil Analytical Results
Table 2 Air Pathway COPC Screening
Table 3 Exposure Factor Assumption

Table 1

Burn Pan Unit Soil Analytical Data

Sample ID	Sample Date	Soil Sample Depth	RDX	ORNL Industrial Soil RSL for RDX	TNT	ORNL Industrial Soil RSL for TNT	HMX	ORNL Industrial Soil RSL for HMX
Phase I, Round 1 Soil Analytical Results								
BP-1-E	9/19/2011	0-2”	**5.4**	24	<0.5	79	**15**	49,000
BP-1-N	9/19/2011	0-2”	**120**	24	<0.5	79	**280**	49,000
BP-1-S	9/19/2011	0-2”	**790**	24	<0.5	79	**530**	49,000
BP-1-W	9/19/2011	0-2”	**20**	24	<0.5	79	**210**	49,000
BP-2-E	9/19/2011	0-2”	**7.2**	24	<0.5	79	**73**	49,000
BP-2-N	9/19/2011	0-2”	**49**	24	<0.5	79	**73**	49,000
BP-2-S	9/19/2011	0-2”	**10**	24	<0.5	79	**110**	49,000
BP-2-W	9/19/2011	0-2”	**12**	24	<0.5	79	**77**	49,000
BP-3-E	9/19/2011	0-2”	**32**	24	<0.5	79	**210**	49,000
BP-3-N	9/19/2011	0-2”	**70**	24	<0.5	79	**140**	49,000
BP-3-S	9/19/2011	0-2”	**56**	24	<0.5	79	**47**	49,000
BP-3-W	9/19/2011	0-2”	**5.8**	24	<0.5	79	**25**	49,000
BP-4-E	9/19/2011	0-2”	**2.4**	24	<0.5	79	**70**	49,000
BP-4-N	9/19/2011	0-2”	**3.9**	24	<0.5	79	**93**	49,000
BP-4-S	9/19/2011	0-2”	**540**	24	**7**	79	**350**	49,000
BP-4-W	9/19/2011	0-2”	**30**	24	<0.5	79	**35**	49,000
DP-A-1	9/19/2011	0-2”	<0.5	24	<0.5	79	**0.66**	49,000
DP-A-2	9/19/2011	0-2”	<0.5	24	<0.5	79	**0.92**	49,000
DP-A-E	9/19/2011	0-2”	**1.3**	24	<0.5	79	**10**	49,000
DP-A-ME	9/19/2011	0-2”	<0.5	24	<0.5	79	**11**	49,000
DP-A-MW	9/19/2011	0-2”	<0.5	24	<0.5	79	**9.6**	49,000
DP-A-W	9/19/2011	0-2”	**4.1**	24	<0.5	79	**160**	49,000
DP-B-E	9/19/2011	0-2”	<0.5	24	<0.5	79	**0.63**	49,000
DP-B-M	9/19/2011	0-2”	<0.5	24	<0.5	79	**0.58**	49,000
DP-B-W	9/19/2011	0-2”	**0.98**	24	<0.5	79	**0.99**	49,000
DP-C-1	9/19/2011	0-2”	<0.5	24	<0.5	79	**1.1**	49,000
DP-C-2	9/19/2011	0-2”	<0.5	24	<0.5	79	**1.2**	49,000
DP-C-E	9/19/2011	0-2”	**0.63**	24	<0.5	79	**11**	49,000
DP-C-E Duplicate	9/19/2011	0-2”	<0.5	24	<0.5	79	**17**	49,000
DP-C-ME	9/19/2011	0-2”	<0.5	24	<0.5	79	**40**	49,000
DP-C-W	9/19/2011	0-2”	<0.5	24	<0.5	79	**0.84**	49,000
DP-C-MW	9/19/2011	0-2”	<0.5	24	<0.5	79	<0.5	49,000
Rinsate (mg/l)	9/19/2011	0-2”	<0.00050	24	<0.00050	79	<0.00050	49,000
Phase I, Round 2 Soil Analytical Results								
BP1-SA	10/24/2011	0-2”	**2.6**	24	<0.5	79	**21**	49,000
BP1-SB	10/24/2011	0-2”	**0.68**	24	<0.5	79	**1.8**	49,000
BP1-SC	10/24/2011	0-2”	**1.6**	24	<0.5	79	**130**	49,000
BP1-NA	10/24/2011	0-2”	**9.5**	24	<0.5	79	**300**	49,000
BP1-NB	10/24/2011	0-2”	**6.4**	24	<0.5	79	**36**	49,000
BP1-NC	10/24/2011	0-2”	<0.5	24	<0.5	79	**68**	49,000
BP2-NA	10/24/2011	0-2”	**3.5**	24	<0.5	79	**19**	49,000
BP2-NB	10/24/2011	0-2”	**1.7**	24	<0.5	79	**42**	49,000
BP2-NC	10/24/2011	0-2”	**4.6**	24	<0.5	79	**14**	49,000
BP3-NA	10/24/2011	0-2”	**1.5**	24	<0.5	79	**14**	49,000
BP3-NA Duplicate	10/24/2011	0-2”	**3.1**	24	<0.5	79	**7.4**	49,000
BP3-NB	10/24/2011	0-2”	**1.2**	24	<0.5	79	**3.9**	49,000
BP3-NC	10/24/2011	0-2”	**1.9**	24	<0.5	79	**5.6**	49,000
BP3-SA	10/24/2011	0-2”	**3.5**	24	<0.5	79	**60**	49,000
BP3-SB	10/24/2011	0-2”	**1.6**	24	<0.5	79	**7.2**	49,000
BP3-SC	10/24/2011	0-2”	**4.7**	24	<0.5	79	**36**	49,000
BP3-EA	10/24/2011	0-2”	**1.6**	24	<0.5	79	**10**	49,000
BP3-EB	10/24/2011	0-2”	**1**	24	<0.5	79	**27**	49,000
BP3-EC	10/24/2011	0-2”	**5.5**	24	<0.5	79	**270**	49,000
BP4-WA	10/24/2011	0-2”	**3.1**	24	<0.5	79	**88**	49,000
BP4-WB	10/24/2011	0-2”	**4.3**	24	<0.5	79	**190**	49,000
BP4-WC	10/24/2011	0-2”	**16**	24	<0.5	79	**100**	49,000
BP4-SA	10/24/2011	0-2”	**5.7**	24	<0.5	79	**20**	49,000
BP4-SB	10/24/2011	0-2”	**5.2**	24	<0.5	79	**120**	49,000
BP4-SC	10/24/2011	0-2”	**5.4**	24	<0.5	79	**61**	49,000
Phase II Soil Analytical Results								
BP-1-N	10/24/2011	4-6”	**3.3**	24	<0.5	79	**3.9**	49,000
BP-1-S	10/24/2011	4-6”	**300**	24	<0.5	79	**360**	49,000
BP-2-N	10/24/2011	4-6”	**1.2**	24	<0.5	79	**5**	49,000
BP-2-N Duplicate	10/24/2011	4-6”	**13**	24	<0.5	79	**22**	49,000
BP-3-N	10/24/2011	4-6”	**1.9**	24	<0.5	79	**4.6**	49,000
BP-3-S	10/24/2011	4-6”	**9**	24	<0.5	79	**4.6**	49,000
BP-3-E	10/24/2011	4-6”	**8.8**	24	<0.5	79	**3.5**	49,000
BP-4-W	10/24/2011	4-6”	**350**	24	<0.5	79	**52**	49,000
BP-4-S	10/24/2011	4-6”	**840**	24	**0.61**	79	**340**	49,000
Rinsate (mg/l)	10/24/2011	4-6”	<0.00050	24	<0.00050	79	<0.00050	49,000
Phase III Soil Analytical Results								
BP-1-S	12/12/2011	10-12”	**13**	24	<0.5	79	**5.3**	49,000
BP-4-W	12/12/2011	10-12”	<0.5	24	<0.5	79	<0.5	49,000
BP-4-S	12/12/2011	10-12”	**4.5**	24	<0.5	79	**2.6**	49,000
Rinsate (mg/l)	12/12/2011	10-12”	<0.00050	24	<0.00050	79	<0.00050	49,000

Table 2 Air Pathway COPC Screening

Receptor : Maximum Off-Site			
Compound	**Average Annual Concentration ($\mu g/m^3$)**	**2011 ORNL Residential Air RSL ($\mu g/m^3$)**	**ORNL RSL Residential Air Exceedance?**
1,2,3-Trimethylbenzene	1.50E-06	7.30E+00	No
1,3-Butadiene	6.92E-07	8.10E-02	No
1,3,5-Trimethylbenzene	5.61E-07	NA	
1,3,5-Trinitrobenzene	2.57E-05	NA	
1,3-Dinitrobenzene	4.34E-07	NA	
2.4,6-Trinitrotoluene	2.11E-05	NA	
2,4-Dinitrotoluene	3.72E-06	2.70E-02	No
2-Methylnaphthalene	9.08E-07	NA	
3,4-Methylphenol (m-& p-cresol)	6.87E-08	NA	
Acenaphthylene	2.15E-07	NA	
Acetophenone	2.56E-06	NA	
Alkanes (Paraffins)	9.61E-06	NA	
Alkenes (Olefins)	4.33E-05	NA	
Anthracene	1.93E-07	NA	
Aromatics	1.80E-05	NA	
Benz(a)anthracene	9.31E-07	8.30E-03	No
Benzene	8.79E-05	3.10E-01	No
Benzo(a)pyrene	6.02E-07	8.70E-04	No
Benzo(b)fluoranthene	1.07E-06	8.70E-03	No
Benzo(g,h,i)perylene	1.97E-07	NA	
Benzo(k)fluoranthene	7.87E-07	8.70E-03	No
Benzl alcohol	1.57E-07	NA	
Biphenyl	4.46E-07	4.20E-01	No
Bis(2-ethylhexyl)phthalate	1.57E-06	1.00E+00	No
Butylbenzyl phthalate	1.71E-06	NA	
Carbon dioxide	2.23E+00	NA	
Carbon monoxide	4.29E-02	NA	
Carbon Tetrachloride	5.58E-07	4.10E-01	No
Di-n-butyl phthalate	1.33E-06	NA	
Di-n-octyl phthalate	2.04E-06	NA	
Dibenzofuran	8.89E-08	NA	
Dichloromethane	4.34E-04	NA	
Diethyl phthalate	1.04E-06	NA	
Dimethyl phthalate	4.38E-07	NA	
Ethylbenzene	3.00E-06	9.70E-01	No
Fluoranthene	6.33E-06	NA	
Fluorene	5.00E-08	NA	
Freon 11	2.24E-06	NA	
Freon 113	5.58E-07	NA	
Freon 12	9.18E-07	NA	
HMX	3.06E-06	NA	
Hyrdrogen chloride	1.45E-03	2.10E+01	No
Hydrogen fluoride	2.14E-02	1.50E+01	No
Indeno(1,2,3-cd)pyrene	2.19E-07	8.70E-03	No
m-&p-Xylene	1.03E-05	1.00E+02	No

Table 2 Air Pathway COPC Screening

Receptor **: Maximum Off-Site**			
Compound	**Average Annual Concentration (µg/m^3)**	**2011 ORNL Residential Air RSL (µg/m^3)**	**ORNL RSL Residential Air Exceedance?**
Methane	2.44E-04	NA	
Methyl chloride	7.55E-07	NA	
n-Nitrosodiphenylamine	1.13E-07	9.40E-01	No
Naphthalene	1.76E-06	7.20E-02	No
Nitrogen dioxide (peroxide)	8.74E-04	NA	
Nitrogen oxide	1.20E-02	NA	
o-Xylene	4.14E-06	1.00E+02	No
p-Ethyltoluene	7.31E-07	NA	
Phenanthrene	3.40E-07	NA	
Phenol	7.18E-07	2.10E+02	No
PM10	6.60E-01	NA	
Pyrene	2.55E-06	NA	
RDX	2.03E-05	NA	
Styrene	1.89E-06	1.00E+03	No
Tetrachloroethylene	2.76E-05	4.10E-01	No
TO-12 (NMOC)	1.09E-04	NA	
Toluene	3.46E-06	5.20E+03	No
Total non-methane hydrocarbons	1.63E-03	NA	
Total non-methane organic compounds	4.44E-04	NA	
Total Unidentified hydrocarbons	6.96E-05	NA	

Note:
NA - Not Applicable

Table 2 Air Pathway COPC Screening

Receptor : S1 Sullivan Middle School			
Compound	**Average Annual Concentration (µg/m^3)**	**2011 ORNL Residential Air RSL (µg/m^3)**	**ORNL RSL Residential Air Exceedance?**
1,2,3-Trimethylbenzene	1.01E-07	7.30E+00	No
1,3-Butadiene	4.67E-08	8.10E-02	No
1,3,5-Trimethylbenzene	3.78E-08	NA	
1,3,5-Trinitrobenzene	1.73E-06	NA	
1,3-Dinitrobenzene	2.92E-08	NA	
2.4,6-Trinitrotoluene	1.42E-06	NA	
2,4-Dinitrotoluene	2.51E-07	2.70E-02	No
2-Methylnaphthalene	6.12E-08	NA	
3,4-Methylphenol (m-& p-cresol)	4.63E-09	NA	
Acenaphthylene	1.45E-08	NA	
Acetophenone	1.73E-07	NA	
Alkanes (Paraffins)	6.48E-07	NA	
Alkenes (Olefins)	2.92E-06	NA	
Anthracene	1.30E-08	NA	
Aromatics	1.21E-06	NA	
Benz(a)anthracene	6.27E-08	8.30E-03	No
Benzene	5.93E-06	3.10E-01	No
Benzo(a)pyrene	4.05E-08	8.70E-04	No
Benzo(b)fluoranthene	7.23E-08	8.70E-03	No
Benzo(g,h,i)perylene	1.33E-08	NA	
Benzo(k)fluoranthene	5.30E-08	8.70E-03	No
Benzl alcohol	1.06E-08	NA	
Biphenyl	3.01E-08	4.20E-01	No
Bis(2-ethylhexyl)phthalate	1.06E-07	1.00E+00	No
Butylbenzyl phthalate	1.15E-07	NA	
Carbon dioxide	1.50E-01	NA	
Carbon monoxide	2.89E-03	NA	
Carbon Tetrachloride	3.76E-08	4.10E-01	No
Di-n-butyl phthalate	8.97E-08	NA	
Di-n-octyl phthalate	1.37E-07	NA	
Dibenzofuran	5.99E-09	NA	
Dichloromethane	2.92E-05	NA	
Diethyl phthalate	7.01E-08	NA	
Dimethyl phthalate	2.95E-08	NA	
Ethylbenzene	2.02E-07	9.70E-01	No
Fluoranthene	4.26E-07	NA	
Fluorene	3.37E-09	NA	
Freon 11	1.51E-07	NA	
Freon 113	3.76E-08	NA	
Freon 12	6.18E-08	NA	
HMX	2.06E-07	NA	
Hyrdrogen chloride	9.80E-05	2.10E+01	No
Hydrogen fluoride	1.44E-03	1.50E+01	No
Indeno(1,2,3-cd)pyrene	1.48E-08	8.70E-03	No
m-&p-Xylene	6.96E-07	1.00E+02	No

Table 2 Air Pathway COPC Screening

Receptor **: S1 Sullivan Middle School**			
Compound	**Average Annual Concentration (µg/m^3)**	**2011 ORNL Residential Air RSL (µg/m^3)**	**ORNL RSL Residential Air Exceedance?**
Methane	1.65E-05	NA	
Methyl chloride	5.09E-08	NA	
n-Nitrosodiphenylamine	7.60E-09	9.40E-01	No
Naphthalene	1.18E-07	7.20E-02	No
Nitrogen dioxide (peroxide)	5.89E-05	NA	
Nitrogen oxide	8.06E-04	NA	
o-Xylene	2.79E-07	1.00E+02	No
p-Ethyltoluene	4.93E-08	NA	
Phenanthrene	2.29E-08	NA	
Phenol	4.84E-08	2.10E+02	No
PM10	4.45E-02	NA	
Pyrene	1.72E-07	NA	
RDX	1.37E-06	NA	
Styrene	1.28E-07	1.00E+03	No
Tetrachloroethylene	1.86E-06	4.10E-01	No
TO-12 (NMOC)	7.36E-06	NA	
Toluene	2.33E-07	5.20E+03	No
Total non-methane hydrocarbons	1.10E-04	NA	
Total non-methane organic compounds	2.99E-05	NA	
Total Unidentified hydrocarbons	4.69E-06	NA	

Note:
NA - Not Applicable

Table 2 Air Pathway COPC Screening

Receptor : S2 Sevier Middle School			
Compound	**Average Annual Concentration (µg/m^3)**	**2011 ORNL Residential Air RSL (µg/m^3)**	**ORNL RSL Residential Air Exceedance?**
1,2,3-Trimethylbenzene	1.36E-07	7.30E+00	No
1,3-Butadiene	6.29E-08	8.10E-02	No
1,3,5-Trimethylbenzene	5.09E-08	NA	
1,3,5-Trinitrobenzene	2.34E-06	NA	
1,3-Dinitrobenzene	3.94E-08	NA	
2.4,6-Trinitrotoluene	1.91E-06	NA	
2,4-Dinitrotoluene	3.38E-07	2.70E-02	No
2-Methylnaphthalene	8.25E-08	NA	
3,4-Methylphenol (m-& p-cresol)	6.24E-09	NA	
Acenaphthylene	1.96E-08	NA	
Acetophenone	2.33E-07	NA	
Alkanes (Paraffins)	8.73E-07	NA	
Alkenes (Olefins)	3.93E-06	NA	
Anthracene	1.76E-08	NA	
Aromatics	1.64E-06	NA	
Benz(a)anthracene	8.46E-08	8.30E-03	No
Benzene	7.99E-06	3.10E-01	No
Benzo(a)pyrene	5.47E-08	8.70E-04	No
Benzo(b)fluoranthene	9.75E-08	8.70E-03	No
Benzo(g,h,i)perylene	1.79E-08	NA	
Benzo(k)fluoranthene	7.15E-08	8.70E-03	No
Benzl alcohol	1.42E-08	NA	
Biphenyl	4.05E-08	4.20E-01	No
Bis(2-ethylhexyl)phthalate	1.42E-07	1.00E+00	No
Butylbenzyl phthalate	1.56E-07	NA	
Carbon dioxide	2.02E-01	NA	
Carbon monoxide	3.90E-03	NA	
Carbon Tetrachloride	5.07E-08	4.10E-01	No
Di-n-butyl phthalate	1.21E-07	NA	
Di-n-octyl phthalate	1.85E-07	NA	
Dibenzofuran	8.08E-09	NA	
Dichloromethane	3.94E-05	NA	
Diethyl phthalate	9.46E-08	NA	
Dimethyl phthalate	3.98E-08	NA	
Ethylbenzene	2.73E-07	9.70E-01	No
Fluoranthene	5.75E-07	NA	
Fluorene	4.55E-09	NA	
Freon 11	2.03E-07	NA	
Freon 113	5.07E-08	NA	
Freon 12	8.34E-08	NA	
HMX	2.78E-07	NA	
Hyrdrogen chloride	1.32E-04	2.10E+01	No
Hydrogen fluoride	1.94E-03	1.50E+01	No
Indeno(1,2,3-cd)pyrene	1.99E-08	8.70E-03	No
m-&p-Xylene	9.38E-07	1.00E+02	No

Table 2 Air Pathway COPC Screening

Receptor **: S2 Sevier Middle School**			
Compound	**Average Annual Concentration (µg/m^3)**	**2011 ORNL Residential Air RSL (µg/m^3)**	**ORNL RSL Residential Air Exceedance?**
Methane	2.22E-05	NA	
Methyl chloride	6.86E-08	NA	
n-Nitrosodiphenylamine	1.02E-08	9.40E-01	No
Naphthalene	1.60E-07	7.20E-02	No
Nitrogen dioxide (peroxide)	7.94E-05	NA	
Nitrogen oxide	1.09E-03	NA	
o-Xylene	3.76E-07	1.00E+02	No
p-Ethyltoluene	6.64E-08	NA	
Phenanthrene	3.09E-08	NA	
Phenol	6.52E-08	2.10E+02	No
PM10	6.00E-02	NA	
Pyrene	2.32E-07	NA	
RDX	1.84E-06	NA	
Styrene	1.72E-07	1.00E+03	No
Tetrachloroethylene	2.51E-06	4.10E-01	No
TO-12 (NMOC)	9.92E-06	NA	
Toluene	3.14E-07	5.20E+03	No
Total non-methane hydrocarbons	1.48E-04	NA	
Total non-methane organic compounds	4.04E-05	NA	
Total Unidentified hydrocarbons	6.32E-06	NA	

Note:
NA - Not Applicable

Table 2 Air Pathway COPC Screening

Receptor: S4 Roosevelt Middle School			
Compound	**Average Annual Concentration ($\mu g/m^3$)**	**2011 ORNL Residential Air RSL ($\mu g/m^3$)**	**ORNL RSL Residential Air Exceedance?**
1,2,3-Trimethylbenzene	1.70E-07	7.30E+00	No
1,3-Butadiene	8.14E-08	8.10E-02	No
1,3,5-Trimethylbenzene	6.59E-08	NA	
1,3,5-Trinitrobenzene	3.03E-06	NA	
1,3-Dinitrobenzene	5.10E-08	NA	
2.4,6-Trinitrotoluene	2.48E-06	NA	
2,4-Dinitrotoluene	4.38E-07	2.70E-02	No
2-Methylnaphthalene	1.07E-07	NA	
3,4-Methylphenol (m-& p-cresol)	8.08E-09	NA	
Acenaphthylene	2.53E-08	NA	
Acetophenone	3.01E-07	NA	
Alkanes (Paraffins)	1.13E-06	NA	
Alkenes (Olefins)	5.09E-06	NA	
Anthracene	2.27E-08	NA	
Aromatics	2.12E-06	NA	
Benz(a)anthracene	1.09E-07	8.30E-03	No
Benzene	1.03E-05	3.10E-01	No
Benzo(a)pyrene	7.07E-08	8.70E-04	No
Benzo(b)fluoranthene	1.26E-07	8.70E-03	No
Benzo(g,h,i)perylene	2.32E-08	NA	
Benzo(k)fluoranthene	9.25E-08	8.70E-03	No
Benzl alcohol	1.84E-08	NA	
Biphenyl	5.24E-08	4.20E-01	No
Bis(2-ethylhexyl)phthalate	1.84E-07	1.00E+00	No
Butylbenzyl phthalate	2.01E-07	NA	
Carbon dioxide	2.62E-01	NA	
Carbon monoxide	5.04E-03	NA	
Carbon Tetrachloride	6.56E-08	4.10E-01	No
Di-n-butyl phthalate	1.56E-07	NA	
Di-n-octyl phthalate	2.39E-07	NA	
Dibenzofuran	1.05E-08	NA	
Dichloromethane	5.10E-05	NA	
Diethyl phthalate	1.22E-07	NA	
Dimethyl phthalate	5.15E-08	NA	
Ethylbenzene	3.53E-07	9.70E-01	No
Fluoranthene	7.44E-07	NA	
Fluorene	5.88E-09	NA	
Freon 11	2.63E-07	NA	
Freon 113	6.56E-08	NA	
Freon 12	1.08E-07	NA	
HMX	3.60E-07	NA	
Hyrdrogen chloride	1.71E-04	2.10E+01	No
Hydrogen fluoride	2.51E-03	1.50E+01	No
Indeno(1,2,3-cd)pyrene	2.58E-08	8.70E-03	No
m-&p-Xylene	1.21E-06	1.00E+02	No

Table 2 Air Pathway COPC Screening

***Receptor*: S4 Roosevelt Middle School**			
Compound	**Average Annual Concentration ($\mu g/m^3$)**	**2011 ORNL Residential Air RSL ($\mu g/m^3$)**	**ORNL RSL Residential Air Exceedance?**
Methane	2.87E-05	NA	
Methyl chloride	8.88E-08	NA	
n-Nitrosodiphenylamine	1.33E-08	9.40E-01	No
Naphthalene	2.07E-07	7.20E-02	No
Nitrogen dioxide (peroxide)	1.03E-04	NA	
Nitrogen oxide	1.41E-03	NA	
o-Xylene	4.86E-07	1.00E+02	No
p-Ethyltoluene	8.60E-08	NA	
Phenanthrene	3.99E-08	NA	
Phenol	8.44E-08	2.10E+02	No
PM10	7.76E-02	NA	
Pyrene	3.00E-07	NA	
RDX	2.38E-06	NA	
Styrene	2.23E-07	1.00E+03	No
Tetrachloroethylene	3.24E-06	4.10E-01	No
TO-12 (NMOC)	1.28E-05	NA	
Toluene	4.07E-07	5.20E+03	No
Total non-methane hydrocarbons	1.92E-04	NA	
Total non-methane organic compounds	5.23E-05	NA	
Total Unidentified hydrocarbons	8.18E-06	NA	

Note:
NA - Not Applicable

Table 2 Air Pathway COPC Screening

Receptor : S5 Lynn View Middle School			
Compound	**Average Annual Concentration (µg/m^3)**	**2011 ORNL Residential Air RSL (µg/m^3)**	**ORNL RSL Residential Air Exceedance?**
1,2,3-Trimethylbenzene	9.86E-08	7.30E+00	No
1,3-Butadiene	4.55E-08	8.10E-02	No
1,3,5-Trimethylbenzene	3.68E-08	NA	
1,3,5-Trinitrobenzene	1.69E-06	NA	
1,3-Dinitrobenzene	2.85E-08	NA	
2.4,6-Trinitrotoluene	1.38E-06	NA	
2,4-Dinitrotoluene	2.45E-07	2.70E-02	No
2-Methylnaphthalene	5.97E-08	NA	
3,4-Methylphenol (m-& p-cresol)	4.52E-09	NA	
Acenaphthylene	1.41E-08	NA	
Acetophenone	1.68E-07	NA	
Alkanes (Paraffins)	6.32E-07	NA	
Alkenes (Olefins)	2.84E-06	NA	
Anthracene	1.27E-08	NA	
Aromatics	1.18E-06	NA	
Benz(a)anthracene	6.12E-08	8.30E-03	No
Benzene	5.78E-06	3.10E-01	No
Benzo(a)pyrene	3.95E-08	8.70E-04	No
Benzo(b)fluoranthene	7.05E-08	8.70E-03	No
Benzo(g,h,i)perylene	1.29E-08	NA	
Benzo(k)fluoranthene	5.17E-08	8.70E-03	No
Benzl alcohol	1.03E-08	NA	
Biphenyl	2.93E-08	4.20E-01	No
Bis(2-ethylhexyl)phthalate	1.03E-07	1.00E+00	No
Butylbenzyl phthalate	1.13E-07	NA	
Carbon dioxide	1.46E-01	NA	
Carbon monoxide	2.82E-03	NA	
Carbon Tetrachloride	3.66E-08	4.10E-01	No
Di-n-butyl phthalate	8.74E-08	NA	
Di-n-octyl phthalate	1.34E-07	NA	
Dibenzofuran	5.84E-09	NA	
Dichloromethane	2.85E-05	NA	
Diethyl phthalate	6.84E-08	NA	
Dimethyl phthalate	2.88E-08	NA	
Ethylbenzene	1.97E-07	9.70E-01	No
Fluoranthene	4.16E-07	NA	
Fluorene	3.29E-09	NA	
Freon 11	1.47E-07	NA	
Freon 113	3.66E-08	NA	
Freon 12	6.03E-08	NA	
HMX	2.01E-07	NA	
Hyrdrogen chloride	9.56E-05	2.10E+01	No
Hydrogen fluoride	1.40E-03	1.50E+01	No
Indeno(1,2,3-cd)pyrene	1.44E-08	8.70E-03	No
m-&p-Xylene	6.79E-07	1.00E+02	No

Table 2 Air Pathway COPC Screening

Receptor **: S5 Lynn View Middle School**			
Compound	**Average Annual Concentration (µg/m^3)**	**2011 ORNL Residential Air RSL (µg/m^3)**	**ORNL RSL Residential Air Exceedance?**
Methane	1.61E-05	NA	
Methyl chloride	4.96E-08	NA	
n-Nitrosodiphenylamine	7.41E-09	9.40E-01	No
Naphthalene	1.15E-07	7.20E-02	No
Nitrogen dioxide (peroxide)	5.74E-05	NA	
Nitrogen oxide	7.86E-04	NA	
o-Xylene	2.72E-07	1.00E+02	No
p-Ethyltoluene	4.80E-08	NA	
Phenanthrene	2.23E-08	NA	
Phenol	4.72E-08	2.10E+02	No
PM10	4.34E-02	NA	
Pyrene	1.68E-07	NA	
RDX	1.33E-06	NA	
Styrene	1.24E-07	1.00E+03	No
Tetrachloroethylene	1.81E-06	4.10E-01	No
TO-12 (NMOC)	7.17E-06	NA	
Toluene	2.27E-07	5.20E+03	No
Total non-methane hydrocarbons	1.07E-04	NA	
Total non-methane organic compounds	2.92E-05	NA	
Total Unidentified hydrocarbons	4.57E-06	NA	

Note:
NA - Not Applicable

Table 2 Air Pathway COPC Screening

Receptor: S6 Washington Elementary School			
Compound	**Average Annual Concentration ($\mu g/m^3$)**	**2011 ORNL Residential Air RSL ($\mu g/m^3$)**	**ORNL RSL Residential Air Exceedance?**
1,2,3-Trimethylbenzene	2.28E-07	7.30E+00	No
1,3-Butadiene	1.05E-07	8.10E-02	No
1,3,5-Trimethylbenzene	8.51E-08	NA	
1,3,5-Trinitrobenzene	3.91E-06	NA	
1,3-Dinitrobenzene	6.58E-08	NA	
2.4,6-Trinitrotoluene	3.20E-06	NA	
2,4-Dinitrotoluene	5.65E-07	2.70E-02	No
2-Methylnaphthalene	1.38E-07	NA	
3,4-Methylphenol (m-& p-cresol)	1.04E-08	NA	
Acenaphthylene	3.27E-08	NA	
Acetophenone	3.89E-07	NA	
Alkanes (Paraffins)	1.46E-06	NA	
Alkenes (Olefins)	6.57E-06	NA	
Anthracene	2.93E-08	NA	
Aromatics	2.73E-06	NA	
Benz(a)anthracene	1.41E-07	8.30E-03	No
Benzene	1.34E-05	3.10E-01	No
Benzo(a)pyrene	9.13E-08	8.70E-04	No
Benzo(b)fluoranthene	1.63E-07	8.70E-03	No
Benzo(g,h,i)perylene	2.99E-08	NA	
Benzo(k)fluoranthene	1.19E-07	8.70E-03	No
Benzl alcohol	2.38E-08	NA	
Biphenyl	6.77E-08	4.20E-01	No
Bis(2-ethylhexyl)phthalate	2.38E-07	1.00E+00	No
Butylbenzyl phthalate	2.60E-07	NA	
Carbon dioxide	3.38E-01	NA	
Carbon monoxide	6.51E-03	NA	
Carbon Tetrachloride	8.47E-08	4.10E-01	No
Di-n-butyl phthalate	2.02E-07	NA	
Di-n-octyl phthalate	3.09E-07	NA	
Dibenzofuran	1.35E-08	NA	
Dichloromethane	6.58E-05	NA	
Diethyl phthalate	1.58E-07	NA	
Dimethyl phthalate	6.65E-08	NA	
Ethylbenzene	4.56E-07	9.70E-01	No
Fluoranthene	9.61E-07	NA	
Fluorene	7.60E-09	NA	
Freon 11	3.40E-07	NA	
Freon 113	8.47E-08	NA	
Freon 12	1.39E-07	NA	
HMX	4.65E-07	NA	
Hyrdrogen chloride	2.21E-04	2.10E+01	No
Hydrogen fluoride	3.24E-03	1.50E+01	No
Indeno(1,2,3-cd)pyrene	3.33E-08	8.70E-03	No
m-&p-Xylene	1.57E-06	1.00E+02	No

Table 2 Air Pathway COPC Screening

***Receptor*: S6 Washington Elementary School**			
Compound	**Average Annual Concentration ($\mu g/m^3$)**	**2011 ORNL Residential Air RSL ($\mu g/m^3$)**	**ORNL RSL Residential Air Exceedance?**
Methane	3.71E-05	NA	
Methyl chloride	1.15E-07	NA	
n-Nitrosodiphenylamine	1.71E-08	9.40E-01	No
Naphthalene	2.67E-07	7.20E-02	No
Nitrogen dioxide (peroxide)	1.33E-04	NA	
Nitrogen oxide	1.82E-03	NA	
o-Xylene	6.28E-07	1.00E+02	No
p-Ethyltoluene	1.11E-07	NA	
Phenanthrene	5.16E-08	NA	
Phenol	1.09E-07	2.10E+02	No
PM10	1.00E-01	NA	
Pyrene	3.88E-07	NA	
RDX	3.08E-06	NA	
Styrene	2.87E-07	1.00E+03	No
Tetrachloroethylene	4.19E-06	4.10E-01	No
TO-12 (NMOC)	1.66E-05	NA	
Toluene	5.25E-07	5.20E+03	No
Total non-methane hydrocarbons	2.48E-04	NA	
Total non-methane organic compounds	6.75E-05	NA	
Total Unidentified hydrocarbons	1.06E-05	NA	

Note:
NA - Not Applicable

Table 2 Air Pathway COPC Screening

Receptor: S7 Mt. Carmel School			
Compound	**Average Annual Concentration ($\mu g/m^3$)**	**2011 ORNL Residential Air RSL ($\mu g/m^3$)**	**ORNL RSL Residential Air Exceedance?**
1,2,3-Trimethylbenzene	1.78E-07	7.30E+00	No
1,3-Butadiene	8.20E-08	8.10E-02	No
1,3,5-Trimethylbenzene	6.64E-08	NA	
1,3,5-Trinitrobenzene	3.05E-06	NA	
1,3-Dinitrobenzene	5.14E-08	NA	
2.4,6-Trinitrotoluene	2.50E-06	NA	
2,4-Dinitrotoluene	4.41E-07	2.70E-02	No
2-Methylnaphthalene	1.08E-07	NA	
3,4-Methylphenol (m-& p-cresol)	8.14E-09	NA	
Acenaphthylene	2.55E-08	NA	
Acetophenone	3.03E-07	NA	
Alkanes (Paraffins)	1.14E-06	NA	
Alkenes (Olefins)	5.13E-06	NA	
Anthracene	2.29E-08	NA	
Aromatics	2.13E-06	NA	
Benz(a)anthracene	1.10E-07	8.30E-03	No
Benzene	1.04E-05	3.10E-01	No
Benzo(a)pyrene	7.13E-08	8.70E-04	No
Benzo(b)fluoranthene	1.27E-07	8.70E-03	No
Benzo(g,h,i)perylene	2.33E-08	NA	
Benzo(k)fluoranthene	9.32E-08	8.70E-03	No
Benzl alcohol	1.86E-08	NA	
Biphenyl	5.28E-08	4.20E-01	No
Bis(2-ethylhexyl)phthalate	1.86E-07	1.00E+00	No
Butylbenzyl phthalate	2.03E-07	NA	
Carbon dioxide	2.64E-01	NA	
Carbon monoxide	5.08E-03	NA	
Carbon Tetrachloride	6.61E-08	4.10E-01	No
Di-n-butyl phthalate	1.58E-07	NA	
Di-n-octyl phthalate	2.41E-07	NA	
Dibenzofuran	1.05E-08	NA	
Dichloromethane	5.14E-05	NA	
Diethyl phthalate	1.23E-07	NA	
Dimethyl phthalate	5.19E-08	NA	
Ethylbenzene	3.56E-07	9.70E-01	No
Fluoranthene	7.50E-07	NA	
Fluorene	5.93E-09	NA	
Freon 11	2.65E-07	NA	
Freon 113	6.61E-08	NA	
Freon 12	1.09E-07	NA	
HMX	3.63E-07	NA	
Hyrdrogen chloride	1.72E-04	2.10E+01	No
Hydrogen fluoride	2.53E-03	1.50E+01	No
Indeno(1,2,3-cd)pyrene	2.60E-08	8.70E-03	No
m-&p-Xylene	1.22E-06	1.00E+02	No

Table 2 Air Pathway COPC Screening

Receptor **: S7 Mt. Carmel School**			
Compound	**Average Annual Concentration (µg/m^3)**	**2011 ORNL Residential Air RSL (µg/m^3)**	**ORNL RSL Residential Air Exceedance?**
Methane	2.90E-05	NA	
Methyl chloride	8.94E-08	NA	
n-Nitrosodiphenylamine	1.34E-08	9.40E-01	No
Naphthalene	2.08E-07	7.20E-02	No
Nitrogen dioxide (peroxide)	1.04E-04	NA	
Nitrogen oxide	1.42E-03	NA	
o-Xylene	4.90E-07	1.00E+02	No
p-Ethyltoluene	8.66E-08	NA	
Phenanthrene	4.02E-08	NA	
Phenol	8.51E-08	2.10E+02	No
PM10	7.82E-02	NA	
Pyrene	3.02E-07	NA	
RDX	2.40E-06	NA	
Styrene	2.24E-07	1.00E+03	No
Tetrachloroethylene	3.27E-06	4.10E-01	No
TO-12 (NMOC)	1.29E-05	NA	
Toluene	4.10E-07	5.20E+03	No
Total non-methane hydrocarbons	1.93E-04	NA	
Total non-methane organic compounds	5.26E-05	NA	
Total Unidentified hydrocarbons	8.24E-06	NA	

Note:
NA - Not Applicable

Table 2 Air Pathway COPC Screening

Receptor: S8 Church Hill Elementary			
Compound	**Average Annual Concentration ($\mu g/m^3$)**	**2011 ORNL Residential Air RSL ($\mu g/m^3$)**	**ORNL RSL Residential Air Exceedance?**
1,2,3-Trimethylbenzene	8.28E-08	7.30E+00	No
1,3-Butadiene	3.82E-08	8.10E-02	No
1,3,5-Trimethylbenzene	3.09E-08	NA	
1,3,5-Trinitrobenzene	1.42E-06	NA	
1,3-Dinitrobenzene	2.39E-08	NA	
2.4,6-Trinitrotoluene	1.16E-06	NA	
2,4-Dinitrotoluene	2.06E-07	2.70E-02	No
2-Methylnaphthalene	5.01E-08	NA	
3,4-Methylphenol (m-& p-cresol)	3.79E-09	NA	
Acenaphthylene	1.19E-08	NA	
Acetophenone	1.41E-07	NA	
Alkanes (Paraffins)	5.30E-07	NA	
Alkenes (Olefins)	2.39E-06	NA	
Anthracene	1.07E-08	NA	
Aromatics	9.93E-07	NA	
Benz(a)anthracene	5.14E-08	8.30E-03	No
Benzene	4.85E-06	3.10E-01	No
Benzo(a)pyrene	3.32E-08	8.70E-04	No
Benzo(b)fluoranthene	5.92E-08	8.70E-03	No
Benzo(g,h,i)perylene	1.09E-08	NA	
Benzo(k)fluoranthene	4.34E-08	8.70E-03	No
Benzl alcohol	8.64E-09	NA	
Biphenyl	2.46E-08	4.20E-01	No
Bis(2-ethylhexyl)phthalate	8.65E-08	1.00E+00	No
Butylbenzyl phthalate	9.46E-08	NA	
Carbon dioxide	1.23E-01	NA	
Carbon monoxide	2.37E-03	NA	
Carbon Tetrachloride	3.08E-08	4.10E-01	No
Di-n-butyl phthalate	7.34E-08	NA	
Di-n-octyl phthalate	1.12E-07	NA	
Dibenzofuran	4.91E-09	NA	
Dichloromethane	2.39E-05	NA	
Diethyl phthalate	5.74E-08	NA	
Dimethyl phthalate	2.42E-08	NA	
Ethylbenzene	1.66E-07	9.70E-01	No
Fluoranthene	3.49E-07	NA	
Fluorene	2.76E-09	NA	
Freon 11	1.23E-07	NA	
Freon 113	3.08E-08	NA	
Freon 12	5.06E-08	NA	
HMX	1.69E-07	NA	
Hyrdrogen chloride	8.03E-05	2.10E+01	No
Hydrogen fluoride	1.18E-03	1.50E+01	No
Indeno(1,2,3-cd)pyrene	1.21E-08	8.70E-03	No
m-&p-Xylene	5.70E-07	1.00E+02	No

Table 2 Air Pathway COPC Screening

***Receptor*: S8 Church Hill Elementary**			
Compound	**Average Annual Concentration ($\mu g/m^3$)**	**2011 ORNL Residential Air RSL ($\mu g/m^3$)**	**ORNL RSL Residential Air Exceedance?**
Methane	1.35E-05	NA	
Methyl chloride	4.17E-08	NA	
n-Nitrosodiphenylamine	6.22E-09	9.40E-01	No
Naphthalene	9.70E-08	7.20E-02	No
Nitrogen dioxide (peroxide)	4.82E-05	NA	
Nitrogen oxide	6.60E-04	NA	
o-Xylene	2.28E-07	1.00E+02	No
p-Ethyltoluene	4.04E-08	NA	
Phenanthrene	1.87E-08	NA	
Phenol	3.96E-08	2.10E+02	No
PM10	3.64E-02	NA	
Pyrene	1.41E-07	NA	
RDX	1.12E-06	NA	
Styrene	1.04E-07	1.00E+03	No
Tetrachloroethylene	1.52E-06	4.10E-01	No
TO-12 (NMOC)	6.02E-06	NA	
Toluene	1.91E-07	5.20E+03	No
Total non-methane hydrocarbons	9.00E-05	NA	
Total non-methane organic compounds	2.45E-05	NA	
Total Unidentified hydrocarbons	3.84E-06	NA	

Note:
NA - Not Applicable

Table 2 Air Pathway COPC Screening

Receptor : Holston Valley Community Hospital			
Compound	**Average Annual Concentration ($\mu g/m^3$)**	**2011 ORNL Residential Air RSL ($\mu g/m^3$)**	**ORNL RSL Residential Air Exceedance?**
1,2,3-Trimethylbenzene	1.47E-07	7.30E+00	No
1,3-Butadiene	6.79E-08	8.10E-02	No
1,3,5-Trimethylbenzene	5.50E-08	NA	
1,3,5-Trinitrobenzene	2.52E-06	NA	
1,3-Dinitrobenzene	4.25E-08	NA	
2.4,6-Trinitrotoluene	2.07E-06	NA	
2,4-Dinitrotoluene	3.65E-07	2.70E-02	No
2-Methylnaphthalene	8.91E-08	NA	
3,4-Methylphenol (m-& p-cresol)	6.74E-09	NA	
Acenaphthylene	2.11E-08	NA	
Acetophenone	2.51E-07	NA	
Alkanes (Paraffins)	9.43E-07	NA	
Alkenes (Olefins)	4.24E-06	NA	
Anthracene	1.89E-08	NA	
Aromatics	1.77E-06	NA	
Benz(a)anthracene	9.13E-08	8.30E-03	No
Benzene	8.62E-06	3.10E-01	No
Benzo(a)pyrene	5.90E-08	8.70E-04	No
Benzo(b)fluoranthene	1.05E-07	8.70E-03	No
Benzo(g,h,i)perylene	1.93E-08	NA	
Benzo(k)fluoranthene	7.72E-08	8.70E-03	No
Benzl alcohol	1.54E-08	NA	
Biphenyl	4.37E-08	4.20E-01	No
Bis(2-ethylhexyl)phthalate	1.54E-07	1.00E+00	No
Butylbenzyl phthalate	1.68E-07	NA	
Carbon dioxide	2.18E-01	NA	
Carbon monoxide	4.21E-03	NA	
Carbon Tetrachloride	5.47E-08	4.10E-01	No
Di-n-butyl phthalate	1.30E-07	NA	
Di-n-octyl phthalate	2.00E-07	NA	
Dibenzofuran	8.72E-09	NA	
Dichloromethane	4.25E-05	NA	
Diethyl phthalate	1.02E-07	NA	
Dimethyl phthalate	4.30E-08	NA	
Ethylbenzene	2.94E-07	9.70E-01	No
Fluoranthene	6.20E-07	NA	
Fluorene	4.91E-09	NA	
Freon 11	2.19E-07	NA	
Freon 113	5.47E-08	NA	
Freon 12	9.00E-08	NA	
HMX	3.00E-07	NA	
Hyrdrogen chloride	1.43E-04	2.10E+01	No
Hydrogen fluoride	2.09E-03	1.50E+01	No
Indeno(1,2,3-cd)pyrene	2.15E-08	8.70E-03	No
m-&p-Xylene	1.01E-06	1.00E+02	No

Table 2 Air Pathway COPC Screening

Receptor **: Holston Valley Community Hospital**			
Compound	**Average Annual Concentration (µg/m^3)**	**2011 ORNL Residential Air RSL (µg/m^3)**	**ORNL RSL Residential Air Exceedance?**
Methane	2.40E-05	NA	
Methyl chloride	7.40E-08	NA	
n-Nitrosodiphenylamine	1.11E-08	9.40E-01	No
Naphthalene	1.72E-07	7.20E-02	No
Nitrogen dioxide (peroxide)	8.57E-05	NA	
Nitrogen oxide	1.17E-03	NA	
o-Xylene	4.06E-07	1.00E+02	No
p-Ethyltoluene	7.17E-08	NA	
Phenanthrene	3.33E-08	NA	
Phenol	7.94E-08	2.10E+02	No
PM10	6.47E-02	NA	
Pyrene	2.50E-07	NA	
RDX	1.99E-06	NA	
Styrene	1.86E-07	1.00E+03	No
Tetrachloroethylene	2.70E-06	4.10E-01	No
TO-12 (NMOC)	1.07E-05	NA	
Toluene	3.39E-07	5.20E+03	No
Total non-methane hydrocarbons	1.60E-04	NA	
Total non-methane organic compounds	4.36E-05	NA	
Total Unidentified hydrocarbons	6.82E-06	NA	

Note:
NA - Not Applicable

Table 2 Air Pathway COPC Screening

Receptor : Asbury Center			
Compound	**Average Annual Concentration ($\mu g/m^3$)**	**2011 ORNL Residential Air RSL ($\mu g/m^3$)**	**ORNL RSL Residential Air Exceedance?**
1,2,3-Trimethylbenzene	2.69E-07	7.30E+00	No
1,3-Butadiene	1.24E-07	8.10E-02	No
1,3,5-Trimethylbenzene	1.00E-07	NA	
1,3,5-Trinitrobenzene	4.61E-06	NA	
1,3-Dinitrobenzene	7.76E-08	NA	
2.4,6-Trinitrotoluene	3.77E-06	NA	
2,4-Dinitrotoluene	6.67E-07	2.70E-02	No
2-Methylnaphthalene	1.63E-07	NA	
3,4-Methylphenol (m-& p-cresol)	1.23E-08	NA	
Acenaphthylene	3.85E-08	NA	
Acetophenone	4.58E-07	NA	
Alkanes (Paraffins)	1.72E-06	NA	
Alkenes (Olefins)	7.75E-06	NA	
Anthracene	3.46E-08	NA	
Aromatics	3.22E-06	NA	
Benz(a)anthracene	1.67E-07	8.30E-03	No
Benzene	1.57E-05	3.10E-01	No
Benzo(a)pyrene	1.08E-07	8.70E-04	No
Benzo(b)fluoranthene	1.92E-07	8.70E-03	No
Benzo(g,h,i)perylene	3.53E-08	NA	
Benzo(k)fluoranthene	1.41E-07	8.70E-03	No
Benzl alcohol	2.80E-08	NA	
Biphenyl	7.98E-08	4.20E-01	No
Bis(2-ethylhexyl)phthalate	2.81E-07	1.00E+00	No
Butylbenzyl phthalate	3.07E-07	NA	
Carbon dioxide	3.98E-01	NA	
Carbon monoxide	7.68E-03	NA	
Carbon Tetrachloride	9.98E-08	4.10E-01	No
Di-n-butyl phthalate	2.38E-07	NA	
Di-n-octyl phthalate	3.65E-07	NA	
Dibenzofuran	1.59E-08	NA	
Dichloromethane	7.76E-05	NA	
Diethyl phthalate	1.86E-07	NA	
Dimethyl phthalate	7.84E-08	NA	
Ethylbenzene	5.38E-07	9.70E-01	No
Fluoranthene	1.13E-06	NA	
Fluorene	8.96E-09	NA	
Freon 11	4.00E-07	NA	
Freon 113	9.98E-08	NA	
Freon 12	1.64E-07	NA	
HMX	5.48E-07	NA	
Hyrdrogen chloride	2.60E-04	2.10E+01	No
Hydrogen fluoride	3.82E-03	1.50E+01	No
Indeno(1,2,3-cd)pyrene	3.92E-08	8.70E-03	No
m-&p-Xylene	1.85E-06	1.00E+02	No

Table 2 Air Pathway COPC Screening

Receptor: Asbury Center			
Compound	**Average Annual Concentration ($\mu g/m^3$)**	**2011 ORNL Residential Air RSL ($\mu g/m^3$)**	**ORNL RSL Residential Air Exceedance?**
Methane	4.37E-05	NA	
Methyl chloride	1.35E-07	NA	
n-Nitrosodiphenylamine	2.02E-08	9.40E-01	No
Naphthalene	3.15E-07	7.20E-02	No
Nitrogen dioxide (peroxide)	1.56E-04	NA	
Nitrogen oxide	2.14E-03	NA	
o-Xylene	7.41E-07	1.00E+02	No
p-Ethyltoluene	1.31E-07	NA	
Phenanthrene	6.08E-08	NA	
Phenol	1.29E-07	2.10E+02	No
PM10	1.18E-01	NA	
Pyrene	4.57E-07	NA	
RDX	3.63E-06	NA	
Styrene	3.39E-07	1.00E+03	No
Tetrachloroethylene	4.94E-06	4.10E-01	No
TO-12 (NMOC)	1.95E-05	NA	
Toluene	6.19E-07	5.20E+03	No
Total non-methane hydrocarbons	2.92E-04	NA	
Total non-methane organic compounds	7.95E-05	NA	
Total Unidentified hydrocarbons	1.25E-05	NA	

Note:
NA - Not Applicable

Table 2 Air Pathway COPC Screening

Receptor: Allendale Child Care Center			
Compound	**Average Annual Concentration ($\mu g/m^3$)**	**2011 ORNL Residential Air RSL ($\mu g/m^3$)**	**ORNL RSL Residential Air Exceedance?**
1,2,3-Trimethylbenzene	2.65E-07	7.30E+00	No
1,3-Butadiene	1.22E-07	8.10E-02	No
1,3,5-Trimethylbenzene	9.89E-08	NA	
1,3,5-Trinitrobenzene	4.54E-06	NA	
1,3-Dinitrobenzene	7.65E-08	NA	
2.4,6-Trinitrotoluene	3.72E-06	NA	
2,4-Dinitrotoluene	6.57E-07	2.70E-02	No
2-Methylnaphthalene	1.60E-07	NA	
3,4-Methylphenol (m-& p-cresol)	1.21E-08	NA	
Acenaphthylene	3.80E-08	NA	
Acetophenone	4.52E-07	NA	
Alkanes (Paraffins)	1.70E-06	NA	
Alkenes (Olefins)	7.64E-06	NA	
Anthracene	3.41E-08	NA	
Aromatics	3.18E-06	NA	
Benz(a)anthracene	1.64E-07	8.30E-03	No
Benzene	1.55E-05	3.10E-01	No
Benzo(a)pyrene	1.06E-07	8.70E-04	No
Benzo(b)fluoranthene	1.89E-07	8.70E-03	No
Benzo(g,h,i)perylene	3.40E-08	NA	
Benzo(k)fluoranthene	1.39E-07	8.70E-03	No
Benzl alcohol	2.76E-08	NA	
Biphenyl	7.87E-08	4.20E-01	No
Bis(2-ethylhexyl)phthalate	2.77E-07	1.00E+00	No
Butylbenzyl phthalate	3.02E-07	NA	
Carbon dioxide	3.93E-01	NA	
Carbon monoxide	7.57E-03	NA	
Carbon Tetrachloride	9.84E-08	4.10E-01	No
Di-n-butyl phthalate	2.35E-07	NA	
Di-n-octyl phthalate	3.59E-07	NA	
Dibenzofuran	1.57E-08	NA	
Dichloromethane	7.75E-05	NA	
Diethyl phthalate	1.84E-07	NA	
Dimethyl phthalate	7.73E-08	NA	
Ethylbenzene	5.30E-07	9.70E-01	No
Fluoranthene	1.12E-06	NA	
Fluorene	8.83E-09	NA	
Freon 11	3.95E-07	NA	
Freon 113	9.84E-08	NA	
Freon 12	1.62E-07	NA	
HMX	5.40E-07	NA	
Hyrdrogen chloride	2.57E-04	2.10E+01	No
Hydrogen fluoride	3.77E-03	1.50E+01	No
Indeno(1,2,3-cd)pyrene	3.87E-08	8.70E-03	No
m-&p-Xylene	1.82E-06	1.00E+02	No

Table 2 Air Pathway COPC Screening

Receptor: Allendale Child Care Center			
Compound	**Average Annual Concentration (µg/m^3)**	**2011 ORNL Residential Air RSL (µg/m^3)**	**ORNL RSL Residential Air Exceedance?**
Methane	4.31E-05	NA	
Methyl chloride	1.33E-07	NA	
n-Nitrosodiphenylamine	1.99E-08	9.40E-01	No
Naphthalene	3.10E-07	7.20E-02	No
Nitrogen dioxide (peroxide)	1.54E-04	NA	
Nitrogen oxide	2.11E-03	NA	
o-Xylene	7.30E-07	1.00E+02	No
p-Ethyltoluene	1.29E-07	NA	
Phenanthrene	5.99E-08	NA	
Phenol	1.27E-07	2.10E+02	No
PM10	1.16E-01	NA	
Pyrene	4.50E-07	NA	
RDX	3.58E-06	NA	
Styrene	3.34E-07	1.00E+03	No
Tetrachloroethylene	4.87E-06	4.10E-01	No
TO-12 (NMOC)	1.93E-05	NA	
Toluene	6.11E-07	5.20E+03	No
Total non-methane hydrocarbons	2.88E-04	NA	
Total non-methane organic compounds	7.84E-05	NA	
Total Unidentified hydrocarbons	1.23E-05	NA	

Note:
NA - Not Applicable

Table 2 Air Pathway COPC Screening

Receptor: Closest Residence			
Compound	**Average Annual Concentration ($\mu g/m^3$)**	**2011 ORNL Residential Air RSL ($\mu g/m^3$)**	**ORNL RSL Residential Air Exceedance?**
1,2,3-Trimethylbenzene	8.46E-07	7.30E+00	No
1,3-Butadiene	3.91E-07	8.10E-02	No
1,3,5-Trimethylbenzene	3.16E-07	NA	
1,3,5-Trinitrobenzene	1.45E-05	NA	
1,3-Dinitrobenzene	2.45E-07	NA	
2.4,6-Trinitrotoluene	1.19E-05	NA	
2,4-Dinitrotoluene	2.10E-06	2.70E-02	No
2-Methylnaphthalene	5.12E-07	NA	
3,4-Methylphenol (m-& p-cresol)	3.88E-08	NA	
Acenaphthylene	1.21E-07	NA	
Acetophenone	1.44E-06	NA	
Alkanes (Paraffins)	5.42E-06	NA	
Alkenes (Olefins)	2.44E-05	NA	
Anthracene	1.09E-07	NA	
Aromatics	1.02E-05	NA	
Benz(a)anthracene	5.25E-07	8.30E-03	No
Benzene	4.96E-05	3.10E-01	No
Benzo(a)pyrene	3.39E-07	8.70E-04	No
Benzo(b)fluoranthene	6.06E-07	8.70E-03	No
Benzo(g,h,i)perylene	1.11E-07	NA	
Benzo(k)fluoranthene	4.44E-07	8.70E-03	No
Benzl alcohol	8.83E-08	NA	
Biphenyl	2.52E-07	4.20E-01	No
Bis(2-ethylhexyl)phthalate	8.84E-07	1.00E+00	No
Butylbenzyl phthalate	9.66E-07	NA	
Carbon dioxide	1.26E+00	NA	
Carbon monoxide	2.42E-02	NA	
Carbon Tetrachloride	3.15E-07	4.10E-01	No
Di-n-butyl phthalate	7.50E-07	NA	
Di-n-octyl phthalate	1.15E-06	NA	
Dibenzofuran	5.02E-08	NA	
Dichloromethane	2.45E-04	NA	
Diethyl phthalate	5.87E-07	NA	
Dimethyl phthalate	2.47E-07	NA	
Ethylbenzene	1.69E-06	9.70E-01	No
Fluoranthene	3.57E-06	NA	
Fluorene	2.82E-08	NA	
Freon 11	1.26E-06	NA	
Freon 113	3.15E-07	NA	
Freon 12	5.18E-07	NA	
HMX	1.73E-06	NA	
Hyrdrogen chloride	8.20E-04	2.10E+01	No
Hydrogen fluoride	1.20E-02	1.50E+01	No
Indeno(1,2,3-cd)pyrene	1.24E-07	8.70E-03	No
m-&p-Xylene	5.83E-06	1.00E+02	No

Table 2 Air Pathway COPC Screening

Receptor: Closest Residence			
Compound	**Average Annual Concentration ($\mu g/m^3$)**	**2011 ORNL Residential Air RSL ($\mu g/m^3$)**	**ORNL RSL Residential Air Exceedance?**
Methane	1.38E-04	NA	
Methyl chloride	4.26E-07	NA	
n-Nitrosodiphenylamine	6.36E-08	9.40E-01	No
Naphthalene	9.91E-07	7.20E-02	No
Nitrogen dioxide (peroxide)	4.93E-04	NA	
Nitrogen oxide	6.75E-03	NA	
o-Xylene	2.33E-06	1.00E+02	No
p-Ethyltoluene	4.12E-07	NA	
Phenanthrene	1.92E-07	NA	
Phenol	4.05E-07	2.10E+02	No
PM10	3.72E-01	NA	
Pyrene	1.44E-06	NA	
RDX	1.14E-05	NA	
Styrene	1.07E-06	1.00E+03	No
Tetrachloroethylene	1.56E-05	4.10E-01	No
TO-12 (NMOC)	6.16E-05	NA	
Toluene	1.95E-06	5.20E+03	No
Total non-methane hydrocarbons	9.20E-04	NA	
Total non-methane organic compounds	2.51E-04	NA	
Total Unidentified hydrocarbons	3.92E-05	NA	

Note:
NA - Not Applicable

Table 3
Exposure Factor Assumptions

Exposure Route	Parameter Code	Parameter Definition	Units	Onsite Worker		Construction Worker		Reference
				CTE	RME	CTE	RME	
Ingestion	CS	RDX Soil Concentration	mg/kg	32.7	136.9	49.4	168.3	Calculated (1)
	IR	Ingestion Rate of Soil	mg/day	50 (2)	50 (2)	330 (3)	330 (3)	
	EF	Exposure Frequency	days/year	150 (2)	150 (2)	250 (3)	250 (3)	
	ED	Exposure Duration	years	7(4)	25 (3)	0.5 (2)	1(2)	
	CF	Conversion Factor	kg/mg	1.00E-06	1.00E-06	1.00E-06	1.00E-06	Default (3,4)
	BW	Body Weight	kg	70	70	70	70	Default (3,4)
	AT-C	Averaging Time - Cancer	days	25,550	25,550	25,550	25,550	Default (3,4)
	AT-N	Averaging Time - Noncancer	days	1,050	3,750	125	250	Calculated
Inhalation	CS	RDX Soil Concentration	mg/kg			51.4	168.3	Calculated (1)
	IR	Inhalation Rate of Soil	m^3/day			20	20	Default (3)
	PEF	Particulate Emission Factor	m^3/kg			4.60E+08	4.60E+08	Calculated
	EF	Exposure Frequency	days/year			250	250	Default (3,4)
	ED	Exposure Duration	year			0.5 (2)	1 (2)	
	BW	Body Weight	kg			70	70	Default (3,4)
	AT-C	Averaging Time - Cancer	days			25,550	25,550	Default (3,4)
	AT-N	Averaging Time - Noncancer	days			125	250	Calculated

(1) Central Tendency Exposure Soil Concentration is the arithmetic mean of RDX concentrations detected in soils 0 to 6 inches for the on-site worker and 0 to 12 inches for the construction worker. RME (UCL) was calculated using Pro UCL 4.1 (EPA 2012)

(2) Based on site-specific informatino and professional judgement

(3) EPA. 2002c. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24. December. Exhibit 1-2, default values for Non-Residential (Commercial/Industrial) Outdoor Worker.

(4) EPA. 1989. Risk Assessment Guidance for Superfund: Vol I - Human Health Evaluation Manual (Part A). EPA/540/1-89/002. Value for non-carcinogenic effects is based on the ED and the value for carcinogenic effects

APPENDIX III

1997 and 2002 Brown and Root *Air Pathway Assessment*

SECTION E-2

AIR PATHWAY ASSESSMENT

E-2 AIR QUALITY ASSESSMENT [TN Rule 1200-1-11-.06(27)(a), 1200-11-.07((5)(b); 40 CFR 264.601(c)]

This section contains the details of the air pathway assessment for the impact of emissions from the HSAAP open burn pan treatment unit (Burn Pan Unit). The Burn Pan Unit consists of four burn pans that are used for the thermal treatment of explosive waste materials. The explosive wastes are classified as RCRA hazardous wastes because of their reactivity characteristics. The Burn Pan Unit is classified as a miscellaneous treatment unit. Hazardous waste regulation 40 CFR 264, Subpart X, contains environmental performance standards for miscellaneous units. The air pathway assessment estimates the environmental impacts of the Burn Pan Unit emissions as required in 40 CFR Subpart X 264.601(c).

E-2-1 Overview

The major topics discussed in this section include the following:

- Conceptual Approach
- Burn Pan Unit Operating Conditions
-
- Air Pathway Assessment
  - Environmental Setting
  - Potential Air Emissions
  - Air Quality Dispersion Modeling Protocol
  - Potential Impact to Human Health and the Environment

Other sections of this permit application also provide important information for the HSAAP air dispersion modeling assessment. For example, Sections C-1 and C-4, respectively, discuss the chemical characteristics of the waste materials treated at the Burn Pan Unit and the potential emissions that can be expected from the treatment process.

Additional supporting information relevant to Section E-2 can be found in Appendices E-2-1 through E-2-7.

E-2-2 Conceptual Approach

The conceptual approach applied in the HSAAP air pathway assessment is to calculate the maximum short-term (equal to or less than 24 hours) and long-term (annual) impacts resulting from the thermal treatment of waste explosive materials at the Burn Pan Unit. The calculated ambient impact from the Burn Pan Unit is based on a scenario of maximum daily and annual net explosive weight (NEW) treatment quantities. The maximum daily and annual treatment quantities evaluated in this assessment are 5,000 and 1,250,000 pounds NEW, respectively. The air pathway assessment for the Burn Pan Unit is based onsite-specific data and on numerous conservative assumptions which are intended to overestimate the potential impact of the Burn Pan Unit and also to streamline the assessment process.

The dispersion model calculations were made to determine the maximum short- and long-term impacts at and beyond the HSAAP boundary, and at selected actual receptor locations. Results of the modeling analysis were compared to ambient air quality standards and risk-based screening criteria to evaluate the impact on human health and the environment via the inhalation pathway. Inhalation was considered to be the primary pathway of concern for the Burn Pan Unit air emissions. Evaluation of other potential pathways, such as ingestion and dermal contact, is warranted only if the results of the air pathway analysis exceed carcinogenic and noncarcinogenic risk criteria.

E-2-3 Burn Pan Unit Operating Conditions

The operating conditions at the Burn Pan Unit are controlled by standard operating procedures (SOPs), Section D-8 has details. These procedures determine the types of materials that are treated, the treatment quantities, and the permissible meteorological conditions for conducting treatment operations.

The treatment of waste explosive materials can be conducted at the Burn Pan Unit Monday through Friday, between the hours of noon and 4:00 p.m., and when meteorological conditions meet the following requirements:

- No precipitation
- Wind speed of less than 30 mph
- No observable threat of electrical storms
- No restricted visibility (dense fog, blowing snow, or dust)
- No low, overcast sky
- No air pollution episodes

Treatment operations are limited to one (1) treatment event per day and may include the use of one to as many as four burn pans per event. Additional operating information regarding the types of materials treated at the Burn Pan Unit, treatment limits, and emission sources is discussed below in Sections E-2-3a through E-2-3b.

E-2-3(a) Materials Treated at the Burn Pan Unit

The only waste materials treated at the Burn Pan Unit are explosive wastes. These waste materials originate from the manufacturing Area B, the product storage area, and the laboratory. These materials include scrap; settling tank materials; catch basin materials recovered from the production buildings; and nonrecoverable, off-specification, obsolete and unneeded product formulations that cannot be sold or recycled. The chemical composition of these waste materials has been described in Sections C-1h(1), C-1h(2), and C-1h(3).

HSAAP manufacturers or stores at least 42 different energetic materials onsite, as discussed in Section C-4. Since most of these formulations are composed primary of RDX, HMX, and TNT, it is possible to group these materials into a representative subset of material groups that are based on primary chemical constituents. This approach streamlines the air pathway assessment by grouping the master list of potential treatment materials into a smaller subset to reduce the assessment effort. A reduced subset of representative energetic material groups for

the Burn Pan Unit is shown in Table E-2-1. This group of 10 energetic materials was used to represent the types of materials treated at Burn Pan Unit.

The subgroups of energetic materials in Table E-2-1 were also used in the development of energetic material heat contents and emission factors for potential contaminant emissions. The development of representative heat content values and emission factors for the energetic material subgroups listed in Table E-2-1 are discussed below in Sections E-2-4(c)(4) and E-2-4(c)(5), respectively.

E-2-3(b) Treatment at SOP Limits

The air pathway assessment evaluated the impact of the Burn Pan Unit operating at the maximum daily and annual treatment limits. The treatment of hazardous waste explosive materials is limited to no more than 5,000 pounds NEW per day. The Burn Pan Unit consists of four (4) burn pans having uniform dimensions. Each burn pan can be loaded to a maximum of 1,500 pounds NEW per day as long as the maximum daily treatment limit is maintained. The daily treatment scenario evaluated in this assessment assumed three pans loaded to 1,500 pounds and one loaded to 500 pounds.

On an annual basis, the Burn Pan Unit is assumed to operate 5 days per week for 50 weeks out of the year. At 5,000 pounds per day, this equates to a maximum annual treatment capacity of 1,250,000 pounds NEW.

E-2-4 Air Pathway Assessment

This section presents the details of the Burn Pan Unit air pathway assessment and a discussion of the modeling results and potential impacts to human health and the environment. Additional supporting information for this section is provided in Appendices E-2-1 through E-2-7.

E-2-4(a) Environmental Setting

E-2-4(a)(1) Topography

The terrain immediately surrounding HSAAP ranges from gently rolling hills on the west and east to very hilly terrain to the north and south. The topography in the vicinity of the Burn Pan Unit is relatively flat with terrain rising gradually to the west, north, and east. The terrain rises more abruptly immediately south of the Burn Pan Unit, just across the Holston River where the Holston River Mountains extend southwest to northeast along the southern boundary of HSAAP.

The base elevation at the Burn Pan Unit is 1,165 feet mean sea level (msl). Terrain to the west and east rises to elevations of 1,400-1,500 feet msl. Immediately to the south, elevations reach about 2,200 feet msl in the Holston River Mountains.

E-2-4(a)(2) Land Use Classification

The land within a 3-kilometer distance of the Burn Pan Unit is composed of either undeveloped woodlands, the Area B manufacturing facilities, or the explosive magazine storage area. Most of this area is owned by HSAAP and is not available for development or growth. For the

TABLE E-2-1
REPRESENTATIVE LIST OF ENERGETIC MATERIALS
TREATED AT HSAAP BURN PAN UNIT
HOLSTON ARMY AMMUNITION PLANT
KINGSTON, TN

Energetic Material
RDX (Cyclotrimethylene trinitramine)
HMX (Cyclotetra methylene tetranitramine)
TNT (2,4,6-Trinitrotoluene)
Composition B
TATB (1,3,5-Trinitrotoluene)
Octol
TATB/RDX
TNAZ (1,3,3-Trinitroazetidine)
PETN (Pentaerythritol tetranitromine)
CL20 (Hexanitroisowurtzitane)

purpose of conducting the Burn Pan Unit air dispersion modeling analysis, the area has been classified as rural using guidance referenced in the U.S. EPA Guideline on Air Quality Models (2/93).

The land use classification was determined on the basis of information contained in United States Geological Survey (USGS) topographic maps for the area within 3 kilometers of the Burn Pan Unit. Based on a review of the Kingsport, Church Hill, Lovelace, and Sullivan Gardens quadrangles, more than 80-percent of the area within 3 kilometers of the Burn Pan Unit can be classified as rural.

E-2-4(a)(3) Climatology

HSAAP conducts onsite meteorological monitoring at the Burning Ground office. The meteorological parameter measurements are limited to wind speed and wind direction during periods of open burn treatment at the Burn Pan Unit. As a result, insufficient data are collected to represent onsite climatology. Historical meteorological data from the Tri-Cities Regional Airport in Sullivan County have been selected to represent the climatology at HSAAP. The airport is located 15 miles east of HSAAP.

The climatology for this region is generally considered temperate. Normal temperatures range from daily maximums of 85°F in July to daily minimums of 24°F in January. The annual mean precipitation for this region is 41 inches. The average monthly rainfall ranges from 2.5 inches during the fall months to 4 inches during the late spring to mid-summer months. The maximum rainfall rate to occur in 24 hours is 3.65 inches. Snowfall seldom occurs before November and rarely stays on the ground more than a few days. The average annual snowfall is approximately 15 inches, but higher amounts occur over the mountains to the east. Approximately 90 days during the late fall, winter, and early spring, the temperature will drop below freezing. Approximately 14 days during the summer, the temperature will rise above 90°F.

Climatic data indicate that the mean Class A annual pan evaporation for this region is approximately 45 inches per year. The annual mean lake evaporation is approximately 33 inches.

Preprocessed hourly meteorological observations developed in the dispersion modeling analysis were used to estimate the frequency of temperature inversions at the Burn Pan Unit. A temperature inversion exists when the atmosphere is characterized by an increase in temperature with altitude. Meteorological conditions are favorable for the formation of temperature inversions when the atmospheric stability classification is E, F, or G. It is assumed that inversions are present if the above stability classifications last for longer than 3 consecutive hours on a given day.

The estimated frequency of inversions is based on a review of hourly stability classifications within each of the 5 years of preprocessed meteorological data used in the dispersion modeling analysis. This database is discussed in Section E-2-4(c)(2). A review of the preprocessed data indicated that the potential inversion conditions (E, F, and G stability) occurred during the early and mid-morning hours; however, the duration of the inversions did not persist past noon on any day. This implies that no inversions are generally present during the times when treatment operations are permitted to take place at the Burn Pan Unit (between noon and 4:00 p.m.).

E-2-4(a)(4) Existing Air Quality

The State of Tennessee has established ambient air quality standards for total suspended particulates as well as all of the federal criteria pollutants (inhalable particulates as PM10, sulfur dioxide, carbon monoxide, lead, nitrogen dioxide, and ozone). In addition, the state has adopted ambient standards for hydrogen fluoride. The Tennessee Department of Environment and Conservation (TDEC), Division of Air Pollution Control, operates a network of monitoring stations that collect ambient air samples to establish the compliance status with ambient air quality standards.

Each county in Tennessee has been assigned a designation regarding the attainment status of the air quality to federal standards based on ambient air samples. The HSAAP spans across two counties, Sullivan and Hawkins. Both counties have been classified as being in attainment for total suspended particulates, PM10, sulfur dioxide, nitrogen dioxide, carbon monoxide, and ozone. No attainment status has been designated for lead for any part of Sullivan or Hawkins counties. Local ambient air quality data also demonstrate compliance with the state hydrogen fluoride standards.

E-2-4(b) Potential Air Emissions

The air pathway assessment conducted for this permit application considered all sources of emissions associated with the operation of the Burn Pan Unit. The potential emission sources associated with the Burn Pan Unit included the following:

- Pretreatment Emissions
- Treatment Emissions
- Post-treatment Emissions

Each potential source of emissions is discussed below.

E-2-4(b)(1) Pretreatment Emissions

Pretreatment emissions from the Burn Pan Unit are considered to be negligible and are assumed to be zero in the air pathway assessment. This assumption is based on the following conditions during the pretreatment period.

All waste material treated at the Burn Pan Unit is in solid, granular form, and the vapor pressure of the energetics is negligible. Most of the waste explosive materials delivered to the Burn Pan Unit are moist. The moisture content of the waste materials at the time of delivery has been measured to be generally in the range of 5-20 percent by weight. The relatively high moisture content of the materials greatly reduces the chance of windblown emissions.

The moist material at the Burn Pan Unit is spread out in the burn pans to a maximum depth of 3 inches. The high sides of the burn pans prevent spillage during the loading process. The materials may remain in the pans uncovered for several hours during the day to promote evaporation and drying of the waste materials. If the moist waste explosives have not dried sufficiently by the end of the day, mobile covers are placed over the pans. The covers may then be removed the next work day to complete the drying process.

E-2-4(b)(2) Treatment Emissions

Potential emissions associated with open burning treatment have been identified through the U.S. Army testing programs, as discussed in Section C-4. Emissions from the Burn Pan Unit are assumed to be composed of products of combustion as well as products of incomplete combustion. Together these emissions are referred to as the "combustion by-products" for the Burn Pan Unit. All combustion by-products for the Burn Pan Unit are assumed to have aerodynamics diameters of 10 microns or less and therefore disperse and transport as a gas.

As stated in Section C-4, emission factors were derived for potential combustion by-products using open burning/open detonation emissions test data collected during U.S. Army testing activities in 1992 and 1994 at the Dugway Proving Grounds. The results of Dugway emission tests described in Section C-4 were used in conjunction with U.S. EPA Region III Risk-Based Screening criteria (obtained from EPA Region III's Internet website under Risk Assessment Guidance) to develop a list of potential short-term and long-term emission factors for the HSAAP Burn Pan Unit. All of the emission constituents identified in the Dugway tests were considered in the risk-based screening assessment. Every emission compound listed in the U.S. EPA Region III Risk-Based Criteria was included in the calculation of carcinogenic risk and noncarcinogenic hazard index. The list of potential short-term and long-term emission factors for the Burn Pan Unit is discussed below in Section E-2-4(c)(5).

E-2-4(b)(3) Post-Treatment Emissions

Post-treatment operations at the Burn Pan Unit consist of removing any treatment residue from the burn pans and placing them in barrels or sealed containers. If any explosive wastes still remain after the treatment process, they are left in the pan and treated at the next burn event. The pans are covered at all times unless the moist waste material is being dried or treatment is taking place. Treatment residue material is tested after the treatment event to demonstrate that

the material is no longer classified as a hazardous waste. Based on these considerations, post-treatment emissions are considered negligible.

E-2-4(c) Air Quality Dispersion Modeling Protocol

A protocol was developed to outline a step-by-step procedure for conducting the air dispersion modeling analysis for the Burn Pan Unit. The protocol was submitted to the TDEC. This section presents an overview of the primary components and assumptions used in the dispersion modeling protocol.

E-2-4(c)(1) Air Quality Dispersion Model

The Open Burn/Open Detonation Dispersion Model (OBODM) was used to estimate the potential air quality impact associated with the open burning of waste explosive materials at the HSAAP Burn Pan Unit. The OBODM was developed by the H. E. Cramer Company in January 1996 under contract with the U.S. Army Dugway Proving Grounds. The OBODM was specifically designed to address impacts from open burn and open detonation treatment units. The OBODM uses cloud/plume rise, dispersion, and deposition algorithms taken from existing models for instantaneous and quasi-instantaneous sources to predict the downwind transport and dispersion of pollutants for simple and complex terrain receptors. The model can be used to calculate peak concentration, time-mean concentration, dosage (time-integrated concentration), and particulate gravitational settling.

OBODM uses the heat content of the energetic material in plume rise equations to predict the buoyant rise of the plume. Emissions can be from multiple sources for either a single event or up to a year of sequential hourly source and meteorological inputs. The model can consider instantaneous (open detonation) or quasi-instantaneous (open burn) releases from point/volume and/or line sources. OBODM assumes a detonation to have a burn duration of less than 15 seconds. Burn durations equal to or greater than 15 seconds are assumed to be an open burn. The Burn Pan Unit was modeled as a quasi-instantaneous, volume source having burn durations between 6.66 and 20.0 minutes. Detailed information regarding the Burn Pan Unit source parameters is discussed in Sections E-2-4(c)(4).

When sequential hourly meteorological data are used with OBODM, a switch option must be set for calm winds that directs OBODM to either make no calculations for calm winds or set the wind speed to 1.0 m/sec. This protocol used the switch option to set wind speed to 1.0 m/sec for all hours normally classified as calm. This option was selected in order to evaluate all potential treatment hours in a year. Additional information on the potential treatment hours in a year is discussed within Section E-2-4(c)(4).

E-2-4(c)(2) Meteorological Data

HSAAP performs only very limited monitoring of onsite meteorological conditions. The information collected, although adequate for operations, is not sufficient for defining onsite climatology or for use in dispersion modeling. As a result, representative hourly meteorological data were obtained from the U.S. EPA Technical Transfer Network (TTN) electronic bulletin board and the National Climatic Data Center (NCDC) for use in the air dispersion modeling analysis.

OBODM was used in conjunction with 5 individual years of hourly surface observations collected at the Tri-Cities Regional Airport located in Sullivan County, Tennessee. This station is approximately 15 miles due east of HSAAP. The most recent 5-year period of hourly observations available from the TTN is 1987 through 1991. Upper air sounding data for the same 5-year period were obtained from the National Weather Service (NWS) upper air reporting station in Huntington, West Virginia. This is the closest upper air reporting station to the Tri-Cities Airport.

The hourly observation and upper air data sets for each of the 5 years were processed by the U.S. EPA PCRAMMET preprocessor program to create an input file compatible with the OBODM. Copies of the preprocessed meteorological data are provided in Appendix E-2-1. Appendix E-2-1 also contains the OBODM model, as well as the input and output files resulting from the modeling analysis.

E-2-4(c)(3) Receptor Networks

The air dispersion modeling analysis conducted for the Burn Pan Unit utilized two separate receptor networks to calculate the ambient impacts. A coarse grid network was used to determine the location of the maximum offsite short-term and long-term impacts. A second network of discrete receptor locations was used to calculate the impact at actual public exposure points, such as the HSAAP boundary, schools, hospitals, day care and long-term health care centers, and the closest public residence to the Burn Pan Unit. A map showing all coarse and discrete receptors evaluated in the dispersion modeling analysis is provided in Appendix E-2-2. Additional information on each receptor network is discussed below.

OBODM was used to calculate maximum 1-hour and annual average concentrations for the coarse grid and discrete receptor networks. OBODM calculated 1-hour concentrations at all receptors assuming one treatment event per hour between the permissible treatment hours of noon and 4:00 p.m. Further details on the Burn Pan Unit assumed operating hours are discussed in Section E-2-4(c)(4). Maximum 1-hour concentrations were extrapolated to longer averaging periods for the purpose of comparing calculated concentrations to applicable air quality standards. The extrapolation procedure is discussed in Section E-2-4(c)(7).

Coarse Grid Network

The coarse grid polar network covered a radial area as far as 10 kilometers beyond the Burn Pan Unit. Coarse grid receptors were positioned at specific distances along 16 radials that extended out from the Burn Pan Unit. Receptors were placed at the following distances (kilometers) along each radial: 0.25, 0.50, 0.75, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 6.0, 7.0, 8.0, 9.0, and 10.0. The radials were placed at 22.5° increments from due north (0.0°, 22.5°, 45°, 67.5°, etc.). The polar array of coarse grid receptors is shown in Appendix E-2-2.

Once the coarse network worst-case impact areas were identified for the 1-hour and annual averaging periods, a fine mesh grid was placed over each coarse network maximum to determine whether higher concentrations could be calculated for each area. The fine mesh grid was centered over the coarse network maximum with receptors extending outwards at 100-meter increments to cover an area of 1600 square meters.

The highest 1-hour and annual average concentrations calculated in the fine mesh analysis for all five years of meteorological data were chosen to represent the maximum offsite impacts.

Discrete Network

A total of 16 receptor locations were used to evaluate the impact at the HSAAP facility boundary. In an effort to reduce the number of receptors used in this analysis, the following coarse grid receptors also served as facility boundary receptors along each of the directional radials: N#8, NNE#7, NE#7, ENE#7, E#7, ESE#6, SE#5, SSE#5, S#6, SSW#7, SW#10, WSW#9, W#10, WNW#9, NW#8, and NNW#8. The number associated with each directional radial is the corresponding downwind distance in kilometers from ascending order, i.e., #1(0.25), #2(0.50), #3(0.75), etc. These receptors are marked with a "B" in Appendix E-2-2.

The closest public residence to the HSAAP open burn unit has been estimated to be located almost due east (80°) at a distance of approximately 2,650 meters (1 foot = 0.3048 meters). This residence is located along the banks of the Holston River near the border of Hawkins and Sullivan counties and is marked by "CR" in Appendix E-2-2.

A select group of elementary, middle, and high schools located within 10 kilometers (km) (1,000 meters = 1 kilometer) of the HSAAP were chosen as discrete receptors. These schools are listed below and are distinguished by their respective identifiers in Appendix E-2-2.

Map Identified	Receptor Location
S1	Sullivan Middle School - Sullivan Gardens, Tennessee
S2	Sevier Middle School - Kingsport, Tennessee
S3	Robinson Middle School - Kingsport, Tennessee
S4	Roosevelt Elementary - Kingsport, Tennessee
S5	Lynn View Middle School - Kingsport, Tennessee
S6	Washington Elementary - Kingsport, Tennessee
B/S7	Mt. Carmel School - Mt. Carmel, Tennessee
S8	Church Hill Elementary School - Churchill, Tennessee

The Holston Valley Hospital and Medical Center is the largest hospital in the area and is located approximately 8.0 km east-northeast (ENE) of the Burn Pan Unit. The coarse grid receptor ENE#15 is very close to the hospital and was used to estimate the impact at Holston Valley Hospital and Medical Center. This discrete receptor point is marked as "H" in Appendix E-2-2.

The Asbury Center Long-Term Health Care facility is located in Kingsport, Tennessee, approximately 3.8 km north-northeast (NNE) of the Burn Pan Unit. This receptor point is marked as "LT1" in Appendix E-2-2.

The closest child day-care center to the Burn Pan Unit is located approximately 3.0 km north, directly across the street from the main entrance to the HSAAP. This facility is known as the Allendale Child Care Center and is located within 200 meters of the N#8 coarse grid receptor point. As a result, the modeling results for the N#8 coarse grid receptor will be used to estimate the impact at the Allendale Child Care Center. This discrete receptor point is marked as "B/DC1" in Appendix E-2-2.

OBODM calculated 1-hour and annual average concentrations for each discrete receptor using all 5 years of meteorological data. The highest calculated 1-hour and annual average concentration for all 5 years was then selected to represent the maximum 1-hour and annual average impact at each receptor.

E-2-4(c)(4) Burn Pan Unit Source Parameters

The simulation of treatment operations in the OBODM is based on actual Burn Pan Unit operating procedures, equipment dimensions, treatment limits, and observed burn time periods. Modeling calculations were made for 1-hour and annual average periods. One-hour concentrations were extrapolated to longer averaging periods for comparison to ambient air quality standards. Source parameters and treatment times were controlled within the OBODM to be consistent with the operating procedures used at the Burn Pan Unit.

OBODM requires specific information regarding the energetic material and other source parameters. The required information includes the following parameters:

- Source Type
- Total Mass of Energetic Material Treated
- Energetic Material Heat Content
- Energetic Material Burn Rate
- Burn Time
- Source Coordinates, Dimensions, and Release Height

Each of these source input parameters is discussed below.

Source Type

Each of the four burn pans at the Burn Pan Unit were modeled as a quasi-instantaneous (open burn), volume source.

Total Mass of Energetic Material Treated

Each treatment event simulated in the OBODM was based on a total treatment quantity of 5,000 pounds NEW using four burn pans. Operating procedures at the Burn Pan Unit limit treatment to no more than three pans at one time and a limit of 1,500 pounds NEW per pan. Therefore, the daily treatment limit of 5,000 pounds can only be accomplished in two separate treatment events. To streamline the modeling analysis and conservatively calculate a worst-case, 1-hour impact, it was assumed that the 5,000-pound daily limit was treated during 1 hour using four pans.

For the annual average modeling scenario, OBODM was set up to evaluate the treatment of 5,000 pounds NEW for the permissible daily operating period (noon to 4:00 p.m.) between Monday and Friday. It was assumed that the first treatment event began at noon and the last treatment commenced at 3:00 p.m. This approach was taken to evaluate all potential treatment hours in a year and to calculate the worst-case, 1-hour impact. The 4-hour per day, 5-day per week operating assumption equates to a total annual treatment quantity of 5,000,000 pounds NEW. This treatment quantity is four times greater than the maximum annual treatment quantity assumed in this assessment. To equate the annual impact to a 1,250,000 pound NEW

maximum annual treatment quantity, all OBODM annual modeling results were divided by 4. Details of this calculation procedure are described in Section E-2-4(c)(7).

Energetic Material Heat Content

OBODM uses the heat content of the energetic materials being treated to calculate the buoyancy associated with plume rise resulting from open burning emissions. Heat content is defined as the amount of heat (calories) release per unit mass (grams) of material treated, that is available for plume rise.

OBODM currently has a database of heat content values for a limited number of energetic materials classified as propellants and explosives. The heat content values assume open burning of propellants and open detonation of explosives. It is important to note that HSAAP conducts only open burning treatment of both explosives and explosive formulations. Thus, the heat content in the OBODM for explosives (RDX, HMX, etc.) is not applicable to the open burning of explosives at the HSAAP because they are based on open detonation. In addition, several of the energetic materials listed in Table E-2-1 are currently not in the OBODM database.

A significant portion of the energy released from an open detonation is lost to the shock wave generated by the detonation process, so less heat is available for buoyant plume rise. In the case of an open burn, most of the energy released from the combustion process is available for plume rise. Therefore, an explosive material has different heat contents depending on whether it is detonated or burned. As a result, it was necessary to develop open burning heat content values for all explosive materials treated at the Burn Pan Unit.

Heat contents for the open burning of the representative energetic materials listed in Table E-2-1 were calculated by the POLU13L Combustion Products Model. The POLU13L model was developed by the Naval Ordnance Station, Indian Head, Maryland, (1994) for the purpose of predicting thermodynamic conditions and combustion products resulting from open burning and open detonation treatment. One of the output products of the POLU13L model is a heat release value for each material-to-air ratio. Heat release is the same as heat content. Therefore, the POLU13L heat release value can be used as a measure of heat content. A copy and description of the POLU13L model are provided in Appendix E-2-3.

Most of the waste materials treated at the Burn Pan Unit are delivered in a moist state. Moisture content in the delivered waste materials has been measured to range between 5 and 20 percent. During the treatment process, a portion of the heat energy released is used to evaporate any remaining water in the materials. As a result, less heat is available for buoyant plume rise. To account for this potential loss of energy, energetic material heat contents were calculated assuming a moisture content of 10 percent. The heat content values selected from the POLU13L model output were taken from the material-to-air mixture ratio that indicated complete combustion (i.e., zero percent carbon monoxide). The heat content for complete combustion was used because the Dugway test data demonstrated that the open burning process is highly efficient based on low carbon monoxide releases. Typical carbon monoxide releases for open burning are 0.001 to 0.0001 lbs/lb NEW (see Section C-4 for details). The results of the POLU13L model calculations for each material are shown in Table E-2-2. The complete listing of the POLU13L model results is provided in Appendix E-2-3.

TABLE E-2-2
SUMMARY OF HEAT CONTENT VALUES
CALCULATED USING THE POLU13L
COMBUSTION PRODUCTS MODEL
HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TN

Energetic Material	Calculated Heat Content (Calories/gram)
RDX	2,040
HMX	2,029
TNT	3,216
Composition B	2,510
TATB	2,550
Octol	2,326
TATB/RDX	2,352
TNAZ	2,004
PETN	1,757
CL20	1,782

Table E-2-2 shows the calculated heat contents ranged from 1,757 calories/gram for PETN to 3,216 calories/gram for TNT. The heat content values for PETN and TNT were selected for use in the low heat content and high heat content short-term modeling demonstrations, respectively, to represent the extreme of material heat contents treated on a daily basis.

The heat content value developed for use in the annual modeling demonstrations was based on an assumed annual mix of representative energetic materials. Based on a review of the energetic constituents commonly found in the products manufactured or stored at the HSAAP, representative annual breakdown of the energetic materials was developed. This annual mix of energetic materials and their assumed percent of annual treatment quantities are shown in Table E-2-3.

The calculated heat content for all materials in Table E-2-2, with the exception of PETN and TNT, were averaged to provide a heat content of 2,114 calories/gram. The average of these eight materials were assumed to represent the heat content of the annual mix material group identified as "Others" in Table E-2-3. This average, along with the individual heat contents for Composition B, RDX and TNT, were then used to calculate an annual average heat content by weighing the percentages of annual treatment quantities in Table E-2-3 with the individual heat contents of Composition B, RDX, TNT and the Others group. This calculation resulted in an annual average heat content of 2,167 calories/gram. Details of the calculation are shown in Appendix E-2-3.

Energetic Material Burn Rate

The material burn rate for each modeling scenario (low, annual average, and high heat content) was determined by dividing the total treatment quantity (pounds) in each pan by the representative treatment event period. Burning Ground Log records indicate that the typical

burn time for a pan filled to capacity (1,500 pounds NEW) is 20 minutes. A pan filled to 500 pounds NEW capacity is then expected to burn in one-third the time, or 6.67 minutes. For example, if 1,500 pounds of energetic material burns in 20 minutes, this equates to a burn rate of 75 pounds per minute or 1.25 pounds per second. This material burn rate was used in all OBODM model calculations.

Burn Time

Open burning treatment is allowed to be conducted at the Burn Pan Unit between the hours of noon and 4:00 p.m., Monday through Friday. The Burn Pan Unit is capable of operating 50 weeks out of the year with the final 2-week period in December being designated as an inactive period because of holidays.

To evaluate all potential treatment hours in a year, the OBODM was set up to calculate the impact from the Burn Pan Unit between the hours of noon and 4:00 p.m., Monday through Friday, for weeks 1-50. No calculations were made for the remaining 2 weeks in each annual period.

Source Coordinates, Dimensions, and Release Height

The dimensions and release height of the burn pans were obtained from HSAAP engineering drawings. Each of the four burn pans have the same dimensions: 20 feet long, by 4 feet

TABLE E-2-3
ANNUAL MIX OF EXPLOSIVE MATERIALS
TREATED AT THE BURN PAN UNIT
HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TN

Annual Mix of Energetic Materials	Percent of Annual Treatment
Composition B	12.5
RDX	32.5
TNT	2.5
Others	52.5

10 inches wide, by 1 foot 6 inches high. Each burn pan is elevated approximately 4 inches above the ground surface on steel beams welded to the pan. The pan is placed on top of concrete parking rails to facilitate daily inspections. Each pan contains a clay layer of approximately 6 inches. Energetic material is spread evenly across the burn pan to a maximum depth of 3 inches.

The locations of the four burn pans have been discussed previously in Section B-1c(1). Each burn pan was assigned a polar coordinate (direction, distance) relative to the origin which is located at the center of the Burn Pan Unit.

E-2-4(c)(5) Emission Factors

The emission factors used in this permit application for Burn Pan Unit combustion-by-products are based on the Dugway bang box open burn/open detonation emission tests. The Dugway testing program is discussed in Section C-4. The database of emission factors used in this assessment reflects a recently updated and expanded listing of combustion by-products that is more comprehensive than the emission factor database currently contained in the OBODM.

Separate emission factors were developed for each of the three heat-content treatment scenarios: low, annual average, and high. The emission factors chosen for each heat content scenario were selected from the list of tested energetic materials that most closely matched the chemical composition of materials listed in Table E-2-2.

Based on Table E-2-2, the low and high heat content modeling scenarios are associated with the treatment of PETN and TNT, respectively. The emission factors for the low heat content (PETN) modeling scenario were calculated from the average of the contaminant emission factors for Composition B, RDX, and TNT bang box test results. Emission factors for the high heat content scenario (TNT) were taken directly from the bang box TNT results.

In the case of the annual modeling scenario, annual average emission factors were developed by weighing the emission factors associated with the annual mix of explosive materials given in Table E-2-3. The Bang Box emission factors associated with each explosive material group in Table E-2-3 were weighed by their percent of annual treatment quantity and summed to create an annual average emission factor. The complete list of emission factors that were applied in the low, annual average and high heat content modeling scenarios is provided in Appendix E-2-4, along with a sample calculation showing the derivation of the annual average scenario emission factors.

E-2-4(c)(6) Potential Impact to Human Health and the Environment

The maximum short-term and long-term concentrations calculated for all receptors described in Section E-2-4(c)(3) were compared to applicable ambient air quality standards and risk-based screening criteria to evaluate the potential impact to human health and the environment. Each of the evaluation criteria is discussed in further detail below.

Air Quality Standards

The ambient air quality standards evaluated in this assessment include state and federal standards that regulate the potential combustion by-products associated with the Burn Pan Unit. The Burn Pan Unit combustion by-products that have applicable state and federal air quality standards have been identified to be carbon monoxide, nitrogen dioxide, and hydrogen fluoride.

The State of Tennessee has adopted the National Ambient Air Quality Standards (NAAQS) for carbon monoxide and nitrogen dioxide. In addition, the state has also promulgated air quality standards for hydrogen fluoride (HF) and a guidance level for hydrogen chloride (HCl). The applicable state and federal air quality standards and the HCl guidance level evaluated in this assessment are shown in Table E-2-4.

TABLE E-2-4
APPLICABLE STATE AND FEDERAL AIR QUALITY STANDARDS
HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TN

National Ambient Air Quality Standards (NAAQS)

Contaminant	Primary Standard Concentration	Averaging Period	Secondary Standard Concentration	Averaging Period
Carbon Monoxide	10,000 $\mu g/m^3$	8-hour	10,000 $\mu g/m^3$	8-hour
	40,000 $\mu g/m^3$	1-hour	40,000 $\mu g/m^3$	1-hour
Nitrogen Dioxide	100 $\mu g/m^3$	Annual Average	100 $\mu g/m^3$	Annual Average

State Of Tennessee Ambient Air Quality Standards

Contaminant	Secondary Standard Concentration	Averaging Period
Hydrogen Fluoride	1.2 $\mu g/m^3$	30 days
	1.6 $\mu g/m^3$	7 days
	2.9 $\mu g/m^3$	24 hours
	3.7 $\mu g/m^3$	12 hours
Hydrogen Chloride*	70 $\mu g/m^3$	24 hours

* - Established as a guidance level and not as an air quality standard $\mu g/m^3$ - Micrograms per cubic meter

Risk-Based Criteria

The risk-based screening criteria used in this assessment were developed by U.S. EPA Region III for use in identifying and focusing on dominant contaminants of concern and exposure routes in baseline risk assessments. A copy of the U.S. EPA Region III screening criteria and risk-based concentrations are provided in Appendix E-2-5.

The risk-based screening criteria provided in Appendix E-2-5 include screening levels for the protection of groundwater and air pathways for nearly 600 chemical compounds. The criteria are based on the calculation of separate carcinogenic and noncarcinogenic risk-based concentrations for each compound and each pathway. The risk-based chemical concentrations correspond to fixed levels of risk (i.e., a hazard quotient of one, or lifetime cancer risk of 1.0×10^{-6}, whichever occurs at a lower concentration) in water, air, fish tissue, and soil.

This assessment utilized the risk-based concentrations for ambient air (inhalation) in micrograms per cubic meter ($\mu g/m^3$). These concentrations were compared to maximum concentrations calculated by the OBODM to estimate the annual total risk and hazard index at all receptors. The cumulative risk was evaluated against a target cancer risk of 1.0×10^{-6} for carcinogenic compounds and a target hazard index of unity (1) for noncarcinogenic compounds.

E-2-4(c)(7) Concentration Calculation Methodology

The OBODM is designed to evaluate one contaminant in each model run. To streamline the modeling analysis for the large number of emission products being considered in this assessment, unit emission rate concentrations were scaled to other contaminant concentrations using a ratio of emission factors.

All OBODM modeling was conducted using carbon monoxide (CO) as the unit emission rate contaminant. Concentrations for other emission products were calculated by multiplying the CO concentration for a given averaging period at a receptor by the ratio of the emission factor for a specific emission product to that of CO. The procedure is valid because concentrations of gaseous emission products calculated by the OBODM are directly proportional to the emission rate and all emission rate products were assumed to disperse and transport a gas. An example calculation showing the procedure is provided in Appendix E-2-6.

The OBODM was used to calculate short-term (1-hour) and long-term (annual) concentrations for all combustion-by-products. One-hour concentrations were then scaled to other applicable air quality standard short-term averaging periods (8-hour, 12-hour, and 24-hour), assuming no additional contribution from the Burn Pan Unit. For the case of the 7-day and 30-day hydrogen fluoride standard averaging periods, the maximum 1-hour hydrogen fluoride concentration at each receptor was assumed to occur consecutively for 1-hour each day for 7 days and 30 days.

For example, if a combustion by-product has an 8-hour air quality standard, the 8-hour concentration was calculated assuming no additional treatment takes place during the 7 hours preceding or following the treatment event. The equation for the 8-hour concentration is as follows:

Maximum 8-Hour Concentration = OBODM Maximum 1-hour Concentration/8

As discussed in Section E-2-4(c)(4), the annual average concentration calculated by OBODM is based the unit operating 4 hours every day, 50 weeks per year to evaluate the worst-case, 1-hour impact for all permissible treatment hours in a year. At a rate of 5,000 pounds NEW per hour, this is equivalent to treating 5,000,000 pounds NEW per year. This treatment quantity is exactly four times greater than the maximum annual treatment limit being evaluated in this permit application. As a result, the annual average concentration calculated by OBODM was divided by a factor of 4 to simulate a maximum annual treatment quantity of 1,250,000 pounds NEW. The equation for calculating the adjusted annual average for 1 hour of treatment per day is as follows:

Adjusted Annual Average = (OBODM Maximum Annual Average)/4

Once all applicable averaging period concentrations were calculated, the concentrations were then compared to Tennessee and federal air quality standards and the risk-based screening criteria for carcinogenic and noncarcinogenic compounds. The results of this comparison are discussed below in Section E-2-4(d).

E-2-4(d) Potential Impact to Human Health and the Environment

This section presents a summary of the air dispersion modeling results and discusses the potential impact to human health and the environmental by comparing ambient impacts to ambient air quality standards and risk-based criteria for all receptors. The calculated ambient concentrations for each heat content modeling scenario and all receptors are listed in Appendix E-2-6. Individual spreadsheets showing the calculation of total risk and total hazard at all receptors are given in Appendix E-2-7. Electronic copies of the spread sheets are provided in Appendix E-2-1.

The OBODM calculated the maximum, offsite, short-term and long-term impacts to occur just beyond the HSAAP southeast facility boundary along the Holston River Mountain range. The maximum 1-hour receptor is located along the 146.9° radial at a distance of 1,416 meters from the Burn Pan Unit. The maximum annual average receptor is located along the 129.6° radial at a distance of 1506 meters from the Burn Pan Unit. Both receptor points are located in the area identified as Bays Mountain Park.

E-2-4(d)(1) Ambient Air Quality Standards

Table E-2-5 compares the calculated impacts of carbon monoxide, nitrogen oxide, and hydrogen chloride for the maximum offsite and discrete receptors to all applicable Tennessee and federal ambient standards.

A review of the calculated concentrations in Table E-2-5 indicates that the impacts resulting from the operation of the Burn Pan Unit do not exceed any state or federal air quality standards or guidance levels with the exception of the state 12-hour and 24-hour HF standards at the maximum offsite and closest residence receptors.

TABLE E-2-5

COMPARISON OF GROUND LEVEL CONCENTRATIONS TO NAAQS[1] AND TDEC[2] AMBIENT AIR QUALITY STANDARDS AND GUIDANCE LEVELS

Pollutant	CO	CO	NO	HCl[4]	HF	HF	HF	HF
Averaging Period	1-hour	8-hour	Annual	24-hour	12-hour	24-hour	7-day	30-day
Standard/Guidance Level	40,000	10,000	100	70	3.7	2.9	1.6	1.2
Concentration Units	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
Receptor (Identifier)	**OBODM Calculated Concentrations**							
Maximum Offsite[3]	43.00	5.38	0.017	1.69	8.83	4.42	0.63	0.15
Sullivan Middle School (S1)	5.11	0.64	0.001	0.20	1.05	0.53	0.08	0.02
Sevier Middle School (S2)	5.29	0.66	0.002	0.21	1.08	0.54	0.08	0.02
Robinson Middle School (S3)	4.71	0.59	0.001	0.18	0.97	0.48	0.07	0.02
Roosevelt Elementary School (S4)	6.03	0.75	0.002	0.24	1.23	0.62	0.09	0.02
Lynn View Middle School (S5)	3.56	0.45	0.001	0.14	0.73	0.37	0.05	0.01
Washington Elementary School (S6)	10.90	1.36	0.003	0.43	2.23	1.12	0.16	0.04
Mt. Carmel School (S7)	16.90	2.11	0.002	0.66	3.47	1.73	0.25	0.06
Church Hill Elementary School (S8)	7.35	0.92	0.001	0.29	1.51	0.75	0.11	0.03
Holston Valley Hospital and Medical Center (H)	5.90	0.74	0.002	0.23	1.21	0.60	0.09	0.02
Asbury Long-Term Health Care Center (LT1)	9.10	1.14	0.003	0.36	1.87	0.93	0.13	0.03
Allendale Child Care Center (DC1)	13.90	1.74	0.003	0.55	2.85	1.43	0.20	0.05
Closest Residence (CR)	21.10	2.63	0.009	0.83	4.32	2.16	0.31	0.07

1-National Ambient Air Quality Standards

2-Tennessee Department of Environment & Conservation

3-Maximum offsite short-term concentrations occurred along 146.9 degree radial @ 1416.1 meters. Maximum offsite long-term concentrations occurred along 129.6 degree radial @ 1506 meters.

4-The value of 70 $\mu g/m^3$ is a guidance level used to assess the air quality impact and is not considered to be a State of Tennessee or Federal ambient air quality standard .

The 12-hour (8.83 $\mu g/m^3$) and 24-hour (4.42 $\mu g/m^3$) HF concentrations at the short-term maximum offsite receptor (146.9°, 1416.1 meters) were calculated to be 239 percent and 152 percent of the 12-hour and 24-hour standards, respectively. For the closest residence receptor, the maximum 12-hour (4.32 $\mu g/m^3$) HF concentration was estimated to be 117 percent of the state 12-hour standard. Appendix E-2-6 contains additional information concerning contaminant concentration calculations.

The exceedances of the 12-hour and 24-hour HF standards are based on a maximum daily treatment quantity of 5,000 pounds NEW for the energetic material containing the highest percentage of fluorine. The constituents containing the highest percentage of fluorine have been identified as "Kel-F" and "Viton A." In order to demonstrate compliance with the most stringent HF standard (12-hour standard), HSAAP will treat no more than 2,000 pounds NEW of fluorine material in a 24-hour period.

E-2-4(d)(2) Total Annual Risk

The calculation spreadsheets for determining the total annual risk from carcinogenic compounds at all receptors are provided in Appendix E-2-7. The total risk for each receptor has been summarized in Table E-2-6. This table indicates that the total annual risks for the maximum offsite and discrete receptors were all well below the target risk of 1.0×10^{-6}. The highest reported annual risk of all receptors was 1.24×10^{-9} for the maximum offsite receptor.

E-2-4(d)(3) Total Annual Hazard Index

The calculation spreadsheets for estimating the total hazard index associated with non-carcinogenic compounds at all receptors are provided in Appendix E-2-7. The total annual hazard indices for all receptors are summarized in Table E-2-7. Table E-2-6 indicates that the total annual hazard index for all receptor locations is substantially below the target hazard index of 1. The highest reported annual hazard index for the maximum offsite receptor was 0.000398.

TABLE E-2-6

TOTAL ANNUAL RISK FOR THE HSAAP BURN PAN UNIT HOLSTON ARMY AMMUNITION PLANT KINGSPORT, TENNESSEE

Receptor - Identifier	Total Annual Risk
Maximum Offsite*	1.24×10^{-9}
Sullivan Middle School - S1	8.35×10^{-11}
Sevier Middle School - S2	1.13×10^{-10}
Robinson Middle School - Se	8.15×10^{-11}
Roosevelt Elementary School - S4	1.45×10^{-10}
Lynn View Middle School - S5	8.15×10^{-11}
Washington Elementary - S6	1.89×10^{-10}
Mt. Carmel School - B/S7	1.49×10^{-10}
Church Hill Elementary - S8	6.96×10^{-11}
Holston Valley Hospital and Medical Center- H	1.43×10^{-10}
Asbury Center Long Term Care - LT1	2.23×10^{-10}
Allendale Child Care - B/DC1	2.21×10^{-10}
Closest Public Residence - CR	7.01×10^{-10}

* The maximum annual offsite receptor is located along the 129.6° radial at a distance of 1,506 meters from the Burn Pan Unit.

TABLE E-2-7

TOTAL ANNUAL HAZARD INDEX FOR THE HSAAP BURN PAN UNIT HOLSTON ARMY AMMUNITION PLANT KINGSTON, TENNESSEE

Receptor - Identifier	Total Hazard Index
Maximum Offsite*	0.000398
Sullivan Middle School - S1	0.0000268
Sevier Middle School - S2	0.0000363
Robinson Middle School - S3	0.0000261
Roosevelt Elementary School - S4	0.0000465
Lynn View Middle School - S5	0.0000261
Washington Elementary - S6	0.0000605
Mt. Carmel School - B/S7	0.0000478
Church Hill Elementary - S8	0.0000223
Holston Valley Hospital and Medical Center - H	0.0000459
Asbury Center Long Term Care - LT1	0.0000713
Allendale Child Care - B/DC1	0.0000707
Closest Public Residence - CR	0.000225

* The maximum annual offsite receptor is located along the 129.6° radial at a distance of 1,506 meters from the Burn Pan Unit.

HOLSTON ARMY AMMUNITION PLANT

OPEN BURN UNIT

AIR DISPERSION MODELING

PROTOCOL

PREPARED BY

BROWN AND ROOT ENVIRONMENTAL

FEBRUARY 1997

Air Dispersion Modeling

This report presents the results of air dispersion modeling performed for the Holston facility in Kingsport, Tennessee. Holston has applied for a Part B Subpart X Permit to treat hazardous waste through open burning (OB) operations. To obtain this permit, Holston must maintain environmental performance standards to protect human health and the environment. To demonstrate this Holston has performed this Air Dispersion Modeling Analysis, the results of which were used as the basis for the Human Health and Ecological Risk Assessment.

A protocol for the air dispersion modeling analysis, included as Appendix A, was submitted to TDEC on February, 1977. The dispersion analysis was conducted in accordance with these guidelines. In addition to the results of the analysis, this report clarifies the procedures used in the analysis.

HOLSTON ARMY AMMUNITION PLANT (HSAAP)
AIR DISPERSION MODELING PROTOCOL
OPEN BURNING TREATMENT UNIT

1.0 AIR QUALITY DISPERSION MODEL

The Open Burn/Open Detonation Dispersion Model (OBODM) will be used to evaluate the potential air quality impact associated with the open burning of waste materials at the Holston Army Ammunition Plant (HSAAP). The OBODM was specifically designed to address impacts from open burning (OB) and open detonation (OD) treatment units. The OBODM uses cloud/plume rise, dispersion, and deposition algorithms taken from existing models for instantaneous and quasi-instantaneous sources to predict the downwind transport and dispersion of pollutants for simple and complex terrain receptors. The model can be used to calculate peak concentration, time-mean concentration, dosage (time-integrated concentration) and particulate gravitational settling. Emissions can be from multiple sources for either a single event or up to a year of sequential hourly source and meteorological inputs.

2.0 METEOROLOGICAL AND CLIMATOLOGICAL DATA

The HSAAP performs very limited monitoring of on-site meteorological conditions. The information collected is not sufficient for defining on-site climatology or for use in dispersion modeling. As a result, all required meteorological and climatological data will be obtained from other sources such as the USEPA Technical Transfer Network (TTN) and the National Climatic Data Center (NCDC). The type of meteorological and climatological data that will be obtained from each source is discussed below.

2.1 Air Quality Modeling Meteorological Data

The OBODM will be used with 5 individual years of hourly surface observations from the Tri-County Airport located in Bristol, Tennessee. The most recent 5-year period of hourly observations available from the TTN are 1987 through 1991. This station is approximately 14 miles due east of the HSAAP. Upper air sounding data for the same 5 year period will be obtained from the National Weather Service (NWS) Huntington, West Virginia station. This is the closest upper air reporting station to the Tri-Cities Airport. Both data sets will be processed by the PCRAMMET program to create an input file compatible with the OBODM. PCRAMMET is a USEPA approved meteorological preprocessor program.

2.2 Climatological Data

The HSAAP does not collect sufficient meteorological monitoring data to define on-site climatology. Climatological conditions for the HSAAP will be represented by climatological data for the Tri-County Airport in Bristol, Tennessee. Information necessary to describe local climatological conditions will be obtained from the NCDC. Additional climatic data references, such as the Climatic Atlas of the United States, will be used on an as needed basis.

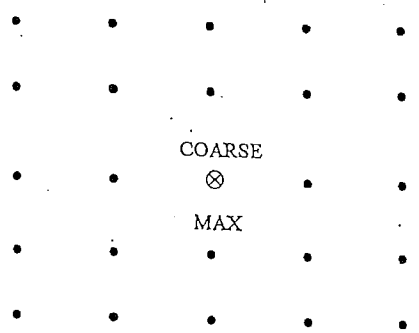
3.0 RECEPTOR NETWORKS

Dispersion modeling will be conducted using 2 receptor networks. The first network will consist of coarse and fine mesh grids to locate the point of maximum contaminant concentrations for all averaging periods of interest within a 10 km radius of the HSAAP. The second network will consist of discrete locations representing the facility boundary, schools, hospitals, long term health care and child day care centers within a 10 km radius of the HSAAP. Each network is described below. The location of each receptor is shown on the Dispersion Modeling Receptor Map in Attachment I.

3.1 Coarse and Fine Mesh Grids

The coarse grid will consist of a polar receptor network. Receptors will be positioned at specific distances along 16 radials that extend out from the OB treatment unit. Receptors will be placed at the following distances (kilometers) along each radial: 0.25, 0.50, 0.75, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0. The radials will be placed at 22.5° increments from due north (0.0°, 22.5°, 45°, 67.5°, etc.). The coarse grid receptor points are shown in Attachment I as a solid circle "•".

Once the maximum impact receptors have been identified for each annual period of meteorological data, the OBODM will be run again at the points of maximum impact using a fine mesh grid. The fine mesh grid will be centered over the location of the coarse grid maximum to determine if a higher impact point exists in the general area of the maximum. Fine mesh receptors will be positioned at 100 meter increments away from the coarse grid maximum to created a Cartesian grid covering of 1600 square meters. An illustration of the fine mesh grid procedure is shown below:



3.2 Discrete Receptors

A description of all discrete receptors that will be evaluated in the air modeling assessment is provided below.

3.2.1 Facility Boundary

A total of 16 receptor locations is being proposed to evaluate the impact at the HSAAP facility boundary. In an effort to reduce the number of receptors used in this analysis, the following coarse grid receptors will also serve as facility boundary receptors along each of the directional radials: N#8, NNE#7, NE#7, ENE#7, E#7, ESE#6, SE#5, SSE#5, S#6, SSW#7, SW#10, WSW#9, W#10, WNW#9, NW#8, and NNW#8. The number associated with each directional radial is the distance in km from ascending order, i. e., #1(0.25), #2(0.50), #3(0.75), etc. These receptor points are located on the Dispersion Model Receptor Map in Attachment I and are designated as "B".

3.2.2 Closest Public Residence

The closest public residence to the HSAAP open burn unit has been estimated to be located almost due east (080°) at a distance of approximately 2,650 meters. This residence is located along the banks of the Holston River near the border of Hawkins and Sullivan Counties. This receptor point is shown in Attachment I and is designated as "CR".

3.2.3 Schools

A select group of elementary, middle and high schools located within 10 km of the HSAAP will be evaluated in the modeling analysis. These schools are shown in Attachment I on the receptor map and are distinguished by their respective identifiers given below:

S1	Sullivan Middle School - Sullivan Gardens, Tennessee
S2	Sevier Middle School - Kingsport, Tennessee
S3	Robinson Middle School - Kingsport, Tennessee
S4	Roosevelt Elementary - Kingsport, Tennessee
S5	Lynn View Middle School - Kingsport, Tennessee
S6	Washington Elementary - Kingsport, Tennessee
B/S7	Mt. Carmel School - Mt. Carmel, Tennessee
S8	Church Hill Elementary School - Churchill, Tennessee

3.3.4 Hospital

The Holston Valley Community Hospital will be designated as a discrete receptor point. This facility is located approximately 8.0 km ENE of the HSAAP. As a result, the coarse grid receptor ENE#15 will be used to estimate the impact at Holston Valley Community Hospital. This receptor is shown in Attachment I on the receptor map and is designated as "H".

3.3.5 Long Term Health Care Center

The Asbury Center long term health care facility located in Kingsport, Tennessee will be used as a discrete receptor. This facility is located approximately 3.8 km northeast of the HSAAP and is designated as receptor "LT1" in Attachment I.

3.3.6 Child Day Care Center

The closest child day care center to the HSAAP is located approximately 3.0 km north directly across the street from the main entrance to the HSAAP. This facility is known as the Allendale Child Care Center. The Center is located within 200 meters of the N#8 coarse grid receptor point. As a result, the modeling results for the N#8 coarse grid receptor will be used to estimate the impact at the Allendale Child Care Center. The Center is designated as receptor "B/DC1" in Attachment I.

4.0 OPEN BURN TREATMENT SIMULATION

The dispersion modeling assessment will use all available information regarding HSAAP OB treatment operations and procedures, source test data and thermodynamic models to conduct a representative analysis of HSAAP OB treatment activities. The information that will be used to simulate OB treatment are discussed below.

4.1 OB Treatment Operating Procedures

The HSAAP has developed operating procedures for the safe conduct of OB treatment. The procedures include permissible operating periods, meteorological conditions and treatment quantities. OB treatment at the HSAAP is allowed to be conducted between the hours of Noon and 4:00 P. M when meteorological conditions are as follows:

- No precipitation
- Wind speed less than 30 mph
- No observable threat of electrical storms
- No restricted visibility (dense fog, blowing snow or dust)
- No low, overcast sky
- No air pollution episodes

The only meteorological condition listed above that will be screened relative to the modeling results will be the 30 mph wind speed limit. All OBODM model calculations that are a result of wind speeds equal or greater than 30 mph will not be used in the assessment.

In addition, OB treatment is limited to no more than 5,000 pounds of material per day. Operating procedures at the OB unit also limit treatment to no more than 3 pans at one time and a limit of 1,500 pounds of material per pan. Therefore, at

maximum operating conditions, 5000 pounds of material would have to be treated during 2 separate OB events. For example, the first OB event would have 3 pans loaded at 1,500 pounds each for a total of 4,500. The remaining 500 pounds would be treated in 1 pan during a second OB event.

For the purpose of the HSAAP modeling assessment, it will be assumed that the 5,000 pound. daily limit will be treated during 1 hour each day using 4 pans. For example, the daily treatment event will be simulated using 3 pans loaded at 1,500 pounds each and 1 pan loaded at 500 pounds for a total of 5,000 pounds. The OBODM will evaluate the treatment of all 5,000 pounds for each hour in which treatment is allowed to be conducted (Noon to 4:00 P.M.). It will be assumed that the last treatment each day will commence no later than 3:00 P.M. This will be done for all 5 years of meteorological data assuming treatment is only conducted Monday through Friday. The OBODM allows the user to select the hours and days in which model will calculate concentrations.

The burn time for all pans will be set at 20 minutes, which is consistent with burn times typically observed by HSAAP OB unit personnel.

4.2 Source Parameters

The OBODM requires information regarding the release parameters of all sources. This information consists of source dimensions, heat content values of the energetic materials, and combustion products (species). All information regarding OB unit source release parameters will be obtained from facility drawings, HSAAP personnel, the POLU13L Combustion Products Model and a database of emissions factors derived from OB emissions tests conducted at Dugway Proving Grounds. The source parameters of interest for this assessment are discussed below.

4.2.1 Pan Dimensions

The size, height above ground level and configuration of the treatment pans will be obtained from HSAAP drawings, standard operating procedures and information obtained from HSAAP OB unit personnel. The OB unit will consist of 4 burn pans having the same dimensions.

4.2.2 Energetic Material Heat Content

The OBODM uses Briggs (1971) plume rise equations to predict the buoyant rise of the plume from an open burn. One of the most influential parameters in the equation is heat content of the energetic material being treatment. Heat content is defined as the amount of heat available for plume rise. The OBODM requires the heat content in calories/gram for all materials being treated by OB.

The maximum heat content of a material is equivalent to the heat of combustion. When energetic materials are burned the heat content is equivalent to the heat of combustion. However, when energetics are detonated some heat is lost to in the formation of the shock wave and the initial fireball. It is the heat content of the fireball that is available for plume rise. Therefore, not all of the heat is available as defined by the heat of combustion.

The OBODM currently has a database of heat content values for a limited number of energetic materials classified as propellants and explosives. The heat content values assume OB of propellants and OD of explosives. It is important to note that the HSAAP only conducts OB treatment of both propellants and explosives. Thus the heat content in the OBODM for explosives (RDX, HMX, etc.) are not applicable to the OB of explosives at the HSAAP. In addition, several of the energetic materials treated at the HSAAP are currently not in the OBODM database. As a result, it is necessary to determine the heat content values for the OB of all explosive materials treated at HSAAP.

The heat content values for propellants and explosives currently in the OBODM have been reviewed and compared to heat release values calculated by the POLU13L Combustion Products Model. The POLU13L model was developed by the Naval Ordnance Station, Indian Head, Maryland for the purpose of predicting thermodynamic conditions and combustion products resulting from OB and OD treatment. A copy and description of the model are provided in Attachment II of this protocol. One of the output variables for the POLU13L model is heat released in calories/gram based on material-to-air mixture ratios. A study was conducted comparing the heat content values in the OBODM database with the heat release values

calculated by the POLU13L model for explosives and propellants when burned at the HSAAP. Results of the comparison study indicated very good agreement for propellants but major differences for explosives when the combustion process results in only carbon dioxide, water, and nitrogen. Based on these results, it is assumed that the heat release value calculated by the POLU13L model at this condition is equivalent to heat content as required in the OBODM for OB.

The air modeling assessment will define a list of energetic materials that are representative of those treated at the HSAAP. For each of these materials, the POLU13L model will be used to calculate the heat released for OB treatment. The heat released associated with the material-to-air ratio mixture indicating complete conversion to carbon dioxide, water and nitrogen will be assigned to each energetic material. It is anticipated that the list of HSAAP treated materials will include several energetic compounds.

All modeling conducted for the assessment of short term (≤ 24 hours) will evaluate the OB unit's impact using the low and high end range of calculated heat contents. Annual average modeling demonstrations will utilize a single heat content value which will represent a weighted average from a mix of explosives that are expected to be treated on an annual basis. This explosive mix is discussed detail below.

For the purpose of determining annual emissions, a mix of explosives will be assumed. The following list represents the types of explosives and their respective percentages of the facility's annual OB treatment.

ENERGETIC MATERIAL ANNUAL MIX	WEIGHTED AVERAGE
RDX (cyclotrimethyline-trinitramine)	25%
TNT (2,4,6-Trinitrotoluene)	25%
HMX (cyclotetramethyline-tetra-nitramine)	25%
NC (nitrocellulose)	5%
TATB (1,3,5-Triamino-2,4,6-trinitrobenzene)	5%
PETN (Pentaerythritol tetranitrate)	5%
Tetryl (2,4,6-Trinitrophenylmethylnitramine)	5%
DATB (1,3-Diamino-2,4,6-trinitrobenzene)	5%

4.2.3 Combustion Product Emission Factors

OB combustion process emission factors will be obtained from test data where available. If test data is not available, emission factors from the most similar explosive material, for which test data is available, will be used.

All combustion species resulting from the HSAAP OB unit will be assumed to be released in the gas phase. The combustion species assumed to be associated with the OB treatment at the HSAAP will be taken from the results of the Bang Box Testing Program which was conducted at the Dugway Proving Grounds. In this testing program, combustion species were identified and emission factors were developed for a select group of energetic materials. The emission factors define the quantities (mass) of pollutants released per unit mass of material burned or detonated for each type of propellant or explosive material. It should be noted that the combustion species identified for the HSAAP will not include inorganic metals because they are not an ingredient in any of the material treated at the OB unit.

The Bang Box Testing data will be used to develop short term and long term emission factors. The long term emission factors will be based on a weighted average of short term emission factors for the annual energetic material mix identified immediately above in Section 4.2.2.

In addition, emission factors (lb/lb) for the incomplete combustion of pan materials will be applied to the amount of energetic material NEW. For example, a destruction and removal efficiency (DRE) of 99.999 percent will be used to estimate unburned emissions of energetic materials. This DRE is based on an evaluation of test data from the Bang Box Testing Program. All halogens (chlorides and fluorides) are assumed to be emitted as an acid gas.

ATTACHMENT 1

USEPA REGION III

RISK- BASED SCREENING CONCENTERATIONS

EPA Region III Risk-Based Concentration Table

Background Information

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January 28, 1997

Development of Risk-Based Concentrations

General

Separate carcinogenic and non-carcinogenic risk-based concentrations were calculated for each compound for each pathway. The concentration in the table is the lower of the two, rounded to two significant figures. The following terms and values were used in the calculations:

Exposure variables	Value	Symbol
General:		
Carcinogenic potency slope oral (risk per mg/kg/d):	*	CPSo
Carcinogenic potency slope inhaled (risk per mg/kg/d):	*	CPSi
Reference dose oral (mg/kg/d):	*	RfDo
Reference dose inhaled (mg/kg/d):	*	RfDi
Target cancer risk:	1e-06	TR
Target hazard quotient:	1	THQ
Body weight, adult (kg):	70	BWa
Body weight, age 1-6 (kg):	15	BWc
Averaging time carcinogens (d):	25550	ATc
Averaging time non-carcinogens (d):	ED*365	ATn
Inhalation, adult (m3/d):	20	IRAa
Inhalation, child (m3/d):	12	IRAc
Inhalation factor, age-adjusted (m3-y/kg-d):	11.66	IFAadj
Tap water ingestion, adult (L/d):	2	IRWa
Tap water ingestion, age 1-6 (L/d):	1	IRWc
Tap water ingestion factor, age-adjusted (L-y/kg-d):	1.09	IFWadj
Fish ingestion (g/d):	54	IRF
Soil ingestion, adult (mg/d):	100	IRSa
Soil ingestion, age 1-6 (mg/d):	200	IRSc
Soil ingestion factor, age adjusted (mg-y/kg-d):	114.29	IFSadj
Residential:		
Exposure frequency (d/y):	350	EFr
Exposure duration, total (y):	30	EDtot
Exposure duration, age 1-6 (y):	6	EDc
Volatilization factor (L/m3):	0.5	K

Exposure variables	Value	Symbol
Occupational:		
Exposure frequency (d/y):	250	EFo
Exposure duration (y):	25	EDo
Fraction of contaminated soil ingested (unitless)	0.5	FC

*: Contaminant-specific toxicological constants. The priority among sources of toxicological constants was as follows: (1) IRIS, (2) HEAST, (3) HEAST alternative method, (4) EPA-NCEA Superfund Health Risk Technical Support Center, (5) withdrawn from IRIS or HEAST, and (6) other EPA documents. Each source was used only if numbers from higher-priority sources were unavailable. The EPA Superfund Health Risk Technical Support Center, part of the EPA National Center for Environmental Assessment in Cincinnati, develops provisional RfDs and CPSs on request for contaminants not in IRIS or HEAST. These provisional values are labeled "E = EPA-NCEA provisional" in the table. It is possible they may be obsolete. If one of the "E" constants is important to a Superfund risk assessment, consider requesting, through a Regional risk assessor, a new provisional value.

Age-adjusted factors

Because contact rates with tap water, ambient air, and residential soil are different for children and adults, carcinogenic risks during the first 30 years of life were calculated using age-adjusted factors. These factors approximated the integrated exposure from birth until age 30 by combining contact rates, body weights, and exposure durations for two age groups - small children and adults. The age-adjusted factor for soil was obtained from RAGS IB; the others were developed by analogy.

Air inhalation

$$IFAadj \quad \frac{m^3 \cdot y}{kg \cdot d} = \frac{EDc \cdot IRAc}{BWc} + \frac{(EDtot - EDc) \cdot IRAa}{BWa}$$

Tap water ingestion

$$IFWadj \quad \frac{L \cdot y}{kg \cdot d} = \frac{EDc \cdot IRWc}{BWc} + \frac{(EDtot - EDc) \cdot IRWa}{BWa}$$

Soil ingestion

$$IFSadj \quad \frac{mg \cdot y}{kg \cdot d} = \frac{EDc \cdot IRSc}{BWc} + \frac{(EDtot - EDc) \cdot IRSa}{BWa}$$

Residential water

Volatilization terms were calculated only for compounds with a mark in the "VOC" column. Compounds having a Henry's Law constant greater than 10^{-5} were considered volatile. The list may be incomplete, but is unlikely to include false positives. The equations and the volatilization factor (K, above) were obtained from RAGS IB. Oral potency slopes and reference doses were used for both oral and inhaled exposures for volatile compounds lacking inhalation values. Inhaled potency slopes were substituted for unavailable oral potency slopes only for volatile compounds; inhaled RfDs were substituted for unavailable

oral RfDs for both volatile and non-volatile compounds. RBCs for carcinogens were based on combined childhood and adult exposure; for non-carcinogens RBCs were based on adult exposure.

Carcinogens

$$RBC\ \frac{\mu g}{L} = \frac{TR \cdot ATc \cdot 1000\ \frac{\mu g}{mg}}{EFr \cdot ([K \cdot IFAadj \cdot CPSi] + [IFWadj \cdot CPSo])}$$

Non-carcinogens

$$RBC\ \frac{\mu g}{L} = \frac{THQ \cdot BWa \cdot ATn \cdot 1000\ \frac{\mu g}{mg}}{EFr \cdot EDtot \cdot \left(\frac{K \cdot IRAa}{RfDi} + \frac{IRWa}{RfDo}\right)}$$

Ambient air

Oral potency slopes and references were used where inhalation values were not available. RBCs for carcinogens were based on combined childhood and adult exposure; for non-carcinogens RBCs were based on adult exposure.

Carcinogens

$$RBC\ \frac{\mu g}{m^3} = \frac{TR \cdot ATc \cdot 1000\ \frac{\mu g}{mg}}{EFr \cdot IFAadj \cdot CPSi}$$

Non-carcinogens

$$RBC\ \frac{\mu g}{m^3} = \frac{THQ \cdot RfDi \cdot BWa \cdot ATn \cdot 1000\ \frac{\mu g}{mg}}{EFr \cdot EDtot \cdot IRAa}$$

Edible fish

All RBCs were based on adult exposure.

Carcinogens

$$RBC\ \frac{mg}{kg} = \frac{TR \cdot BWa \cdot ATc}{EFr \cdot EDtot \cdot \frac{IRF}{1000\ \frac{g}{kg}} \cdot CPSo}$$

Non-carcinogens

$$RBC\ \frac{mg}{kg} = \frac{THQ \cdot RfDo \cdot BWa \cdot ATn}{EFr \cdot EDtot \cdot \frac{IRF}{1000\ \frac{g}{kg}}}$$

Commercial/industrial soil ingestion

RBCs were based on adult occupational exposure, including an assumption that only 50% of total soil ingestion is work-related.

Carcinogens

$$RBC\ \frac{mg}{kg} = \frac{TR\ BWa\ ATc}{EFo \cdot EDo \cdot \frac{IRSa}{10^6\ \frac{mg}{kg}} \cdot FC \cdot CPSo}$$

Non-carcinogens

$$RBC\ \frac{mg}{kg} = \frac{THQ \cdot RfDo \cdot BWa \cdot ATn}{EFo \cdot EDo \cdot \frac{IRSa}{10^6\ \frac{mg}{kg}} \cdot FC}$$

Residential soil ingestion

RBCs for carcinogens were based on combined childhood and adult exposure; RBCs for non-carcinogens were based on childhood exposure only.

Carcinogens

$$RBC\ \frac{mg}{kg} = \frac{TR \cdot ATc}{EFr \cdot \frac{IFSadj}{10^6\ \frac{mg}{kg}} \cdot CPSo}$$

Non-carcinogens

$$RBC\ \frac{mg}{kg} = \frac{THQ \cdot RfDo \cdot BWc \cdot ATn}{EFr \cdot EDc \cdot \frac{IRSc}{10^6\ \frac{mg}{kg}}}$$

Development of Soil Screening Levels

General

In December 1994 the EPA Office of Solid Waste and Emergency Response proposed Soil Screening Guidance (Document 9355.4-1, PB95-963530, EPA540/R-94/101, available through NTIS at 703-487-4650). This draft document provides (1) a framework in which soil screening levels are to be used, (2) a detailed methodology for calculating soil screening levels, and (3) soil screening levels for 107 substances. (Note: EPA released an updated draft of this document in early 1996. We have decided to wait until the SSL guidance is final before changing the RBC table.)

Consistent with this new guidance, the risk-based concentration table now includes two columns of generic soil screening levels (SSLs). OSWER's 107 proposed soil screening

levels have been added verbatim. In addition, the proposed SSL methodology has been used to calculate soil screening levels for more substances, which are also included in the new table. The table clearly distinguishes the OSWER SSLs from the "unofficial" ones.

These SSLs provide reasonable maximum estimates of transfers of contaminants from soil to other media. One column contains soil concentrations protective of groundwater quality; the other contains soil concentrations protective of air quality. "Protective" is defined in the same terms as the risk-based concentrations for tap water and air -- that residential contact scenarios will yield a fixed upper bound risk of 10^{-6} or a fixed hazard quotient of 1 (whichever occurs at the lower concentration).

OSWER's SSLs should be used only within the framework proposed in the guidance document. The additional SSLs included in the RBC table are intended for the same uses (although they obviously carry less weight than the formally proposed numbers).

The SSLs are based on the following assumptions:

Input variables	Value	Symbol*
Surface soil moisture content (g/g)	0.1	W_s
Vadose zone soil moisture content (kg/kg)	0.2	W_v
Surface soil bulk density (g/cm^3)	1.5	ρ_{bs}
Vadose zone soil bulk density (kg/L)	1.5	ρ_{bv}
Surface soil particle density (g/cm^3)	2.65	ρ_{ss}
Vadose zone soil particle density (g/cm^3)	2.65	ρ_{sv}
Total surface soil porosity (L pore /L soil)	0.43	N_s
Total vadose zone soil porosity (L pore/L soil)	0.43	N_v
Air-filled surface soil porosity (L air/L soil)	0.28	θ_{as}
Water-filled surface soil porosity (L water/L soil)	0.15	θ_{ws}
Air-filled vadose zone soil porosity (L air/L soil)	0.13	θ_{av}
Water-filled vadose zone soil porosity (L water/L soil)	0.30	θ_{wv}
Organic carbon fraction of surface soil (g/g)	0.006	FOC_s
Organic carbon fraction of vadose zone soil (g/g)	0.002	FOC_v
Dispersion factor for 0.5 acres (g/m^{2}s per kg/m^3)	35.1	Q/C
Particulate emission factor (m^3/kg)	6.79e+08	PEF
Exposure interval (s)	9.50e+08	T
Dilution-attenuation factor (unitless)	10	DAF

*: Symbols were adjusted, variables were rearranged, and derived and chemical-specific variables were omitted for simplicity and clarity. Presentation of the input variables in a single table using the same terms as in the OSWER SSL document would have been confusing. The terms used here are generally similar to OSWER's, and can easily be compared with the SSL guidance document.

With two exceptions described in the following section, SSL calculations were based on the

same algorithms presented in the OSWER draft SSL guidance document. For details of the calculations (and for general background information on SSLs), I strongly recommend consulting that document. The "unofficial" SSLs were developed under the following conditions:

Soil Screening Levels for Inhalation

Inhaled reference doses and potency slopes were used if available. If inhalation values were not available, oral RfDs and potency slopes were substituted. SSLs were calculated only for substances for which aqueous solubility, Koc, Henry's Law constant, and diffusivity in air were available. SSLs were calculated only for substances for which a volatilization factor could be calculated. This was done because OSWER's large proposed particulate emission factor rendered it pointless to estimate SSLs for particulate emissions alone. The final calculated SSL shown in the RBC table is the smaller of the risk-based SSL and the soil saturation concentration. All calculated SSLs were rounded to 2 significant figures.

The OSWER risk algorithms for inhalation were revised in order to be consistent with the rest of the RBC table. Only calculated SSLs were affected by this; SSLs proposed by OSWER are presented verbatim. Calculated SSLs for inhalation of carcinogens were based on an integrated lifetime exposure rather than adult exposure. SSLs for inhalation of noncarcinogens were based on adult exposure for 350 days per year rather than 365 days per year. The following algorithms were used to calculate inhalation SSLs:

Carcinogens

$$SSL\ \frac{mg}{kg} = \frac{TR \cdot ATc}{EFr \cdot IFAadj \cdot \left(\frac{1}{VF} + \frac{1}{PEF}\right) \cdot CPSi}$$

Non-carcinogens

$$SSL\ \frac{mg}{kg} = \frac{THQ \cdot BWa \cdot ATn \cdot RfDi}{EFr \cdot EDtot \cdot IRAa \cdot \left(\frac{1}{VF} + \frac{1}{PEF}\right)}$$

Soil Screening Levels for Groundwater Use

All algorithms were as proposed by OSWER. MCLs were used as target groundwater concentrations if available. If MCLs were unavailable the risk-based concentration in the "tap water" column of the RBC table was used as the target groundwater concentration. All SSLs for groundwater are based on a dilution-attenuation factor (DAF) of 10. Since these SSLs scale linearly with DAF, the SSLs for DAF=1 would be ten times lower. They were omitted to conserve space. All groundwater SSLs were rounded to 2 significant figures and capped at unity.

1/29-7

Sources: I=IRIS H=HEAST A=HEAST alternate W=Withdrawn from IRIS or HEAST
E=EPA-NCEA Regional Support provisional value O=Other EPA documents.

Basis : C=carcinogenic effects N=noncarcinogenic effects
S=soil saturation concentration M=EPA MCL
E=EPA draft Soil Screening Level

Contaminant	CAS	RfDo mg/kg/d		RfDi mg/kg/d		CPSo kg·d/mg		CPSi kg·d/mg		V O C	Risk-Based Concentrations: Tap Water µg/L		Ambient Air µg/m3		Fish mg/kg		Soil Ingestion: Industrial mg/kg		Soil Screening Levels- Transfers from Soil to: Residential mg/kg	Air mg/kg	Groundwater mg/kg
Acephate	30560191	4.00E-03	I			8.70E-03	I				7.7	C	0.72	C	0.36	C	660	C	73 C	0	0
Acetaldehyde	75070			2.57E-03	I			7.70E-03	I		94	N	0.81	C	0		0		0	0	0
Acetochlor	34256821	2.00E-02	I								730	N	73	N	27	N	41000	N	1600 N	0	0
Acetone	67641	1.00E-01	I								3700	N	370	N	140	N	200000	N	7800 N	62000 E	8 E
Acetone cyanohydrin	75865	7.00E-02	H	4.00E-02	A						2600	N	150	N	95	N	140000	N	5500 N	0	0
Acetonitrile	75078	6.00E-03	I	1.43E-02	A						220	N	52	N	8.1	N	12000	N	470 N	0	0
Acetophenone	98862	1.00E-01	I	5.71E-06	W					x	0.042	N	0.021	N	140	N	200000	N	7800 N	0	0
Acifluorfen	62476599	1.30E-02	I								470	N	47	N	18	N	27000	N	1000 N	0	0
Acrolein	107028	2.00E-02	H	5.71E-06	I						730	N	0.021	N	27	N	41000	N	1600 N	0	0
Acrylamide	79061	2.00E-04	I			4.50E+00	I	4.55E+00	I		0.015	C	0.0014	C	0.0007	C	1.3	C	0.14 C	0	0
Acrylic acid	79107	5.00E-01	I	2.86E-04	I						18000	N	1	N	680	N	1000000	N	39000 N	0	0
Acrylonitrile	107131	1.00E-03	H	5.71E-04	I	5.40E-01	I	2.38E-01	I		0.12	C	0.026	C	0.0058	C	11	C	1.2 C	0	0
Alachlor	15972608	1.00E-02	I			8.00E-02	H				0.84	C	0.078	C	0.039	C	72	C	8 C	0	0
Alar	1596845	1.50E-01	I								5500	N	550	N	200	N	310000	N	12000 N	0	0
Aldicarb	116063	1.00E-03	I								37	N	3.7	N	1.4	N	2000	N	78 N	570 S	0.036 M
Aldicarb sulfone	1646884	1.00E-03	I								37	N	3.7	N	1.4	N	2000	N	78 N	0	0
Aldrin	309002	3.00E-05	I			1.70E+01	I	1.71E+01	I		0.004	C	0.00037	C	0.00019	C	0.34	C	0.038 C	0.5 E	0.005 E
Ally	74223646	2.50E-01	I								9100	N	910	N	340	N	510000	N	20000 N	0	0
Allyl alcohol	107186	5.00E-03	I								180	N	18	N	6.8	N	10000	N	390 N	0	0
Allyl chloride	107051	5.00E-02	W	2.86E-04	I						1800	N	1	N	68	N	100000	N	3900 N	0	0
Aluminum	7429905	1.00E+00	E								37000	N	3700	N	1400	N	1000000	N	78000 N	0	0
Aluminum phosphide	20859738	4.00E-04	I								15	N	1.5	N	0.54	N	820	N	31 N	0	0
Amdro	67485294	3.00E-04	I								11	N	1.1	N	0.41	N	610	N	23 N	0	0
Ametryn	834128	9.00E-03	I								330	N	33	N	12	N	18000	N	700 N	0	0
m-Aminophenol	591275	7.00E-02	H								2600	N	260	N	95	N	140000	N	5500 N	0	0
4-Aminopyridine	504245	2.00E-05	H								0.73	N	0.073	N	0.027	N	41	N	1.6 N	0	0
Amitraz	33089611	2.50E-03	I								91	N	9.1	N	3.4	N	5100	N	200 N	0	0
Ammonia	7664417			2.86E-02	I						1000	N	100	N	0		0		0	0	0
Ammonium sulfamate	7773060	2.00E-01	I								7300	N	730	N	270	N	410000	N	16000 N	0	0
Aniline	62533			2.86E-04	I	5.70E-03	I				10	N	1	N	0.55	C	1000	C	110 C	45 N	0.031 N
Antimony and compounds	7440360	4.00E-04	I								15	N	1.5	N	0.54	N	820	N	31 N	0	0
Antimony pentoxide	1314609	5.00E-04	H								18	N	1.8	N	0.68	N	1000	N	39 N	0	0
Antimony potassium tartrate	304610	9.00E-04	H								33	N	3.3	N	1.2	N	1800	N	70 N	0	0
Antimony tetroxide	1332316	4.00E-04	H								15	N	1.5	N	0.54	N	820	N	31 N	0	0
Antimony trioxide	1309644	4.00E-04	H								15	N	1.5	N	0.54	N	820	N	31 N	0	0
Apollo	74115245	1.30E-02	I								470	N	47	N	18	N	27000	N	1000 N	0	0
Aramite	140578	5.00E-02	H			2.50E-02	I	2.49E-02	I		2.7	C	0.25	C	0.13	C	230	C	26 C	0	0
Arsenic	7440382	3.00E-04	I								11	N	1.1	N	0.41	N	610	N	23 N	380 E	15 E
Arsenic (as carcinogen)	7440382					1.50E+00	I	1.51E+01	I		0.045	C	0.00041	C	0.0021	C	3.8	C	0.43 C	380 E	15 E
Arsine	7784421			1.43E-05	I						0.52	N	0.052	N	0		0		0	0	0
Assure	76578148	9.00E-03	I								330	N	33	N	12	N	18000	N	700 N	0	0
Asulam	3337711	5.00E-02	I								1800	N	180	N	68	N	100000	N	3900 N	0	0
Atrazine	1912249	3.50E-02	I			2.22E-01	H				0.3	C	0.028	C	0.014	C	26	C	2.9 C	0	0
Avermectin B1	65195553	4.00E-04	I								15	N	1.5	N	0.54	N	820	N	31 N	0	0
Azobenzene	103333					1.10E-01	I	1.08E-01	I		0.61	C	0.058	C	0.029	C	52	C	5.8 C	0	0
Barium and compounds	7440393	7.00E-02	I	1.43E-04	A						2600	N	0.52	N	95	N	140000	N	5500 N	350000 E	32 E
Baygon	114261	4.00E-03	I								150	N	15	N	5.4	N	8200	N	310 N	0	0
Bayleton	43121433	3.00E-02	I								1100	N	110	N	41	N	61000	N	2300 N	0	0
Baythroid	68359375	2.50E-02	I								910	N	91	N	34	N	51000	N	2000 N	0	0
Benefin	1861401	3.00E-01	I								11000	N	1100	N	410	N	610000	N	23000 N	0	0
Benomyl	17804352	5.00E-02	I								1800	N	180	N	68	N	100000	N	3900 N	0	0
Bentazon	25057890	2.50E-03	I								91	N	9.1	N	3.4	N	5100	N	200 N	0	0
Benzaldehyde	100527	1.00E-01	I							x	610	N	370	N	140	N	200000	N	7800 N	0	0
Benzene	71432			1.71E-03	E	2.90E-02	I	2.90E-02	I	x	0.36	C	0.22	C	0.11	C	200	C	22 C	0.5 E	0.02 E
Benzenethiol	108985	1.00E-05	H								0.37	N	0.037	N	0.014	N	20	N	0.78 N	0	0
Benzidine	92875	3.00E-03	I			2.30E+02	I	2.35E+02	I		0.00029	C	2.7E-05	C	1.4E-05	C	0.025	C	0.0028 C	1.3 C	0.0000011 C
Benzoic acid	65850	4.00E+00	I								150000	N	15000	N	5400	N	1000000	N	310000 N	320 S	280 E

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Benzotrichloride	98077					1.30E+01	I				0.0052	C	0.00048	C	0.00024	C	0.44	C	0.049	C	0.012	C	0.000073	C
Benzyl alcohol	100516	3.00E-01	H								11000	N	1100	N	410	N	610000	N	23000	N	0		0	
Benzyl chloride	100447					1.70E-01	I			x	0.062	C	0.037	C	0.019	C	34	C	3.8	C	0.5	C	0.00036	C
Beryllium and compounds	7440417	5.00E-03	I			4.30E+00	I	8.40E+00	I		0.016	C	0.00075	C	0.00073	C	1.3	C	0.15	C	690	E	180	E
Bidrin	141662	1.00E-04	I								3.7	N	0.37	N	0.14	N	200	N	7.8	N	0		0	
Biphenthrin (Talstar)	82657043	1.50E-02	I								550	N	55	N	20	N	31000	N	1200	N	0		0	
1,1-Biphenyl	92524	5.00E-02	I								1800	N	180	N	68	N	100000	N	3900	N	9000	S	110	N
Bis(2-chloroethyl)ether	111444					1.10E+00	I	1.16E+00	I	x	0.0092	C	0.0054	C	0.0029	C	5.2	C	0.58	C	0.3	E	0.0003	E
Bis(2-chloroisopropyl)ether	39638329	4.00E-02	I			7.00E-02	H	3.50E-02	H	x	0.26	C	0.18	C	0.045	C	82	C	9.1	C	0		0	
Bis(chloromethyl)ether	542881					2.20E+02	I	2.17E+02	I	x	0.000049	C	2.9E-05	C	1.4E-05	C	0.026	C	0.0029	C	0.000037	C	0.0000001	C
Bis(2-chloro-1-methylethyl)ether	0					7.00E-02	W	7.00E-02	W		0.96	C	0.089	C	0.045	C	82	C	9.1	C	0		0	
Bis(2-ethylhexyl)phthalate (DEHP)	117817	2.00E-02	I			1.40E-02	I				4.8	C	0.45	C	0.23	C	410	C	46	C	210	E	11	E
Bisphenol A	80057	5.00E-02	I								1800	N	180	N	68	N	100000	N	3900	N	0		0	
Boron (and borates)	7440428	9.00E-02	I	5.71E-03	H						3300	N	21	N	120	N	180000	N	7000	N	0		0	
Boron trifluoride	7637072			2.00E-04	H						7.3	N	0.73	N	0		0		0		0		0	
Bromodichloromethane	75274	2.00E-02	I			6.20E-02	I			x	0.17	C	0.1	C	0.051	C	92	C	10	C	1800	E	0.3	E
Bromoethene	593602							1.10E-01	H	x	0.096	C	0.057	C	0		0		0		0		0	
Bromoform (tribromomethane)	75252	2.00E-02	I			7.90E-03	I	3.85E-03	I	x	2.4	C	1.6	C	0.4	C	720	C	81	C	46	E	0.5	E
Bromomethane	74839	1.40E-03	I	1.43E-03	I					x	8.7	N	5.2	N	1.9	N	2900	N	110	N	2	E	0.1	E
4-Bromophenyl phenyl ether	101553	5.80E-02	O								2100	N	210	N	78	N	120000	N	4500	N	0		0	
Bromophos	2104963	5.00E-03	H								180	N	18	N	6.8	N	10000	N	390	N	0		0	
Bromoxynil	1689845	2.00E-02	I								730	N	73	N	27	N	41000	N	1600	N	0		0	
Bromoxynil octanoate	1689992	2.00E-02	I								730	N	73	N	27	N	41000	N	1600	N	0		0	
1,3-Butadiene	106990							9.80E-01	I	x	0.011	C	0.0064	C	0		0		0		0.0013	C	0.000072	C
1-Butanol	71363	1.00E-01	I								3700	N	370	N	140	N	200000	N	7800	N	9700	E	8	E
Butyl benzyl phthalate	85687	2.00E-01	I								7300	N	730	N	270	N	410000	N	16000	N	530	E	68	E
Butylate	2008415	5.00E-02	I								1800	N	180	N	68	N	100000	N	3900	N	0		0	
sec-Butylbenzene	135988	1.00E-02	E							x	61	N	37	N	14	N	20000	N	780	N	80	S	0.27	M
tert-Butylbenzene	104518	1.00E-02	E							x	61	N	37	N	14	N	20000	N	780	N	0		0.27	M
Butylphthalyl butylglycolate	85701	1.00E+00	I								37000	N	3700	N	1400	N	1000000	N	78000	N	0		0	
Cacodylic acid	75605	3.00E-03	H								110	N	11	N	4.1	N	6100	N	230	N	0		0	
Cadmium and compounds	7440439	5.00E-04	I	5.71E-05	W			6.30E+00	I		18	N	0.00099	C	0.68	N	1000	N	39	N	920	E	6	E
Caprolactam	105602	5.00E-01	I								18000	N	1800	N	680	N	1000000	N	39000	N	0		0	
Captafol	2425061	2.00E-03	I			8.60E-03	H				7.8	C	0.73	C	0.37	C	670	C	74	C	0		0	
Captan	133062	1.30E-01	I			3.50E-03	H				19	C	1.8	C	0.9	C	1600	C	180	C	0		0	
Carbaryl	63252	1.00E-01	I								3700	N	370	N	140	N	200000	N	7800	N	0.34	S	23	N
Carbofuran	1563662	5.00E-03	I								180	N	18	N	6.8	N	10000	N	390	N	0		0	
Carbon disulfide	75150	1.00E-01	I	2.00E-01	I					x	1000	N	730	N	140	N	200000	N	7800	N	11	E	14	E
Carbon tetrachloride	56235	7.00E-04	I	5.71E-04	E	1.30E-01	I	5.25E-02	I	x	0.16	C	0.12	C	0.024	C	44	C	4.9	C	0.2	E	0.03	E
Carbosulfan	55285148	1.00E-02	I								370	N	37	N	14	N	20000	N	780	N	0		0	
Carboxin	5234684	1.00E-01	I								3700	N	370	N	140	N	200000	N	7800	N	0		0	
Chlorai	75876	2.00E-03	I								73	N	7.3	N	2.7	N	4100	N	160	N	0		0	
Chloramben	133904	1.50E-02	I								550	N	55	N	20	N	31000	N	1200	N	0		0	
Chloranil	118752					4.03E-01	H				0.17	C	0.016	C	0.0078	C	14	C	1.6	C	0		0	
Chlordane	57749	6.00E-05	I			1.30E+00	I	1.29E+00	I		0.052	C	0.0049	C	0.0024	C	4.4	C	0.49	C	10	E	2	E
Chlorimuron-ethyl	90982324	2.00E-02	I								730	N	73	N	27	N	41000	N	1600	N	0		0	
Chlorine	7782505	1.00E-01	I								3700	N	370	N	140	N	200000	N	7800	N	0		0	
Chlorine dioxide	10049044			5.71E-05	I						2.1	N	0.21	N	0		0		0		0		0	
Chloroacetaldehyde	107200	6.90E-03	O								250	N	25	N	9.3	N	14000	N	540	N	0		0	
Chloroacetic acid	79118	2.00E-03	H								73	N	7.3	N	2.7	N	4100	N	160	N	0		0	
2-Chloroacetophenone	532274			8.57E-06	I						0.31	N	0.031	N	0		0		0		0		0	
4-Chloroaniline	106478	4.00E-03	I								150	N	15	N	5.4	N	8200	N	310	N	1200	S	0.3	E
Chlorobenzene	108907	2.00E-02	I	5.71E-03	A					x	39	N	21	N	27	N	41000	N	1600	N	94	E	0.6	E
Chlorobenzilate	510156	2.00E-02	I			2.70E-01	H	2.70E-01	H		0.25	C	0.023	C	0.012	C	21	C	2.4	C	0		0	
p-Chlorobenzoic acid	74113	2.00E-01	H								7300	N	730	N	270	N	410000	N	16000	N	0		0	
4-Chlorobenzotrifluoride	98566	2.00E-02	H								730	N	73	N	27	N	41000	N	1600	N	86	N	7.5	N
2-Chloro-1,3-butadiene	126998	2.00E-02	A	2.00E-03	H					x	14	N	7.3	N	27	N	41000	N	1600	N	0		0	
1-Chlorobutane	109693	4.00E-01	H							x	2400	N	1500	N	540	N	820000	N	31000	N	0		0	
Chlorodibromomethane	124481	2.00E-02	I			8.40E-02	I			x	0.13	C	0.075	C	0.038	C	68	C	7.6	C	1900	E	0.2	E
1-Chloro-1,1-difluoroethane	75683			1.43E+01	I					x	87000	N	52000	N	0		0		0		0		0	
Chlorodifluoromethane	75456			1.43e+01	I					x	87000	N	52000	N	0		0		0		0		0	
Chloroethane	75003	4.00E-01	E	2.86E+00	I					x	8600	N	10000	N	540	N	820000	N	31000	N	2600	S	33	N
2-Chloroethyl vinyl ether	110758	2.50E-02	O							x	150	N	91	N	34	N	51000	N	2000	N	0		0	
Chloroform	67663	1.00E-02	I			6.10E-03	I	8.05E-02	I	x	0.15	C	0.078	C	0.52	C	940	C	100	C	0.2	E	0.3	E

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Chloromethane	74873					1.30E-02	H	6.30E-03	H	x	1.4	C	0.99	C	0.24	C	440	C	49	C	0.063	C	0.0066	C
4-Chloro-2,2-methylaniline hydrochlori	3165933					4.60E-01	H				0.15	C	0.014	C	0.0069	C	12	C	1.4	C	0		0	
4-Chloro-2-methylaniline	95692					5.80E-01	H				0.12	C	0.011	C	0.0054	C	9.9	C	1.1	C	0		0	
beta-Chloronaphthalene	91587	8.00E-02	I								2900	N	290	N	110	N	160000	N	6300	N	2.8	S	140	N
o-Chloronitrobenzene	88733					2.50E-02	H			x	0.42	C	0.25	C	0.13	C	230	C	26	C	0		0	
p-Chloronitrobenzene	100005					1.80E-02	H			x	0.59	C	0.35	C	0.18	C	320	C	35	C	0		0	
2-Chlorophenol	95578	5.00E-03	I								180	N	18	N	6.8	N	10000	N	390	N	53000	E	2	E
2-Chloropropane	75296			2.86E-02	H					x	170	N	100	N	0		0		0		22	N	0.64	N
Chlorothalonil	1897456	1.50E-02	I			1.10E-02	H				6.1	C	0.57	C	0.29	C	520	C	58	C	0		0	
o-Chlorotoluene	95498	2.00E-02	I							x	120	N	73	N	27	N	41000	N	1600	N	1200	N	5.6	N
Chlorpropham	101213	2.00E-01	I								7300	N	730	N	270	N	410000	N	16000	N	0		0	
Chlorpyrifos	2921882	3.00E-03	I								110	N	11	N	4.1	N	6100	N	230	N	0		0	
Chlorpyrifos-methyl	5598130	1.00E-02	H								370	N	37	N	14	N	20000	N	780	N	0		0	
Chlorsulfuron	64902723	5.00E-02	I								1800	N	180	N	68	N	100000	N	3900	N	0		0	
Chlorthiophos	60238564	8.00E-04	H								29	N	2.9	N	1.1	N	1600	N	63	N	0		0	
Chromium III and compounds	16065831	1.00E+00	I	5.71E-07	W						37000	N	0.0021	N	1400	N	1000000	N	78000	N	0		0	
Chromium VI and compounds	18540299	5.00E-03	I					4.20E+01	I		180	N	0.00015	C	6.8	N	10000	N	390	N	140	E	19	E
Coal tar	8001589							2.20E+00	W		0		0.0028	C	0		0		0		0		0	
Cobalt	7440484	6.00E-02	E								2200	N	220	N	81	N	120000	N	4700	N	0		0	
Coke Oven Emissions	8007452							2.17E+00	I		0		0.0029	C	0		0		0		0		0	
Copper and compounds	7440508	4.00E-02	E								1500	N	150	N	54	N	82000	N	3100	N	0		0	
Crotonaldehyde	123739	1.00E-02	W			1.90E+00	H	1.90E+00	W		0.035	C	0.0033	C	0.0017	C	3	C	0.34	C	0		0	
Cumene	98828	4.00E-02	I	2.57E-03	H						1500	N	9.4	N	54	N	82000	N	3100	N	81	N	65	N
Cyanides:	0										0		0		0		0		0		0		0	
Barium cyanide	542621	1.00E-01	W								3700	N	370	N	140	N	200000	N	7800	N	0		0	
Calcium cyanide	592018	4.00E-02	I								1500	N	150	N	54	N	82000	N	3100	N	0		0	
Chlorine cyanide	506774	5.00E-02	I								1800	N	180	N	68	N	100000	N	3900	N	0		0	
Copper cyanide	544923	5.00E-03	I								180	N	18	N	6.8	N	10000	N	390	N	0		0	
Cyanazine	21725462	2.00E-03	H			8.40E-01	H				0.08	C	0.0075	C	0.0038	C	6.8	C	0.76	C	0		0	
Cyanogen	460195	4.00E-02	I								1500	N	150	N	54	N	82000	N	3100	N	0		0	
Cyanogen bromide	506683	9.00E-02	I								3300	N	330	N	120	N	180000	N	7000	N	0		0	
Cyanogen chloride	506774	5.00E-02	I								1800	N	180	N	68	N	100000	N	3900	N	0		0	
Free cyanide	57125	2.00E-02	I								730	N	73	N	27	N	41000	N	1600	N	0		0	
Hydrogen cyanide	74908	2.00E-02	I	8.57E-04	I						730	N	3.1	N	27	N	41000	N	1600	N	0		0	
Potassium cyanide	151508	5.00E-02	I								1800	N	180	N	68	N	100000	N	3900	N	0		0	
Potassium silver cyanide	506616	2.00E-01	I								7300	N	730	N	270	N	410000	N	16000	N	0		0	
Silver cyanide	506649	1.00E-01	I								3700	N	370	N	140	N	200000	N	7800	N	0		0	
Sodium cyanide	143339	4.00E-02	I								1500	N	150	N	54	N	82000	N	3100	N	0		0	
Thiocyanate	0	2.00E-02	E								730	N	73	N	27	N	41000	N	1600	N	0		0	
Zinc cyanide	557211	5.00E-02	I								1800	N	180	N	68	N	100000	N	3900	N	0		0	
Cyclohexanone	108941	5.00E+00	I							x	30000	N	18000	N	6800	N	1000000	N	390000	N	0		0	
Cyclohexlamine	108918	2.00E-01	I								7300	N	730	N	270	N	410000	N	16000	N	0		0	
Cyhalothrin/Karate	68085858	5.00E-03	I								180	N	18	N	6.8	N	10000	N	390	N	0		0	
Cypermethrin	52315078	1.00E-02	I								370	N	37	N	14	N	20000	N	780	N	0		0	
Cyromazine	66215278	7.50E-03	I								270	N	27	N	10	N	15000	N	590	N	0		0	
Dacthal	1861321	1.00E-02	I								370	N	37	N	14	N	20000	N	780	N	0		0	
Dalapon	75990	3.00E-02	I								1100	N	110	N	41	N	61000	N	2300	N	0		0	
Danitol	39515418	2.50E-02	I								910	N	91	N	34	N	51000	N	2000	N	0		0	
DDD	72548					2.40E-01	I				0.28	C	0.026	C	0.013	C	24	C	2.7	C	37	S	0.7	E
DDE	72559					3.40E-01	I				0.2	C	0.018	C	0.0093	C	17	C	1.9	C	10	S	0.5	E
DDT	50293	5.00E-04	I			3.40E-01	I	3.40E-01	I		0.2	C	0.018	C	0.0093	C	17	C	1.9	C	80	E	1	E
Decabromodiphenyl ether	1163195	1.00E-02	I							x	61	N	37	N	14	N	20000	N	780	N	0		0	
Demeton	8065483	4.00E-05	I								1.5	N	0.15	N	0.054	N	82	N	3.1	N	0		0	
Diallate	2303164					6.10E-02	H			x	0.17	C	0.1	C	0.052	C	94	C	10	C	0		0	
Diazinon	333415	9.00E-04	H								33	N	3.3	N	1.2	N	1800	N	70	N	5400	S	2.8	N
Dibenzofuran	132649	4.00E-03	E								150	N	15	N	5.4	N	8200	N	310	N	120	S	120	N
1,4-Dibromobenzene	106376	1.00E-02	I							x	61	N	37	N	14	N	20000	N	780	N	0		0	
1,2-Dibromo-3-chloropropane	96128			5.71E-05	I	1.40E+00	H	2.42E-03	H	x	0.048	C	0.21	N	0.0023	C	4.1	C	0.46	C	1.9	N	0.00061	M
1,2-Dibromoethane	106934			5.71E-05	H	8.50E+01	I	7.70E-01	I	x	0.00075	C	0.0081	C	3.7E-05	C	0.067	C	0.0075	C	0.0058	C	0.00018	M
Dibutyl phthalate	84742	1.00E-01	I								3700	N	370	N	140	N	200000	N	7800	N	100	E	120	E
Dicamba	1918009	3.00E-02	I								1100	N	110	N	41	N	61000	N	2300	N	0		0	
1,2-Dichlorobenzene	95501	9.00E-02	I	4.00E-02	A					x	270	N	150	N	120	N	180000	N	7000	N	300	E	6	E
1,3-Dichlorobenzene	541731	8.90E-02	O							x	540	N	320	N	120	N	180000	N	7000	N	0		0	
1,4-Dichlorobenzene	106467			2.29E-01	I	2.40E-02	H			x	0.44	C	0.26	C	0.13	C	240	C	27	C	7700	E	1	E

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3,3'-Dichlorobenzidine	91941					4.50E-01	I				0.15	C	0.014	C	0.007	C	13	C	1.4	C	52	S	0.01	E
1,4-Dichloro-2-butene	764410							9.30E+00	H	x	0.0011	C	0.00067	C	0		0		0		0		0	
Dichlorodifluoromethane	75718	2.00E-01	I	5.71E-02	A					x	390	N	210	N	270	N	410000	N	16000	N	37	N	7.5	N
1,1-Dichloroethane	75343	1.00E-01	H	1.43E-01	A					x	810	N	520	N	140	N	200000	N	7800	N	980	E	11	E
1,2-Dichloroethane (EDC)	107062			2.86E-03	E	9.10E-02	I	9.10E-02	I	x	0.12	C	0.069	C	0.035	C	63	C	7	C	0.3	E	0.01	E
1,1-Dichloroethylene	75354	9.00E-03	I			6.00E-01	I	1.75E-01	I	x	0.044	C	0.036	C	0.0053	C	9.5	C	1.1	C	0.04	E	0.03	E
1,2-Dichloroethylene (cis)	156592	1.00E-02	H							x	61	N	37	N	14	N	20000	N	780	N	1500	E	0.2	E
1,2-Dichloroethylene (trans)	156605	2.00E-02	I							x	120	N	73	N	27	N	41000	N	1600	N	3600	E	0.3	E
1,2-Dichloroethylene (mixture)	540590	9.00E-03	H							x	55	N	33	N	12	N	18000	N	700	N	0		0	
2,4-Dichlorophenol	120832	3.00E-03	I								110	N	11	N	4.1	N	6100	N	230	N	4800	S	0.5	E
2,4-Dichlorophenoxyacetic Acid (2,4-D	94757	1.00E-02	I							x	61	N	37	N	14	N	20000	N	780	N	7000	S	1.7	M
4-(2,4-Dichlorophenoxy)butyric Acid	94826	8.00E-03	I								290	N	29	N	11	N	16000	N	630	N	0		0	
1,2-Dichloropropane	78875			1.14E-03	I	6.80E-02	H			x	0.16	C	0.092	C	0.046	C	84	C	9.4	C	11	E	0.02	E
2,3-Dichloropropanol	616239	3.00E-03	I								110	N	11	N	4.1	N	6100	N	230	N	0		0	
1,3-Dichloropropene	542756	3.00E-04	I	5.71E-03	I	1.75E-01	H	1.30E-01	H	x	0.077	C	0.048	C	0.018	C	33	C	3.7	C	0.1	E	0.001	E
Dichlorvos	62737	5.00e-04	I	1.43E-04	I	2.90E-01	I				0.23	C	0.022	C	0.011	C	20	C	2.2	C	3.5	C	0.00072	C
Dicofol	115322					4.40E-01	W				0.15	C	0.014	C	0.0072	C	13	C	1.5	C	0		0	
Dicyclopentadiene	77736	3.00E-02	H	5.71E-05	A					x	0.42	N	0.21	N	41	N	61000	N	2300	N	0		0	
Dieldrin	60571	5.00E-05	I			1.60E+01	I	1.61E+01	I		0.0042	C	0.00039	C	0.0002	C	0.36	C	0.04	C	2	E	0.001	E
Diesel emissions	0			1.43E-03	I						52	N	5.2	N	0		0		0		0		0	
Diethyl phthalate	84662	8.00E-01	I								29000	N	2900	N	1100	N	1000000	N	63000	N	520	E	110	E
Diethylene glycol, monobutyl ether	112345			5.71E-03	H						210	N	21	N	0		0		0		0		0	
Diethylene glycol, monoethyl ether	111900	2.00E+00	H								73000	N	7300	N	2700	N	1000000	N	160000	N	0		0	
Diethylformamide	617845	1.10E-02	H								400	N	40	N	15	N	22000	N	860	N	0		0	
Di(2-ethylhexyl)adipate	103231	6.00E-01	I			1.20E-03	I				56	C	5.2	C	2.6	C	4800	C	530	C	0		0	
Diethylstilbestrol	56531					4.70E+03	H				0.000014	C	1.3E-06	C	7E-07	C	0.0012	C	0.00014	C	0		0	
Difenzoquat (Avenge)	43222486	8.00E-02	I								2900	N	290	N	110	N	160000	N	6300	N	0		0	
Diflubenzuron	35367385	2.00E-02	I								730	N	73	N	27	N	41000	N	1600	N	0		0	
1,1-Difluoroethane	75376			1.14E+01	I					x	69000	N	42000	N	0		0		0		0		0	
Diisopropyl methylphosphonate (DIMP	1445756	8.00E-02	I								2900	N	290	N	110	N	160000	N	6300	N	0		0	
Dimethipin	55290647	2.00E-02	I								730	N	73	N	27	N	41000	N	1600	N	0		0	
Dimethoate	60515	2.00E-04	I								7.3	N	0.73	N	0.27	N	410	N	16	N	0		0	
3,3'-Dimethoxybenzidine	119904					1.40E-02	H				4.8	C	0.45	C	0.23	C	410	C	46	C	0		0	
Dimethylamine	124403			5.71E-06	W						0.21	N	0.021	N	0		0		0		0		0	
2,4-Dimethylaniline hydrochloride	21436964					5.80E-01	H				0.12	C	0.011	C	0.0054	C	9.9	C	1.1	C	0		0	
2,4-Dimethylaniline	95681					7.50E-01	H				0.09	C	0.0083	C	0.0042	C	7.6	C	0.85	C	0		0	
N-N-Dimethylaniline	121697	2.00E-03	I								73	N	7.3	N	2.7	N	4100	N	160	N	0		0	
3,3'-Dimethylbenzidine	119937					9.20E+00	H				0.0073	C	0.00068	C	0.00034	C	0.62	C	0.069	C	29	C	0.00039	C
N,N-Dimethylformamide	68122	1.00E-01	H	8.57E-03	I						3700	N	31	N	140	N	200000	N	7800	N	0		0	
1,1-Dimethylhydrazine	57147					2.60E+00	W	3.50E+00	W		0.026	C	0.0018	C	0.0012	C	2.2	C	0.25	C	0		0	
1,2-Dimethylhydrazine	540738					3.70E+01	W	3.70E+01	W		0.0018	C	0.00017	C	8.5E-05	C	0.15	C	0.017	C	0		0	
2,4-Dimethylphenol	105679	2.00E-02	I								730	N	73	N	27	N	41000	N	1600	N	5400	S	3	E
2,6-Dimethylphenol	576261	6.00E-04	I								22	N	2.2	N	0.81	N	1200	N	47	N	0		0	
3,4-Dimethylphenol	95658	1.00E-03	I								37	N	3.7	N	1.4	N	2000	N	78	N	0		0	
Dimethyl phthalate	131113	1.00E+01	H								370000	N	37000	N	14000	N	1000000	N	780000	N	1600	E	1200	E
Dimethyl terephthalate	120616	1.00E-01	I								3700	N	370	N	140	N	200000	N	7800	N	0		0	
1,2-Dinitrobenzene	528290	4.00E-04	H								15	N	1.5	N	0.54	N	820	N	31	N	0		0	
1,3-Dinitrobenzene	99650	1.00E-04	I								3.7	N	0.37	N	0.14	N	200	N	7.8	N	0		0	
1,4-Dinitrobenzene	100254	4.00E-04	H								15	N	1.5	N	0.54	N	820	N	31	N	0		0	
4,6-Dinitro-o-cyclohexyl phenol	131895	2.00E-03	I								73	N	7.3	N	2.7	N	4100	N	160	N	0		0	
2,4-Dinitrophenol	51285	2.00E-03	I								73	N	7.3	N	2.7	N	4100	N	160	N	360	N	0.1	E
Dinitrotoluene mixture	0					6.80E-01	I				0.099	C	0.0092	C	0.0046	C	8.4	C	0.94	C	0		0	
2,4-Dinitrotoluene	121142	2.00E-03	I								73	N	7.3	N	2.7	N	4100	N	160	N	120	S	0.2	E
2,6-Dinitrotoluene	606202	1.00E-03	H								37	N	3.7	N	1.4	N	2000	N	78	N	370	S	0.1	E
Dinoseb	88857	1.00E-03	I								37	N	3.7	N	1.4	N	2000	N	78	N	0		0	
di-n-Octyl phthalate	117840	2.00E-02	H								730	N	73	N	27	N	41000	N	1600	N	1000000	S	1000000	E
1,4-Dioxane	123911					1.10E-02	I				6.1	C	0.57	C	0.29	C	520	C	58	C	0		0	
Diphenamid	957517	3.00E-02	I								1100	N	110	N	41	N	61000	N	2300	N	0		0	
Diphenylamine	122394	2.50E-02	I								910	N	91	N	34	N	51000	N	2000	N	0		0	
1,2-Diphenylhydrazine	122667					8.00E-01	I	7.70E-01	I		0.084	C	0.0081	C	0.0039	C	7.2	C	0.8	C	0		0	
Diquat	85007	2.20E-03	I								80	N	8	N	3	N	4500	N	170	N	0		0	
Direct black 38	1937377					8.60E+00	H				0.0078	C	0.00073	C	0.00037	C	0.67	C	0.074	C	0		0	
Direct blue 6	2602462					8.10E+00	H				0.0083	C	0.00077	C	0.00039	C	0.71	C	0.079	C	0		0	
Direct brown 95	16071866					9.30E+00	H				0.0072	C	0.00067	C	0.00034	C	0.62	C	0.069	C	0		0	

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Disulfoton	298044	4.00E-05	I										1.5	N	0.15	N	0.054	N	82	N	3.1	N	0		0	
1,4-Dithiane	505293	1.00E-02	I										370	N	37	N	14	N	20000	N	780	N	0		0	
Diuron	330541	2.00E-03	I										73	N	7.3	N	2.7	N	4100	N	160	N	0		0	
Dodine	2439103	4.00E-03	I										150	N	15	N	5.4	N	8200	N	310	N	0		0	
Endosulfan	115297	6.00E-03	I										220	N	22	N	8.1	N	12000	N	470	N	1	S	3	E
Endothall	145733	2.00E-02	I										730	N	73	N	27	N	41000	N	1600	N	0		0	
Endrin	72208	3.00E-04	I										11	N	1.1	N	0.41	N	610	N	23	N	16	S	0.4	E
Epichlorohydrin	106898	2.00E-03	H	2.86E-04	I	9.90E-03	I	4.20E-03	I				6.8	C	1	N	0.32	C	580	C	65	C	0		0	
1,2-Epoxybutane	106887			5.71E-03	I								210	N	21	N	0		0		0		0		0	
Ethephon (2-chloroethyl phosphonic ac	16672870	5.00E-03	I										180	N	18	N	6.8	N	10000	N	390	N	0		0	
Ethion	563122	5.00E-04	I										18	N	1.8	N	0.68	N	1000	N	39	N	0		0	
2-Ethoxyethanol acetate	111159	3.00E-01	A										11000	N	1100	N	410	N	610000	N	23000	N	0		0	
2-Ethoxyethanol	110805	4.00E-01	H	5.71E-02	I								15000	N	210	N	540	N	820000	N	31000	N	0		0	
Ethyl acrylate	140885					4.80E-02	H						1.4	C	0.13	C	0.066	C	120	C	13	C	0		0	
EPTC (S-Ethyl dipropylthiocarbamate)	759944	2.50E-02	I										910	N	91	N	34	N	51000	N	2000	N	0		0	
Ethyl acetate	141786	9.00E-01	I										33000	N	3300	N	1200	N	1000000	N	70000	N	0		0	
Ethylbenzene	100414	1.00E-01	I	2.86E-01	I							x	1300	N	1000	N	140	N	200000	N	7800	N	260	E	5	E
Ethylene cyanohydrin	109784	3.00E-01	H										11000	N	1100	N	410	N	610000	N	23000	N	0		0	
Ethylene diamine	107153	2.00E-02	H										730	N	73	N	27	N	41000	N	1600	N	0		0	
Ethylene glycol	107211	2.00E+00	I										73000	N	7300	N	2700	N	1000000	N	160000	N	0		0	
Ethylene glycol, monobutyl ether	111762			5.71E-03	H								210	N	21	N	0		0		0		0		0	
Ethylene oxide	75218					1.02E+00	H	3.50E-01	H				0.066	C	0.018	C	0.0031	C	5.6	C	0.63	C	0		0	
Ethylene thiourea (ETU)	96457	8.00E-05	I			1.19E-01	H						0.57	C	0.053	C	0.027	C	48	C	5.4	C	0		0	
Ethyl ether	60297	2.00E-01	I									x	1200	N	730	N	270	N	410000	N	16000	N	0		0	
Ethyl methacrylate	97632	9.00E-02	H										3300	N	330	N	120	N	180000	N	7000	N	0		0	
Ethyl p-nitrophenyl phenylphosphorothi	2104645	1.00E-05	I										0.37	N	0.037	N	0.014	N	20	N	0.78	N	0		0	
Ethylnitrosourea	759739					1.40E+02	W						0.00048	C	4.5E-05	C	2.3E-05	C	0.041	C	0.0046	C	0		0	
Ethylphthalyl ethyl glycolate	84720	3.00E+00	I										110000	N	11000	N	4100	N	1000000	N	230000	N	0		0	
Express	10120	8.00E-03	I										290	N	29	N	11	N	16000	N	630	N	0		0	
Fenamiphos	22224926	2.50E-04	I										9.1	N	0.91	N	0.34	N	510	N	20	N	0		0	
Fluometuron	2164172	1.30E-02	I										470	N	47	N	18	N	27000	N	1000	N	0		0	
Fluoride	7782414	6.00E-02	I										2200	N	220	N	81	N	120000	N	4700	N	0		0	
Fluoridone	59756604	8.00E-02	I										2900	N	290	N	110	N	160000	N	6300	N	0		0	
Flurprimidol	56425913	2.00E-02	I										730	N	73	N	27	N	41000	N	1600	N	0		0	
Flutolanil	66332965	6.00E-02	I										2200	N	220	N	81	N	120000	N	4700	N	0		0	
Fluvalinate	69409945	1.00E-02	I										370	N	37	N	14	N	20000	N	780	N	0		0	
Folpet	133073	1.00E-01	I			3.50E-03	I						19	C	1.8	C	0.9	C	1600	C	180	C	0		0	
Fomesafen	72178020					1.90E-01	I						0.35	C	0.033	C	0.017	C	30	C	3.4	C	0		0	
Fonofos	944229	2.00E-03	I										73	N	7.3	N	2.7	N	4100	N	160	N	0		0	
Formaldehyde	50000	2.00E-01	I					4.55E-02	I				7300	N	0.14	C	270	N	410000	N	16000	N	0		0	
Formic Acid	64186	2.00E+00	H										73000	N	7300	N	2700	N	1000000	N	160000	N	0		0	
Fosetyl-al	39148248	3.00E+00	I										110000	N	11000	N	4100	N	1000000	N	230000	N	0		0	
Furan	110009	1.00E-03	I										37	N	3.7	N	1.4	N	2000	N	78	N	0		0	
Furazolidone	67458					3.80E+00	H						0.018	C	0.0016	C	0.00083	C	1.5	C	0.17	C	0		0	
Furfural	98011	3.00E-03	I	1.43E-02	A								110	N	52	N	4.1	N	6100	N	230	N	0		0	
Furium	531828					5.00E+01	H						0.0013	C	0.00013	C	6.3E-05	C	0.11	C	0.013	C	0		0	
Furmecyclox	60568050					3.00E-02	I						2.2	C	0.21	C	0.11	C	190	C	21	C	0		0	
Glufosinate-ammonium	77182822	4.00E-04	I										15	N	1.5	N	0.54	N	820	N	31	N	0		0	
Glycidaldehyde	765344	4.00E-04	I	2.86E-04	H								15	N	1	N	0.54	N	820	N	31	N	0		0	
Glyphosate	1071836	1.00E-01	I										3700	N	370	N	140	N	200000	N	7800	N	0		0	
Haloxyfop-methyl	69806402	5.00E-05	I										1.8	N	0.18	N	0.068	N	100	N	3.9	N	0		0	
Harmony	79277273	1.30E-02	I										470	N	47	N	18	N	27000	N	1000	N	0		0	
HCH (alpha)	319846					6.30E+00	I	6.30E+00	I				0.011	C	0.00099	C	0.0005	C	0.91	C	0.1	C	0.9	E	0.0004	E
HCH (beta)	319857					1.80E+00	I	1.80E+00	I				0.037	C	0.0035	C	0.0018	C	3.2	C	0.35	C	16	E	0.002	E
HCH (gamma) Lindane	58899	3.00E-04	I			1.30E+00	H						0.052	C	0.0048	C	0.0024	C	4.4	C	0.49	C	4.2	C	0.006	E
HCH-technical	608731					1.80E+00	I	1.79E+00	I				0.037	C	0.0035	C	0.0018	C	3.2	C	0.35	C	0		0	
Heptachlor	76448	5.00E-04	I			4.50E+00	I	4.55E+00	I	x			0.0023	C	0.0014	C	0.0007	C	1.3	C	0.14	C	0.3	E	0.06	E
Heptachlor epoxide	1024573	1.30E-05	I			9.10E+00	I	9.10E+00	I	x			0.0012	C	0.00069	C	0.00035	C	0.63	C	0.07	C	1	E	0.03	E
Hexabromobenzene	87821	2.00E-03	I							x			12	N	7.3	N	2.7	N	4100	N	160	N	0		0	
Hexachlorobenzene	118741	8.00E-04	I			1.60E+00	I	1.61E+00	I	x			0.0066	C	0.0039	C	0.002	C	3.6	C	0.4	C	1	E	0.8	E
Hexachlorobutadiene	87683	2.00E-04	H			7.80E-02	I	7.70E-02	I	x			0.14	C	0.081	C	0.04	C	73	C	8.2	C	1	E	0.1	E
Hexachlorocyclopentadiene	77474	7.00E-03	I	2.00E-05	H					x			0.15	N	0.073	N	9.5	N	14000	N	550	N	2	E	10	E
Hexachlorodibenzo-p-dioxin mixture	19408743					6.20E+03	I	4.55E+03	I				0.000011	C	1.4E-06	C	5E-07	C	0.00092	C	0.0001	C	0		0	
Hexachloroethane	67721	1.00E-03	I			1.40E-02	I	1.40E-02	I	x			0.75	C	0.45	C	0.23	C	410	C	46	C	49	E	0.2	E

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Hexachlorophene	70304	3.00E-04	I														11	N	1.1	N	0.41	N	610	N	23	N	0		0	
Hexahydro-1,3,5-trinitro-1,3,5-triazine	121824	3.00E-03	I			1.10E-01	I										0.61	C	0.057	C	0.029	C	52	C	5.8	C	0		0	
1,6-Hexamethylene diisocyanate	822060			2.86E-06	I												0.1	N	0.01	N	0		0		0		0		0	
n-Hexane	110543	6.00E-02	H	5.71E-02	I											x	350	N	210	N	81	N	120000	N	4700	N	32	N	13	N
Hexazinone	51235042	3.30E-02	I														1200	N	120	N	45	N	67000	N	2600	N	0		0	
Hydrazine, hydrazine sulfate	302012					3.00E+00	I	1.71E+01	I								0.022	C	0.00037	C	0.0011	C	1.9	C	0.21	C	0		0	
Hydrogen chloride	7647010			5.71E-03	I												210	N	21	N	0		0		0		0		0	
Hydrogen sulfide	7783064	3.00E-03	I	2.85E-04	I												110	N	1	N	4.1	N	6100	N	230	N	0		0	
Hydroquinone	123319	4.00E-02	H														1500	N	150	N	54	N	82000	N	3100	N	0		0	
Imazalil	35554440	1.30E-02	I														470	N	47	N	18	N	27000	N	1000	N	0		0	
Imazaquin	81335377	2.50E-01	I														9100	N	910	N	340	N	510000	N	20000	N	0		0	
Iprodione	36734197	4.00E-02	I														1500	N	150	N	54	N	82000	N	3100	N	0		0	
Iron	7439896	3.00E-01	E														11000	N	1100	N	410	N	610000	N	23000	N	0		0	
Isobutanol	78831	3.00E-01	I													x	1800	N	1100	N	410	N	610000	N	23000	N	0		0	
Isophorone	78591	2.00E-01	I			9.50E-04	I										71	C	6.6	C	3.3	C	6000	C	670	C	3400	E	0.2	E
Isopropalin	33820530	1.50E-02	I														550	N	55	N	20	N	31000	N	1200	N	0		0	
Isopropyl methyl phosphonic acid	1832548	1.00E-01	I														3700	N	370	N	140	N	200000	N	7800	N	0		0	
Isoxaben	82558507	5.00E-02	I														1800	N	180	N	68	N	100000	N	3900	N	0		0	
Kepone	143500					1.80E+01	E										0.0037	C	0.00035	C	0.00018	C	0.32	C	0.035	C	0		0	
Lactofen	77501634	2.00E-03	I														73	N	7.3	N	2.7	N	4100	N	160	N	0		0	
Linuron	330552	2.00E-03	I														73	N	7.3	N	2.7	N	4100	N	160	N	0		0	
Lithium	7439932	2.00E-02	E														730	N	73	N	27	N	41000	N	1600	N	0		0	
Londax	83056996	2.00E-01	I														7300	N	730	N	270	N	410000	N	16000	N	0		0	
Malathion	121755	2.00E-02	I														730	N	73	N	27	N	41000	N	1600	N	0		0	
Maleic anhydride	108316	1.00E-01	I														3700	N	370	N	140	N	200000	N	7800	N	0		0	
Maleic hydrazide	123331	5.00E-01	I														18000	N	1800	N	680	N	1000000	N	39000	N	0		0	
Malononitrile	109773	2.00E-05	H														0.73	N	0.073	N	0.027	N	41	N	1.6	N	0		0	
Mancozeb	8018017	3.00E-02	H														1100	N	110	N	41	N	61000	N	2300	N	0		0	
Maneb	12427382	5.00E-03	I														180	N	18	N	6.8	N	10000	N	390	N	0		0	
**Manganese and compounds	7439965	2.30E-02	I	1.43e-05	I												840	N	0.052	N	31	N	47000	N	1800	N	0		0	
Mephosfolan	950107	9.00E-05	H														3.3	N	0.33	N	0.12	N	180	N	7	N	0		0	
Mepiquat chloride	24307264	3.00E-02	I														1100	N	110	N	41	N	61000	N	2300	N	0		0	
Mercuric chloride	7487947	3.00E-04	I														11	N	1.1	N	0.41	N	610	N	23	N	0		0	
Mercury (inorganic)	7439976	3.00E-04	H	8.57E-05	H												11	N	0.31	N	0.41	N	610	N	23	N	7	E	3	E
Mercury (methyl)	22967926	1.00E-04	I														3.7	N	0.37	N	0.14	N	200	N	7.8	N	0		0	
Merphos	150505	3.00E-05	I														1.1	N	0.11	N	0.041	N	61	N	2.3	N	0		0	
Merphos oxide	78488	3.00E-05	I														1.1	N	0.11	N	0.041	N	61	N	2.3	N	0		0	
Metalaxyl	57837191	6.00E-02	I														2200	N	220	N	81	N	120000	N	4700	N	0		0	
Methacrylonitrile	126987	1.00E-04	I	2.00E-04	A												3.7	N	0.73	N	0.14	N	200	N	7.8	N	0		0	
Methamidophos	10265926	5.00E-05	I														1.8	N	0.18	N	0.068	N	100	N	3.9	N	0		0	
Methanol	67561	5.00E-01	I														18000	N	1800	N	680	N	1000000	N	39000	N	0		0	
Methidathion	950378	1.00E-03	I														37	N	3.7	N	1.4	N	2000	N	78	N	0		0	
Methomyl	16752775	2.50E-02	I														910	N	91	N	34	N	51000	N	2000	N	0		0	
Methoxychlor	72435	5.00E-03	I														180	N	18	N	6.8	N	10000	N	390	N	41	S	62	E
2-Methoxyethanol acetate	110496	2.00E-03	A														73	N	7.3	N	2.7	N	4100	N	160	N	0		0	
2-Methoxyethanol	109864	1.00E-03	H	5.71E-03	I												37	N	21	N	1.4	N	2000	N	78	N	0		0	
2-Methoxy-5-nitroaniline	99592					4.60E-02	H										1.5	C	0.14	C	0.069	C	120	C	14	C	0		0	
Methyl acetate	79209	1.00E+00	H														37000	N	3700	N	1400	N	1000000	N	78000	N	0		0	
Methyl acrylate	96333	3.00E-02	A														1100	N	110	N	41	N	61000	N	2300	N	0		0	
2-Methylaniline hydrochloride	636215					1.80E-01	H										0.37	C	0.035	C	0.018	C	32	C	3.5	C	0		0	
2-Methylaniline	95534					2.40E-01	H										0.28	C	0.026	C	0.013	C	24	C	2.7	C	0		0	
Methyl chlorocarbonate	79221	1.00E+00	W														37000	N	3700	N	1400	N	1000000	N	78000	N	0		0	
4-(2-Methyl-4-chlorophenoxy) butyric a	94815	1.00E-02	I														370	N	37	N	14	N	20000	N	780	N	0		0	
2-Methyl-4-chlorophenoxyacetic acid	94746	5.00E-04	I														18	N	1.8	N	0.68	N	1000	N	39	N	0		0	
2-(2-Methyl-14-chlorophenoxy)propioni	93652	1.00E-03	I														37	N	3.7	N	1.4	N	2000	N	78	N	0		0	
Methylcyclohexane	108872			8.57E-01	H												31000	N	3100	N	0		0		0		60	S	1500	N
Methylene bromide	74953	1.00E-02	A													x	61	N	37	N	14	N	20000	N	780	N	0		0	
Methylene chloride	75092	6.00E-02	I	8.57E-01	H	7.50E-03	I	1.64E-03	I							x	4.1	C	3.8	C	0.42	C	760	C	85	C	7	E	0.01	E
4,4'-Methylene bis(2-chloroaniline)	101144	7.00E-04	H			1.30E-01	H	1.30E-01	H								0.52	C	0.048	C	0.024	C	44	C	4.9	C	0		0	
4,4'-Methylenebisbenzeneamine	101779					2.50E-01	W										0.27	C	0.025	C	0.013	C	23	C	2.6	C	0		0	
4,4'-Methylene bis(N,N'-dimethyl)anilin	101611					4.60E-02	I										1.5	C	0.14	C	0.069	C	120	C	14	C	0		0	
4,4'-Methylenediphenyl isocyanate	101688			5.71E-06	I											x	0.035	N	0.021	N	0		0		0		0		0	
Methyl ethyl ketone	78933	6.00E-01	I	2.86E-01	I											x	1900	N	1000	N	810	N	1000000	N	47000	N	0		0	
Methyl hydrazine	60344					1.10E+00	W										0.061	C	0.0057	C	0.0029	C	5.2	C	0.58	C	0		0	

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Methyl isobutyl ketone	108101	8.00E-02	H	2.29E-02	A						2900	N	84	N	110	N	160000	N	6300	N	0		0	
Methyl methacrylate	80626	8.00E-02	H								2900	N	290	N	110	N	160000	N	6300	N	0		0	
2-Methyl-5-nitroaniline	99558					3.30E-02	H				2	C	0.19	C	0.096	C	170	C	19	C	0		0	
Methyl parathion	298000	2.50E-04	I								9.1	N	0.91	N	0.34	N	510	N	20	N	28	S	0.041	N
2-Methylphenol (o-cresol)	95487	5.00E-02	I								1800	N	180	N	68	N	100000	N	3900	N	12000	S	6	E
3-Methylphenol (m-cresol)	103394	5.00E-02	I								1800	N	180	N	68	N	100000	N	3900	N	0		0	
4-Methylphenol (p-cresol)	106445	5.00E-03	H								180	N	18	N	6.8	N	10000	N	390	N	0		0	
Methyl styrene (mixture)	25013154	6.00E-03	A	1.14E-02	A					x	60	N	42	N	8.1	N	12000	N	470	N	100	N	1	N
Methyl styrene (alpha)	98839	7.00E-02	A							x	430	N	260	N	95	N	140000	N	5500	N	8.8	S	7.5	N
Methyl tertbutyl ether (MTBE)	1634044	5.00E-03	E	8.57E-01	I					x	180	N	3100	N	6.8	N	10000	N	390	N	0		0	
Metolaclor (Dual)	51218452	1.50E-01	H								5500	N	550	N	200	N	310000	N	12000	N	0		0	
Metribuzin	21087649	2.50E-02	I								910	N	91	N	34	N	51000	N	2000	N	0		0	
Mirex	2385855	2.00E-04	I			1.80E+00	W				0.037	C	0.0035	C	0.0018	C	3.2	C	0.35	C	0		0	
Molinate	2212671	2.00E-03	I								73	N	7.3	N	2.7	N	4100	N	160	N	0		0	
Molybdenum	7439987	5.00E-03	I								180	N	18	N	6.8	N	10000	N	390	N	0		0	
Monochloramine	10599903	1.00E-01	I								3700	N	370	N	140	N	200000	N	7800	N	0		0	
Naled	300765	2.00E-03	I								73	N	7.3	N	2.7	N	4100	N	160	N	0		0	
2-Naphthylamine	91598					1.30e+02	E				0.00052	C	4.8E-05	C	2.4E-05	C	0.044	C	0.0049	C	0		0	
Napropamide	15299997	1.00E-01	I								3700	N	370	N	140	N	200000	N	7800	N	0		0	
Nickel refinery dust	0							8.40E-01	I		0		0.0075	C	0		0		0		0		0	
Nickel and compounds	7440020	2.00E-02	I								730	N	73	N	27	N	41000	N	1600	N	6900	E	21	E
Nickel subsulfide	12035722							1.70E+00	I		0		0.0037	C	0		0		0		0		0	
Nitrapyrin	1929824	1.50E-03	W								55	N	5.5	N	2	N	3100	N	120	N	0		0	
Nitrate	14797558	1.60E+00	I								58000	N	5800	N	2200	N	1000000	N	130000	N	0		0	
Nitric oxide	10102439	1.00E-01	W								3700	N	370	N	140	N	200000	N	7800	N	0		0	
Nitrite	14797650	1.00E-01	I								3700	N	370	N	140	N	200000	N	7800	N	0		0	
2-Nitroaniline	88744	6.00E-05	W	5.71E-05	H						2.2	N	0.21	N	0.081	N	120	N	4.7	N	0		0	
3-Nitroaniline	99092	3.00E-03	O								110	N	11	N	4.1	N	6100	N	230	N	0		0	
4-Nitroaniline	100016	3.00E-03	O								110	N	11	N	4.1	N	6100	N	230	N	0		0	
Nitrobenzene	98953	5.00E-04	I	5.71E-04	A					x	3.4	N	2.1	N	0.68	N	1000	N	39	N	110	E	0.09	E
Nitrofurantoin	67209	7.00E-02	H								2600	N	260	N	95	N	140000	N	5500	N	0		0	
Nitrofurazone	59870					1.50E+00	H	9.40E+00	H		0.045	C	0.00067	C	0.0021	C	3.8	C	0.43	C	0		0	
Nitrogen dioxide	10102440	1.00E+00	W								37000	N	3700	N	1400	N	1000000	N	78000	N	0		0	
Nitroguanidine	556887	1.00E-01	I								3700	N	370	N	140	N	200000	N	7800	N	0		0	
4-Nitrophenol	100027	6.20E-02	O								2300	N	230	N	84	N	130000	N	4800	N	0		0	
2-Nitropropane	79469			5.71E-03	I			9.40E+00	H		210	N	0.00067	C	0		0		0		0		0	
N-Nitrosodi-n-butylamine	924163					5.40E+00	I	5.60E+00	I		0.012	C	0.0011	C	0.00058	C	1.1	C	0.12	C	0		0	
N-Nitrosodiethanolamine	1116547					2.80E+00	I				0.024	C	0.0022	C	0.0011	C	2	C	0.23	C	0		0	
N-Nitrosodiethylamine	55185					1.50E+02	I	1.51E+02	I		0.00045	C	4.1E-05	C	2.1E-05	C	0.038	C	0.0043	C	0		0	
N-Nitrosodimethylamine	62759					5.10E+01	I	4.90E+01	I		0.0013	C	0.00013	C	6.2E-05	C	0.11	C	0.013	C	0		0	
N-Nitrosodiphenylamine	86306					4.90E-03	I				14	C	1.3	C	0.64	C	1200	C	130	C	29	C	0.2	E
N-Nitroso di-n-propylamine	621647					7.00E+00	I				0.0096	C	0.00089	C	0.00045	C	0.82	C	0.091	C	0.014	C	0.00002	E
N-Nitroso-N-methylethylamine	10595956					2.20E+01	I				0.0031	C	0.00028	C	0.00014	C	0.26	C	0.029	C	0		0	
N-Nitrosopyrrolidine	930552					2.10E+00	I	2.13E+00	I		0.032	C	0.0029	C	0.0015	C	2.7	C	0.3	C	0		0	
m-Nitrotoluene	99081	1.00E-02	H							x	61	N	37	N	14	N	20000	N	780	N	460	S	0.42	N
o-Nitrotoluene	88722	1.00E-02	H							x	61	N	37	N	14	N	20000	N	780	N	460	S	0.42	N
p-Nitrotoluene	99990	1.00E-02	H							x	61	N	37	N	14	N	20000	N	780	N	460	S	0.42	N
Norflurazon	27314132	4.00E-02	I								1500	N	150	N	54	N	82000	N	3100	N	0		0	
NuStar	85509199	7.00E-04	I								26	N	2.6	N	0.95	N	1400	N	55	N	0		0	
Octabromodiphenyl ether	32536520	3.00E-03	I								110	N	11	N	4.1	N	6100	N	230	N	0		0	
Octahydro-1357-tetranitro-1357-tetraz	2691410	5.00E-02	I								1800	N	180	N	68	N	100000	N	3900	N	0		0	
Octamethylpyrophosphoramide	152169	2.00E-03	H								73	N	7.3	N	2.7	N	4100	N	160	N	0		0	
Oryzalin	19044883	5.00E-02	I								1800	N	180	N	68	N	100000	N	3900	N	0		0	
Oxadiazon	19666309	5.00E-03	I								180	N	18	N	6.8	N	10000	N	390	N	0		0	
Oxamyl	23135220	2.50E-02	I								910	N	91	N	34	N	51000	N	2000	N	0		0	
Oxyfluorfen	42874033	3.00E-03	I								110	N	11	N	4.1	N	6100	N	230	N	0		0	
Paclobutrazol	76738620	1.30E-02	I								470	N	47	N	18	N	27000	N	1000	N	0		0	
Paraquat	1910425	4.50E-03	I								160	N	16	N	6.1	N	9200	N	350	N	0		0	
Parathion	56382	6.00E-03	H								220	N	22	N	8.1	N	12000	N	470	N	110	S	3.9	N
Pebulate	1114712	5.00E-02	H								1800	N	180	N	68	N	100000	N	3900	N	0		0	
Pendimethalin	40487421	4.00E-02	I								1500	N	150	N	54	N	82000	N	3100	N	0		0	
Pentabromo-6-chloro cyclohexane	87843					2.30E-02	H				2.9	C	0.27	C	0.14	C	250	C	28	C	0		0	
Pentabromodiphenyl ether	32534819	2.00E-03	I								73	N	7.3	N	2.7	N	4100	N	160	N	0		0	
Pentachlorobenzene	608935	8.00E-04	I							x	4.9	N	2.9	N	1.1	N	1600	N	63	N	570	N	48	N

Pentachloronitrobenzene	82688	3.00E-03	I			2.60E-01	H			x	0.041	C	0.024	C	0.012	C	22	C	2.5	C	0		0	
Pentachlorophenol	87865	3.00E-02	I			1.20E-01	I				0.56	C	0.052	C	0.026	C	48	C	5.3	C	7.9	C	0.2	E
Permethrin	52645531	5.00E-02	I								1800	N	180	N	68	N	100000	N	3900	N	0		0	
Phenmedipham	13684634	2.50E-01	I								9100	N	910	N	340	N	510000	N	20000	N	0		0	
Phenol	108952	6.00E-01	I								22000	N	2200	N	810	N	1000000	N	47000	N	21000	S	49	E
m-Phenylenediamine	108452	6.00E-03	I								220	N	22	N	8.1	N	12000	N	470	N	0		0	
p-Phenylenediamine	106503	1.90E-01	H								6900	N	690	N	260	N	390000	N	15000	N	0		0	
Phenylmercuric acetate	62384	8.00E-05	I								2.9	N	0.29	N	0.11	N	160	N	6.3	N	0		0	
2-Phenylphenol	90437					1.94E-03	H				35	C	3.2	C	1.6	C	3000	C	330	C	0		0	
Phorate	298022	2.00E-04	H								7.3	N	0.73	N	0.27	N	410	N	16	N	0		0	
Phosmet	732116	2.00E-02	I								730	N	73	N	27	N	41000	N	1600	N	0		0	
Phosphine	7803512	3.00E-04	I	8.57E-05	I						11	N	0.31	N	0.41	N	610	N	23	N	0		0	
Phosphoric acid	7664382			2.86E-03	I						100	N	10	N	0		0		0		0		0	
Phosphorus (white)	7723140	2.00E-05	I								0.73	N	0.073	N	0.027	N	41	N	1.6	N	0		0	
p-Phthalic acid	100210	1.00E+00	H								37000	N	3700	N	1400	N	1000000	N	78000	N	0		0	
Phthalic anhydride	85449	2.00E+00	I	3.43E-02	H						73000	N	130	N	2700	N	1000000	N	160000	N	0		0	
Picloram	1918021	7.00E-02	I								2600	N	260	N	95	N	140000	N	5500	N	0		0	
Pirimiphos-methyl	29232937	1.00E-02	I								370	N	37	N	14	N	20000	N	780	N	0		0	
Polybrominated biphenyls	0	7.00E-06	H			8.90E+00	H				0.0076	C	0.0007	C	0.00035	C	0.64	C	0.072	C	0		0	
Polychlorinated biphenyls (PCBs)	1336363					7.70E+00	I				0.0087	C	0.00081	C	0.00041	C	0.74	C	0.083	C	0		0	
Aroclor 1016	12674112	7.00E-05	I								2.6	N	0.26	N	0.095	N	140	N	5.5	N	0		0	
Aroclor 1254	11097691	2.00E-05	I								0.73	N	0.073	N	0.027	N	41	N	1.6	N	0		0	
Polychlorinated terphenyls (PCTs)	0					4.50E+00	E				0.015	C	0.0014	C	0.0007	C	1.3	C	0.14	C	0		0	
Polynuclear aromatic hydrocarbons	0										0		0		0		0		0		110000	S	0	
Acenaphthene	83329	6.00E-02	I								2200	N	220	N	81	N	120000	N	4700	N	120	S	200	E
Anthracene	120127	3.00E-01	I								11000	N	1100	N	410	N	610000	N	23000	N	6.8	S	4300	E
Benz[a]anthracene	56553					7.30E-01	E	6.10E-01	E		0.092	C	0.01	C	0.0043	C	7.8	C	0.88	C	27	S	0.7	E
Benzo[b]fluoranthene	205992					7.30E-01	E	6.10E-01	E		0.092	C	0.01	C	0.0043	C	7.8	C	0.88	C	23	S	4	E
Benzo[k]fluoranthene	207089					7.30E-02	E	6.10E-02	E		0.92	C	0.1	C	0.043	C	78	C	8.8	C	0		4	E
Benzo[a]pyrene	50328					7.30E+00	I	6.10E+00	W		0.0092	C	0.001	C	0.00043	C	0.78	C	0.088	C	11	S	4	E
Carbazole	86748					2.00E-02	H				3.4	C	0.31	C	0.16	C	290	C	32	C	11	S	0.5	E
Chrysene	218019					7.30E-03	E	6.10E-03	E		9.2	C	1	C	0.43	C	780	C	88	C	3.6	S	1	E
Dibenz[ah]anthracene	53703					7.30E+00	E	6.10E+00	E		0.0092	C	0.001	C	0.00043	C	0.78	C	0.088	C	7.2	S	11	E
Fluoranthene	206440	4.00E-02	I								1500	N	150	N	54	N	82000	N	3100	N	68	S	980	E
Fluorene	86737	4.00E-02	I								1500	N	150	N	54	N	82000	N	3100	N	89	S	160	E
Indeno[1,2,3-cd]pyrene	193395					7.30E-01	E	6.10E-01	E		0.092	C	0.01	C	0.0043	C	7.8	C	0.88	C	280	S	35	E
Naphthalene	91203	4.00E-02	W								1500	N	150	N	54	N	82000	N	3100	N	180	S	30	E
Pyrene	129000	3.00E-02	I								1100	N	110	N	41	N	61000	N	2300	N	56	S	1400	E
Prochloraz	67747095	9.00E-03	I			1.50E-01	I				0.45	C	0.042	C	0.021	C	38	C	4.3	C	0		0	
Profluralin	26399360	6.00E-03	H								220	N	22	N	8.1	N	12000	N	470	N	0		0	
Prometon	1610180	1.50E-02	I								550	N	55	N	20	N	31000	N	1200	N	0		0	
Prometryn	7287196	4.00E-03	I								150	N	15	N	5.4	N	8200	N	310	N	0		0	
Pronamide	23950585	7.50E-02	I								2700	N	270	N	100	N	150000	N	5900	N	0		0	
Propachlor	1918167	1.30E-02	I								470	N	47	N	18	N	27000	N	1000	N	0		0	
Propanil	709988	5.00E-03	I								180	N	18	N	6.8	N	10000	N	390	N	0		0	
Propargite	2312358	2.00E-02	I								730	N	73	N	27	N	41000	N	1600	N	0		0	
Propargyl alcohol	107197	2.00E-03	I								73	N	7.3	N	2.7	N	4100	N	160	N	0		0	
Propazine	139402	2.00E-02	I								730	N	73	N	27	N	41000	N	1600	N	0		0	
Propham	122429	2.00E-02	I								730	N	73	N	27	N	41000	N	1600	N	0		0	
Propiconazole	60207901	1.30E-02	I								470	N	47	N	18	N	27000	N	1000	N	0		0	
Propylene glycol	57556	2.00E+01	H								730000	N	73000	N	27000	N	1000000	N	1000000	N	0		0	
Propylene glycol, monoethyl ether	52125538	7.00E-01	H								26000	N	2600	N	950	N	1000000	N	55000	N	0		0	
Propylene glycol, monomethyl ether	107982	7.00E-01	H	5.71E-01	I						26000	N	2100	N	950	N	1000000	N	55000	N	0		0	
Propylene oxide	75569			8.57E-03	I	2.40E-01	I	1.29E-02	I		0.28	C	0.49	C	0.013	C	24	C	2.7	C	0		0	
Pursuit	81335775	2.50E-01	I								9100	N	910	N	340	N	510000	N	20000	N	0		0	
Pydrin	51630581	2.50E-02	I								910	N	91	N	34	N	51000	N	2000	N	0		0	
Pyridine	110861	1.00E-03	I								37	N	3.7	N	1.4	N	2000	N	78	N	0		0	
Quinalphos	13593038	5.00E-04	I								18	N	1.8	N	0.68	N	1000	N	39	N	0		0	
Quinoline	91225					1.20E+01	H				0.0056	C	0.00052	C	0.00026	C	0.48	C	0.053	C	0		0	
Resmethrin	10463868	3.00E-02	I								1100	N	110	N	41	N	61000	N	2300	N	0		0	
Ronnel	299843	5.00E-02	H								1800	N	180	N	68	N	100000	N	3900	N	0		0	
Rotenone	83794	4.00E-03	I								150	N	15	N	5.4	N	8200	N	310	N	0		0	
Savey	78587050	2.50E-02	I								910	N	91	N	34	N	51000	N	2000	N	0		0	
Selenious Acid	7783008	5.00E-03	I								180	N	18	N	6.8	N	10000	N	390	N	0		0	

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Selenium	7782492	5.00E-03	I								180	N	18	N	6.8	N	10000	N	390	N	0		3	E
Selenourea	630104	5.00E-03	H								180	N	18	N	6.8	N	10000	N	390	N	0		0	
Sethoxydim	74051802	9.00E-02	I								3300	N	330	N	120	N	180000	N	7000	N	0		0	
Silver and compounds	7440224	5.00E-03	I								180	N	18	N	6.8	N	10000	N	390	N	0		0	
Simazine	122349	5.00E-03	I			1.20E-01	H				0.56	C	0.052	C	0.026	C	48	C	5.3	C	0		0	
Sodium azide	26628228	4.00E-03	I								150	N	15	N	5.4	N	8200	N	310	N	0		0	
Sodium diethyldithiocarbamate	148185	3.00E-02	I			2.70E-01	H				0.25	C	0.023	C	0.012	C	21	C	2.4	C	0		0	
Sodium fluoroacetate	62748	2.00E-05	I								0.73	N	0.073	N	0.027	N	41	N	1.6	N	0		0	
Sodium metavanadate	13718268	1.00E-03	H								37	N	3.7	N	1.4	N	2060	N	78	N	0		0	
Strontium, stable	7440246	6.00E-01	I								22000	N	2200	N	810	N	1000000	N	47000	N	0		0	
Strychnine	57249	3.00E-04	I								11	N	1.1	N	0.41	N	610	N	23	N	0		0	
Styrene	100425	2.00E-01	I	2.86E-01	I					x	1600	N	1000	N	270	N	410000	N	16000	N	1400	E	2	E
Systhane	88671890	2.50E-02	I								910	N	91	N	34	N	51000	N	2000	N	0		0	
2,3,7,8-TCDD (dioxin)	1746016					1.56E+05	H	1.16E+05	H		4.3E-07	C	5.4E-08	C	0	C	0.000037	C	4.1E-06	C	0		0	
Tebuthiuron	34014181	7.00E-02	I								2600	N	260	N	95	N	140000	N	5500	N	0		0	
Temephos	3383968	2.00E-02	H								730	N	73	N	27	N	41000	N	1600	N	0		0	
Terbacil	5902512	1.30E-02	I								470	N	47	N	18	N	27000	N	1000	N	0		0	
Terbufos	13071799	2.50E-05	H								0.91	N	0.091	N	0.034	N	51	N	2	N	0		0	
Terbutryn	886500	1.00E-03	I								37	N	3.7	N	1.4	N	2000	N	78	N	0		0	
1,2,4,5-Tetrachlorobenzene	95943	3.00E-04	I							x	1.8	N	1.1	N	0.41	N	610	N	23	N	91	N	0.69	N
1,1,1,2-Tetrachloroethane	630206	3.00E-02	I			2.60E-02	I	2.59E-02	I	x	0.41	C	0.24	C	0.12	C	220	C	25	C	0		0	
1,1,2,2-Tetrachloroethane	79345					2.00E-01	I	2.03E-01	I	x	0.052	C	0.031	C	0.016	C	29	C	3.2	C	0.4	E	0.001	E
Tetrachloroethylene (PCE)	127184	1.00E-02	I			5.20E-02	E	2.03E-03	E	x	1.1	C	3.1	C	0.061	C	110	C	12	C	11	E	0.04	E
2,3,4,6-Tetrachlorophenol	58902	3.00E-02	I								1100	N	110	N	41	N	61000	N	2300	N	0		0	
p,a,a,a-Tetrachlorotoluene	5216251					2.00E+01	H			x	0.00053	C	0.00031	C	0.00016	C	0.29	C	0.032	C	0		0	
Tetrachlorovinphos	961115	3.00E-02	I			2.40E-02	H				2.8	C	0.26	C	0.13	C	240	C	27	C	0		0	
Tetraethyldithiopyrophosphate	3689245	5.00E-04	I								18	N	1.8	N	0.68	N	1000	N	39	N	0		0	
Tetraethyl lead	78002	1.00E-07	I								0.0037	N	0.00037	N	0.00014	N	0.2	N	0.0078	N	0.00068	N	0.000034	N
1,1,1,2-Tetrafluoroethane	811972		I	2.29E+01						x	140000	N	84000	N	0		0		0		0		0	
Thallic oxide	1314325	7.00E-05	W								2.6	N	0.26	N	0.095	N	140	N	5.5	N	0		0	
Thallium	0										0		0		0		0		0		0		0.4	E
Thallium acetate	563688	9.00E-05	I								3.3	N	0.33	N	0.12	N	180	N	7	N	0		0	
Thallium carbonate	6533739	8.00E-05	I								2.9	N	0.29	N	0.11	N	160	N	6.3	N	0		0	
Thallium chloride	7791120	8.00E-05	I								2.9	N	0.29	N	0.11	N	160	N	6.3	N	0		0	
Thallium nitrate	10102451	9.00E-05	I								3.3	N	0.33	N	0.12	N	180	N	7	N	0		0	
Thallium selenite	12039520	9.00E-05	W								3.3	N	0.33	N	0.12	N	180	N	7	N	0		0	
Thallium sulfate	7446186	8.00E-05	I								2.9	N	0.29	N	0.11	N	160	N	6.3	N	0		0	
Thiobencarb	28249776	1.00E-02	I								370	N	37	N	14	N	20000	N	780	N	0		0	
2-(Thiocyanomethylthio)-benzothiazole	21564170	3.00E-02	H								1100	N	110	N	41	N	61000	N	2300	N	0		0	
Thiofanox	39196184	3.00E-04	H								11	N	1.1	N	0.41	N	610	N	23	N	0		0	
Thiophanate-methyl	23564058	8.00E-02	I								2900	N	290	N	110	N	160000	N	6300	N	0		0	
Thiram	137268	5.00E-03	I								180	N	18	N	6.8	N	10000	N	390	N	0		0	
Tin and compounds	0	6.00E-01	H								22000	N	2200	N	810	N	1000000	N	47000	N	0		0	
Toluene	108883	2.00E-01	I	1.14E-01	I					x	750	N	420	N	270	N	410000	N	16000	N	520	E	5	E
Toluene-2,4-diamine	95807					3.20E+00	H				0.021	C	0.002	C	0.00099	C	1.8	C	0.2	C	0		0	
Toluene-2,5-diamine	95705	6.00E-01	H								22000	N	2200	N	810	N	1000000	N	47000	N	0		0	
Toluene-2,6-diamine	823405	2.00E-01	H								7300	N	730	N	270	N	410000	N	16000	N	0		0	
p-Toluidine	106490					1.90E-01	H				0.35	C	0.033	C	0.017	C	30	C	3.4	C	0		0	
Toxaphene	8001352					1.10E+00	I	1.12E+00	I		0.061	C	0.0056	C	0.0029	C	5.2	C	0.58	C	5	E	0.04	E
Tralomethrin	66841256	7.50E-03	I								270	N	27	N	10	N	15000	N	590	N	0		0	
Triallate	2303175	1.30E-02	I								470	N	47	N	18	N	27000	N	1000	N	0		0	
Triasulfuron	82097505	1.00E-02	I								370	N	37	N	14	N	20000	N	780	N	0		0	
1,2,4-Tribromobenzene	615543	5.00E-03	I							x	30	N	18	N	6.8	N	10000	N	390	N	0		0	
Tributyltin oxide (TBTO)	56359	3.00E-05	I								1.1	N	0.11	N	0.041	N	61	N	2.3	N	0		0	
2,4,6-Trichloroaniline hydrochloride	33663502					2.90E-02	H				2.3	C	0.22	C	0.11	C	200	C	22	C	0		0	
2,4,6-Trichloroaniline	634935					3.40E-02	H				2	C	0.18	C	0.093	C	170	C	19	C	0		0	
1,2,4-Trichlorobenzene	120821	1.00E-02	I	5.71e-02	H					x	190	N	210	N	14	N	20000	N	780	N	240	E	2	E
**1,1,1-Trichloroethane	71556	3.50E-02	E	2.86E-01	W					x	790	N	1000	N	47	N	72000	N	2700	N	980	E	0.9	E
1,1,2-Trichloroethane	79005	4.00E-03	I			5.70E-02	I	5.60E-02	I	x	0.19	C	0.11	C	0.055	C	100	C	11	C	0.8	E	0.01	E
Trichloroethylene (TCE)	79016	6.00E-03	E			1.10E-02	W	6.00E-03	E	x	1.6	C	1	C	0.29	C	520	C	58	C	3	E	0.02	E
Trichlorofluoromethane	75694	3.00E-01	I	2.00E-01	A					x	1300	N	730	N	410	N	610000	N	23000	N	790	N	13	N
2,4,5-Trichlorophenol	95954	1.00E-01	I								3700	N	370	N	140	N	200000	N	7800	N	8200	S	120	E
2,4,6-Trichlorophenol	88062					1.10E-02	I	1.09E-02	I		6.1	C	0.57	C	0.29	C	520	C	58	C	150	C	0.06	E
2,4,5-Trichlorophenoxyacetic acid	93765	1.00E-02	I								370	N	37	N	14	N	20000	N	780	N	0		0	

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2-(2,4,5-Trichlorophenoxy)propionic ac	93721	8.00E-03	I								290	N	29	N	11	N	16000	N	630	N	0		0	
1,1,2-Trichloropropane	598776	5.00E-03	I						x		30	N	18	N	6.8	N	10000	N	390	N	13	N	0.14	N
1,2,3-Trichloropropane	96184	6.00E-03	I			7.00e+00	I		x		0.0015	C	0.00089	C	0.00045	C	0.82	C	0.091	C	0.000027	C	0.000006	C
1,2,3-Trichloropropene	96195	5.00E-03	H						x		30	N	18	N	6.8	N	10000	N	390	N	0		0	
1,1,2-Trichloro-1,2,2- trifluoroethane	76131	3.00E+01	I	8.57E+00	H				x		59000	N	31000	N	41000	N	1000000	N	1000000	N	2400	S	3100	N
Tridiphane	58138082	3.00E-03	I								110	N	11	N	4.1	N	6100	N	230	N	0		0	
Triethylamine	121448			2.00E-03	I						73	N	7.3	N	0		0		0		0		0	
Trifluralin	1582098	7.50E-03	I			7.70E-03	I				8.7	C	0.81	C	0.41	C	740	C	83	C	0		0	
1,2,4-Trimethylbenzene	95636	5.00e-02	E						x		300	N	180	N	68	N	100000	N	3900	N	0		0	
1,3,5-Trimethylbenzene	108678	5.00e-02	E						x		300	N	180	N	68	N	100000	N	3900	N	98	S	0.26	M
Trimethyl phosphate	512561					3.70E-02	H				1.8	C	0.17	C	0.085	C	150	C	17	C	0		0	
1,3,5-Trinitrobenzene	99354	5.00E-05	I								1.8	N	0.18	N	0.068	N	100	N	3.9	N	0		0	
Trinitrophenylmethylnitramine	479458	1.00E-02	H								370	N	37	N	14	N	20000	N	780	N	0		0	
2,4,6-Trinitrotoluene	118967	5.00E-04	I			3.00E-02	I				2.2	C	0.21	C	0.11	C	190	C	21	C	0		0	
Uranium (soluble salts)	7440611	3.00E-03	I								110	N	11	N	4.1	N	6100	N	230	N	0		0	
Vanadium	7440622	7.00E-03	H								260	N	26	N	9.5	N	14000	N	550	N	0		0	
Vanadium pentoxide	1314621	9.00E-03	I								330	N	33	N	12	N	18000	N	700	N	0		0	
Vanadium sulfate	36907423	2.00E-02	H								730	N	73	N	27	N	41000	N	1600	N	0		0	
Vernam	1929777	1.00E-03	I								37	N	3.7	N	1.4	N	2000	N	78	N	0		0	
Vinclozolin	50471448	2.50E-02	I								910	N	91	N	34	N	51000	N	2000	N	0		0	
Vinyl acetate	108054	1.00E+00	H	5.71E-02	I						37000	N	210	N	1400	N	1000000	N	78000	N	370	E	84	E
Vinyl bromide	593602			8.57E-04	I				x		5.2	N	3.1	N	0		0		0		2	N	0.018	N
Vinyl chloride	75014					1.90E+00	H	3.00E-01 H	x		0.019	C	0.021	C	0.0017	C	3	C	0.34	C	0.002	E	0.01	E
Warfarin	81812	3.00E-04	I								11	N	1.1	N	0.41	N	610	N	23	N	0.046	N	1800	N
m-Xylene	1.08E+05	2.00E+00	H	2.00E-01	W				x		1400	N	730	N	2700	N	1000000	N	160000	N	950	S	2.40E+02	M
o-Xylene	9.55E+04	2.00E+00	H	2.00E-01	W				x		1400	N	730	N	2700	N	1000000	N	160000	N	730	S	1.50E+02	M
p-Xylene	1.06E+05			8.57E-02	W				x		520	N	310	N	0		0		0		1000	S	2.20E+02	M
Xylene (mixed)	1.33E+06	2.00E+00	I						x		12000	N	7300	N	2700	N	1000000	N	160000	N	320	E	7.40E+01	E
Zinc	7.44E+06	3.00E-01	I								11000	N	1100	N	410	N	610000	N	23000	N	0		4.20E+04	E
Zinc phosphide	1.31E+06	3.00E-04	I								11	N	1.1	N	0.41	N	610	N	23	N	0		0.00E+00	
Zineb	1.21E+07	5.00E-02	I								1800	N	180	N	68	N	100000	N	3900	N	0		0.00E+00	

APPENDIX E-2-3

POLU13L COMBUSTION PRODUCTS MODEL AND HEAT CONTENT CALCULATIONS

POLU13L COMBUSTION PRODUCTS MODEL

THE POLU13L PROGRAM

By Edward E. Baroody

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II PROGRAM IDENTIFICATION---

POLU13L MODEL - APRIL, 1994--- PC VERSION

BY EDWARD E. BAROODY--NAVAL SURFACE WARFARE CENTER, INDIAN HEAD MD. 20640
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****

III BACKGROUND---

This program is an update of the original POLU10 computer modeling published by the Ordnance Environmental Support Office (OESO)(1). Several modifications of this program are already in use under the titles of POLU13A, POLU13G, etc. This one should add to the confusion. After several years of use and feedback from many users, additional features have been added to the program. There are examples of batch files included for each of these different calculations. These different features are described in the section under "TYPES OF CALCULATIONS".

There are other features planned for the program. Additional combustion species are now being complied that will be added to the species' library, including a number of metallic species.

****

IV GETTING STARTED---

Don't get upset by the documentation and files in this program. It is designed to be user friendly. You don't need to know all of the files to use the program. The "*.IN" and "*.OUT" files are example files to check out the program and as an aid to running the various options. The "F77L3.*" files are used to run the program so you can forget about them. Just make sure they are transferred to the hard drive. Unless you are into upgrading the ingredients' files, you won't have to worry about files "PEPLIBPC.FOR", "INGREDPC.DAT", "INGNUMB.DAT", "INGCODE2.DAT", or "INGCODE1.DAT". There is probably someone in your office that will want to play with these files to confuse you.

Follow the instructions in the "TO SET UP" and "TO MAKE A TRIAL RUN AND TEST" sections to make sure that the output file "POLU13L.OUT" calculated from these instructions agrees with file "POL13LT.OUT". The file

"IDENDATA.DOC" identifies and explains the output data. If this works, go t
the section "EXPLANATION OF HOW TO INPUT DATA TO RUN POLU13L (BATCH AND ME
DRIVEN)" and run through at least the first exercise (No. 1---Running POLU13L
by Batch Method---). The input data are also menu driven. I recommend that
you use the batch method of putting in the data. Read the explanation of the
file "INGNUMB.DAT" and get a hard copy of it. Later, read or print a copy of
"EXPLOSIV.ILS", and "EXPLOSIV.ULS" for an explanation of the abbreviations
and the references to the ingredients' data.
****

V TO SET UP---
Insert the 3.5" disks into drive A and copy to the computer's hard drive.
****

VI TO MAKE TRIAL RUN AND TEST---
1. ENTER ---POLU13L<POLU13L.IN ---AND RETURN
2. OUTPUT DATA ARE IN FILE "POLU13L.OUT".
3. IF THINGS RAN CORRECTLY, "POLU13L.OUT" IS THE SAME AS "POL13LT.OUT".
****

VII TYPES OF CALCULATIONS---
1.) BURN/OPEN DETONATION (OB/OD)---These are the two original types of calculations the POLU10 and its updates use. These options are used to burn or detonate materials in open fields. There functions are explain in the original report(1).

2.) UNDERGROUND DETONATION---There have been several request for this ty of calculation, which is ran under the following conditions:

a.) The energetic materials are buried underground and the force of the detonation is absorbed by the ground.

b.) The explosive force of the buried energetic materials exerts a maximum amount of work against the underground hole.

c.) The temperature of the combustion gases that emerge from the ground is lower than the maximum temperature of the materials when detonated above ground.

The program computes a "TOTAL HEAT RELEASED, HEAT LOST (DUE TO WORK AGAINST THE GROUND) and RESIDUAL HEAT." The calculated residual heat in the gases emerging from the ground is the energy recommended for dispersion modeling in the atmosphere. The theory for this type of calculation is based on the report published by NSWC/IH(2).

The batch file "UGROUND.IN" is an example of this type of calculation. The output data will be in file "UGROUND.OUT". This file should agree with the enclosed file "UGROUNDT.OUT". These files show only one calculation, not a series of 10 that is normally done in OB/OD calculations. This is because of the energy loses and the low temperatures of the emerging gases under these conditions. It is unlikely that the gases emerging from the ground will be hot enough to react with the air. For dispersion modeling, the best case scenario would be to use the gases as calculated emerging from the ground and the "RESIDUAL HEAT" calculated for these runs.

Copy the file "UGROUND.IN" to another batch file name and change the data to the calculation for your energetic material. It is easier to change data in a batch file with the same format than to start a completely n batch file.

There are circumstances where the underground explosions do not exert a maximum amount of work against the hole(such as partially buried explosives). Under such conditions, the program can still calculate an approximation for

these conditions. Again the theory is based on how much energy is lost due to work against the ground or environment and the temperature drop of the gases. These two factors greatly influence the combustion products formed and the residual heat available for dispersion model programs. If the conditions will not allow maximum work against the dirt or environment, then the following calculations can be tried:

Keep the chamber pressure at 1000 psi and change the exhaust pressure. One or more of the exhaust pressures might be used in Table I. When the exhaust pressures are raised, the program calculates less energy as doing work against the environment. If the chamber pressure is held at 1000 psi and the exhaust pressure is changed from 0.0017 psi to 0.17 psi, the calculations show less energy going to work against the environment. At 0.17 psi the combustion products will have a higher temperature and the residual energy would be higher. The difficult part in these calculations is to estimate the energy lost against the environment. A range of residual heats can be calculated by changing the exhaust pressures as shown in Table I. The file "UGROUND.IN" uses 0.0017 psi for maximum work against the ground.

Table I

chamber pressure(psi)	Exhaust pressure (psi)
1000.	0.017
1000.	0.17
1000.	1.70
1000.	2.0
1000.	3.0
1000.	etc.

3.) SPILLS---This option calculates the combustion products when there are spills of chemicals (For energetic materials use the open burn (OB) calculation for these conditions.) on the ground, storage tank eruptions, highway accidents, etc. These would be circumstances where there are fuels or chemicals burning, but not detonating. The main thing to consider, is that the chemicals have an insufficient amount of air present to completely burn the spilled chemicals. Therefore, the calculations would be done with very small percentages of air compared to the material. Some rules of the thumb are as follows:

(1.) Minimum air to burn the material-- For a large chemical spill burning, the worst case scenario would probably be a fire with a minimum amount of air reacting with the chemicals.

(2.) The SPILL1T.OUT file shows a series of calculations going up to 10% hexane/90%air. It is uncertain how realistic the calculations are with this lower percent of hexane. Notice how the methane concentration does not change drastically up to 60%hexane/40% ratio. If there is any information as to the approximation of the flame temperature for any particular chemical burning in air, then the fuel/air ratio could be adjusted (through trial and error) until this temperature is reached. This should be a good estimation of the combustion products for a spill. Interestingly, more solid carbon is formed as the air increases.

(3.) Unless there is supporting data or circumstances to suggest otherwise, the material/air wt. ratios probably should be kept below 80% material/20%air.

(4.) HEAT OF DETONATION---This calculation is based on reference (2). The heat of detonation is assumed to be the maximum amount of energy released when the energetic materials is detonated and the combustion gases are working against the environment. The file "HDET.IN" and "HDETT.OUT" are

examples of this type of calculation.

(5.) HEAT OF EXPLOSION---The heat of explosion is based on the energy released when the energetic materials, or other compounds, are ignited in an inert atmosphere of helium, or other inert gases. Normally, the materials are placed in a calorimeter, pressurized with an inert gas to approximately 450 psi and ignited (not detonated) by a hot wire. The heat released is referred to as the heat of explosion. This is not the same as a heat of detonation described above. The two heats are calculated differently by the program. The files "HOE.IN" and "HOET.OUT" are examples of these types of calculations.

(6.) HEAT OF COMBUSTION---This type of combustion refers to materials that are burned in pure oxygen. Do not confuse this calculation with any of the others described above. Normally, the experimental data from a heat of combustion are determined in a calorimeter under pressures of approx. 450 psi of oxygen. These data are used to determine the heats of formation of compounds. Unless you have experience with calorimeters or an idea of what the combustion products are, it is recommended that you use this option only for compounds with the elements Carbon, Hydrogen, Oxygen & Nitrogen (CHON compounds. All four elements do not have to be in the compound). As the percentage of oxygen is added to the compound in your calculations, all of the carbon will eventually be oxidized to carbon dioxide, the hydrogen to water and the nitrogen to nitrogen gas. At this point of the material/oxygen weight ratio, the compound has been completely oxidized and the highest energy released from the oxidation of the compound in oxygen has been obtained. The compounds burned in pure oxygen assures that all of the carb is completely burned to carbon dioxide, the hydrogen to water and t nitrogen to gas. The products of combustion must be known before the heat of formation of a compound can be determined. Burning the compound in pressurized oxygen is a good way to determine well defined final products.

Many of the experimentally determined heats of formation of the CHON compounds in the "INGNUMB.DAT" file were determined by calorimetry. (This is true for the first part of the "INGNUMB.DAT" file determined at NSWC/IH as I personally had a hand in most of the experimentally determined heats of formation reported from NSWC/IH) (REFS. 3, 4, 5 & 6). The heats of combustion determined with POLU13L using this option should be very close to the values obtained from actual experimental data from a calorimeter. For CHON compounds the heats of combustion from this option should serve as a check for experimentally determined data. The files "HCOMB1.IN, HCOMB1A.IN, HCOMB1T.OUT & HCOMB1AT.OUT, HCOMB2.IN, HCOMB2A.IN, HCOMB2T.OUT, and HCOMB2AT.OUT" are examples of this option.

The heat of combustion is sometimes used as an estimation of energy released from heating fuels, jet fuels, or other materials burned in air with the assumption that there is complete oxidation of the materials with oxygen. Such complete oxidations with oxygen from the air are difficult to obtain. If you are going to do a calculation with oxygen from air, use a large percentage of air with the "Open Burn" above.

(6.) MOTOR---To estimate the combustion in a gasoline motor, do a series of calculations with gasoline and air. Hexane, octane or a similar hydrocarbon can be used as an estimation. A large percentage of air needed for these calculations. File "MOTOR.IN" has been run with the outp data in file "MOTORT.OUT" with the following in the "Open Burn" option: %Hexane/%air ratios 9/91, 8/92, 7/93, 6/94, 5/94, 4/96, 3/97, 2/98, 1/99 (the fuel/air wt. ratio should be in this range for good combustion). If the

exact pressures in the motor's chamber and the exhaust are known, substitute the pressure of the motor's chamber for the 1000 psi and the pressure at the motor's exhaust for the 14.7 psi. This will give better results for the internal combustion in the engine.

(7.) INCEN1---DETERMINING AIR/MATERIAL RATIOS TO MEET INCINERATOR

Numerous request have been made to determine the combustion products in incinerators. The materials can be energetic or non-energetic, such as solvents. Basically, the difference between these types of calculations and a simple "OPEN BURN" calculation is the air/material weight ratios that are used in the calculations. The files "INCEN1.IN" and "INCEN1T.OUT" using ethanol are examples of this type of calculation. In "OPEN BURN" in an open field, the high ratio of air/material cannot be obtained as when the air is forced into the incinerator. Under such circumstances, ratios of air/material can be high such as 10 to 99 as shown in "INCEN1T.OUT". Simply knowing the air/material ratio, the POLU13L program can be used to calculate the combustion products from a incinerator. If the pressures inside the incinerator and the combustion products exhaust to the outside are known, they can be used instead of 1000 psi,and 14.7 psi.For example if the pressure in the incinerator is known to be 300 psi and exhaust to 40 psi, before it goes to the outside, substitute 300 for 1000 and 40 for 14.7 psi. Otherwise the 1000 psi and 14.7 psi should be close enough.

Temperature---POLU13L can be used to determine the correct air/ material ratio if a definite temperature is desired in the incinerator. Assume the air/material ratio must be known to run the incinerator at 1500 K.

(a.)Firstly, run a trial series of calculations with different air/material ratios. In the "INCEN1T.OUT" file, the series of runs show that the air/ material ratios at 94/6 and 95/5 have flame temperatures of 1609.609 K & 1422.95 K respectively.

(b.) If the air/material ratio at the temperature of 1500 K is needed, then vary the ratio, to say 94.5/5.5 air/material, that would calculate a flame temperature to approx. 1500 K. Several trial and error runs will enable you to "box-in" the proper ratio.

(8.) INCEN2---DETERMINING AIR/MATERIAL/WATER RATIOS FOR INCINERATORS---
There have been request to meet the following conditions:

(1.) Determine the air/material weight ratio to obtain a certain temperature in the incinerator.

(2.) After (1.) has been completed: (a) determine how much water must be added to lower the incinerator temperature to a certain temperature, (b) determine the products formed.

This problem can be solved by doing a series of calculations. For example, assume that an AIR/TNT wt. ratio is needed for the incinerator flame temperature to be 2500 K, before mixing with water in the incinerator.

Step 1---Do a series of AIR/TNT wt. ratio runs to obtain a flame temperature of 2450 K. This is done by trial and error by simply changing the AIR/TNT ratio. In file "POL13LT.OUT" the 60%AIR/40%TNT ratio has a flame temperature of 2453.812 K (close enough for this example).

Step 2--- Add water to this 60%AIR/40%TNT ratio formulation to get the desired lower temperature. This was done in file "INCEN2T.OUT". In this file, the calculations start out with 40% TNT, 60% AIR, 0% WATER. Notice that the flame temperature in the first row, 0% LAST INGREDIENT/100% MATERIAL, is 2453.812 K, the same as the 60%AIR/40%TNT ratio in file "POL13LT.OUT". The MATERIAL BURNED in "INCEN2T.OUT" is composed of 40% TNT and 60% AIR. Air is being treated as an ingredient in the material and WATER as the oxidizer.

If the final desired temperature of the AIR, TNT and WATER is 1229.42[illegible] K, then the proper weights of the three components (AIR, TNT and WATER) wou[illegible] be as follows:

WT. OF MATERIAL FROM FILE "INCEN2T.OUT" IS 70 MATERIAL AND WATER 30 OR THE PERCENTAGES OF TNT, AIR AND WATER TO MIX IN THE INCINERATOR IS:

%TNT	=	.40 X 70	=	28
%AIR	=	.60 X 70	=	42
%WATER =			=	30
TOTAL			=	100

By combining air with the energetic materials and using water in the "oxidizer" position of the POLU13L program (which is the last ingredient entered into the calculations) trial and error calculations can be computed to get the desired flame temperatures, ratios of material, air and water and other data. I (or someone) hope to automate these types of features in future modifications of the program .

****

VIII ENERGY OUTPUT FOR DISPERSION MODELS---

CAUTION: (1)---Do not use the data from the calculations in the rows "Enthalpy kcal/gfw" calculated in the output files for dispersion models' calculations. Use "total heat released or residual heat" as explained below.

(2)---When the materials contain high percentages of sever[illegible] metals, the energy values calculated by the program (TOTAL HEAT RELEASE HOE, HEATS OF DETONATION AND EXPLOSION, RESIDUAL) are questionable. One reason is that the species' library does not contain all of the possible species of combustion from such a variety of metals.

The main improvement over the previous POLU programs is the calculation of the energy released to be used for dispersion models. The program is designed to calculate the heat released for the energetic materials or with mixtures of air or oxygen. The energy released are discussed for the following conditions:

(1.) OPEN BURN---An example of energy released for dispersion models is the row "TOTAL HEAT RELEASED*" in file "POL13LT.OUT". As the footnote states:

*THE TOTAL HEAT RELEASED, IN CAL/GR AT STP, IN EACH COLUMN IS FOR 100 GRAMS OF MATERIAL BURNED OR DETONATED, NOT THE MATERIAL WT.LISTED IN "WT. MATERIAL" ROW. USE THESE VALUES IN DISPERSION MODELS.

These values are for the energy released when the material, TNT, is burned and the products given in the column are formed. Both the TNT, AIR, and these products are at standard temperature (298K) and pressure (1 atmosphere). The 765.512 cal/gr in the 100% MATERIAL/0% AIR is the heat released in cal/gram for TNT burned alone without the presence of air at STP.

Notice the TOTAL HEAT RELEASED value of 3573.08 cal/gram in the 20% WT. MATERIAL/80% WT. AIR column. This is not the energy released for this TNT/AIR wt. ratio, but the energy released at STP when one gram of TNT is burned in a 20%TNT/80%AIR wt. ratio.

Another way to explain this value is for a calculation based on [illegible] grams of TNT and AIR in the reaction where 20 grams of TNT reacts with 80 grams of air. In this case the TOTAL HEAT RELEASED would be 357308.0 cal per 100 grams of TNT burned at this 20%TNT/80%AIR wt. ratio, not for 20 grams of

TNT. The values for the TOTAL HEAT RELEASED are based on one gram of material burned. Thus the values in this row can be directly compared with the same units.

When the TOTAL HEAT RELEASED is calculated for 100% of just the material in the OPEN BURN option, it is the same as an heat of explosion as calculated by the POLU13L PROGRAM. Compare this value to the TOTAL HEAT RELEASED in the "HOET.OUT" file. Notice that the 765.512 cal/gr value is the same when calculating the HOE for an energetic material.

(2.) OPEN DETONATION---An example of energy released for dispersion models is the row "TOTAL HEAT RELEASED*" in file "NG13L1T.OUT". As the footnote states:
*THE TOTAL HEAT RELEASED, IN CAL/GR AT STP, IN EACH COLUMN IS FOR 100 GRAMS OF MATERIAL BURNED OR DETONATED, NOT THE MATERIAL WT.LISTED IN "WT. MATERIAL" ROW. USE THESE VALUES IN DISPERSION MODELS.

These values are for the energy released when the material, NG, is burned and the products given in the columns are formed. The NG, AIR and these products are at standard temperature (298K) and pressure (1 atmosphere). The value 835.393 cal/gr in the 100%WT.MATERIAL/0% WT.AIR is the heat released in cal/gram for NG burned alone or without the presence of air at STP. Compare this value of 835.393 cal/gr with the 100%WT. MATERIAL/0% WT.AIR column in the file "NG13L2T.OUT" (an OPEN BURN CALCULATION), 1556.679 cal/gr, which is larger. The reason is, that the OPEN DETONATION calculation accounts for the loss in shock wave energy that is assumed to leave the detonation gases before these gases react with air.

(3.) UGROUND DETONATION---The "UGROUNDT.OUT" file is an example of this type of calculation. There are three rows to explain the energy released from this type of calculation: (1.) TOTAL HEAT RELEASED (2.) HEAT LOST (3.) RESIDUAL HEAT.

(a.) TOTAL HEAT RELEASED---Energy in cal/gr at STP. This is the calculated "heat of detonation" for this material. The detonation is assumed to occur without air. It is the amount of energy available to work against the ground in a confined underground detonation. The final temperature of the products formed in most cases under these conditions would probably be below the "frozen temperature" of the gases. Therefore the composition of the gases would "freeze" or remain the same as they approach ambient temperature. Probably the best scenario is to assume that the gaseous compositions will not change when they come to the surface. The temperature of these gases would be so low that little reaction would occur (with some exceptions, nitric oxide, HCl, etc.) with the air.

(b.) HEAT LOST---(CAL/GR) AT STP---This is the amount of energy assumed lost due to work against the ground.

(c.) RESIDUAL HEAT---(CAL/GR) AT STP---This is the energy left in the gases or total heat minus the heat lost after an underground detonation. Use this energy in dispersion models for gases leaving the ground.

The "TOTAL HEAT RELEASED" is first calculated. It is assumed that when the combustion gases work against the dirt underground, part of the "TOTAL HEAT RELEASED" is lost (listed as "HEAT LOST"). The difference between these two values ("TOTAL HEAT RELEASED" MINUS "HEAT LOST")is the "RESIDUAL HEAT" that leaves the hole with the combustion gases. The RESIDUAL HEAT is the energy to use for dispersion model calculations when the combustion gases are mixed with the air.

(4.) HOE---An example of energy released is the row "TOTAL HEAT

RELEASED*" in file "HOET.OUT". As the footnote states:
*THE TOTAL HEAT RELEASED---IN CAL/GR AT STP. THIS IS THE MAXIMUM HEAT
EXPLOSION OF THE MATERIAL WHEN IT BURNS IN THE ABSENCE OF AIR.
This option was added to calculate the heat of explosion of energetic materials would release if burned in a calorimeter.

(5.) HDET---An example of energy released is the row "TOTAL HEAT RELEASED*" in file "HDETT.OUT". As the footnote states:
*THE TOTAL HEAT RELEASED---IN CAL/GR AT STP. THIS IS THE MAXIMUM HEAT OF DETONATION OF THE MATERIAL WHEN IT DETONATES IN THE ABSENCE OF AIR.
This option was added to calculate the maximum heat of detonation of energetic materials as explained in ref.(2). The energy from this type of calculation is NOT used in dispersion models. The heat for dispersion models is calculated using the OPEN DETONATION option. The "HDET" is used to calculate the maximum heat of detonation for energetic materials mainly as comparison values to other energetic materials.
****

IX EXAMPLES OF INPUT BATCH FILES---
When running batch files, copy the type of file that fits your calculations and modify the copied file with the ingredients, etc. for your run. Since the calculations have the same format, this saves a lot of time.

POLU13L.IN ---This file is set to do an OPEN BURN calculation. The ingredients (TNT and AIR, numbers 890 and 15 in file "INGNUMB.DAT") are read from "INFILE.11". The output file will be "POLU13L.OUT", which should be a duplicate of "POL13LT.OUT". The input data are explained below. The file al does an OPEN DETONATION calculation by changing Line 3 of the data fr 1,3,2,0,10,2,1,1 to 1,3,2,0, 10,1,1,1.

POLU13L2.IN---This file is set to do an OPEN BURN calculation. TNT thermal data are read in directly and AIR is read in by the code number 15. This file shows how data can be read in both directly and from code numbers in "INGNUMB.DAT". The output file will be "POLU13L2.OUT" which should be a duplicate of "POL13L2T.OUT". The file also does an OPEN DETONATION calculation by changing Line 3 of the data from 1,3,1,1,10,2,1,1 to 1,3,1,1,10,1,1,1.

POLU13L3.IN---This file is set to do an OPEN BURN calculation. TNT and AIR thermal data are read in directly as non-coded date. The input data are not read by coded numbers from file "INGNUMB DAT". The output file will be "POLU13L3.OUT", which should be a duplicate of "POL13L3T.OUT".. The file also does an OPEN DETONATION calculation by changing Line 3 of the data from 1,3,0,2,10,2,1,1 to 1,3,0,2,10,1,1,1.

NG13L1.IN---This is an OPEN DETONATION calculation. NG and AIR thermal data are read in directly by coded numbers from file "INGNUMB.DAT". The output file will be "NG13L1.OUT", which should be a duplicate of "NG13L1T.OUT".

NG13L2.IN---The is an OPEN BURN calculation. NG and AIR thermal data are read in directly by coded numbers from the file "INGNUMB.DAT". The output file will be "NG13L2.OUT", which should be a duplicate of "NG13L2T.OUT"..

TNT25.IN---The program also does an OPEN BURN calculation. TNT thermal dat are read in directly and by the code number 890 (AIR is read in by code number 15). This file shows how data can be read in both directly and from

code numbers in "INGNUMB.DAT". Also, it demonstrates that the program can handle 25 input ingredients. The output file will be "TNT25.OUT", which should be a duplicate of "TNT25T.OUT"..

UGROUND.IN---This is an example of an "Underground Detonation" as explained in the section "TYPES OF CALCULATIONS". The output file will be "UGROUND.OUT", which should be a duplicate of "UGROUNDT.OUT.

HOE.IN---This is an example of an "Heat of Explosion" as explained in the section "TYPES OF CALCULATIONS". The output file will be "HOE.OUT", which should be a duplicate of "HOET.OUT".

HDET.IN---This is an example of an "Heat of Detonation" as explained in the section "TYPES OF CALCULATIONS". The output file will be "HDET.OUT".

SPILL1.IN---This is an example of a "Spills" as explained in the section "TYPES OF CALCULATIONS". The output file will be "SPILL1.OUT", which should ba a duplicate of "SPILL1T.OUT"..

MOTOR.IN---This is an example of a MOTOR calculation as explained in the section "TYPES OF CALCULATIONS". The output file will be "MOTOR.OUT", which should be a duplicate of "MOTORT.OUT".

INCEN1.IN---This is an example of a INCEN1 calculation as explained in the section "TYPES OF CALCULATIONS". The output file will be "INCEN1.OUT", which should be a duplicate of "INCEN1T.OUT".

INCEN2.IN---This is an example of a INCEN2 calculation as explained in the section "TYPES OF CALCULATIONS". The output file will be "INCEN2.OUT", which should be a duplicate of "INCEN2T.OUT".

HCOMB1.IN---This is an example of an "heat of combustion" as explained in the section "TYPES OF CALCULATIONS". The percentage changes in oxygen are 0.,10.,20.,30.,40.,50.,60.,70.,80.,90. These are the estimated percentages to get the heat of combustion to where all carbon, hydrogen and nitrogen in TNT goes to carbon dioxide, water, and nitrogen gas. At the 20%TNT/80%Oxygen ratio, the heat of combustion is 3572.906 cal/gram. The heat of combustion determined experimentally at NSWC/IH was 3581 cal/gram. "HCOMB1.IN" can be used in conjunction with file "HCOMB1A.IN" where the percentages of the oxygen is varied 70.,71.,72.,73.,74.,75.,76.,77., 78.,79. for a more accurate percentage of the TNT/oxygen ratio to determine where all of the carbon, hydrogen, and nitrogen go completely to carbon dioxide, water, and nitrogen gas. The output file will be "HCOMB1.OUT", which should be a duplicate of "HCOMB1T.OUT".

HCOMB1A.IN--- Used in conjunction with file "HCOMB1.IN", this file helps determine where all of the carbon, hydrogen, and nitrogen burn completely to carbon dioxide, hydrogen, and nitrogen gas for TNT to calculate a more accurate value for the heat of combustion of TNT. The output file will be "HCOMB1A.OUT, which should be a duplicate of "HCOMB1AT.OUT".

HCOMB2.IN---This is an example of an "heat of combustion" as explained in the section "TYPES OF CALCULATIONS". The percentage changes in oxygen are 0.,10.,20.,30.,40.,50.,60.,70.,80.,90. These are the estimated percentages to get the heat of combustion to where all carbon, hydrogen and nitrogen in NG

goes to carbon dioxide, water, and nitrogen gas. At the 50 %NG/50%Oxyge ratio, the heat of combustion is 1594.933 cal/gram. The heat of combusti determined experimentally (2) was 1590 cal/gram. "HCOMB2.IN" can be used in conjunction with file "HCOMB2A.IN" where the percentages of the oxygen is varied 20.,21.,22.,23.,24.,25.,26.,27.,28.,29. For a more accurate percentage of the NG/oxygen ratio to determine where all carbon, hydrogen and nitrogen in NG goes to carbon dioxide, water, and nitrogen gas. The output file will be "HCOMB2.OUT, which should be a duplicate of "HCOMB2T.OUT".

HCOMB2A.IN--- Used in conjunction with file "HCOMB2.IN", this file helps determine where all carbon, hydrogen and nitrogen in NG goes to carbon dioxide, water, and nitrogen gas to calculate a more accurate value for the heat of combustion of NG. The output file will be "HCOMB2A.OUT, which should be a duplicate of "HCOMB2AT.OUT".
****

X EXAMPLES OF OUTPUT FILES---

The files below are examples of how the output data will look when ran from the "*.IN" files as explained above. These files are used to check out the program.

POL13LT.OUT---Used for testing. When the file "POLU13L.IN" is ran, the output data will be in file "POLU13L.OUT". It should be the same as "POL13LT.OUT".

POL13L2T.OUT---Used for testing. When the file "POLU13L2.IN" is ran, the output data will be in file "POLU13L2.OUT". It should be the same as "POL13LT2.OUT".

POL13L3T.OUT---Used for testing. When the file "POLU13L3.IN" is ran, the output data will be in file "POLU13L3.OUT". It should be the same as " P O L 1 3 L 3 T . O U T " .

"*T.OUT"---These remaining files correspond to the same names as the "*.in" files described above and are used to test the program.

XI IDENTIFICATION AND EXPLANATION OF FILES TO RUN POLU13L---

STARTUP---Directs the new user to DOSREAD.ME or WPREAD.ME files to explain POLU13L.

DOSREAD.ME---Documentation on explanation, files, setup, how to run, input data files, etc. to run POLU13l. Written in DOS Text.

WPREAD.ME---Documentation on explanation, files, setup, how to run, input data files, etc. to run POLU13l. Written in WORD PERFECT Text.

F77L3 ---File from LAHEY Computer Systems (Fortran) used to run program.

F77L3.FIX---File from LAHEY Computer Systems (Fortran) used to run program.

F77L3.FIG---File from LAHEY Computer Systems (Fortran) used to run program.

F77L3.LIB---File from LAHEY Computer Systems (Fortran) used to run progra

F77L3.CER---File from LAHEY Computer Systems (Fortran) used to run program.

F77L3.EER---File from LAHEY Computer Systems (Fortran) used to run program.

F77L3.EXE---File from LAHEY Computer Systems (Fortran) used to run program.

POLU13L.FOR--- This is the source file for the POLU13L MODEL.

POLSIZEK.INC---An "INCLUDE" file used in POLU13L.FOR.

POL13K1.INC---An "INCLUDE" file used in POLU13L.FOR.

POL13K2.INC---An "INCLUDE" file used in POLU13L.FOR.

POLCHARA.INC---An "INCLUDE" file used in POLU13L.FOR.

LAHEY.INC---An "INCLUDE" file used in POLU13L.FOR.

POLU13L.EXE---Executable form of POLU13L.FOR.

IDENDATA.DOC---Explanation of data in "*.OUT" files from POLU13L. Written in DOS TEXT.

WPDENDAT.DOC---Explanation of data in "*.OUT" files from POLU13L. Written in WORD PERFECT TEXT.

IDENSPEC.DOC---Identifies some of the combustion species by name in the output files. Written in DOS TEXT.

INFILE.12--- This is a binary auxiliary data file read in the main "POLU13L.EXE" program on unit 12. It contains thermodynamic data for the combustion products. This data came from JANNAF thermochemical tables.

INFILE.11--- ASCII form of the ingredients file. This file contains the data for most of the ingredients for the propellants and explosives that are used today. This is further explained under the file "PEPLIBPC.FOR". These data are read in the main "POLU13L.EXE" program from unit 11.

INGNUMB.DAT--- It lists the ingredients available in the ingredient's data library or "INFILE.11". Each ingredient has a number in front of it. When these numbers are assigned to input data files, the program automatically calls in the data for these ingredients. This saves the user the trouble of putting in these data every run. As explained below, ingredients not in this file can be read in directly.

EXPLOSIVE.ILS---This file helps explain the abbreviations in file "INGNUM.DAT" for the data listed by E.E. Baroody, NSWC/IH only. Not all of the abbreviations are given. The references for many of the ingredients are listed. This file is used in conjunction with file "EXPLOSIVE.ULS".

EXPLOSIVE.ULS---This file helps explain the abbreviations in file "INGNUM,DAT" for the data listed by E.E. Baroody, NSWC/IH only. Not all of the abbreviations are given. The references for many of the ingredients are listed. This file is used in conjunction with file "EXPLOSIVE.ILS".

PEPLIBPC.FOR--- This is a source file. This program reformats the ingredients data to run in POLU13L.EXE. The ingredients' data are in two formats, NSWC/IH and NWC(China Lake). To make use of the data from both

facilities, this program reformats the data into one format for POLU13L.EXF Much of the data from these two sources are duplicated, but it is helpful comparing ingredients data from other sources. These data are in PEPLIBPC.EXE--- The executable form of PEPLIBPC.FOR. "INGREDPC.DAT" is the input file for this program.

INGREDPC.DAT--- This file contains ingredients' data from both NSWC/IH and NWC(China Lake). The two different formats used by these two facilities are reformatted by "PEPLIBPC.EXE" to run in POLU13L.EXE. This is the input file for PEPLIBPC.EXE. The column numbers below is how the ingredients data are put into this file. Simply make sure any new ingredients data are in the same columns as the data already in this file. If necessary, the "READ and WRITE" statements of this program can be modified to reformat other data to run with POLU13L.

COLUMN NOS.	
1-20	--INGREDIENT NAME-up to 20 characters.
21-27	--HEAT OF FORMATION-under H field,in cal/g, add dec. pt.
28-32	--DENSITY-under D field,in lbs/cu.in., fill field with zeros if necessary, no dec. pt.
33-38	--NO. OF ATOMS OF 1ST ELEMENT-under "a" field, add dec.pt.
39-40	-- 1ST ELEMENT SYMBOLS-under S field, up to 6, left adjust.
41-46	--NO. OF ATOMS OF 2ND ELEMENT-under "a" field, add dec.pt.
47-48	-- 2ND ELEMENT SYMBOLS-under S field, up to 6, left adjust.
49-54	--NO. OF ATOMS OF 3RD ELEMENT-under "a" field, add dec.pt.
55-56	-- 3RD ELEMENT SYMBOLS-under S field, up to 6, left adjust.
57-62	--NO. OF ATOMS OF 4TH ELEMENT-under "a" field, add dec.pt.
63-64	-- 4TH ELEMENT SYMBOLS-under S field, up to 6, left adjust.
65-70	--NO. OF ATOMS OF 5TH ELEMENT-under "a" field, add dec.pt.
71-72	-- 5TH ELEMENT SYMBOLS-under S field, up to 6, left adjust.
73-78	--NO. OF ATOMS OF 6TH ELEMENT-under "a" field, add dec.pt.
79-80	-- 6TH ELEMENT SYMBOLS-under S field, up to 6, left adjust.

EXAMPLE:

```
TNT                  -78.   05980    7.C     5.H     3.N     6.O
NAME(20 CHAR)        HHHHHHHDDDDDaaaaaaSSaaaaaaSSaaaaaaSSaaaaaaSSaaaaaaSSaa
```

INGCODE2.DAT--- When PEPLIBPC.EXE runs correctly, this is one of two output files from the program. The ingredients' data in this file are now in the proper format to be used by POLU13L.EXE. This file must be renamed "INFILE.11" to be recognized by POLU13L.EXE.

INGCODE1.DAT--- This is the second output file from PEPLIBPC.EXE. It is the same as INGCODE2.DAT except that the ingredients have been numbered to be used by the user in setting up input files. This file has been renamed "INGNUMB.DAT".

****

XII EXPLANATION OF HOW TO INPUT DATA TO RUN POLU13L (BATCH AND MENU DRIVEN)-

NOTE:The data for the "lines" and "prompts" of the batch and menu driven methods are the same. It is recommended in the best of circles that yo learn the batch method. It saves a lot of time and less chances f mistakes. Also, you save your input files for future references, which yo will find very valuable.

NO. 1---RUNNING POLU13L BY BATCH METHOD---

CREATE A BATCH FILE CALLED "TEST13L.IN". THE INPUT DATA GOES INTO THIS FILE BY LINES AS DESCRIBED BELOW. (NOTE: "INGNUMB.DAT" AND "INGNUM.DAT" ARE THE SAME FILES.)
LINE 1---TYPE IN OUTPUT FILE NAME (DEFAULT: POLU.OUT)
EXAMPLE: TEST13L.OUT
LINE 2---TITLE OF RUN
EXAMPLE: TNT/AIR-TIME, DATE
LINE 3--- Enter data below on one line separated by commas. No decimal points.

1---Pressure units--1 = lb/sq. inch, 2 = atmospheres.
2---Round-off--Controls the decimal place of the output data.--
0= 1xE-5, 1 = 1xE-10, 2 = 1xE-17, 3 = 1xE-4, 4 = 1xE-25, 5 = 1x E-3, 6 = 1xE-2.
3---No. of coded Ingred.--enter number of coded ingredients in calculations from file "ingnum.dat". Air (or oxygen) must be included as another ingredient.
(NOTE: Our example will use two ingredients, TNT and AIR)
4---No. of non-coded ingred.--enter number of non-coded ingredients not in file "ingnumb.dat". (NOTE: All thermal data for TNT and AIR will come from "ingnumb.dat",so this is zero.)
5---No. of runs--enter number of runs or calculations.
6---Open detonation/open burn(OD/OB)--1 = open detonation 2 = open burn.
7---Units of output data--1 = units in grams products per 100 grams propellant, 3 = units in grams products per liter of gases (at STP), 2 = prints both units of 1 and 3.
8---Conditions--Set No. 6 =1 for normal open burn/open detonation run

Set No. 6 (OD/OB) = 2 when conditions = 2, 3, 4, or 5	
2 = underground	detonation-CP* = 1000. & EX = 0.0017psi
3 = heat of	detonation-CP* = 1000. & EX = 0.0017 psi
4 = heat of	explosion- CP* = 1000. & EX = 14.7 psi
5 = heat of	combustion-CP* = 1000. & EX = 14.7 psi and use oxygen instead of air.

*Set CP(chamber pressure) & EX(exhaust pressure) the values shown.

EXAMPLE: 1,3,2,0,10,2,1,1

LINE 4--- ENTER 10 PERCENTAGES OF AIR FOR FUEL/AIR RATIOS. SEPARATE BY COMMAS & INCLUDE DECIMAL POINTS. ENTER DATA ON ONE LINE. TEN IS MAXIMUM NUMBER OF PERCENTAGES.
EXAMPLE: 0.,10.,20.,30.,40.,50.,60.,70.,80.,90.

LINE 5---ENTER 2 INGREDIENT CODE NUMBERS FROM FILE "INGNUM.DAT" SEPARATED BY COMMAS.
EXAMPLE: 890,15

LINE 6--- ENTER CHAMBER AND EXHAUST PRESSURES IN PSI AND INGREDIENT WEIGHTS ON ONE LINE SEPARATED BY COMMAS. CHAMBER PRESSURE IS NORMALLY 1000. AND EXHAUST 14.7. ENTER INGREDIENT WEIGHTS OF THOSE NOT CODED IN FILE "INGNUM.DAT" FIRST. 0 PERCENTAGE AIR (OR OXYGEN) MUST BE LAST INGREDIENT WEIGHT ENTERED. INCLUDE DEC. PTS. IN ALL DATA.

EXAMPLE: 1000.,14.7,100.,0.0

IN SUMMARY, BATCH FILE "TEST13L.IN" LOOKS LIKE THIS BELOW, WHICH IS ALREADY IN YOUR FILES AS "POLU13L.IN".

```
TEST13L.OUT
TNT/AIR--TIME, DATE
1,3,2,0,10,2,1,1
0.,10.,20.,30.,40.,50.,60.,70.,80.,90.
890,15
1000.,14.7,100.,0.
```

****

TO RUN THIS BATCH FILE, ENTER THE FOLLOWING COMMAND.

```
POLU13L<TEST13L.IN
```

****

THE OUTPUT DATA WILL APPEAR IN OUTPUT FILE "TEST13L.OUT". IF EVERYTHING RAN CORRECTLY, YOUR FILE "TEST13L.OUT" SHOULD BE THE SAME AS "POL13LT.OUT" IN YOUR FILES.

****

NO. 2---RUNNING POLU13L FROM SCREEN (MENU DRIVEN)----

ENTER THIS COMMAND---POLU13L

****

THE FOLLOWING PROMPTS WILL APPEAR ON SCREEN. ENTER THE DATA AND HIT RETURN.
EXAMPLE:

```
PROMPT  1---TYPE IN OUTPUT FILE NAME (DEFAULT: POLU.OUT)
ENTER: MENU13L.OUT

PROMPT 2---TITLE OF RUN
ENTER: TNT/AIR--TIME, DATE

PROMPT 3--- Enter data below on one line separated by commas. No  decimal
points.
     1---Pressure units--1 = lb/sq. inch, 2 = atmospheres.
     2---Round-off--Controls the decimal place of the output data.--
     0= 1xE-5, 1 = 1xE-10, 2 = 1xE-17, 3 = 1xE-4, 4 = 1xE-25, 5 = 1x
     E-3,  6 = 1xE-2.
    3---No. of coded Ingred.--enter number of coded ingredients in
     calculations from file "ingnum.dat".  Air (or oxygen) must be
     included as another ingredient.
    4---No. of non-coded ingred.--enter number of non-coded ingredients not
     in file "ingnum.dat".
    5---No. of runs--enter number of runs or calculations.
    6---Open detonation/open burn(OD/OB)--1 = open detonation
      2 = open burn.
    7---Units of output data--1 = units in grams products
     per 100 grams propellant, 3 = units in grams products per
      liter of gases (at STP), 2 = prints both units of 1 and 3.
    8---Conditions--Set No. 6 =1 for normal open burn/open detonation run
            Set No. 6 (OD/OB) = 2 when conditions = 2, 3, 4, or 5
            2 = underground detonation-CP* = 1000. & EX = 0.0017psi
            3 = heat of detonation-CP* = 1000. & EX = 0.0017 psi
            4 = heat of explosion- CP* = 1000. & EX = 14.7 psi
```

5 = heat of combustion-CP* = 1000. & EX = 14.7 psi and use oxygen instead of air.
*Set CP(chamber pressure) & EX(exhaust pressure) the values shown.

ENTER: 1,3,2,0,10,2,1,1

PROMPT 4--- ENTER 10 PERCENTAGES OF AIR FOR FUEL/AIR RATIOS. SEPARATE BY COMMAS & INCLUDE DECIMAL POINTS. ENTER DATA ON ONE LINE. TEN IS MAXIMUM NUMBER OF PERCENTAGES.

ENTER: 0.,10.,20.,30.,40.,50.,60.,70.,80.,90.

PROMPT 5---ENTER 2 INGREDIENT CODE NUMBERS FROM FILE "INGNUM.DAT" SEPARATED BY COMMAS.
ENTER: 890,15

PROMPT 6--- ENTER CHAMBER AND EXHAUST PRESSURES IN PSI AND INGREDIENT WEIGHTS ON ONE LINE SEPARATED BY COMMAS. CHAMBER PRESSURE IS NORMALLY 1000. AND EXHAUST 14.7. ENTER INGREDIENT WEIGHTS OF THOSE NOT CODED IN FILE "INGNUM.DAT" FIRST. 0 PERCENTAGE AIR MUST BE LAST INGREDIENT WEIGHT ENTERED. INCLUDE DEC. PTS. IN ALL DATA.

ENTER: 1000., 14.7,100., 0.0

THE OUTPUT DATA WILL APPEAR IN OUTPUT FILE "MENU13L.OUT". IF EVERYTHING RAN CORRECTLY, "MENU13L.OUT" SHOULD BE THE SAME AS "POL13LT.OUT" IN YOUR FILES.
****

<u>NO. 3---RUNNING POLU13L BY BATCH METHOD WITH TNT THERMAL DATA READ IN DIRECTLY AND AIR BY CODE NUMBER FROM FILE "INGNUMB.DAT".---</u>

CREATE A BATCH FILE CALLED "TEST13L2.IN". THE INPUT DATA GOES INTO THIS FILE BY LINES AS DESCRIBED BELOW.
(NOTE: "INGNUMB.DAT" AND "INGNUM.DAT" ARE THE SAME FILES.)

LINE 1---TYPE IN OUTPUT FILE NAME (DEFAULT: POLU.OUT)
EXAMPLE: TEST13L2.OUT

LINE 2---TITLE OF RUN
EXAMPLE: TNT/AIR--TNT READ IN AS NON-CODED DATA

LINE 3--- Enter data below on one line separated by commas. No decimal points.

1---Pressure units--1 = lb/sq. inch, 2 = atmospheres.
2---Round-off--Controls the decimal place of the output data.-- 0 = 1xE-5, 1 = 1xE-10, 2 = 1xE-17, 3 = 1xE-4, 4 = 1xE-25, 5 = 1x E-3, 6 = 1xE-2.
3---No. of coded Ingred.--enter number of coded ingredients in calculations from file "ingnum.dat". Air (or oxygen) must be included as another ingredient.
(NOTE: Our example will use one coded [AIR = 15] so this is 1)
4---No. of non-coded ingred.--enter number of non-coded ingredients not in file "ingnum.dat".
(NOTE: thermal data for one ingredient,TNT, is read in directly in line 5 so this is set to 1.)
5---No. of runs--enter number of runs or calculations.

6---Open detonation/open burn(OD/OB)--1 = open detonation
2 = open burn. See 8 (conditions) below.
7---Units of output data--1 = units in grams products per 100 grams propellant, 3 = units in grams products per liter of gases (at STP), 2 = prints both units of 1 and 3.
8---Conditions--Set No. 6 = 1 for normal open burn/open detonation run
Set No. 6 (OD/OB) = 2 when conditions = 2, 3, 4, or 5
2 = underground detonation-CP* = 1000. & EX = 0.0017psi
3 = heat of detonation-CP* = 1000. & EX = 0.0017 psi
4 = heat of explosion- CP* = 1000. & EX = 14.7 psi
5 = heat of combustion-CP* = 1000. & EX = 14.7 psi and use oxygen instead of air.
*Set CP(chamber pressure) & EX(exhaust pressure) the values shown.

EXAMPLE: 1,3,1,1,10,2,1,1

LINE 4--- ENTER 10 PERCENTAGES OF AIR FOR FUEL/AIR RATIOS. SEPARATE BY COMMAS & INCLUDE DECIMAL POINTS. ENTER DATA ON ONE LINE. TEN IS MAXIMUM NUMBER OF PERCENTAGES.
EXAMPLE: 0.,10.,20.,30.,40.,50.,60.,70.,80.,90.
****
We are assuming that the thermal data for TNT is not in file "INGNUMB.DAT" and has to be read in. You need an additional line of data for TNT that is now LINE 5 for this run.
****
LINE 5--- ENTER THERMAL DATA FOR INGREDIENT NO. 1 NOT IN FILE "INGNUM.DAT."

COLUMN NOS.	
1-20	--INGREDIENT NAME-up to 20 characters.
21-27	--HEAT OF FORMATION-under H field,in cal/g, add dec. pt.
28-32	--DENSITY-under D field,in lbs/cu.in., fill field with zeros if necessary, no dec. pt.
33-38	--NO. OF ATOMS OF 1ST ELEMENT-under "a" field, add dec.pt.
39-40	-- 1ST ELEMENT SYMBOLS-under S field, up to 6, left adjust.
41-46	--NO. OF ATOMS OF 2ND ELEMENT-under "a" field, add dec.pt.
47-48	-- 2ND ELEMENT SYMBOLS-under S field, up to 6, left adjust.
49-54	--NO. OF ATOMS OF 3RD ELEMENT-under "a" field, add dec.pt.
55-56	-- 3RD ELEMENT SYMBOLS-under S field, up to 6, left adjust.
57-62	--NO. OF ATOMS OF 4TH ELEMENT-under "a" field, add dec.pt.
63-64	-- 4TH ELEMENT SYMBOLS-under S field, up to 6, left adjust.
65-70	--NO. OF ATOMS OF 5TH ELEMENT-under "a" field, add dec.pt.
71-72	-- 5TH ELEMENT SYMBOLS-under S field, up to 6, left adjust.
73-78	--NO. OF ATOMS OF 6TH ELEMENT-under "a" field, add dec.pt.
79-80	-- 6TH ELEMENT SYMBOLS-under S field, up to 6, left adjust.

EXAMPLE:

```
TNT                  -78.   05980    7.C     5.H     3.N     6.O
NAME(20 CHAR)        HHHHHHHHDDDDDaaaaaaSSaaaaaaSSaaaaaaSSaaaaaaSSaaaaaaSSaa
12345678901234567890123456789012345678901234567890123456789012345678901234567890123
(It is helps to enter the "number line" 1234567890...etc. first and then p
in the data in the columns shown. Notice how -78. starts at column 21 or
the 12345678901234567890 position in this line. Also, the line
NAME(20 CHAR)        HHHHHHHHDDDDDaaaaaaSSaaaaaaSSaaaaaaSSaaaaaaSSaaaaaaSSaa is
shown here just to help place the data in their proper columns.
```

DELETE THE NUMBER LINE AND THE "NAME(20 CHAR)
HHHHHHHDDDDDaaaaaaSSaaaaaaSSaaaaaaSSaaaaaaSSaaaaaaSSaa" LINE AFTER YOU HAVE CORRECTLY PUT IN THE DATA. THESE LINES ARE NOT PART OF THE INPUT DATA, BUT A HELP IN LINING UP THE DATA WHEN THE THERMAL DATA IS READ IN DIRECTLY.)
****

Since AIR is the only ingredient we get from file "INGNUMB.DAT", 15 is entered.
LINE 6---ENTER 1 INGREDIENT CODE NUMBERS FROM FILE "INGNUM.DAT" SEPARATED BY COMMAS.
EXAMPLE: 15

LINE 7--- ENTER CHAMBER AND EXHAUST PRESSURES IN PSI AND INGREDIENT WEIGHTS ON ONE LINE SEPARATED BY COMMAS. CHAMBER PRESSURE IS NORMALLY 1000. AND EXHAUST 14.7. ENTER INGREDIENT WEIGHTS OF THOSE NOT CODED IN FILE "INGNUM.DAT" FIRST. 0 PERCENTAGE AIR MUST BE LAST INGREDIENT WEIGHT ENTERED. INCLUDE DEC. PTS. IN ALL DATA.
EXAMPLE: 1000.,14.7,100.,0.0

IN SUMMARY, BATCH FILE "TEST13L2.IN" LOOKS LIKE THIS, WHICH IS THE SAME AS "POLU13L2.IN". YOUR DATA IN "TEST13L2.OUT" SHOULD BE THE SAME AS THE FILE "POL13L2T.OUT".

```
TEST13L2.OUT
TNT/AIR--TNT READ IS AS NON-CODED DATA
1,3,1,1,10,2,1,1
0.,10.,20.,30.,40.,50.,60.,70.,80.,90.
TNT                -78.   05980    7.C     5.H     3.N     6.O
15
1000.,14.7,100.,0.
```

(NOTE: AS AN EXERCISE, PUT IN THIS SUMMARY DATA OF "TEST13L2.IN" FROM THE SCREEN OR THE "MENU DRIVEN" OPTION NO.2. IT WILL DEMONSTRATE HOW YOU CAN PUT THERMAL DATA DIRECTLY INTO THE PROGRAM FROM THE SCREEN.)
****
TO RUN THIS BATCH FILE ENTER THE FOLLOWING COMMAND:

```
POLU13L<TEST13L2.IN
```

THE OUTPUT DATA WILL APPEAR IN OUTPUT FILE "TEST13L2.OUT". IF EVERYTHING RAN CORRECTLY, THIS FILE SHOULD BE THE SAME AS "POL13LT2.OUT" IN YOUR FILES.
****

XIII CAUTIONS---
(1.) If the materials or chemicals to be burned, like a hydrocarbon, do not have any oxygen, then the first percentage of air cannot be zero. If the computer encounters zero percentage air, and there is no oxygen in the materials, the program won't run. To remedy this, start the calculations with a small percentage of air, such as 1 percent or more. Experiment to get the smallest percentage of air the program can run under these circumstances. This will assume that the small percentage of air added is part of the materials burned, but the data calculated under these circumstances should be accurate enough.

(2.) Do not use the data from the calculations in the rows "enthalpy kcal/gfw" calculated in the output files in dispersion models. Use "TOTAL HEAT RELEASED" or "RESIDUAL HEAT" as explained in the section "ENERGY OUTPUT FOR DISPERSION MODELS".

(3)---When the materials contain high percentages of several metals, the energy values calculated by the program (TOTAL HEAT RELEASED, HOE, HEATS DETONATION AND EXPLOSION, RESIDUAL) are questionable. One reason is that the species' library does not contain all of the possible species of combustion from such a variety of metals.
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XIV REFERENCES---

(1.) "Computer Predictions of Pollution Products from Open Burn an Detonation of Navy Explosives and Propellants"--by Edward E. Baroody, Naval Surface Weapons Center/White Oak, etc., Ordnance Environmental Support Office (OESO), Naval Ordnance Station, Indian Head, Maryland 20640, Jan. 1987.

(2) "Heat of Explosion, Heat of Detonation, and Reaction Products: Their Estimation and Relation to the First Law of Thermodynamics", Edward E. Baroody, Susan T. Peters, U.S. Naval Ordnance Station, Indian Head, Maryland, IHTR 1340, 7 May 1990.

(3) "Heats of Formation of Propellant Compounds", Edward E. Baroody & George Carpenter, Department of the Navy, Naval Ordnance Station, Indian Head, Md.,20640, Report IHTR 368, Oct. 20, 1972.

(4) "Heats of Formation of Propellant Compounds", Edward E. Baroody & G. A. Carpenter, U. S. Naval Surface Warfare Center, Silver Spring, Md., 20810, June 4, 1976, Report NSWC/WOL TR 76-77.

(5) "Heats of Formation of Propellant Compounds", Edward E.Baroody, U. S. Naval Surface Weapons Center, Silver Spring, Md. 20910, Dec. 1, 1982, Report NSWC TR 83-250.

(6) "Heats of Formation of Propellant compounds", Edward E. Baroody, Susan T. Peters, Department of The Navy, Naval Ordnance Station, Indian Head, Md., 20640,Oct. 1, 1987, IHSP 87-252.

POLU13L HEAT CONTENT CALCULATIONS

CALCULATION WORKSHEET Order No. 19116 (01-91) PAGE 1 OF 1

CLIENT	JOB NUMBER
HOLSTON AAP	JT-95

SUBJECT: HEAT CONTENT VALUES FOR OBODM

BASED ON	DRAWING NUMBER
POLU13M MODEL/HSAAP CONSTITUENT DATA	Revised 3/6/97

BY	CHECKED BY	APPROVED BY	DATE
J. LUCAS	G. Wagner		3/5/97

Representative energetic materials for HSAAP assumed to be open burned with 0% moisture content

ENERGETIC MATERIAL	HEAT CONTENT (cal/g)**
✓ RDX	2,040 ✓
✓ COMP B	2,510 ✓
HMX*	2,029 ✓
TATB*	2,550 ✓
OCTOL*	2,326 ✓
TATB + RDX*	2,352 ✓
TNAZ*	2,004 ✓
PETN*	1757 MIN ✓
✓ TNT	3216 MAX ✓
CL20*	1782

- ANNUAL weighted AVERAGE heat CONTENT

Estimated annual treatment breakdown

COMP B	12.5%	.125 x 2510 =	314 ✓
RDX	32.5%	.325 x 2040 =	663 ✓
TNT	2.5%	.025 x 3216 =	80 ✓
others*	52.5%	.525 x 2114 =	1110 ✓
	100%	ANNUAL HC	2167 ✓

others heat content 2114 is average of values listed above

** - Heat Content values were obtained from POLU13L MODEL results. Heat contents were selected from the material-to-air ratio which indicated complete combustion (i.e. zero percent carbon monoxide)

MATERIAL=RDX & WATER 3/5/97

OPEN BURN---MATERIAL DOES NOT DETONATE BEFORE REACTING WITH AIR---

		H	C	N	O						
RDX	-(S)	0.0060	.0030	.0060	.0060	.0000	.0000	.0000	.0000	.0000	.0000	.000	90.000	72.	0.0656
WATER - H20		0.0020	.0000	.0000	.0010	.0000	.0000	.0000	.0000	.0000	.0000	.000	10.000	-3792.	0.0361
AIR	-(G	0.0000	.0000	.0060	.0010	.0000	.0000	.0000	.0000	.0000	.0000	.000	0.000	0.	0.0000
														1.0000	

OGRAM ATOM AMOUNTS FOR MATERIAL WEIGHT OF 100.000

0 (H)	(C)	(N)	(O)	(							
3.541144	1.215510	2.431020	2.986082								
WT. MATERIAL	100.000	90.000	80.000	70.000	60.000	50.000	40.000	30.000	20.000	10.000
WT.--LAST INGREDIENT	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000
OXID/MATERIAL RATIO	0.0000	0.1111	0.2500	0.4286	0.6667	1.0000	1.5000	2.3333	4.0000	9.0000

---COMBUSTION CONDITIONS: THE MATERIAL AND AIR ARE BURNED TOGETHER AT 1000.00 PSI---

--CAUTION: DATA BELOW FLAME TEMP. OF 300 K QUESTIONABLE.

FLAME TEMP. T(K)	2886.309	2895.431	2901.830	2899.886	2871.524	2761.320	2488.364	2075.127	1577.679	994.837
FLAME TEMP. T(F)	4735.956	4752.375	4763.894	4760.394	4709.344	4510.976	4019.655	3275.828	2380.421	1331.306
ENTHALPY KCAL/GFW	-31.397	-28.257	-25.117	-21.978	-18.838	-15.698	-12.559	-9.419	-6.279	-3.140

---COMBUSTION CONDITIONS: THE COMBUSTION PRODUCTS FROM MATERIAL AND AIR AFTER EXPANDING FROM 1000.00 PSI TO 14.7000 PSI---

FLAME TEMP. T(K)	1327.972	1337.012	1346.989	1358.410	1373.159	1341.508	1088.152	835.673	580.772	327.971
FLAME TEMP. T(F)	1930.950	1947.221	1965.179	1985.738	2012.287	1955.315	1499.274	1044.811	585.990	130.947
ENTHALPY KCAL/GFW	-103.056	-97.972	-92.901	-87.837	-82.739	-75.951	-63.516	-50.142	-35.968	-20.937
T.VOL.GASES--LITERS (GASES AT STP)	94.282	101.299	110.071	121.348	136.387	158.635	197.628	262.620	392.598	782.537
TOTAL HEAT RELEASED*	1213.381	1313.365	1438.307	1598.894	1812.911	2039.735	2039.796	2039.778	2039.614	2039.118

COMBUSTION PRODUCTS ROUNDED OFF TO 1.00E-03

-----GRAMS PRODUCTS/100 GRAMS (GS/G)MATERIAL BURNED-----

N2	34.053	42.814	53.765	67.846	86.619	112.894	152.323	218.035	349.451	743.699
CO2	26.885	29.572	33.150	38.056	45.172	53.490	53.488	53.486	53.481	53.465
H2O	20.893	22.439	24.282	26.527	29.284	31.896	31.896	31.896	31.894	31.890
CO	16.935	15.224	12.946	9.824	5.294	0.000	0.000	0.000	0.000	0.000
H2	1.231	1.058	0.852	0.601	0.292	0.000	0.000	0.000	0.000	0.000
N2O5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001
O2	0.000	0.000	0.000	0.000	0.000	1.695	12.277	29.908	65.161	170.921
NO	0.000	0.000	0.000	0.000	0.000	0.019	0.009	0.001	0.000	0.000
HO	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000

*THE TOTAL HEAT RELEASED, IN CAL/GR AT STP, IN EACH COLUMN IS FOR 100 GRAMS
OF MATERIAL BURNED OR DETONATED, NOT THE MATERIAL WT. LISTED IN "WT. MATERIAL" ROW.
USE THESE VALUES IN DISPERSION MODELS.

---LIST OF TOTAL COMBUSTION PRODUCTS CONSIDERED---

N2	CO2	H2O	CO	H2	NH3	N2O5	N2O4	N2O4$	N2O4*	C4N2	N2O3	C3O2	NHO3	NO3
C5	C4H10	C4H8	C2N2	C4	O3	NHO2	NO2	C3H8	C2H4O	N2O	CNHO	C3H6	N3	CNO
CN2	CN2	C2O	C2N	C3	H2O2	HO2	N2H4	N2H4*	O2	NHO	C2H6	N2H2	CH2O	NO
NO	CHO	CHO	C2H4	CNH	C2H2	CN	CN	C2H	C2	H3O	H2O*	H2O*	HO	HO
CH4	NH2	O	CH3	NH	CH2	N	CH	C	C$	C$	H	H		

MATERIAL=compb & h20 3/5/97

OPEN BURN---MATERIAL DOES NOT DETONATE BEFORE REACTING WITH AIR---

	H	C	N	O								
COMPB	0.003	0.002	0.002	0.003	0.000	0.000	0.000	0.000	0.000	0.000	90.000	13.	0.0620
WATER - H20	0.002	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	10.000	-3792.	0.0361
AIR -(G	0.000	0.000	0.006	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.	0.0000
OGRAM ATOM AMOUNTS FOR MATERIAL WEIGHT OF 100.000												1.0000	
O (H) (C) (N) (O) (													
3.361192 1.838763 1.934076 2.964625													
WT. MATERIAL	100.000	90.000	80.000	70.000	60.000	50.000	40.000	30.000	20.000	10.000			
WT.--LAST INGREDIENT	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000			
OXID/MATERIAL RATIO	0.0000	0.1111	0.2500	0.4286	0.6667	1.0000	1.5000	2.3333	4.0000	9.0000			

---COMBUSTION CONDITIONS: THE MATERIAL AND AIR ARE BURNED TOGETHER AT 1000.00 PSI---
--CAUTION: DATA BELOW FLAME TEMP. OF 300 K QUESTIONABLE.

FLAME TEMP. T(K)	2323.191	2381.462	2443.716	2510.461	2581.899	2655.532	2700.787	2447.823	1868.295	1161.777
FLAME TEMP. T(F)	3722.344	3827.231	3939.289	4059.430	4188.019	4320.558	4402.016	3946.680	2903.531	1631.799
ENTHALPY KCAL/GFW	-36.795	-33.116	-29.436	-25.757	-22.077	-18.397	-14.718	-11.038	-7.359	-3.680

---COMBUSTION CONDITIONS: THE COMBUSTION PRODUCTS FROM MATERIAL AND AIR AFTER EXPANDING FROM 1000.00 PSI TO 14.7000 PSI---

FLAME TEMP. T(K)	997.217	1020.187	1050.711	1085.970	1124.885	1167.822	1217.340	1059.389	725.802	396.198
FLAME TEMP. T(F)	1335.590	1376.937	1431.879	1495.345	1565.393	1642.680	1731.812	1447.501	847.044	253.756
ENTHALPY KCAL/GFW	-95.492	-91.244	-87.002	-82.764	-78.539	-74.338	-70.147	-59.429	-42.691	-24.583
T.VOL.GASES--LITERS (GASES AT STP)	100.267	107.560	116.430	127.733	142.777	163.829	195.406	255.790	385.772	775.712
TOTAL HEAT RELEASED*	888.131	984.461	1108.155	1268.532	1482.673	1782.426	2231.747	2510.405	2510.293	2509.798

COMBUSTION PRODUCTS ROUNDED OFF TO 1.00E-03

-----GRAMS PRODUCTS/100 GRAMS (GS/G)MATERIAL BURNED-----

CO	32.604	31.158	29.199	26.522	22.703	16.870	6.920	0.000	0.000	0.000
CO2	29.300	31.842	35.016	39.245	45.248	54.414	70.045	80.916	80.911	80.895
N2	27.089	35.851	46.803	60.884	79.658	105.941	145.366	211.071	342.490	736.738
H2O	8.452	9.947	11.915	14.427	17.638	21.824	27.333	30.275	30.273	30.269
H2	2.406	2.263	2.052	1.773	1.414	0.946	0.329	0.000	0.000	0.000
CH4	0.144	0.046	0.010	0.002	0.000	0.000	0.000	0.000	0.000	0.000
NH3	0.003	0.002	0.002	0.001	0.001	0.000	0.000	0.000	0.000	0.000
N2O5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001
O2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	11.056	46.314	152.073
NO	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.000

*THE TOTAL HEAT RELEASED, IN CAL/GR AT STP, IN EACH COLUMN IS FOR 100 GRAMS
OF MATERIAL BURNED OR DETONATED, NOT THE MATERIAL WT. LISTED IN "WT. MATERIAL" ROW.
USE THESE VALUES IN DISPERSION MODELS.

---LIST OF TOTAL COMBUSTION PRODUCTS CONSIDERED---

CO	CO2	N2	H2O	H2	CH4	NH3	N2O5	N2O4	N2O4$	N2O4*	C4N2	N2O3	CNH	C3O2
NHO3	NO3	C5	C4H10	C4H8	C2N2	C4	O3	NHO2	NO2	C3H8	C2H4O	N2O	CNHO	C3H6
N3	CNO	CN2	CN2	C2O	C2N	C3	H2O2	HO2	N2H4	N2H4*	O2	NHO	C2H6	N2H2
CH2O	NO	NO	CHO	CHO	C2H4	C2H2	CN	CN	C2H	C2	H3O	H2O*	H2O*	HO
HO	NH2	O	CH3	NH	CH2	N	CH	C	C$	C$	H	H		

MATERIAL=HMX & WATER 3/5/97

OPEN BURN---MATERIAL DOES NOT DETONATE BEFORE REACTING WITH AIR---

	H	C	N	O								
HMX	0.0080	0.0040	0.0080	0.0080	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	90.000	61.	0.0686
WATER - H2O	0.0020	0.0000	0.0000	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	10.000	-3792.	0.0361
AIR -(G	0.0000	0.0000	0.0060	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.	0.0000
												1.0000	

OGRAM ATOM AMOUNTS FOR MATERIAL WEIGHT OF 100.000

0 (H)	(C)	(N)	(O)	(							
3.541144	1.215510	2.431020	2.986082								
WT. MATERIAL	100.000	90.000	80.000	70.000	60.000	50.000	40.000	30.000	20.000	10.000	
WT.--LAST INGREDIENT	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	
OXID/MATERIAL RATIO	0.0000	0.1111	0.2500	0.4286	0.6667	1.0000	1.5000	2.3333	4.0000	9.0000	

---COMBUSTION CONDITIONS: THE MATERIAL AND AIR ARE BURNED TOGETHER AT 1000.00 PSI---
--CAUTION: DATA BELOW FLAME TEMP. OF 300 K QUESTIONABLE.

FLAME TEMP. T(K)	2867.161	2878.143	2886.682	2887.267	2861.676	2752.690	2478.678	2066.263	1571.007	991.051
FLAME TEMP. T(F)	4701.489	4721.256	4736.628	4737.680	4691.616	4495.443	4002.220	3259.874	2368.413	1324.492
ENTHALPY KCAL/GFW	-32.471	-29.224	-25.977	-22.730	-19.483	-16.236	-12.989	-9.741	-6.494	-3.247

---COMBUSTION CONDITIONS: THE COMBUSTION PRODUCTS FROM MATERIAL AND AIR AFTER EXPANDING FROM 1000.00 PSI TO 14.7000 PSI---

FLAME TEMP. T(K)	1316.528	1326.281	1337.009	1349.207	1364.713	1333.965	1082.288	831.277	577.848	326.538
FLAME TEMP. T(F)	1910.350	1927.907	1947.216	1969.172	1997.083	1941.737	1488.718	1036.899	580.726	128.369
ENTHALPY KCAL/GFW	-103.550	-98.418	-93.299	-88.189	-83.047	-76.211	-63.703	-50.272	-36.047	-20.972
T.VOL.GASES--LITERS (GASES AT STP)	94.282	101.299	110.071	121.348	136.387	158.635	197.628	262.620	392.598	782.537
TOTAL HEAT RELEASED*	1202.603	1302.591	1427.536	1588.131	1802.157	2028.999	2029.053	2029.033	2028.868	2028.372

COMBUSTION PRODUCTS ROUNDED OFF TO 1.00E-03

-----GRAMS PRODUCTS/100 GRAMS (GS/G)MATERIAL BURNED-----

N2	34.053	42.814	53.765	67.846	86.619	112.894	152.323	218.035	349.451	743.699
CO2	27.074	29.740	33.291	38.160	45.226	53.490	53.488	53.486	53.481	53.465
H2O	20.816	22.371	24.225	26.484	29.262	31.896	31.896	31.896	31.894	31.890
CO	16.814	15.117	12.857	9.758	5.260	0.000	0.000	0.000	0.000	0.000
H2	1.240	1.066	0.859	0.606	0.295	0.000	0.000	0.000	0.000	0.000
N2O5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001
O2	0.000	0.000	0.000	0.000	0.000	1.696	12.277	29.908	65.161	170.921
NO	0.000	0.000	0.000	0.000	0.000	0.018	0.009	0.001	0.000	0.000
HO	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000

*THE TOTAL HEAT RELEASED, IN CAL/GR AT STP, IN EACH COLUMN IS FOR 100 GRAMS OF MATERIAL BURNED OR DETONATED, NOT THE MATERIAL WT. LISTED IN "WT. MATERIAL" ROW. USE THESE VALUES IN DISPERSION MODELS.

---LIST OF TOTAL COMBUSTION PRODUCTS CONSIDERED---

N2	CO2	H2O	CO	H2	NH3	N2O5	N2O4	N2O4$	N2O4*	C4N2	N2O3	C3O2	NHO3	NO3
C5	C4H10	C4H8	C2N2	C4	O3	NHO2	NO2	C3H8	C2H4O	N2O	CNHO	C3H6	N3	CNO
CN2	CN2	C2O	C2N	C3	H2O2	HO2	N2H4	N2H4*	O2	NHO	C2H6	N2H2	CH2O	NO
NO	CHO	CHO	C2H4	CNH	C2H2	CN	CN	C2H	C2	H3O	H2O*	H2O*	HO	HO
CH4	NH2	O	CH3	NH	CH2	N	CH	C	C$	C$	H	H		

MATERIAL=TATB & WATER 3/5/97

OPEN BURN---MATERIAL DOES NOT DETONATE BEFORE REACTING WITH AIR---

	H	C	N	O								
TATB	0.0020	0.0020	0.0020	0.0020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	90.000	-179. 0.0700
WATER - H2O	0.0020	0.0000	0.0000	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	10.000	-3792. 0.0361
AIR -(G	0.0000	0.0000	0.0060	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0. 0.0000

OGRAM ATOM AMOUNTS FOR MATERIAL WEIGHT OF 100.000 1.0000

O (H)	(C)	(N)	(O)	(							
3.267918	2.097434	2.107494	2.624492								
WT. MATERIAL	100.000	90.000	80.000	70.000	60.000	50.000	40.000	30.000	20.000	10.000	
WT.--LAST INGREDIENT	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	
OXID/MATERIAL RATIO	0.0000	0.1111	0.2500	0.4286	0.6667	1.0000	1.5000	2.3333	4.0000	9.0000	

---COMBUSTION CONDITIONS: THE MATERIAL AND AIR ARE BURNED TOGETHER AT 1000.00 PSI---
--CAUTION: DATA BELOW FLAME TEMP. OF 300 K QUESTIONABLE.

FLAME TEMP. T(K)	1331.754	1398.669	1525.830	1684.861	1856.866	2041.997	2242.952	2426.938	1894.335	1176.785
FLAME TEMP. T(F)	1937.757	2058.205	2287.094	2573.350	2882.959	3216.194	3577.913	3909.087	2950.404	1658.813
ENTHALPY KCAL/GFW	-53.989	-48.590	-43.191	-37.792	-32.393	-26.994	-21.595	-16.197	-10.798	-5.399

---COMBUSTION CONDITIONS: THE COMBUSTION PRODUCTS FROM MATERIAL AND AIR AFTER EXPANDING FROM 1000.00 PSI TO 14.7000 PSI---

FLAME TEMP. T(K)	900.970	898.926	895.352	889.274	879.904	881.629	948.199	1049.799	743.212	403.690
FLAME TEMP. T(F)	1162.346	1158.666	1152.234	1141.293	1124.428	1127.532	1247.358	1430.238	878.382	267.241
ENTHALPY KCAL/GFW	-93.338	-87.941	-82.870	-78.263	-74.144	-70.518	-67.193	-63.928	-46.535	-26.560
T.VOL.GASES--LITERS (GASES AT STP)	103.668	110.892	119.857	131.306	146.488	169.148	202.092	254.738	383.378	773.318
TOTAL HEAT RELEASED*	653.499	713.752	792.836	900.484	1050.969	1287.454	1719.307	2468.625	2549.759	2549.259

COMBUSTION PRODUCTS ROUNDED OFF TO 1.00E-03

-----GRAMS PRODUCTS/100 GRAMS (GS/G)MATERIAL BURNED-----

CO2	31.933	34.174	37.186	41.419	47.526	56.029	67.401	89.550	92.295	92.280
N2	29.517	38.277	49.229	63.309	82.082	108.366	147.794	213.503	344.919	739.167
CO	20.437	21.613	22.711	23.512	23.838	22.228	15.840	1.750	0.000	0.000
H2O	7.993	8.049	8.184	8.455	8.916	10.928	17.633	28.406	29.433	29.428
C$	6.722	5.662	4.421	2.968	1.200	0.000	0.000	0.000	0.000	0.000
H2	2.066	2.078	2.081	2.065	2.027	1.946	1.319	0.115	0.000	0.000
CH4	1.324	1.249	1.180	1.119	1.067	0.492	0.006	0.000	0.000	0.000
NH3	0.005	0.006	0.006	0.006	0.007	0.006	0.002	0.000	0.000	0.000
N2O5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001
O2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	33.340	139.100

*THE TOTAL HEAT RELEASED, IN CAL/GR AT STP, IN EACH COLUMN IS FOR 100 GRAMS
OF MATERIAL BURNED OR DETONATED, NOT THE MATERIAL WT. LISTED IN "WT. MATERIAL" ROW.
USE THESE VALUES IN DISPERSION MODELS.

---LIST OF TOTAL COMBUSTION PRODUCTS CONSIDERED---

CO2	N2	CO	H2O	C$	H2	CH4	NH3	N2O5	N2O4	N2O4$	N2O4*	C4N2	N2O3	C3O2
NHO3	NO3	C5	C4H10	C4H8	C2N2	C4	O3	NHO2	CNH	NO2	C3H8	C2H4O	N2O	CNHO
C3H6	N3	CNO	CN2	CN2	C2O	C2N	C3	H2O2	HO2	N2H4	N2H4*	O2	NHO	C2H6
N2H2	CH2O	NO	NO	CHO	CHO	C2H4	C2H2	CN	CN	C2H	C2	H3O	H2O*	H2O*
HO	HO	NH2	O	CH3	NH	CH2	N	CH	C	C$	H	H		

MATERIAL=OCTOL & WATER 3/5/97

OPEN BURN---MATERIAL DOES NOT DETONATE BEFORE REACTING WITH AIR---

	H	C	N	O							
OCTOL	0.0030	0.0020	0.0020	0.0030	0.0000	0.0000	0.0000	0.0000	0.0000	90.000	26.	0.0655
WATER - H2O	0.0020	0.0000	0.0000	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	10.000	-3792.	0.0361
AIR -(G	0.0000	0.0000	0.0060	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.	0.0000
											1.0000	

OGRAM ATOM AMOUNTS FOR MATERIAL WEIGHT OF 100.000

0 (H)	(C)	(N)	(O)	(							
3.428661	1.605003	2.120443	2.972691								
WT. MATERIAL	100.000	90.000	80.000	70.000	60.000	50.000	40.000	30.000	20.000	10.000	
WT.--LAST INGREDIENT	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	
OXID/MATERIAL RATIO	0.0000	0.1111	0.2500	0.4286	0.6667	1.0000	1.5000	2.3333	4.0000	9.0000	

---COMBUSTION CONDITIONS: THE MATERIAL AND AIR ARE BURNED TOGETHER AT 1000.00 PSI---

--CAUTION: DATA BELOW FLAME TEMP. OF 300 K QUESTIONABLE.

FLAME TEMP. T(K)	2532.448	2574.146	2618.642	2665.795	2713.781	2750.671	2684.405	2309.231	1755.859	1096.929
FLAME TEMP. T(F)	4099.006	4174.063	4254.156	4339.030	4425.407	4491.807	4372.529	3697.216	2701.147	1515.072
ENTHALPY KCAL/GFW	-35.580	-32.022	-28.464	-24.906	-21.348	-17.790	-14.232	-10.674	-7.116	-3.558

---COMBUSTION CONDITIONS: THE COMBUSTION PRODUCTS FROM MATERIAL AND AIR AFTER EXPANDING FROM 1000.00 PSI TO 14.7000 PSI---

FLAME TEMP. T(K)	1102.231	1125.407	1150.971	1177.912	1207.862	1241.551	1276.858	971.087	668.575	369.280
FLAME TEMP. T(F)	1524.616	1566.332	1611.627	1660.841	1714.752	1775.392	1838.944	1288.556	744.034	205.305
ENTHALPY KCAL/GFW	-98.921	-94.296	-89.678	-85.072	-80.487	-75.923	-70.714	-56.119	-40.263	-23.251
T.VOL.GASES--LITERS (GASES AT STP)	98.265	105.289	114.063	125.341	140.380	161.432	193.362	258.354	388.332	778.272
TOTAL HEAT RELEASED*	998.714	1098.651	1223.625	1384.297	1598.460	1898.128	2325.831	2325.791	2325.653	2325.158

COMBUSTION PRODUCTS ROUNDED OFF TO 1.00E-03

-----GRAMS PRODUCTS/100 GRAMS (GS/G)MATERIAL BURNED-----

N2	29.701	38.463	49.414	63.495	82.269	108.552	147.973	213.683	345.101	739.349
CO2	28.906	31.349	34.546	38.883	45.137	54.841	70.630	70.628	70.623	70.607
CO	26.552	25.001	22.968	20.208	16.227	10.050	0.000	0.000	0.000	0.000
H2O	12.812	14.455	16.453	18.930	22.040	26.006	30.883	30.882	30.881	30.876
H2	2.021	1.838	1.615	1.338	0.990	0.546	0.000	0.000	0.000	0.000
CH4	0.004	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NH3	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000
N2O5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001
O2	0.000	0.000	0.000	0.000	0.000	0.000	0.499	18.128	53.383	159.143
NO	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.004	0.000	0.000

*THE TOTAL HEAT RELEASED, IN CAL/GR AT STP, IN EACH COLUMN IS FOR 100 GRAMS OF MATERIAL BURNED OR DETONATED, NOT THE MATERIAL WT. LISTED IN "WT. MATERIAL" ROW. USE THESE VALUES IN DISPERSION MODELS.

---LIST OF TOTAL COMBUSTION PRODUCTS CONSIDERED---

N2	CO2	CO	H2O	H2	CH4	NH3	N2O5	N2O4	N2O4$	N2O4*	C4N2	N2O3	C3O2	NHO3
NO3	C5	C4H10	C4H8	C2N2	C4	O3	NHO2	NO2	C3H8	C2H4O	N2O	CNHO	C3H6	N3
CNO	CN2	CN2	C2O	C2N	C3	H2O2	HO2	N2H4	N2H4*	O2	NHO	C2H6	N2H2	CH2O
NO	NO	CHO	CHO	CNH	C2H4	C2H2	CN	CN	C2H	C2	H3O	H2O*	H2O*	HO
HO	NH2	O	CH3	NH	CH2	N	CH	C	C$	C$	H	H		

MATERIAL=TATB,RDX & WATER 3/5/97

OPEN BURN---MATERIAL DOES NOT DETONATE BEFORE REACTING WITH AIR---

		H	C	N	O	F							
RDX	-(S)	0.0060	.0030	.0060	.0060	.0000	.0000	.0000	.0000	.0000	.0000	32.000	72.	0.0656
TATB		0.0020	.0020	.0020	.0020	.0000	.0000	.0000	.0000	.0000	.0000	54.000	-179.	0.0700
VITON A		0.0040	.0050	.0000	.0000	.0070	.0000	.0000	.0000	.0000	.0000	4.000	-1801.	0.0650
WATER - H2O		0.0020	.0000	.0000	.0010	.0000	.0000	.0000	.0000	.0000	.0000	10.000	-3792.	0.0361
AIR	-(G	0.0000	.0000	.0060	.0010	.0000	.0000	.0000	.0000	.0000	.0000	0.000	0.	0.0000
OGRAM ATOM AMOUNTS FOR MATERIAL WEIGHT OF 100.000														1.0000

0 (H)	(C)	(N)	(O)	(F)	(
3.343996	1.797546	2.128859	2.661083	0.138976	

WT. MATERIAL	100.000	90.000	80.000	70.000	60.000	50.000	40.000	30.000	20.000	10.000
WT.--LAST INGREDIENT	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000
OXID/MATERIAL RATIO	0.0000	0.1111	0.2500	0.4286	0.6667	1.0000	1.5000	2.3333	4.0000	9.0000

---COMBUSTION CONDITIONS: THE MATERIAL AND AIR ARE BURNED TOGETHER AT 1000.00 PSI---
--CAUTION: DATA BELOW FLAME TEMP. OF 300 K QUESTIONABLE.

FLAME TEMP. T(K)	1784.578	1884.980	1991.773	2105.816	2228.367	2360.698	2497.464	2340.571	1779.387	1110.042
FLAME TEMP. T(F)	2752.841	2933.564	3125.791	3331.069	3551.660	3789.857	4036.036	3753.627	2743.497	1538.676
ENTHALPY KCAL/GFW	-52.445	-47.201	-41.956	-36.711	-31.467	-26.222	-20.978	-15.733	-10.489	-5.245

---COMBUSTION CONDITIONS: THE COMBUSTION PRODUCTS FROM MATERIAL AND AIR AFTER EXPANDING FROM 1000.00 PSI TO 14.7000 PSI---

FLAME TEMP. T(K)	917.356	910.733	902.889	913.829	948.291	1007.638	1076.682	992.088	681.886	375.161
FLAME TEMP. T(F)	1191.841	1179.920	1165.801	1185.493	1247.523	1354.349	1478.627	1326.358	767.994	215.890
ENTHALPY KCAL/GFW	-99.150	-94.179	-89.400	-84.791	-80.300	-75.860	-71.455	-61.684	-44.030	-25.167
T.VOL.GASES--LITERS (GASES AT STP)	100.198	107.281	116.161	129.192	145.258	166.449	198.031	256.816	386.790	776.727
TOTAL HEAT RELEASED*	727.314	798.441	889.633	1027.010	1227.610	1525.788	1975.494	2351.669	2351.449	2350.720

COMBUSTION PRODUCTS ROUNDED OFF TO 1.00E-03

-----GRAMS PRODUCTS/100 GRAMS (GS/G)MATERIAL BURNED-----

CO2	30.215	33.016	36.661	40.916	46.187	53.696	66.563	79.098	79.092	79.071
N2	29.816	38.577	49.528	63.609	82.384	108.668	148.094	213.801	345.218	739.465
CO	25.169	25.292	25.194	23.576	20.862	16.168	7.980	0.000	0.000	0.000
H2O	7.015	7.289	7.675	9.485	12.584	17.394	24.033	28.870	28.869	28.867
HF	2.779	2.779	2.779	2.779	2.778	2.778	2.777	2.776	2.774	2.766
H2	2.167	2.142	2.109	2.063	1.809	1.284	0.541	0.000	0.000	0.000
C$	1.722	0.924	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CH4	1.107	1.082	1.043	0.418	0.051	0.001	0.000	0.000	0.000	0.000
NH3	0.005	0.005	0.006	0.005	0.003	0.001	0.000	0.000	0.000	0.000
C2F6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001
N2O5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001
N2F4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001
COF4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001
C2F4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001
O2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	8.770	44.025	149.785
NO	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000

*THE TOTAL HEAT RELEASED, IN CAL/GR AT STP, IN EACH COLUMN IS FOR 100 GRAMS
OF MATERIAL BURNED OR DETONATED, NOT THE MATERIAL WT. LISTED IN "WT. MATERIAL" ROW.
USE THESE VALUES IN DISPERSION MODELS.

---LIST OF TOTAL COMBUSTION PRODUCTS CONSIDERED---

CO2	N2	CO	H2O	HF	H2	C$	CH4	NH3	C2F6	N2O5	N2F4	COF4	C2F4	C2NF3
N2O4	N2O4$	N2O4*	CF4	NOF3	NO3F	C4N2	N2O3	NF3	CHF3	CF3	C3O2	N2F2	N2F2	COF2
NO2F	CNH	NHO3	C2F2	NO3	C5	C4H10	C4H8	OF2	C2N2	CH2F2	NF2	O2F	CF2	CF2
NOF	C4	CHOF	O3	NHO2	NO2	CNF	C3H8	C2H4O	C2HF	N2O	CNHO	C3H6	N3	CNO
CN2	CN2	C2O	C2N	F2	C3	HOF	OF	CH3F	H2O2	NF	HO2	N2H4	N2H4*	CHF
O2	NHO	CF	C2H6	N2H2	CH2O	NO	NO	CHO	CHO	C2H4	C2H2	CN	CN	C2H
C2	H3O	F	H2O*	H2O*	HO	HO	NH2	O	CH3	NH	CH2	N	CH	C
C$	H	H												

MATERIAL=TNAZ & WATER 3/5/97

OPEN BURN---MATERIAL DOES NOT DETONATE BEFORE REACTING WITH AIR---

	H	C	N	O								
(TNAZ)TRINITZETIDINE	0.0040	0.0030	0.0040	0.0060	0000	0000	0000	0000	0000	0000	0000	000	90.000	46.	0.0665
WATER - H2O	0.0020	0000	0000	0010	0000	0000	0000	0000	0000	0000	0000	000	10.000	-3792.	0.0361
AIR -(G	0.0000	0000	0060	0010	0000	0000	0000	0000	0000	0000	0000	000	0.000	0.	0.0000
														1.0000	

OGRAM ATOM AMOUNTS FOR MATERIAL WEIGHT OF 100.000

0 (H)	(C)	(N)	(O)	(							
2.984178	1.405540	1.874053	3.366142								
WT. MATERIAL	100.000	90.000	80.000	70.000	60.000	50.000	40.000	30.000	20.000	10.000
WT.--LAST INGREDIENT	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000
OXID/MATERIAL RATIO	0.0000	0.1111	0.2500	0.4286	0.6667	1.0000	1.5000	2.3333	4.0000	9.0000

---COMBUSTION CONDITIONS: THE MATERIAL AND AIR ARE BURNED TOGETHER AT 1000.00 PSI---
--CAUTION: DATA BELOW FLAME TEMP. OF 300 K QUESTIONABLE.

FLAME TEMP. T(K)	3186.156	3156.211	3116.236	3058.458	2966.171	2802.814	2512.063	2090.767	1584.398	995.687
FLAME TEMP. T(F)	5275.680	5221.779	5149.824	5045.824	4879.708	4585.666	4062.313	3303.981	2392.516	1332.836
ENTHALPY KCAL/GFW	-33.820	-30.438	-27.056	-23.674	-20.292	-16.910	-13.528	-10.146	-6.764	-3.382

---COMBUSTION CONDITIONS: THE COMBUSTION PRODUCTS FROM MATERIAL AND AIR AFTER EXPANDING FROM 1000.00 PSI TO 14.7000 PSI---

FLAME TEMP. T(K)	1627.893	1619.124	1611.137	1605.626	1611.284	1376.451	1111.285	848.589	586.276	328.956
FLAME TEMP. T(F)	2470.807	2455.024	2440.647	2430.728	2440.911	2018.212	1540.913	1068.061	595.896	132.721
ENTHALPY KCAL/GFW	-110.811	-104.959	-99.086	-93.140	-86.832	-76.330	-63.900	-50.503	-36.250	-21.095
T.VOL.GASES--LITERS (GASES AT STP)	86.050	93.067	101.838	113.115	128.154	153.526	192.518	257.511	387.488	777.428
TOTAL HEAT RELEASED*	1368.043	1467.819	1592.504	1752.760	1966.271	2003.585	2003.818	2003.820	2003.663	2003.167

COMBUSTION PRODUCTS ROUNDED OFF TO 1.00E-03

-----GRAMS PRODUCTS/100 GRAMS (GS/G)MATERIAL BURNED-----

CO2	34.171	38.124	43.274	50.225	60.048	61.853	61.852	61.849	61.844	61.829
N2	26.251	35.012	45.964	60.044	78.817	105.081	144.520	210.233	341.649	735.897
H2O	21.334	22.362	23.561	24.969	26.617	26.878	26.879	26.878	26.877	26.872
CO	17.620	15.105	11.826	7.402	1.150	0.000	0.000	0.000	0.000	0.000
H2	0.621	0.506	0.371	0.214	0.029	0.000	0.000	0.000	0.000	0.000
HO	0.000	0.000	0.000	0.000	0.001	0.002	0.000	0.000	0.000	0.000
N2O5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001
O2	0.000	0.000	0.000	0.000	0.000	6.137	16.731	34.363	69.617	175.377
NO	0.000	0.000	0.000	0.000	0.000	0.043	0.013	0.001	0.000	0.000

*THE TOTAL HEAT RELEASED, IN CAL/GR AT STP, IN EACH COLUMN IS FOR 100 GRAMS
OF MATERIAL BURNED OR DETONATED, NOT THE MATERIAL WT. LISTED IN "WT. MATERIAL" ROW.
USE THESE VALUES IN DISPERSION MODELS.

---LIST OF TOTAL COMBUSTION PRODUCTS CONSIDERED---

CO2	N2	H2O	CO	H2	HO	N2O5	N2O4	N2O4$	N2O4*	H	C4N2	N2O3	C3O2	NHO3
NO3	C5	C4H10	C4H8	C2N2	C4	O3	NHO2	NO2	C3H8	C2H4O	N2O	CNHO	C3H6	N3
CNO	CN2	CN2	C2O	C2N	C3	H2O2	HO2	NH3	N2H4	N2H4*	O2	NHO	C2H6	N2H2
CH2O	NO	NO	CHO	CHO	C2H4	CNH	C2H2	CN	CN	C2H	C2	H3O	H2O*	H2O*
HO	CH4	NH2	O	CH3	NH	CH2	N	CH	C	C$	C$	H		

MATERIAL=PETN & WATER 3/5/97

OPEN BURN---MATERIAL DOES NOT DETONATE BEFORE REACTING WITH AIR---

	H	C	N	O										
PETN	0.008	0.005	0.004	0.012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	90.000	-401.	0.0640
WATER - H2O	0.002	0.0000	0.0000	0.001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	10.000	-3792.	0.0361
AIR -(G	0.0000	0.0000	0.006	0.001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.000	0.	0.0000
														1.0000	

OGRAM ATOM AMOUNTS FOR MATERIAL WEIGHT OF 100.000

O (H)	(C)	(N)	(O)	(							
3.387517	1.423370	1.138696	3.971151								
WT. MATERIAL	100.000	90.000	80.000	70.000	60.000	50.000	40.000	30.000	20.000	10.000
WT.--LAST INGREDIENT	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000
OXID/MATERIAL RATIO	0.0000	0.1111	0.2500	0.4286	0.6667	1.0000	1.5000	2.3333	4.0000	9.0000

---COMBUSTION CONDITIONS: THE MATERIAL AND AIR ARE BURNED TOGETHER AT 1000.00 PSI---

--CAUTION: DATA BELOW FLAME TEMP. OF 300 K QUESTIONABLE.

FLAME TEMP. T(K)	3045.170	3012.514	2964.147	2887.177	2757.530	2542.045	2231.102	1849.453	1408.478	898.522
FLAME TEMP. T(F)	5021.906	4963.125	4876.065	4737.520	4504.154	4116.281	3556.583	2869.615	2075.861	1157.940
ENTHALPY KCAL/GFW	-73.989	-66.590	-59.191	-51.793	-44.394	-36.995	-29.596	-22.197	-14.798	-7.399

---COMBUSTION CONDITIONS: THE COMBUSTION PRODUCTS FROM MATERIAL AND AIR AFTER EXPANDING FROM 1000.00 PSI TO 14.7000 PSI---

FLAME TEMP. T(K)	1636.561	1629.151	1624.270	1630.776	1402.748	1180.860	959.213	735.640	511.994	295.547
FLAME TEMP. T(F)	2486.410	2473.072	2464.286	2475.997	2065.547	1666.148	1267.182	864.752	462.190	72.584
ENTHALPY KCAL/GFW	-146.347	-136.910	-127.380	-117.342	-103.873	-89.220	-73.791	-57.679	-40.866	-23.310
T.VOL.GASES--LITERS (GASES AT STP)	82.724	89.741	98.513	109.813	128.331	154.325	193.318	258.311	388.288	778.228
TOTAL HEAT RELEASED*	1370.708	1470.443	1595.090	1753.719	1756.639	1756.840	1756.885	1756.825	1756.660	1756.163

COMBUSTION PRODUCTS ROUNDED OFF TO 1.00E-03

-----GRAMS PRODUCTS/100 GRAMS (GS/G)MATERIAL BURNED-----

CO2	45.535	49.761	55.228	62.494	62.639	62.638	62.636	62.634	62.629	62.614
H2O	27.261	28.177	29.246	30.488	30.512	30.513	30.513	30.512	30.510	30.506
N2	15.950	24.711	35.663	49.740	68.500	94.793	134.223	199.932	331.348	725.596
CO	10.887	8.197	4.718	0.093	0.000	0.000	0.000	0.000	0.000	0.000
H2	0.364	0.261	0.142	0.003	0.000	0.000	0.000	0.000	0.000	0.000
HO	0.000	0.000	0.001	0.006	0.003	0.000	0.000	0.000	0.000	0.000
N2O5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001
O2	0.000	0.000	0.000	0.025	4.973	12.036	22.619	40.247	75.500	181.259
NO	0.000	0.000	0.000	0.007	0.037	0.016	0.003	0.000	0.000	0.000

*THE TOTAL HEAT RELEASED, IN CAL/GR AT STP, IN EACH COLUMN IS FOR 100 GRAMS OF MATERIAL BURNED OR DETONATED, NOT THE MATERIAL WT. LISTED IN "WT. MATERIAL" ROW. USE THESE VALUES IN DISPERSION MODELS.

---LIST OF TOTAL COMBUSTION PRODUCTS CONSIDERED---

CO2	H2O	N2	CO	H2	HO	N2O5	N2O4	N2O4$	N2O4*	C4N2	N2O3	C3O2	H	NHO3
NO3	C5	C4H10	C4H8	C2N2	C4	O3	NHO2	NO2	C3H8	C2H4O	N2O	CNHO	C3H6	N3
CNO	CN2	CN2	C2O	C2N	C3	H2O2	HO2	N2H4	N2H4*	O2	NHO	C2H6	N2H2	CH2O
NO	NO	CHO	CHO	C2H4	CNH	C2H2	CN	CN	C2H	C2	H3O	H2O*	H2O*	NH3
HO	CH4	NH2	O	CH3	NH	CH2	N	CH	C	C$	C$	H		

MATERIAL=TNT & WATER 3/5/97

OPEN BURN---MATERIAL DOES NOT DETONATE BEFORE REACTING WITH AIR---

	H	C	N	O									
TRINITROTOLUENE	0.005	0.007	0.003	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	90.000	-78.	0.0597
WATER - H2O	0.002	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.000	-3792.	0.0361
AIR -(G	0.000	0.000	0.006	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.	0.0000
OGRAM ATOM AMOUNTS FOR MATERIAL WEIGHT OF 100.000													1.0000	
0 (H) (C) (N) (O) (														
3.091272 2.773607 1.188689 2.932440														

WT. MATERIAL	100.000	90.000	80.000	70.000	60.000	50.000	40.000	30.000	20.000	10.000
WT.--LAST INGREDIENT	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000
OXID/MATERIAL RATIO	0.0000	0.1111	0.2500	0.4286	0.6667	1.0000	1.5000	2.3333	4.0000	9.0000

---COMBUSTION CONDITIONS: THE MATERIAL AND AIR ARE BURNED TOGETHER AT 1000.00 PSI---
--CAUTION: DATA BELOW FLAME TEMP. OF 300 K QUESTIONABLE.

FLAME TEMP. T(K)	1440.125	1500.638	1620.217	1771.271	1934.080	2108.278	2296.594	2497.140	2279.795	1403.642
FLAME TEMP. T(F)	2132.824	2241.748	2456.990	2728.888	3021.943	3335.500	3674.469	4035.452	3644.231	2067.156
ENTHALPY KCAL/GFW	-44.902	-40.412	-35.921	-31.431	-26.941	-22.451	-17.961	-13.471	-8.980	-4.490

---COMBUSTION CONDITIONS: THE COMBUSTION PRODUCTS FROM MATERIAL AND AIR AFTER EXPANDING FROM 1000.00 PSI TO 14.7000 PSI---

FLAME TEMP. T(K)	965.547	960.621	954.035	944.965	932.746	916.366	965.462	1067.486	951.667	502.071
FLAME TEMP. T(F)	1278.584	1269.717	1257.863	1241.537	1219.543	1190.058	1278.432	1462.074	1253.600	444.327
ENTHALPY KCAL/GFW	-88.263	-83.351	-78.772	-74.655	-71.015	-67.866	-65.120	-62.441	-52.272	-29.919
T.VOL.GASES--LITERS (GASES AT STP)	108.147	115.248	124.096	135.439	150.527	171.616	204.908	257.624	375.533	765.473
TOTAL HEAT RELEASED*	703.420	764.289	844.179	952.801	1104.338	1324.816	1738.069	2485.799	3216.161	3215.693

COMBUSTION PRODUCTS ROUNDED OFF TO 1.00E-03

-----GRAMS PRODUCTS/100 GRAMS (GS/G)MATERIAL BURNED-----

CO	40.357	41.607	42.740	43.512	43.737	43.017	35.519	18.829	0.000	0.000
CO2	26.442	28.556	31.479	35.701	41.893	51.317	66.175	92.476	122.054	122.039
N2	16.648	25.409	36.360	50.440	69.213	95.496	134.923	200.633	332.047	726.297
C$	8.227	7.137	5.874	4.408	2.635	0.382	0.000	0.000	0.000	0.000
H2O	5.225	5.337	5.522	5.822	6.277	6.962	11.528	20.575	27.842	27.837
H2	2.341	2.336	2.322	2.295	2.248	2.175	1.818	0.813	0.000	0.000
CH4	0.754	0.724	0.696	0.673	0.654	0.641	0.029	0.000	0.000	0.000
NH3	0.003	0.003	0.004	0.004	0.005	0.005	0.003	0.000	0.000	0.000
N2O5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001
O2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	18.041	123.802
NO	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000

*THE TOTAL HEAT RELEASED, IN CAL/GR AT STP, IN EACH COLUMN IS FOR 100 GRAMS OF MATERIAL BURNED OR DETONATED, NOT THE MATERIAL WT. LISTED IN "WT. MATERIAL" ROW. USE THESE VALUES IN DISPERSION MODELS.

---LIST OF TOTAL COMBUSTION PRODUCTS CONSIDERED---

CO	CO2	N2	C$	H2O	H2	CH4	NH3	CNH	N2O5	N2O4	N2O4$	N2O4*	C4N2	N2O3
C3O2	NHO3	NO3	C5	C4H10	C4H8	C2N2	C4	O3	NHO2	NO2	C3H8	C2H4O	N2O	CNHO
C3H6	N3	CNO	CN2	CN2	C2O	C2N	C3	H2O2	HO2	N2H4	N2H4*	O2	NHO	C2H6
N2H2	CH2O	NO	NO	CHO	CHO	C2H4	C2H2	CN	CN	C2H	C2	H3O	H2O*	H2O*
HO	HO	NH2	O	CH3	NH	CH2	N	CH	C	C$	H	H		

MATERIAL=CL20 & WATER

OPEN BURN---MATERIAL DOES NOT DETONATE BEFORE REACTING WITH AIR---

	H	C	N	O									
CL20	0.0060	0.0060	0.0120	0.0120	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	90.000	224.	0.0737
WATER - H2O	0.0020	0.0000	0.0000	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	10.000	-3792.	0.0361
AIR -(G	0.0000	0.0000	0.0060	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	0.	0.0000

OGRAM ATOM AMOUNTS FOR MATERIAL WEIGHT OF 100.000 1.0000

0 (H)	(C)	(N)	(O)	(
2.342410	1.232286	2.464572	3.019634	

WT. MATERIAL	100.000	90.000	80.000	70.000	60.000	50.000	40.000	30.000	20.000	10.000
WT.--LAST INGREDIENT	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000
OXID/MATERIAL RATIO	0.0000	0.1111	0.2500	0.4286	0.6667	1.0000	1.5000	2.3333	4.0000	9.0000

---COMBUSTION CONDITIONS: THE MATERIAL AND AIR ARE BURNED TOGETHER AT 1000.00 PSI---
--CAUTION: DATA BELOW FLAME TEMP. OF 300 K QUESTIONABLE.

FLAME TEMP. T(K)	3250.802	3200.941	3136.661	3048.040	2914.980	2700.673	2373.688	1957.141	1478.053	931.983
FLAME TEMP. T(F)	5392.044	5302.294	5186.589	5027.072	4787.563	4401.812	3813.238	3063.453	2201.095	1218.169
ENTHALPY KCAL/GFW	-17.760	-15.984	-14.208	-12.432	-10.656	-8.880	-7.104	-5.328	-3.552	-1.776

---COMBUSTION CONDITIONS: THE COMBUSTION PRODUCTS FROM MATERIAL AND AIR AFTER EXPANDING FROM 1000.00 PSI TO 14.7000 PSI---

FLAME TEMP. T(K)	1736.315	1722.098	1710.473	1709.076	1495.328	1248.920	1009.074	770.683	534.174	303.522
FLAME TEMP. T(F)	2665.968	2640.377	2619.451	2616.937	2232.190	1788.657	1356.933	927.830	502.113	86.939
ENTHALPY KCAL/GFW	-94.549	-90.263	-85.885	-81.149	-73.402	-63.938	-53.568	-42.489	-30.723	-18.235
T.VOL.GASES--LITERS (GASES AT STP)	81.588	88.605	97.376	108.656	126.667	152.663	191.656	256.648	386.626	776.565
TOTAL HEAT RELEASED*	1364.400	1464.104	1588.706	1748.536	1781.582	[illegible]	1782.079	1782.036	1781.871	1781.376

COMBUSTION PRODUCTS ROUNDED OFF TO 1.00E-03

-----GRAMS PRODUCTS/100 GRAMS (GS/G)MATERIAL BURNED-----

N2	34.523	43.284	54.235	68.315	87.061	113.360	152.795	218.505	349.922	744.169
CO2	34.344	38.834	44.673	52.526	54.228	54.228	54.227	54.224	54.219	54.204
H2O	18.141	18.949	19.866	20.900	21.096	21.098	21.098	21.097	21.096	21.091
CO	12.657	9.799	6.083	1.085	0.001	[illegible]	0.000	0.000	0.000	0.000
H2	0.331	0.240	0.138	0.022	0.000	0.000	0.000	0.000	0.000	0.000
HO	0.001	0.001	0.001	0.003	0.006	0.001	0.000	0.000	0.000	0.000
N2O5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001
NO	0.000	0.000	0.000	0.002	0.061	0.027	0.006	0.000	0.000	0.000
O2	0.000	0.000	0.000	0.001	4.210	11.281	21.869	39.498	74.751	180.511

*THE TOTAL HEAT RELEASED, IN CAL/GR AT STP, IN EACH COLUMN IS FOR 100 GRAMS
OF MATERIAL BURNED OR DETONATED, NOT THE MATERIAL WT. LISTED IN "WT. MATERIAL" ROW.
USE THESE VALUES IN DISPERSION MODELS.

---LIST OF TOTAL COMBUSTION PRODUCTS CONSIDERED---

N2	CO2	H2O	CO	H2	HO	H	N2O5	NO	N2O4	N2O4$	N2O4*	C4N2	N2O3	C3O2
NHO3	NO3	C5	C4H10	C4H8	C2N2	C4	O3	NHO2	NO2	C3H8	C2H4O	N2O	CNHO	C3H6
N3	CNO	CN2	CN2	C2O	C2N	C3	H2O2	HO2	N2H4	N2H4*	O2	NHO	C2H6	N2H2
CH2O	NO	CHO	CHO	C2H4	CNH	C2H2	CN	CN	C2H	C2	H3O	H2O*	H2O*	NH3
HO	CH4	NH2	O	CH3	NH	CH2	N	CH	C	C$	C$	H		

APPENDIX E-2-4

DETERMINATION OF ANNUAL WASTE MATERIALS MIX

EMISSION FACTOR CALCULATIONS FOR LOW, ANNUAL AVERAGE, AND HIGH HEAT CONTENT MODELING SCENARIOS

DETERMINATION OF ANNUAL MIX

OF MATERIALS TREATED AT THE

HSAAP BURN PAN UNIT

APPENDIX E-2-4

DETERMINATION OF ANNUAL MIX OF MATERIALS TREATED AT HSAAP

Types and quantities of emissions from the open burning of waste explosives depend on the type and quantity of materials treated in the burn pan unit. The following procedure was used to develop an assumed mix of waste materials treated on a yearly basis. This assumed mix was then used to estimate the type and quantity of open burning treatment emissions from the burn pan unit.

STEP 1: List the explosive materials treated at HSAAP.

Table 1 lists the materials treated at HSAAP, along with the breakdown of explosives which comprise the energetic materials in each formulation. Table 2 lists the non-explosive constituents of the explosive formulations. Information from the chlorine- and fluorine-containing compounds was used to estimate emissions of acid gases.

STEP 2: Categorize each material into groups (based on predominant explosive(s) found in the material).

Using these formulations, each material was grouped by the predominant explosive or explosives found in the formulation. For example, Cyclotol (70/30) is comprised of the explosives RDX and TNT; it is grouped into the RDX & TNT group. Table 3 presents the list of materials treated at HSAAP, along with the group into which each material falls. The final groupings of explosives and number of materials in each group included the following:

• RDX	13
• RDX & TNT (Composition B)	5
• HMX	12
• TATB	3
• HMX & TNT	2
• TATB & RDX	1
• TNAZ	1
• CL20	1
• PETN	1
• TNT	1

STEP 3: List explosives for which Emission Factors are available (Dugway Data).

As discussed in Section C-4, emission factors were available from Bang Box tests performed at Dugway Proving Grounds for several explosives. The following explosives were among those tested at Dugway:

- Amatol (50% TNT, 50% Ammonium Nitrate)
- Composition B (RDX, TNT, Wax)
- Double Base
- HBX (RDX, TNT, Al, Wax)

TABLE 1

PERCENTAGE OF EXPLOSIVE CONSTITUENTS IN MATERIALS TREATED

HOLSTON ARMY AMMUNITIONS PLANT
KINGSPORT, TN

	PERCENTAGE OF EXPLOSIVES IN COMPOUNDS							
	HMX	RDX	NC	TNT	TATB	TNAZ	PETN	CL-20
Compound								
Composition A-5		98.5						
Composition B		59.5		39.5				
Composition B-3		59.5		40.5				
Composition B-4		60		39.5				
Composition C-4		90.5						
Composition CH-6		97.5						
Composition D-2			14					
CXM-9	97.5							
CXM-3		96.5						
CXM-6		95						
CXM-7		95.3						
Cyclotol (70/30)		70		30				
Cyclotol (75/25)		75		25				
HMX	100							
LX-04	85							
LX-07	90							
LX-09	93.3							
LX-10-2	94.6							
LX-14-1	95.5							
LX-17					92.5			
Octol 70/30	70			30				
Octol 75/25	75			25				
PBX-0280		95						
PBX-9404	94		2.9					
PBX-9407		94						
PBX-9501	94.9							
PBX-9502					95			
PBXN-7		35			60			
PBXN-3	86							
PBXN-5	95							
PBXN-6		95						
PBXN-9	92							
RDX		100						
Composition A-3		90						
Composition A-4		96.5						
TNT				100				
1,3,3-Trinitroazetidine (TNAZ)						100		
CL-20								100
TATB					100			
PETN							100	
HDX-106		88.2						

PERCENTAGE OF NON-EXPLOSIVE CONSTITUENTS IN COMPOUNDS TREATED HOLSTON ARMY AMMUNITIONS PLANT KINGSPORT, TN

	PERCENTAGE OF NON-EXPOLSIVE MATERIAL IN COMPOUNDS															
Compound	Stearic Acid	Wax	Calcium Silicate	Polyisobutylene	Calcium Stearate	Dioctyl Adipate	Process Oil	DMDNB	Graphite	Lecithin	Polyester Resin	Dioctyl Maleate	NP	PDNPA	Polyurethane Elastomer	Tris-beta-chloroethyl phosphate
Composition A-5	1.5															
Composition B		1														
Composition B-3																
Composition B-4			0.5													
Composition C-4				2.4		5.6	1.5	1.25								
Composition CH-6				0.5	1.5				0.5							
Composition D-2		84								2						
CXM-9										0.15						
CXM-3												3.5				
CXM-6													5			
CXM-7						4.7										
Cyclotol (70/30)																
Cyclotol (75/25)																
HMX																
LX-04																
LX-07																
LX-09																
LX-10-2														4.4		
LX-14-1																
LX-17															4.5	
Octol 70/30																
Octol 75/25																
PBX-0280																
PBX-9404															5	
PBX-9407																2.98
PBX-9501																
PBX-9502													2.5			
PBXN-7																
PBXN-3																
PBXN-5																
PBXN-6																
PBXN-9						6										
RDX																
Composition A-3		10														
Composition A-3, Type II																
Composition A-4		3.5														
TNT																
1,3,3-Trinitroazetidine (TNAZ)																
CL-20																
TATB																
PETN																
HDX-106				8.2												

TABLE 2

PERCENTAGE OF NON-EXPLOSIVE CONSTITUENTS
IN COMPOUNDS TREATED
HOLSTON ARMY AMMUNITIONS PLANT
KINGSPORT, TN
PAGE 2

	PERCENTAGE OF NON-EXPOLSIVE MATERIAL IN COMPOUNDS												
Compound	Plastic Resin	Estane	Irganox	Kel-F	Nylon	Viton -A	Teflon	Dioctyl Sebacate	Polyacrylic Elastomer	Lauryl Methacrylate	FEFO	Diphenylanime	Polyethylene Emulsion
Composition A-5													
Composition B													
Composition B-3													
Composition B-4													
Composition C-4													
Composition CH-6													
Composition D-2													
CXM-9										2.35			
CXM-3													
CXM-6													
CXM-7													
Cyclotol (70/30)													
Cyclotol (75/25)													
HMX													
LX-04						15							
LX-07						10							
LX-09											2.3		
LX-10-2						5.4							
LX-14-1													
LX-17				7.5									
Octol 70/30													
Octol 75/25													
PBX-0280													
PBX-9404												0.1	
PBX-9407	6												
PBX-9501		2.5	0.1										
PBX-9502				5									
PBXN-7						5							
PBXN-3					14								
PBXN-5						5							
PBXN-6						5							
PBXN-9									2				
RDX													
Composition A-3													10
Composition A-3, Type II													
Composition A-4													
TNT													
1,3,3-Trinitroazetidine (TNAZ)													
CL-20													
TATB													
PETN													
HDX-106							1.4	2.2					

TABLE 3

GROUPING OF MATERIALS TREATED
HOLSTON ARMY AMMUNITIONS PLANT
KINGSPORT, TN

Compound	Category
Composition A-5	RDX
Composition B	RDX & TNT
Composition B-3	RDX & TNT
Composition B-4	RDX & TNT
Composition C-4	RDX
Composition CH-6	RDX
Composition D-2	-
CXM-9	HMX
CXM-3	RDX
CXM-6	RDX
CXM-7	RDX
Cyclotol (70/30)	RDX & TNT
Cyclotol (75/25)	RDX & TNT
HMX	HMX
LX-04	HMX
LX-07	HMX
LX-09	HMX
LX-10-2	HMX
LX-14-1	HMX
LX-17	TATB
Octol 70/30	HMX & TNT
Octol 75/25	HMX & TNT
PBX-0280	RDX
PBX-9404	HMX
PBX-9407	RDX
PBX-9501	HMX
PBX-9502	TATB
PBXN-7	TATB & RDX
PBXN-3	HMX
PBXN-5	HMX
PBXN-6	RDX
PBXN-9	HMX
RDX	RDX
Composition A-3	RDX
Composition A-4	RDX
TNT	TNT
1,3,3-Trinitroazetidine (TNAZ)	TNAZ
CL-20	CL20
TATB	TATB
PETN	PETN
HDX-106	RDX

- M1 (85% Nitrocellulose)
- M6 (85% Nitrocellulose)
- RDX
- TNT
- Triple Base

A comparison of these compounds to the groupings of materials indicated that only three of the 10 groups (specifically, RDX, Composition B and TNT) had been directly analyzed in the Dugway tests. For the other groups (HMX, TATB, etc.), the average of these three would be used to approximate the emission factors for these groups. This is summarized in Table 4.

STEP 4: Determine percentage of all materials which fit into the identified classes.

A total of 40 materials are treated at HSAAP. Using the number of materials in each group, the annual mix of materials treated was determined by calculating the percentage of each grouping among those treated at HSAAP. The final annual mix of materials was calculated to be:

Group	Number of Materials in Group	Percentage of Total
RDX	13	32.5%
Composition B	5	12.5%
TNT	1	2.5%
Others	21	52.5%

TABLE 4

SUMMARY OF GROUPINGS AND ASSOCIATED DUGWAY TEST RESULTS
HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TN

Group	Number of Materials in Group	Associated Dugway Test Data
RDX	13	RDX
RDX & TNT (Composition B)	5	Composition B
HMX	12	Average *
TATB	3	Average *
HMX & TNT	2	Average *
TATB & RDX	1	Average *
TNAZ	1	Average *
CL20	1	Average *
PETN	1	Average *
TNT	1	TNT

* Average of RDX, Composition B and TNT emissions data.

EMISSION FACTOR SAMPLE CALCULATION SHEETS

Sheet:	Emission Factors							
Calculations:								
Short-Term Emission Factor - TNT				TNT Emission Factors (High Heat Content)				
Short-Term Emission Factor - PETN				PETN Emission Factors (Low Heat Content)				
Long-Term Emission Factor				Emission Factors are weighted average:				
				12.5% Composition B + 32.5% RDX + 2.5% TNT				
				+ 52.5% (Average of Comp. B, RDX and TNT)				
				Based on annual mix of materials treated at HSAAP.				
				[See Section E-2-4c(5) and Appendix E-2-3]				
Example:								
Compound:						Benzene		
Composition B Emission Factor:						5.16E-06		
RDX Emission Factor:						6.90E-05		
TNT Emission Factor:						6.28E-06		
Average of Above Emission Factors:						2.68E-05		
12.5% of Composition B Emission Factor:						6.45E-07		
32.5% of RDX Emission Factor:						2.24E-05		
2.5% of TNT Emission Factor:						1.57E-07		
52.5% of Average of Emission Factors:						1.41E-05		
Sum of These Percentages (Long-Term Emission Factor):						3.73E-05		

CALCULATION WORKSHEET Order No. 19116 (01-91)

CLIENT: HOLSTON (HSAAP)	JOB NUMBER: JF95-4000
SUBJECT: DISPERSION MODEL EMISSION FACTORS (except Chlorine & Fluorine)	
BASED ON: DUGWAY TEST DATA	~~DRAWING NUMBER~~
BY: MLeger / CHECKED BY: Wayne	APPROVED BY / DATE: 3/20/97

* SHORT-TERM EMISSION FACTORS
  - TNT (HIGH HEAT CONTENT)
  - PETN (LOW HEAT CONTENT).

  - PETN EMISSION FACTORS ARE AVERAGE OF COMPOSITION B, RDX AND TNT DUGWAY TEST RESULTS (SEE SECTION E-2-4c(5)).

* LONG-TERM EMISSION FACTORS
  - WEIGHTED AVERAGE BASED ON ANNUAL MIX OF MATERIALS TREATED AT HSAAP.
  - SEE SECTION E-2-4c(5) AND APPENDIX E-2-3 FOR DISCUSSION.
  - ANNUAL MIX:

COMPOSITION B	12.5%
RDX	32.5%
TNT	2.5%
OTHERS	52.5%
	100%

  - "OTHERS" MODELED AS AVERAGE OF COMP B, RDX AND TNT EMISSION FACTORS.

EXAMPLE CALCULATE LONG-TERM EMISSION FACTOR FOR BENZENE.

$$EF_{ANN,\,BENZENE} = 0.125\,EF_{COMP\,B} + 0.325\,EF_{RDX} + 0.025\,EF_{TNT} + 0.525\left(\frac{EF_{COMP\,B} + EF_{RDX} + EF_{TNT}}{3}\right)$$

CLIENT	JOB NUMBER
HOLSTON (HSAAP)	JF95-4000
SUBJECT: DISPERSION MODELING EMISSION FACTORS (except Chlorine & Fluorine)	
BASED ON: DUGWAY TEST DATA	DRAWING NUMBER
BY: MLeger / CHECKED BY: Wagner	APPROVED BY / DATE: 3/20/97

where: $EF_{ANN,BENZENE}$ = LONG-TERM BENZENE EMISSION FACTOR

$EF_{COMP\,B}$ = COMPOSITION B EMISSION FACTOR FOR BENZENE
EF_{RDX} = RDX EMISSION FACTOR FOR BENZENE
EF_{TNT} = TNT EMISSION FACTOR FOR BENZENE

FROM DUGWAY TEST DATA, FOR BENZENE

$EF_{COMP\,B} = 5.16E-6$
$EF_{RDX} = 6.90E-5$
$EF_{TNT} = 6.28E-6$

$$\therefore EF_{ANN,BENZENE} = 0.125(5.16E-6) + 0.325(6.90E-5) + 0.025(6.28E-6) + 0.525\left(\frac{5.16E-6 + 6.90E-5 + 6.28E-6}{3}\right)$$

$$= 6.45E-7 + 2.24E-5 + 1.57E-7 + 1.41E-5$$

$$= 3.73E-5$$

CLIENT	JOB NUMBER
Holston Army Ammunition Plant	
SUBJECT: Chlorine/Fluorine emissions from OB treatment	
BASED ON	DRAWING NUMBER
BY: Wagner	CHECKED BY: M
APPROVED BY	DATE: 3/17/97

- Short term emissions:

(Daily NEW treated)(% of material in compound treated)(gm wt of cl / gm wt of compound)

* Daily NEW treated = 5000 lbs
* Percent of chlorine-containing material in compound treated.

2.98% of PBX9404 is tris-beta-chloroethyl-phospate ($C_6H_{12}Cl_3O_4P$)

5% of PBX9502 is Kel-F ($C_8H_2Cl_3F_{11}$)

C = 12
H = 1
Cl = 35.4
F = 18.99
O = 15.99
P = 30.97
N = 14.00

} Atomic Weights

gram molecular weight of $(C_6H_{12}Cl_3O_4P)$ =

$(6 \cdot 12) + (12 \cdot 1) + (3 \cdot 35.4) + (4 \cdot 15.99) + (1 \cdot 30.97)$

$72.0 + 12.0 + 106.2 + 63.96 + 30.97 = 285.13$ ✓

gram molecular weight of $(C_8H_2Cl_3F_{11})$ =

$(8 \cdot 12.0) + (2 \cdot 1) + (3 \cdot 35.4) + (11 \cdot 18.99)$

$96.0 + 2 + 106.2 + 208.89 = 413.09$ ✓

* Provided by Holston Army Ammunitions Plant

CLIENT	JOB NUMBER
Holston Army Ammunitions Plant	
SUBJECT: Chlorine / Fluorine emissions from OB treatment	
BASED ON	DRAWING NUMBER
BY: Wagner	CHECKED BY: MC / APPROVED BY / DATE: 3/17/97

chlorine emissions from:

PBX9404

$$\left(\frac{5000 \text{ lbs}}{\text{PBX9404}}\right)\left(\frac{2.98\% \text{ of PBX9404 is tris-beta-chloroethyl-phospate}}{}\right)\left(\frac{106.2 \text{ gm mole. wt } Cl_3}{285.13 \text{ gm mole wt of } C_6H_{12}Cl_3O_4P}\right)$$

$$(5000)\quad(.0298)\quad(.3725)$$

= 55.50 lbs Cl ✓

$$\left(\frac{5000 \text{ lbs}}{\text{PBX9502}}\right)\left(\frac{5\% \text{ of PBX9502 is Kel-F}}{}\right)\left(\frac{106.2 \text{ gm mole wt of } Cl_3}{413.09 \text{ gm mole wt of } C_8H_2Cl_3F_{11}}\right)$$

$$(5000)\quad(0.05)\quad(0.2571)$$

64.27 lbs Cl ✓

use as short-term emission factor for Cl

why?

P

$$\frac{64.27 \text{ lbs Cl}}{5000 \text{ lbs PBX9502}} = 0.0129 \frac{\text{lb Cl}}{\text{lb PBX9502}} \times \frac{36.4 \text{ gm mol wt HCl}}{35.4 \text{ gm mol wt Cl}}$$

HCl

Cl

$$= 0.0133 \frac{\text{lb HCl}}{\text{lb}_{\text{PBX9502}}}$$ ✓ short term emission factor for HCl

CALCULATION WORKSHEET Order No. 19116 (01-91)

CLIENT Holston Army Ammunition Plant	JOB NUMBER
SUBJECT Chlorine / Fluorine emissions from OB treatment	
BASED ON	DRAWING NUMBER
BY Wagner	CHECKED BY M / APPROVED BY / DATE 3/17/97

Percent of Fluorine containing material in compounds:

FEFO, Kel-F, Viton A, Teflon.

2.3% of LX-09 is FEFO ($C_5H_6N_4O_{10}F_2$)

5% of PBX-9502 is Kel-F ($C_8H_2Cl_3F_{11}$)

5% of PBX-9502 is Viton A ($C_5H_{3.5}F_{6.5}$)
" of PBXN-5 "
" of PBXN-6 "

1.4% of HDX-106 is Teflon (CF_2)

gram mole. wt of compound:

FEFO
$(5 \cdot 12) + (6 \cdot 1) + (4 \cdot 1) + (10 \cdot 16) + (2 \cdot 18.99)$
$60 + 6 + 56 + 160 + 37.98 = 319.98$ ✓

Kel-F
$(8 \cdot 12) + (2 \cdot 1) + (3 \cdot 35.4) + (11 \cdot 18.99)$
$96 + 2 + 106.2 + 208.89 = 413.09$ ✓

Viton A
$(5 \cdot 12) + (3.5 \cdot 1) + (6.5 \cdot 18.99)$
$60 + 3.5 + 123.44 = 186.94$ ✓

Teflon
$(1 \cdot 12) + (2 \cdot 18.99)$
$12 + 37.98 = 49.98$ ✓

CLIENT	JOB NUMBER
Holston Army Ammunition Plant	
SUBJECT: Chlorine/Fluorine emissions from OB treatment	
BASED ON	DRAWING NUMBER
BY: Wagner / CHECKED BY: JK	APPROVED BY / DATE: 12/21/2001

$$\left(\frac{5000\ \text{lbs FEFO}}{}\right)\left(\frac{2.3\%\ \text{of LX-09 is FEFO}}{}\right)\left(\frac{37.98\ \text{gm mol wt of } F_2}{319.98\ \text{gm mol wt of } C_5H_6N_4O_{10}F_2}\right)$$

$$(5000)\quad (0.023)\quad (0.1187)$$

13.65 lbs F ✓

$$\left(\frac{5000\ \text{lbs}}{}\right)\left(\frac{5\%\ \text{of PBX9502 is Kel-F}}{}\right)\left(\frac{208.84\ \text{gm mol wt of } F_{11}}{413.09\ \text{gm mol wt of } C_8H_2Cl_3F_{11}}\right)$$

$$(5000)\quad (0.05)\quad (0.51)$$

126.39 lbs F ✓

$$\left(\frac{5000\ \text{lbs}}{}\right)\left(\frac{15\%\ \text{of PBX-9502 is Viton A}}{}\right)\left(\frac{123.44\ \text{gm mol wt of } F_{6.5}}{186.94\ \text{gm mol wt of } C_5H_{3.5}F_{6.5}}\right)$$

$$= (5000) \times (0.15) \times (.6603)$$

495.23 lbs F ✓ Use as short-term emission factor for F

$$\left(\frac{495.23\ \text{lbs F}}{5000\ \text{lbs Viton A}}\right)\left(\frac{19.99\ \text{gm mole wt HF}}{18.99\ \text{gm mole wt F}}\right) = \frac{0.1043\ \text{lbs HF}}{1\text{b PBX9502}}$$

short term emission

CLIENT Holston Army Ammunition Plant	JOB NUMBER
SUBJECT Chlorine & Fluorine Emissions from OB Treatment	
BASED ON Additive Percentages	DRAWING NUMBER
BY J. Lucas / CHECKED BY / APPROVED BY / DATE 12/29/2001	

TEFLON

$$(5000 \text{ lbs.})\left(1.4\% \text{ of HDX-1061's } \underset{\text{TEFLON}}{}\right)\left(\frac{37.98 \text{ gm. mol. wt. of } F_2}{49.98 \text{ gm. mol. wt. of } CF_2}\right)$$

$$= (5000)(0.014)(0.75)$$

$$= 53.19 \text{ lbs Fluorine}$$

The AVERAGE fluorine emissions for ALL additives
$= (53.19 + 495.23 + 126.39 + 13.65)/4 = 172.12$ lbs.

ANNUAL Emission Factors for Chlorine & Fluorine

Chlorine Emissions:

$$(1{,}250{,}000 \text{ lbs/yr})\left(\frac{2}{40}\right)\left(\frac{60 \text{ lbs Cl}^*}{5{,}000 \text{ lbs}}\right) = 750 \text{ lbs Cl/yr.}$$

* Average of chlorine emissions resulting from the treatment of 5,000 lbs New of PBX 9404 and PBX 9502.

Fluorine Emissions:

$$(1{,}250{,}000 \text{ lbs/yr})\left(\frac{10}{40}\right)\left(\frac{172.12 \text{ lbs F}}{5{,}000 \text{ lbs}}\right) = 10{,}758 \text{ lbs F/yr.}$$

CLIENT	JOB NUMBER		
Holston Army Ammunition Plant			
SUBJECT: Chlorine & Fluorine Emissions from OB Treatment.			
BASED ON: Additive Percentages	DRAWING NUMBER		
BY: J. Lucas	CHECKED BY	APPROVED BY	DATE: 12/29/2001

HCl ANNUAL EMISSION FACTOR:

$$\left(750 \frac{\text{lbs Cl}}{\text{yr}}\right)\left(\frac{1}{1{,}250{,}000 \text{ lbs/yr}}\right)\left(\frac{36.4 \text{ gm. mol. wt. HCl}}{35.4 \text{ gm. mol. wt. Cl}}\right)$$

$$= 6.17 \text{ E-04} \frac{\text{lbs HCl}}{\text{lb. treated}} \quad \text{(ANNUAL)}$$

HF ANNUAL EMISSION FACTOR:

$$\left(10{,}758 \text{ lbs F/yr}\right)\left(\frac{1}{1{,}250{,}000 \text{ lbs/yr}}\right)\left(\frac{19.99 \text{ gm. mol. wt HF}}{18.99 \text{ gm. mol. wt F}}\right)$$

$$= 9.06 \text{ E-03} \frac{\text{lbs HF}}{\text{lb treated}} \quad \text{(ANNUAL)}$$

APPENDIX E-2-4
SUMMARY OF BURN PAN UNIT SHORT-TERM AND LONG-TERM EMISSION FACTORS
HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TN

	A	B	C	D	E	J	K	L
1	Compound	Composition B (56/68/6 RDX-TNT-WAX)	RDX (cyclotrimethyl-enetrinitramine)	TNT (2,4,6-Trinitrotoluene)	Average	Short-Term Emission Factor - TNT	Short-Term Emission Factor - PETN	Long-Term Emission Factor
2	1,2,4-Trimethylbenzene	9.79E-07			9.79E-07		9.79E-07	6.36E-07
3	1,3 - Butadiene			5.34E-07	5.34E-07	5.34E-07	5.34E-07	2.94E-07
4	1,3,5-Trimethylbenzene	3.66E-07			3.66E-07		3.66E-07	2.38E-07
5	1,3,5-Trinitrobenzene	1.72E-05		2.88E-05	1.53E-05	2.88E-05	1.53E-05	1.09E-05
6	1,3-Dinitrobenzene	2.83E-07			2.83E-07		2.83E-07	1.84E-07
7	2,4,6-Trinitrotoluene [1]	6.80E-06		3.45E-05	1.38E-05	3.45E-05	1.38E-05	8.94E-06
8	2,4-Dinitrotoluene	2.33E-07		7.55E-06	2.59E-06	7.55E-06	2.59E-06	1.58E-06
9	2-Methylnapthalene	9.81E-08		1.78E-06	6.26E-07	1.78E-06	6.26E-07	3.85E-07
10	3,4-Methylphenol (m- & p-cresol)			5.30E-08	5.30E-08	5.30E-08	5.30E-08	2.92E-08
11	Acenaphthylene			1.66E-07	1.66E-07	1.66E-07	1.66E-07	9.13E-08
12	Acetophenone	1.67E-07		5.18E-06	1.78E-06	5.18E-06	1.78E-06	1.09E-06
13	Alkanes (Paraffins)	1.14E-05		3.29E-06	4.90E-06	3.29E-06	4.90E-06	4.08E-06
14	Alkenes (Olefins)	3.36E-05		4.14E-05	2.50E-05	4.14E-05	2.50E-05	1.84E-05
15	Anthracene			1.49E-07	1.49E-07	1.49E-07	1.49E-07	8.20E-08
16	Aromatics	2.35E-05		2.93E-06	8.81E-06	2.93E-06	8.81E-06	7.64E-06
17	Benz(a)anthracene			7.18E-07	7.18E-07	7.18E-07	7.18E-07	3.95E-07
18	Benzene	5.16E-06	6.90E-05	6.28E-06	2.68E-05	6.28E-06	2.68E-05	3.73E-05
19	Benzo(a)pyrene			4.64E-07	4.64E-07	4.64E-07	4.64E-07	2.55E-07
20	Benzo(b)fluoranthene			8.28E-07	8.28E-07	8.28E-07	8.28E-07	4.55E-07
21	Benzo(g,h,i)perylene			1.52E-07	1.52E-07	1.52E-07	1.52E-07	8.36E-08
22	Benzo(k)fluoranthene			6.07E-07	6.07E-07	6.07E-07	6.07E-07	3.34E-07
23	Benzyl alcohol	1.92E-07		4.42E-08	7.87E-08	4.42E-08	7.87E-08	6.64E-08
24	Biphenyl			3.44E-07	3.44E-07	3.44E-07	3.44E-07	1.89E-07
25	bis (2-Ethylhexyl)phthalate	1.63E-06		8.81E-07	8.37E-07	8.81E-07	8.37E-07	6.65E-07
26	Butylbenzyl phthalate	4.83E-07		2.91E-06	1.13E-06	2.91E-06	1.13E-06	7.27E-07
27	Carbon Dioxide	1.25E+00	5.70E-01	1.42E+00	1.08E+00	1.42E+00	1.08E+00	9.44E-01
28	Carbon Monoxide	4.17E-03	3.10E-02	7.23E-03	1.41E-02	7.23E-03	1.41E-02	1.82E-02
29	Carbon Tetrachloride	3.64E-07			3.64E-07		3.64E-07	2.37E-07
30	Di-n-butyl phthalate	2.08E-07		2.51E-06	9.06E-07	2.51E-06	9.06E-07	5.64E-07
31	Di-n-octyl phthalate	2.30E-06		8.70E-07	1.06E-06	8.70E-07	1.06E-06	8.64E-07
32	Dibenzofuran			6.86E-08	6.86E-08	6.86E-08	6.86E-08	3.77E-08
33	Dichloromethane	2.83E-04			2.83E-04		2.83E-04	1.84E-04
34	Diethyl phthalate	1.85E-07		1.93E-06	7.05E-07	1.93E-06	7.05E-07	4.42E-07
35	Dimethyl phthalate	2.86E-07			2.86E-07		2.86E-07	1.86E-07
36	Ethylbenzene	1.96E-06			1.96E-06		1.96E-06	1.27E-06
37	Fluoranthene			4.88E-06	4.88E-06	4.88E-06	4.88E-06	2.68E-06
38	Fluorene			3.86E-08	3.86E-08	3.86E-08	3.86E-08	2.12E-08
39	Freon 11	1.46E-06			1.46E-06		1,46E-06	9.49E-07
40	Freon 113	3.64E-07			3.64E-07		3.64E-07	2.37E-07
41	Freon 12	3.71E-07		1.39E-06	5.87E-07	1.39E-06	5.87E-07	3.89E-07
42	HMX			2.36E-06	2.36E-06	2.36E-06	2.36E-06	1.30E-06
43	Hydrogen Chloride [2]					1.33E-02	1.33E-02	6.17E-04
44	Hydrogen Fluoride [3]					1.04E-01	1.04E-01	9.06E-03
45	Indeno (1,2,3 - cd) pyrene			1.69E-07	1.69E-07	1.69E-07	1.69E-07	9.30E-08
46	m- & p-Xylene	6.74E-06			6.74E-06		6.74E-06	4.38E-06
47	Methane		2.00E-04	1.83E-05	7.28E-05	1.83E-05	7.28E-05	1.04E-04
48	Methyl chloride	7.38E-07		4.94E-07	4.11E-07	4.94E-07	4.11E-07	3.20E-07
49	n-Nitrosodiphenylamine			8.70E-08	8.70E-08	8.70E-08	8.70E-08	4.79E-08
50	Naphthalene	9.81E-08		3.58E-06	1.23E-06	3.58E-06	1.23E-06	7.45E-07
51	Nitrogen Dioxide (peroxide)	1.92E-04	6.00E-04	6.59E-05	2.86E-04	6.59E-05	2.86E-04	3.71E-04
52	Nitrogen Oxide	9.28E-03	9.00E-04	9.20E-03	6.46E-03	9.20E-03	6.46E-03	5.07E-03
53	o-Xylene	2.70E-06			2.70E-06		2.70E-06	1.76E-06
54	p-Ethyltoluene	7.36E-07		4.47E-07	3.94E-07	4.47E-07	3.94E-07	3.10E-07
55	Phenanthrene	7.57E-08		6.07E-07	2.28E-07	6.07E-07	2.28E-07	1.44E-07
56	Phenol	2.15E-09		1.52E-06	5.07E-07	1.52E-06	5.07E-07	3.05E-07
57	PM10 [5]	2.80E-01	2.80E-01	2.80E-01	2.80E-01	2.80E-01	2.80E-01	2.80E-01
58	Pyrene	6.34E-08		5.32E-06	1.79E-06	5.32E-06	1.79E-06	1.08E-06
59	RDX [4]	5.60E-06	1.00E-05	9.59E-06	8.40E-06	9.59E-06	8.40E-06	8.60E-06
60	Styrene			1.46E-06	1.46E-06	1.46E-06	1.46E-06	8.03E-07
61	Tetrachloroethylene	1.80E-05			1.80E-05		1.80E-05	1.17E-05
62	TO - 12 (NMOC)			8.42E-05	8.42E-05	8.42E-05	8.42E-05	4.63E-05
63	Toluene	3.92E-06		1.46E-06	1.79E-06	1.46E-06	1.79E-06	1.47E-06
64	Total Non-methane Hydrocarbons	1.14E-04	1.30E-03	3.92E-05	4.84E-04	3.92E-05	4.84E-04	6.92E-04
65	Total Non-methane Organic Compounds	2.90E-04			2.90E-04		2.90E-04	1.89E-04
66	Total Unidentified Hydrocarbons	4.54E-05			4.54E-05		4.54E-05	2.95E-05
67								
68	[1] 2,4,6-TNT Emission Factor for Composition B based on 99.999% DRE.							
69	[2] Hydrogen Chloride Emission Factor based on maximum (for short-term) and average (for long-term) chlorine content of items treated at HSAAP							
70	[3] Hydrogen Fluoride Emission Factor based on maximum (for short-term) and average (for long-term) fluorine content of items treated at HSAAP							
71	[4] RDX Emission Factor for Composition B and RDX based on 99.999% DRE.							

APPENDIX E-2-4
SUMMARY OF BURN PAN UNIT SHORT-TERM AND LONG-TERM EMISSION FACTORS
HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TN

	A	I	K	L
1	Compound	Maximum Emission Factor (lb/lb)	Short-Term Average Emission Factor - PETN	Long-Term Average Emission Factor
2	1,2,4-Trimethylbenzene	9.79E-07	9.79E-07	6.36E-07
3	1,3 - Butadiene	5.34E-07	5.34E-07	2.94E-07
4	1,3,5-Trimethylbenzene	3.66E-07	3.66E-07	2.38E-07
5	1,3,5-Trinitrobenzene	2.88E-05	1.53E-05	1.09E-05
6	1,3-Dinitrobenzene	2.83E-07	2.83E-07	1.84E-07
7	2,4,6-Trinitrotoluene [1]	3.45E-05	1.38E-05	8.94E-06
8	2,4-Dinitrotoluene	7.55E-06	2.59E-06	1.58E-06
9	2-Methylnapthalene	1.78E-06	6.26E-07	3.85E-07
10	3,4-Methylphenol (m- & p-cresol)	5.30E-08	5.30E-08	2.92E-08
11	Acenaphthylene	1.66E-07	1.66E-07	9.13E-08
12	Acetophenone	5.18E-06	1.78E-06	1.09E-06
13	Alkanes (Paraffins)	1.14E-05	4.90E-06	4.08E-06
14	Alkenes (Olefins)	4.14E-05	2.50E-05	1.84E-05
15	Anthracene	1.49E-07	1.49E-07	8.20E-08
16	Aromatics	2.35E-05	8.81E-06	7.64E-06
17	Benz(a)anthracene	7.18E-07	7.18E-07	3.95E-07
18	Benzene	6.90E-05	2.68E-05	3.73E-05
19	Benzo(a)pyrene	4.64E-07	4.64E-07	2.55E-07
20	Benzo(b)fluoranthene	8.28E-07	8.28E-07	4.55E-07
21	Benzo(g,h,i)perylene	1.52E-07	1.52E-07	8.36E-08
22	Benzo(k)fluoranthene	6.07E-07	6.07E-07	3.34E-07
23	Benzyl alcohol	1.92E-07	7.87E-08	6.64E-08
24	Biphenyl	3.44E-07	3.44E-07	1.89E-07
25	bis (2-Ethylhexyl)phthalate	1.63E-06	8.37E-07	6.65E-07
26	Butylbenzyl phthalate	2.91E-06	1.13E-06	7.27E-07
27	Carbon Dioxide	1.42E+00	1.08E+00	9.44E-01
28	Carbon Monoxide	3.10E-02	1.41E-02	1.82E-02
29	Carbon Tetrachloride	3.64E-07	3.64E-07	2.37E-07
30	Di-n-butyl phthalate	2.51E-06	9.06E-07	5.64E-07
31	Di-n-octyl phthalate	2.30E-06	1.06E-06	8.64E-07
32	Dibenzofuran	6.86E-08	6.86E-08	3.77E-08
33	Dichloromethane	2.83E-04	2.83E-04	1.84E-04
34	Diethyl phthalate	1.93E-06	7.05E-07	4.42E-07
35	Dimethyl phthalate	2.86E-07	2.86E-07	1.86E-07
36	Ethylbenzene	1.96E-06	1.96E-06	1.27E-06
37	Fluoranthene	4.88E-06	4.88E-06	2.68E-06
38	Fluorene	3.86E-08	3.86E-08	2.12E-08
39	Freon 11	1.46E-06	1.46E-06	9.49E-07
40	Freon 113	3.64E-07	3.64E-07	2.37E-07
41	Freon 12	1.39E-06	5.87E-07	3.89E-07
42	HMX	2.36E-06	2.36E-06	1.30E-06
43	Hydrogen Chloride [2]		1.33E-02	6.17E-04
44	Hydrogen Fluoride [3]		1.04E-01	9.06E-03
45	Indeno (1,2,3 - cd) pyrene	1.69E-07	1.69E-07	9.30E-08
46	m- & p-Xylene	6.74E-06	6.74E-06	4.38E-06
47	Methane	2.00E-04	7.28E-05	1.04E-04
48	Methyl chloride	7.38E-07	4.11E-07	3.20E-07
49	n-Nitrosodiphenylamine	8.70E-08	8.70E-08	4.79E-08
50	Naphthalene	3.58E-06	1.23E-06	7.45E-07
51	Nitrogen Dioxide (peroxide)	6.00E-04	2.86E-04	3.71E-04
52	Nitrogen Oxide	9.28E-03	6.46E-03	5.07E-03
53	o-Xylene	2.70E-06	2.70E-06	1.76E-06
54	p-Ethyltoluene	7.36E-07	3.94E-07	3.10E-07
55	Phenanthrene	6.07E-07	2.28E-07	1.44E-07
56	Phenol	1.52E-06	5.07E-07	3.05E-07
57	PM10[5]	2.80E-01	2.80E-01	2.80E-01
58	Pyrene	5.32E-06	1.79E-06	1.08E-06
59	RDX [4]	1.00E-05	8.40E-06	8.60E-06
60	Styrene	1.46E-06	1.46E-06	8.03E-07
61	Tetrachloroethylene	1.80E-05	1.80E-05	1.17E-05
62	TO - 12 (NMOC)	8.42E-05	8.42E-05	4.63E-05
63	Toluene	3.92E-06	1.79E-06	1.47E-06
64	Total Non-methane Hydrocarbons	1.30E-03	4.84E-04	6.92E-04
65	Total Non-methane Organic Compounds	2.90E-04	2.90E-04	1.89E-04
66	Total Unidentified Hydrocarbons	4.54E-05	4.54E-05	2.95E-05
67				
68	[1] 2,4,6-TNT Emission Factor for Composition B based on 99.999% DRE.			
69	[2] Hydrogen Chloride Emission Factor based on maximum (for short-term) and average (for long-term) chlo			
70	[3] Hydrogen Fluoride Emission Factor based on maximum (for short-term) and average (for long-term) fluo			
71	[4] RDX Emission Factor for Composition B and RDX based on 99.999% DRE.			

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APPENDIX E-2-5

U.S. EPA REGION III RISK BASED SCREENING CRITERIA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
841 Chestnut Building
Philadelphia, Pennsylvania 19107

SUBJECT: Risk-Based Concentration Table **DATE:** 9/25/2001

FROM: Jennifer Hubbard, Toxicologist
Superfund Technical Support Section (3HS41)

TO: RBC Table Users

Attached is the EPA Region III Risk-Based Concentration (RBC) Table, which we prepare and post periodically for all interested parties.

CONTENTS, USES, AND LIMITATIONS OF THE RBC TABLE

The RBC Table contains Reference Doses (RfDs) and Cancer Slope Factors (CSFs) for 400-500 chemicals. These toxicity factors have been combined with "standard" exposure scenarios to calculate RBCs--chemical concentrations corresponding to fixed levels of risk (i.e., a Hazard Quotient (HQ) of 1, or lifetime cancer risk of 1E-6, whichever occurs at a lower concentration) in water, air, fish tissue, and soil.

The Region III toxicologists use RBCs to screen sites not yet on the NPL, respond rapidly to citizen inquiries, and spot-check formal baseline risk assessments. The primary use of RBCs is for chemical screening during baseline risk assessment (see EPA Regional Guidance EPA/903/R-93-001, "Selecting Exposure Routes and Contaminants of Concern by Risk-Based Screening"). The exposure equations come from EPA's Risk Assessment Guidance for Superfund (RAGS), while the exposure factors are those recommended in RAGS or supplemental guidance from the Superfund program. The attached technical background document provides specific equations and assumptions. Simply put, RBCs are like risk assessments run in reverse. For a single contaminant in a single medium, under standard default exposure assumptions, the RBC corresponds to the target risk or hazard quotient.

RBCs also have several important limitations. Specifically excluded from consideration are (1) transfers from soil to air, (2) cumulative risk from multiple contaminants or media, and (3) dermal risk. Additionally, the risks for inhalation of vapors from water are based on a very simple model, whereas detailed risk assessments may use more detailed showering models. Many RBCs are also based on adult risks. For more information about children's risks, see the Technical Background Document and Frequently Asked Question #12. Furthermore, the toxicity information in the Table has been assembled by hand and (despite extensive checking and years of use) may contain errors. It's advisable to cross-check before relying on any RfDs or CSFs in the Table. If you note any errors, please let us know.

It is important to note that this Table uses inhalation RfDs and CSFs rather than RfCs (Reference Concentrations) and inhalation unit cancer risks. This is because the latter factors incorporate exposure assumptions and therefore can only be used for one exposure scenario. Because risk assessors need to evaluate risks for many types of scenarios, the factors have been converted to the more traditional RfDs and CSFs. Unless otherwise indicated in the toxicity-factor source, the assumption is that RfCs and unit risks should be adjusted by a 70-kilogram body weight and a 20 m^3/day inhalation rate to generate the RfDs and CSFs.

Many users want to know if the RBCs can be used as valid no-action levels or cleanup levels, especially for soils. The answer is a bit complex. First, it is important to realize that the RBC Table does not constitute regulation or guidance, and should not be viewed as a substitute for a site-specific risk assessment. For sites where:

1. A single medium is contaminated;
2. A single contaminant contributes nearly all the health risk;
3. Volatilization, dermal contact, and other pathways not included in the RBCs are not expected to be significant;
4. The exposure scenarios and assumptions used in the RBC table are appropriate for the site;
5. The fixed risk levels used in the RBC table are appropriate for the site; and
6. Risk to ecological receptors is not expected to be significant;

the RBCs would probably be protective as no-action levels or cleanup goals. However, to the extent that a site deviates from this description, as most do, the RBCs would not necessarily be appropriate.

To summarize, the Table should generally not be used to set cleanup or no-action levels at CERCLA sites or RCRA Corrective Action sites, to substitute for EPA guidance for preparing baseline risk assessments, or to determine if a waste is hazardous under RCRA.

SPECIAL NOTES

The RBC Table was originally developed by Roy L. Smith, Ph.D., for use by risk assessors in the Region III Superfund program. Dr. Smith is no longer with Region III, and the Table continues to evolve. You may notice some modifications of formatting and conventions used in the Table.

For instance, besides formatting, the following changes are noteworthy:

As usual, updated toxicity factors have been used wherever available. However, because IRIS and provisional values are updated more frequently than the RBC Table, RBC Table users are ultimately responsible for obtaining the most up-to-date values. The RBC Table is provided as a convenience, but toxicity factors are compiled from the original sources and it is those original sources that should serve as the definitive reference.

Certain outdated and withdrawn numbers have been removed from the Table.

Changes to the table since the last semi-annual version have been marked with asterisks (**). Changes may involve a corrected CAS number or a correction in the VOC status, a change in the SSL, or changes of RfDs and CSFs on IRIS.

RBCs are no longer rounded to 1E6 ppm. For certain low-toxicity chemicals, the RBCs exceed possible concentrations at the target risks. In such cases, Dr. Smith rounded these numbers to the highest possible concentration, or 1E6 ppm. This type of truncation has been discontinued so that Table users can adjust the RBCs to a different target risk whenever necessary. For example, when screening chemicals at a target HQ of 0.1, noncarcinogenic RBCs may simply be divided by 10. Such scaling is not possible when RBCs are rounded. Users who are interested in truncation can also consult the Soil Screening Guidance for a discussion of "Csat," the saturation concentration.

This Table was originally compiled to assist Superfund risk assessors in screening hazardous waste sites. The large number of chemicals made the Table unwieldy and difficult to keep current. Many of the chemicals did not typically (or even occasionally) appear at Superfund sites. Starting with the April 1998 version of the Table, the 600+ chemicals were reduced to some 400-500 chemicals by eliminating many of those atypical chemicals. Through time, the Table may continue to grow or decrease in size.

At Region III Superfund sites, noncancer RBCs are typically adjusted downward to correspond to a target HQ of 0.1 rather than 1. (This is done to ensure that chemicals with additive effects are not prematurely eliminated during screening. Note that the RBCs displayed on the table are shown at an HQ of 1; to arrive at the RBC at 0.1, data users must do the conversion themselves.) However, some chemicals have RBCs at HQs of 0.1 that are lower than their RBCs at 1E-6 cancer risk. In other words, the screening RBC would change from carcinogenic to noncarcinogenic. A feature of this Table is that these chemicals are now flagged with a "!" symbol. Therefore, assessors screening with adjusted RBCs will be alerted to this situation. See the companion attachment to the RBC Table, "ALTRBC," for alternate values for "!" RBCs.

Earlier versions of this Table included a substitution of inhalation toxicity factors for oral factors whenever oral factors were unavailable (this applied only to groundwater and air,

but not soil or fish). This practice was discontinued in order to minimize the uncertainty associated with such a conversion. The discontinuation of this practice did not significantly decrease the number of available RBCs.

The criterion for "VOC status" is in accordance with RAGS Part B: chemicals with Henry's Law constants greater than 1E-5 and molecular weight less than 200 are now marked as VOCs. This increases consistency with the national guidance and with other EPA regions that use risk-based screening numbers.

Earlier versions of this Table included soil screening levels (SSLs), when those values were available in draft form. Since the finalization of the SSL Guidance, risk assessors are urged to consult the final SSL Guidance directly. However, for generic use in Region III, the table now contains soil-to-groundwater SSLs in accordance with the new guidance. For more information, see the Region III memo on SSLs, or consult the national SSL guidance directly (Soil Screening Guidance: User's Guide, April 1996, Publication 9355.4-23; and Soil Screening Guidance: Technical Background Document, May 1996; EPA/540/R-95/128).

You may notice there are now two rows for uranium, one reflecting the IRIS (EPA consensus) value and the other reflecting a more recent, but provisional value. Region III has shown both on this table, rather than choosing one over the other, to give Table users as much information as possible.

Vinyl chloride is handled differently from most other chemicals because of the unique aspects of its slope factor derivation. Readers are referred to the memo, "Derivation of Vinyl Chloride RBCs," which is a companion document to this RBC Table.

FREQUENTLY ASKED QUESTIONS

To help you better understand the RBC Table, here are answers to our most often-asked questions:

1. How can the age-adjusted inhalation factor (11.66) be less than the inhalation rate for either a child (12) or an adult (20)?

   Age-adjusted factors are not intake rates, but rather partial calculations which have different units from intake rates. (Therefore, they are not directly comparable.) The fact that these partial calculations have values similar to intake rates is really coincidental, an artifact of the similar magnitude of years of exposure and time-averaged body weight.

2. For manganese, IRIS shows an oral RfD of 0.14 mg/kg/day, but the RBC Table uses 2E-2 mg/kg/day. Why?

The IRIS RfD includes manganese from all sources, including diet. The explanatory text in IRIS recommends using a modifying factor of 3 when calculating risks associated with non-food sources, and the Table follows this recommendation. IRIS also recommends subtracting dietary exposure (default assumption in this case 5 mg). Thus, the IRIS RfD has been lowered by a factor of 2 x 3, or 6. The Table now reflects manganese RBCs for both "food" and "non-food" (most environmental) sources.

3. What is the source of the child's inhalation rate of 12 m^3/day?

The calculation comes from basic physiology. It's a scaling of the mass-specific 20 m^3/day rate for adults from a body mass of 70 kg to 15 kg, using the 2/3 power of mass, as follows:

Ircm = mass-specific child inhalation rate (m^3/kg/day)
Irc = child inhalation rate (m^3/day)

20 m^3/day / 70 kg = 0.286 m^3/kg/day (mass-specific adult inhalation rate)

0.286 m^3/kg/day x $(70^{0.67})$ = (Ircm) x $(15^{0.67})$

Ircm = 0.803 m^3/kg/day

Irc = Ircm x 15 kg = 0.803 m^3/kg/day x 15 kg = 12.04 m^3/day

4. Can the oral RfDs in the RBC Table be applied to dermal exposure?

Not directly. Oral RfDs are usually based on administered dose and therefore tacitly include a GI absorption factor. Thus, any use of oral RfDs (or CSFs) in dermal risk calculations should involve removing this absorption factor. Consult the Risk Assessment Guidance for Superfund, Part A, Appendix A, for further details on how to do this.

5. The exposure variables table in the RBC background document lists the averaging time for non-carcinogens as "ED*365." What does that mean?

ED is exposure duration, in years, and * is the computer-ese symbol for multiplication. Multiplying ED by 365 simply converts the duration to days. In fact, the ED term is included in both the numerator and denominator of the RBC algorithms for non-cancer risk, canceling it altogether. See RAGS for more information.

6. Why is inorganic lead not included in the RBC Table?

EPA has no consensus RfD or CSF for inorganic lead, so it is not possible to calculate RBCs as we have done for other chemicals. EPA considers lead to be a special case because of the difficulty in identifying the classic "threshold" needed to develop an RfD.

EPA therefore evaluates lead exposure by using blood-lead modeling, such as the Integrated Exposure-Uptake Biokinetic Model (IEUBK). The EPA Office of Solid Waste has also released a detailed directive on risk assessment and cleanup of residential soil lead. The directive recommends that soil lead levels less than 400 mg/kg are generally safe for residential use. Above that level, the document suggests collecting data and modeling blood-lead levels with the IEUBK model. For the purposes of screening, therefore, 400 mg/kg is recommended for residential soils. For water, we suggest 15 ug/l (the EPA Action Level in water), and for air, the National Ambient Air Quality Standard.

7. Where did the CSFs for carcinogenic PAHs come from?

The PAH CSFs are all calculated relative to benzo[a]pyrene, which has an IRIS slope factor. The relative factors for the other PAHs can be found in "Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons," Final Draft, ECAO-CIN-842 (March, 1993).

8. May I please have a copy of a previous RBC Table?

We do not distribute outdated copies of the RBC Table. Each new version of the Table supersedes all previous versions.

9. Please elaborate on the meaning of the "W" source code in the Table.

The "W" code means that a RfD or CSF is currently not present on either IRIS or HEAST, but that it was once present on either IRIS or HEAST and was removed. Such withdrawal usually indicates that consensus on the number no longer exists among EPA scientists, but not that EPA believes the contaminant to be unimportant.

Withdrawn numbers are shown in the Table because we still need to deal with these contaminants during the long delays before replacement numbers are ready. For the purpose of screening, a "W" value is similar to a provisional value in that neither value has achieved Agency consensus. The "W" code should serve as a clear warning that before making any serious decision involving that contaminant, you will need to develop an interim value based on current scientific understanding.

If you are assessing risks at a site where a major contaminant is coded "W," consider working with your Region EPA risk assessor to develop a current toxicity constant. If the site is being studied under CERCLA, the EPA-NCEA Regional Technical Support group

may be able to assist.

10. Can I get copies of supporting documents for interim toxicity constants which are coded "E" in the RBC Table?

Unfortunately, Region 3 does not have a complete set of supporting documents. The EPA-NCEA Superfund Technical Support Center prepares these interim toxicity constants in response to site-specific requests from Regional risk assessors, and sends the documentation only to the requestor. The RBC Tables contain only the latest interim values that we've either requested or have otherwise received. NCEA maintains the master data base of these chemicals, but will not release documentation of provisional values unless they are recent. Furthermore, since NCEA's Superfund Technical Support Center is mainly for the support of Superfund, it usually cannot develop new criteria unless authorized to do so for a specific Superfund project.

If an "E"-coded contaminant is a chemical of potential concern at your site, we urge you to work with the EPA Regional risk assessor assigned to the project in order to develop or obtain documentation for provisional values. EPA Region 3 furnishes documents only when needed to support Regional risk assessments or recommendations.

11. Why is there no oral RfD for mercury? How should I handle mercury?

IRIS gives oral RfDs for mercuric chloride and for methylmercury, but not for elemental mercury. Therefore, the RBC Table reflects this primary source. Consult your toxicologist to determine which of the available mercury numbers is suitable for the conditions at your site (e.g., whether mercury is likely to be organic or inorganic.)

12. How are children's risks considered?

The RBCs were examined to determine whether the child receptor would be expected to be more sensitive. Because most carcinogenic RBCs already include the child lifetime segment, and worker RBCs do not need to include the child, this assessment focused on non-cancer RBCs for water, air, and fish. (Residential soil non-cancer RBCs already are based on children's exposure.)

For tap water RBCs, 212 chemicals (out of about 450) had child RBCs that would be lower than adult RBCs. In all cases but one, the difference was a factor of 2.3. The single exception involved a factor of 1.24. For air RBCs, 306 chemicals had child RBCs that would be lower than adult RBCs. In all cases the difference was a factor of 2.8. (This also applies only to the use of inhalation RfDs, not RfCs.) For fish RBCs, 286 chemicals had child RBCs that would be lower than adult RBCs. In all cases but one, the difference was a factor of 2.3. The single exception involved a factor of 1.11.

Therefore, child users could possibly have lower noncancer RBCs, but the factor is less than 3. Users of the RBC table should be aware of this issue in case they wish to consider the child receptor beyond the current standard RBCs. (Note that Region III guidance instructs users to include a tenfold screening factor for non-carcinogens when preparing a Region III risk assessment, for reasons of additivity.)

This FAQ response addresses only the differences in exposure factors between children and adults. Age-based differences in toxicity have not yet been defined for most chemicals (there are rare exceptions, such as vinyl chloride and nitrate).

Sources I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRIS or HEAST
E = EPA-NCEA provisional value O = other

Basis: C = Carcinogenic effects N = Noncarcinogenic effects ! = RBC at HI of 0.1 < RBC-c

Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Risk-based concentrations: Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Soil Residential mg/kg	Region III SSLs: Soil, for groundwater migration DAF 1 mg/kg	DAF 20 mg/kg
ACETALDEHYDE	75070			2.57E-003 I	7.7E-003 I	y	1.6E+000 C	8.1E-001 C				3.8E-004	7.7E-003 C
ACETOCHLOR	34256821	2E-002 I					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N		
ACETONE	67641	1.00E-001 I				y	6.1E+002 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N	1.2E-001	2.5E+000 N
ACETONITRILE	75058			1.7E-002 I		y	1.2E+002 N	6.2E+001 N				2.9E-002	5.8E-001 N
ACETOPHENONE	98862	1.00E-001 I		5.70E-006 W		y	4.2E-002 N	2.1E-002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N	1.1E-005	2.2E-004 N
ACROLEIN	107028	2.00E-002 H		5.70E-006 I		y	4.2E-002 N	2.1E-002 N	2.7E+001 N	4.1E+004 N	1.6E+003 N	1.0E-005	2.0E-004 N
ACRYLAMIDE	79061	2.00E-004 I	4.50E+000 I		4.50E+000 I		1.5E-002 C	1.4E-003 C	7.0E-004 C	1.3E+000 C	1.4E-001 C	3.7E-006	7.4E-005 C
ACRYLONITRILE	107131	1.00E-003 H	5.40E-001 I	5.70E-004 I	2.40E-001 I	y	3.7E-002 C	2.6E-002 C	5.8E-003 C	1.1E+001 C	1.2E+000 C	7.4E-006	1.5E-004 C
ALACHLOR	15972608	1.00E-002 I	8.00E-002 H				8.4E-001 C	7.8E-002 C	3.9E-002 C	7.2E+001 C	8.0E+000 C	3.5E-004	7.0E-003 C
ALAR	1596845	1.50E-001 I					5.5E+003 N	5.5E+002 N	2.0E+002 N	3.1E+005 N	1.2E+004 N		
ALDICARB	116063	1.00E-003 I					3.7E+001 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N	1.0E-002	2.1E-001 N
ALDICARB SULFONE	1646884	1.00E-003 I					3.7E+001 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N	7.5E-003	1.5E-001 N
ALDRIN	309002	3.00E-005 I	1.70E+001 I		1.70E+001 I		3.9E-003 C	3.7E-004 C	1.9E-004 C	3.4E-001 C	3.8E-002 C	3.8E-004	7.7E-003 C
ALUMINUM	7429905	1.00E+000 E		1.00E-003 E			3.7E+004 N	3.7E+000 N	1.4E+003 N	2.0E+006 N	7.8E+004 N		
AMINODINITROTOLUENES		6.00E-005 E					2.2E+000 N	2.2E-001 N	8.1E-002 N	1.2E+002 N	4.7E+000 N		
4-AMINOPYRIDINE	504245	2.00E-005 H					7.3E-001 N	7.3E-002 N	2.7E-002 N	4.1E+001 N	1.6E+000 N		
AMMONIA	7664417			2.86E-002 I		y	2.1E+002 N	1.0E+002 N					
ANILINE	62533	7.00E-003 E	5.70E-003 I	2.90E-004 I			1.2E+001 C	1.1E+000 N	5.5E-001 C	1.0E+003 C	1.1E+002 C I	6.8E-003	1.4E-001 C
ANTIMONY	7440360	4.00E-004 I					1.5E+001 N	1.5E+000 N	5.4E-001 N	8.2E+002 N	3.1E+001 N	6.6E-001	1.3E+001 N
ANTIMONY PENTOXIDE	1314609	5.00E-004 H					1.8E+001 N	1.8E+000 N	6.8E-001 N	1.0E+003 N	3.9E+001 N		
ANTIMONY TETROXIDE	1332816	4.00E-004 H					1.5E+001 N	1.5E+000 N	5.4E-001 N	8.2E+002 N	3.1E+001 N		
ANTIMONY TRIOXIDE	1309644	4.00E-004 H		5.70E-005 I			1.5E+001 N	2.1E-001 N	5.4E-001 N	8.2E+002 N	3.1E+001 N		
ARSENIC	7440382	3.00E-004 I	1.50E+000 I		1.51E+001 I		4.5E-002 C	4.1E-004 C	2.1E-003 C	3.8E+000 C	4.3E-001 C	1.3E-003	2.6E-002 C
ARSINE	7784421			1.40E-005 I		y	1.0E-001 N	5.1E-002 N					
ASSURE	76578148	9.00E-003 I					3.3E+002 N	3.3E+001 N	1.2E+001 N	1.8E+004 N	7.0E+002 N		
ATRAZINE	1912249	3.50E-002 I	2.20E-001 H				3.0E-001 C	2.8E-002 C	1.4E-002 C	2.6E+001 C	2.9E+000 C	4.4E-004	8.8E-003 C
AZOBENZENE	103333		1.10E-001 I		1.10E-001 I		6.1E-001 C	5.7E-002 C	2.9E-002 C	5.2E+001 C	5.8E+000 C	1.8E-003	3.5E-002 C
BARIUM	7440393	7.00E-002 I		1.40E-004 A			2.6E+003 N	5.1E-001 N	9.5E+001 N	1.4E+005 N	5.5E+003 N	1.1E+002	2.1E+003 N
BAYGON	114261	4.00E-003 I					1.5E+002 N	1.5E+001 N	5.4E+000 N	8.2E+003 N	3.1E+002 N		
BAYTHROID	68359375	2.50E-002 I					9.1E+002 N	9.1E+001 N	3.4E+001 N	5.1E+004 N	2.0E+003 N		
BENTAZON	25057890	3.00E-002 I					1.1E+003 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N		
BENZALDEHYDE	100527	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N		
BENZENE	71432	3.00E-003 E	5.5E-002 I	1.70E-003 E	2.90E-002 I	y	3.2E-001 C	2.2E-001 C	5.7E-002 C	1.0E+002 C	1.2E+001 C	9.0E-005	1.8E-003 C
BENZENETHIOL	108985	1.00E-005 H				y	6.1E-002 N	3.7E-002 N	1.4E-002 N	2.0E+001 N	7.8E-001 N		
BENZIDINE	92875	3.00E-003 I	2.30E+002 I		2.30E+002 I		2.9E-004 C	2.7E-005 C	1.4E-005 C	2.5E-002 C	2.8E-003 C		
BENZOIC ACID	65850	4.00E+000 I					1.5E+005 N	1.5E+004 N	5.4E+003 N	8.2E+006 N	3.1E+005 N		
BENZYL ALCOHOL	100516	3.00E-001 H					1.1E+004 N	1.1E+003 N	4.1E+002 N	6.1E+005 N	2.3E+004 N	4.4E+000	8.8E+001 N
BENZYL CHLORIDE	100447		0.17 I			y	6.2E-002 C	3.7E-002 C	1.9E-002 C	3.4E+001 C	3.8E+000 C	1.9E-005	3.7E-004 C
BERYLLIUM	7440417	2.00E-003 I		5.7E-006 I	8.40E+000 I		7.3E+001 N	7.5E-004 C	2.7E+000 N	4.1E+003 N	1.6E+002 N	5.8E+001	1.2E+003 N
BIPHENYL	92524	5.00E-002 I				y	3.0E+002 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N	4.8E+000	9.6E+001 N
BIS(2-CHLOROETHYL)ETHER	111444		1.10E+000 I		1.10E+000 I	y	9.6E-003 C	5.7E-003 C	2.9E-003 C	5.2E+000 C	5.8E-001 C	2.2E-006	4.4E-005 C
BIS(2-CHLOROISOPROPYL)ETHER	108601	4.00E-002 I	7.00E-002 H		3.50E-002 H	y	2.6E-001 C	1.8E-001 C	4.5E-002 C	8.2E+001 C	9.1E+000 C	8.4E-005	1.7E-003 C
BIS(CHLOROMETHYL)ETHER	542881		2.20E+002 I		2.20E+002 I	y	4.8E-005 C	2.8E-005 C	1.4E-005 C	2.6E-002 C	2.9E-003 C	9.7E-009	1.9E-007 C
BIS(2-ETHYLHEXYL)PHTHALATE	117817	2.00E-002 I	1.40E-002 I		1.40E-002 E		4.8E+000 C	4.5E-001 C	2.3E-001 C	4.1E+002 C	4.6E+001 C	1.4E+002	2.9E+003 C
BORON	7440428	9.00E-002 I		5.70E-003 H			3.3E+003 N	2.1E+001 N	1.2E+002 N	1.8E+005 N	7.0E+003 N		

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Basis: C = Carcinogenic effects N = Noncarcinogenic effects ! = RBC at HI of 0.1 < RBC-c

Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Risk-based concentrations: Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Soil Residential mg/kg	Region III SSLs: Soil, for groundwater migration DAF 1 mg/kg	DAF 20 mg/kg
BROMODICHLOROMETHANE	75274	2.00E-002 I	6.20E-002 I			y	1.7E-001 C	1.0E-001 C	5.1E-002 C	9.2E+001 C	1.0E+001 C	5.4E-005	1.1E-003 C
BROMOETHENE	593602			8.6E-004 I	1.10E-001 H	y	1.1E-001 C	5.7E-002 C				5.4E-005	1.1E-003 C
BROMOFORM	75252	2.00E-002 I	7.90E-003 I		3.90E-003 I		8.5E+000 C	1.6E+000 C	4.0E-001 C	7.2E+002 C	8.1E+001 C	3.3E-003	6.7E-002 C
BROMOMETHANE	74839	1.40E-003 I		1.40E-003 I		y	8.5E+000 N	5.1E+000 N	1.9E+000 N	2.9E+003 N	1.1E+002 N	2.1E-003	4.1E-002 N
BROMOPHOS	2104963	5.00E-003 H					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N		
1,3-BUTADIENE	106990				1.80E+000 H	y	7.0E-003 C	3.5E-003 C				3.9E-006	7.8E-005 C
1-BUTANOL	71363	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N	7.8E-001	1.6E+001 N
BUTYLBENZYLPHTHALATE	85687	2.00E-001 I					7.3E+003 N	7.3E+002 N	2.7E+002 N	4.1E+005 N	1.6E+004 N	8.4E+002	1.7E+004 N
BUTYLATE	2008415	5.00E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N		
N-BUTYLBENZENE	104518	4.00E-002 E				y	2.4E+002 N	1.5E+002 N	5.4E+001 N	8.2E+004 N	3.1E+003 N		
SEC-BUTYLBENZENE	135988	4.00E-002 E				y	2.4E+002 N	1.5E+002 N	5.4E+001 N	8.2E+004 N	3.1E+003 N		
TERT-BUTYLBENZENE	98066	4.00E-002 E				y	2.4E+002 N	1.5E+002 N	5.4E+001 N	8.2E+004 N	3.1E+003 N		
CADMIUM-WATER	7440439	5.00E-004 I		5.7E-005 E	6.30E+000 I		1.8E+001 N	9.9E-004 C	6.8E-001 N	1.0E+003 N	3.9E+001 N	1.4E+000	2.7E+001 N
CADMIUM-FOOD	7440439	1.00E-003 I		5.7E-005 E	6.30E+000 I		3.7E+001 N	9.9E-004 C	1.4E+000 N	2.0E+003 N	7.8E+001 N	2.7E+000	5.5E+001 N
CAPROLACTAM	105602	5.00E-001 I					1.8E+004 N	1.8E+003 N	6.8E+002 N	1.0E+006 N	3.9E+004 N		
CARBARYL	63252	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N	1.5E+000	3.0E+001 N
CARBON DISULFIDE	75150	1.00E-001 I		2.00E-001 I		y	1.0E+003 N	7.3E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N	9.5E-001	1.9E+001 N
CARBON TETRACHLORIDE	56235	7.00E-004 I	1.30E-001 I	5.71E-004 E	5.30E-002 I	y	1.6E-001 C	1.2E-001 C	2.4E-002 C	4.4E+001 C	4.9E+000 C	1.1E-004	2.1E-003 C
CARBOSULFAN	55285148	1.00E-002 I					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N		
CHLORAL HYDRATE	302170	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N		
CHLORANIL	118752		4.00E-001 H				1.7E-001 C	1.6E-002 C	7.9E-003 C	1.4E+001 C	1.6E+000 C		
CHLORDANE	57749	5.00E-004 I	3.5E-001 I	2.00E-004 I	3.5E-001 I		1.9E-001 C	1.8E-002 C	9.0E-003 C	1.6E+001 C	1.8E+000 C	4.6E-002	9.2E-001 C
CHLORINE	7782505	1.00E-001 I		5.7E-005 E		y	4.2E-001 N	2.1E-001 N	1.4E+002 N	2.0E+005 N	7.8E+003 N		
CHLORINE DIOXIDE	10049044	3.00E-002 I		5.70E-005 I		y	4.2E-001 N	2.1E-001 N	4.1E+001 N	6.1E+004 N	2.3E+003 N		
CHLOROACETIC ACID	79118	2.00E-003 H					7.3E+001 N	7.3E+000 N	2.7E+000 N	4.1E+003 N	1.6E+002 N		
4-CHLOROANILINE	106478	4.00E-003 I					1.5E+002 N	1.5E+001 N	5.4E+000 N	8.2E+003 N	3.1E+002 N	4.8E-002	9.7E-001 N
CHLOROBENZENE	108907	2.00E-002 I		1.7E-002 E		y	1.1E+002 N	6.2E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N	4.0E-002	8.0E-001 N
CHLOROBENZILATE	510156	2.00E-002 I	2.70E-001 H		2.70E-001 H		2.5E-001 C	2.3E-002 C	1.2E-002 C	2.1E+001 C	2.4E+000 C	1.3E-003	2.7E-002 C
P-CHLOROBENZOIC ACID	74113	2.00E-001 H					7.3E+003 N	7.3E+002 N	2.7E+002 N	4.1E+005 N	1.6E+004 N		
2-CHLORO-1,3-BUTADIENE	126998	2.00E-002 A		2.00E-003 H		y	1.4E+001 N	7.3E+000 N	2.7E+001 N	4.1E+004 N	1.6E+003 N	6.0E-003	1.2E-001 N
1-CHLOROBUTANE	109693	4.00E-001 H				y	2.4E+003 N	1.5E+003 N	5.4E+002 N	8.2E+005 N	3.1E+004 N	1.0E+000	2.0E+001 N
1-CHLORO-1,1-DIFLUOROETHANE	75683			1.40E+001 I		y	1.0E+005 N	5.1E+004 N				7.0E+001	1.4E+003 N
CHLORODIFLUOROMETHANE	75456			1.40E+001 I		y	1.0E+005 N	5.1E+004 N				7.0E+001	1.4E+003 N
CHLOROETHANE	75003	4.00E-001 E	2.90E-003 E	2.90E+000 I		y	3.6E+000 C	2.2E+000 C	1.1E+000 C	2.0E+003 C	2.2E+002 C	9.6E-004	1.9E-002 C
CHLOROFORM	67663	1.00E-002 I	6.10E-003 I	8.6E-005 E	8.10E-002 I	y	1.5E-001 C !	7.7E-002 C !	5.2E-001 C	9.4E+002 C	1.0E+002 C !	4.5E-005	8.9E-004 C
**CHLOROMETHANE	74873		1.30E-002 H	2.6E-002 I	3.5E-003 E	y	2.1E+000 C	1.8E+000 C	2.4E-001 C	4.4E+002 C	4.9E+001 C	5.2E-004	1.0E-002 C
4-CHLORO-2-METHYLANILINE	95692		5.80E-001 H				1.2E-001 C	1.1E-002 C	5.4E-003 C	9.9E+000 C	1.1E+000 C		
BETA-CHLORONAPHTHALENE	91587	8.00E-002 I				y	4.9E+002 N	2.9E+002 N	1.1E+002 N	1.6E+005 N	6.3E+003 N	1.6E+000	3.2E+001 N
O-CHLORONITROBENZENE	88733		2.50E-002 H			y	4.2E-001 C	2.5E-001 C	1.3E-001 C	2.3E+002 C	2.6E+001 C		
P-CHLORONITROBENZENE	100005		1.80E-002 H			y	5.9E-001 C	3.5E-001 C	1.8E-001 C	3.2E+002 C	3.5E+001 C		
2-CHLOROPHENOL	95578	5.00E-003 I				y	3.0E+001 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N		
2-CHLOROPROPANE	75296			2.90E-002 H		y	2.1E+002 N	1.1E+002 N				6.6E-002	1.3E+000 N
O-CHLOROTOLUENE	95498	2.00E-002 I				y	1.2E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N	6.5E-002	1.3E+000 N
CHLORPYRIFOS	2921882	3.00E-003 I					1.1E+002 N	1.1E+001 N	4.1E+000 N	6.1E+003 N	2.3E+002 N	3.2E+000	6.3E+001 N
CHLORPYRIFOS-METHYL	5598130	1.00E-002 H					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N		

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							Risk-based concentrations					Soil, for groundwater migration	
Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg	DAF 1 mg/kg	DAF 20 mg/kg
CHROMIUM III	16065831	1.50E+000 I					5.5E+004 N	5.5E+003 N	2.0E+003 N	3.1E+006 N	1.2E+005 N	9.9E+007	2.0E+009 N
CHROMIUM VI	18540299	3.00E-003 I		3.00E-005 I	4.10E+001 H		1.1E+002 N	1.5E-004 C	4.1E+000 N	6.1E+003 N	2.3E+002 N	2.1E+000	4.2E+001 N
COBALT	7440484	2.00E-002 E		5.00E-006 E			7.3E+002 N	1.8E-002 N	2.7E+001 N	4.1E+004 N	1.6E+003 N		
COKE OVEN EMISSIONS (COAL TAR)	8007452				2.2 I			2.8E-003 C					
COPPER	7440508	4.00E-002 H					1.5E+003 N	1.5E+002 N	5.4E+001 N	8.2E+004 N	3.1E+003 N	5.3E+002	1.1E+004 N
CROTONALDEHYDE	123739		1.90E+000 H			y	5.6E-003 C	3.3E-003 C	1.7E-003 C	3.0E+000 C	3.4E-001 C	1.5E-005	3.1E-004 C
CUMENE	98828	1.00E-001 I		1.10E-001 I		y	6.6E+002 N	4.0E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N	3.2E+000	6.4E+001 N
CYANIDE (FREE)	57125	2.00E-002 I					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N	7.4E+000	1.5E+002 N
CALCIUM CYANIDE	592018	4E-002 I					1.5E+003 N	1.5E+002 N	5.4E+001 N	8.2E+004 N	3.1E+003 N		
COPPER CYANIDE	544923	5.00E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N		
CYANAZINE	21725462	2.00E-003 H	8.40E-001 H				8.0E-002 C	7.5E-003 C	3.8E-003 C	6.8E+000 C	7.6E-001 C	2.6E-005	5.3E-004 C
CYANOGEN	460195	4.00E-002 I				y	2.4E+002 N	1.5E+002 N	5.4E+001 N	8.2E+004 N	3.1E+003 N		
CYANOGEN BROMIDE	506683	9.00E-002 I					3.3E+003 N	3.3E+002 N	1.2E+002 N	1.8E+005 N	7.0E+003 N		
CYANOGEN CHLORIDE	506774	5.00E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N		
HYDROGEN CYANIDE	74908	2.00E-002 I		8.60E-004 I		y	6.2E+000 N	3.1E+000 N	2.7E+001 N	4.1E+004 N	1.6E+003 N	1.1E-001	2.2E+000 N
POTASSIUM CYANIDE	151508	5.00E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N		
POTASSIUM SILVER CYANIDE	506616	2.00E-001 I					7.3E+003 N	7.3E+002 N	2.7E+002 N	4.1E+005 N	1.6E+004 N		
SILVER CYANIDE	506649	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N	3.1E+001	6.2E+002 N
SODIUM CYANIDE	143339	4.00E-002 I					1.5E+003 N	1.5E+002 N	5.4E+001 N	8.2E+004 N	3.1E+003 N		
THIOCYANATE		5.00E-002 E					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N		
ZINC CYANIDE	557211	5.00E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N	1.1E+002	2.3E+003 N
CYCLOHEXANONE	108941	5.00E+000 I					1.8E+005 N	1.8E+004 N	6.8E+003 N	1.0E+007 N	3.9E+005 N	6.1E+001	1.2E+003 N
CYHALOTHRIN/KARATE	68085858	5.00E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N		
CYPERMETHRIN	52315078	1.00E-002 I					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N		
DACTHAL	1861321	1.00E-002 I					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N		
DALAPON	75990	3.00E-002 I					1.1E+003 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N	3.5E-001	7.1E+000 N
DDD	72548		2.40E-001 I				2.8E-001 C	2.6E-002 C	1.3E-002 C	2.4E+001 C	2.7E+000 C	5.6E-001	1.1E+001 C
DDE	72559		3.40E-001 I				2.0E-001 C	1.8E-002 C	9.3E-003 C	1.7E+001 C	1.9E+000 C	1.8E+000	3.5E+001 C
DDT	50293	5.00E-004 I	3.40E-001 I		3.40E-001 I		2.0E-001 C	1.8E-002 C	9.3E-003 C	1.7E+001 C	1.9E+000 C	5.8E-002	1.2E+000 C
DIAZINON	333415	9.00E-004 H					3.3E+001 N	3.3E+000 N	1.2E+000 N	1.8E+003 N	7.0E+001 N	2.1E-002	4.3E-001 N
DIBENZOFURAN	132649	4.00E-003 E				y	2.4E+001 N	1.5E+001 N	5.4E+000 N	8.2E+003 N	3.1E+002 N	3.8E-001	7.7E+000 N
1,4-DIBROMOBENZENE	106376	1.00E-002 I					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N		
DIBROMOCHLOROMETHANE	124481	2.00E-002 I	8.40E-002 I			y	1.3E-001 C	7.5E-002 C	3.8E-002 C	6.8E+001 C	7.6E+000 C	4.1E-005	8.3E-004 C
1,2-DIBROMO-3-CHLOROPROPANE	96128		1.40E+000 H	5.70E-005 I	2.40E-003 H	y	4.7E-002 C I	2.1E-001 N	2.3E-003 C	4.1E+000 C	4.6E-001 C	4.4E-005	8.7E-004 C
1,2-DIBROMOETHANE	106934		8.50E+001 I	5.70E-005 H	7.60E-001 I	y	7.5E-004 C	8.2E-003 C	3.7E-005 C	6.7E-002 C	7.5E-003 C	4.3E-007	8.5E-006 C
DIBUTYLPHTHALATE	84742	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N	2.5E+002	5.0E+003 N
DICAMBA	1918009	3.00E-002 I					1.1E+003 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N	2.2E-001	4.5E+000 N
**1,2-DICHLOROBENZENE	95501	9.00E-002 I		4.00E-002 H		y	2.7E+002 N	1.5E+002 N	1.2E+002 N	1.8E+005 N	7.0E+003 N	2.3E-001	4.6E+000 N
1,3-DICHLOROBENZENE	541731	3.00E-002 E				y	1.8E+002 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N	1.5E-001	2.9E+000 N
1,4-DICHLOROBENZENE	106467	3.00E-002 E	2.40E-002 H	2.29E-001 I	2.2E-002 E	y	4.7E-001 C	2.8E-001 C	1.3E-001 C	2.4E+002 C	2.7E+001 C	3.6E-004	7.1E-003 C
3,3'-DICHLOROBENZIDINE	91941		4.50E-001 I				1.5E-001 C	1.4E-002 C	7.0E-003 C	1.3E+001 C	1.4E+000 C	2.5E-004	4.9E-003 C
1,4-DICHLORO-2-BUTENE	764410				9.30E+000 H	y	1.3E-003 C	6.7E-004 C				4.0E-007	8.0E-006 C
DICHLORODIFLUOROMETHANE	75718	2.00E-001 I		5.00E-002 A		y	3.5E+002 N	1.8E+002 N	2.7E+002 N	4.1E+005 N	1.6E+004 N	5.5E-001	1.1E+001 N
1,1-DICHLOROETHANE	75343	1.00E-001 H		1.40E-001 A		y	8.0E+002 N	5.1E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N	2.3E-001	4.5E+000 N
1,2-DICHLOROETHANE	107062	3.00E-002 E	9.10E-002 I	1.40E-003 E	9.10E-002 I	y	1.2E-001 C	6.9E-002 C	3.5E-002 C	6.3E+001 C	7.0E+000 C	5.2E-005	1.0E-003 C

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Basis: C = Carcinogenic effects N = Noncarcinogenic effects ! = RBC at HI of 0.1 < RBC-c

Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Risk-based concentrations: Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Soil Residential mg/kg	Region III SSLs: Soil, for groundwater migration DAF 1 mg/kg	DAF 20 mg/kg
1,1-DICHLOROETHENE	75354	9.00E-003 I	6.00E-001 I		1.75E-001 I	y	4.4E-002 C	3.6E-002 C	5.3E-003 C	9.5E+000 C	1.1E+000 C	1.8E-005	3.6E-004 C
CIS-1,2-DICHLOROETHENE	156592	1.00E-002 H				y	6.1E+001 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N	1.7E-002	3.5E-001 N
TRANS-1,2-DICHLOROETHENE	156605	2.00E-002 I				y	1.2E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N	4.1E-002	8.2E-001 N
TOTAL 1,2-DICHLOROETHENE	540590	9.00E-003 H				y	5.5E+001 N	3.3E+001 N	1.2E+001 N	1.8E+004 N	7.0E+002 N	1.9E-002	3.7E-001 N
2,4-DICHLOROPHENOL	120832	3.00E-003 I					1.1E+002 N	1.1E+001 N	4.1E+000 N	6.1E+003 N	2.3E+002 N	6.0E-002	1.2E+000 N
2,4-D	94757	1.00E-002 I					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N	4.5E-001	9.0E+000 N
4-(2,4-DICHLOROPHENOXY)BUTYRIC ACID	94826	8E-003 I					2.9E+002 N	2.9E+001 N	1.1E+001 N	1.6E+004 N	6.3E+002 N		
1,2-DICHLOROPROPANE	78875		6.80E-002 H	1.14E-003 I		y	1.6E-001 C	9.2E-002 C	4.6E-002 C	8.4E+001 C	9.4E+000 C	1.0E-004	2.1E-003 C
2,3-DICHLOROPROPANOL	616239	3.00E-003 I					1.1E+002 N	1.1E+001 N	4.1E+000 N	6.1E+003 N	2.3E+002 N		
1,3-DICHLOROPROPENE	542756	3.00E-002 I	1.00E-001 I	5.71E-003 I	1.00E-002 I	y	4.4E-001 C	6.3E-001 C	3.2E-002 C	5.7E+001 C	6.4E+000 C	1.6E-004	3.1E-003 C
DICHLORVOS	62737	5E-004 I	0.29 I	1.43E-004 I			2.3E-001 C	2.2E-002 C	1.1E-002 C	2.0E+001 C	2.2E+000 C	5.5E-005	1.1E-003 C
DICOFOL	115322		4.4E-001 W				1.5E-001 C	1.4E-002 C	7.2E-003 C	1.3E+001 C	1.5E+000 C	9.3E-004	1.9E-002 C
DICYCLOPENTADIENE	77736	3E-002 H		6.00E-005 A		y	4.4E-001 N	2.2E-001 N	4.1E+001 N	6.1E+004 N	2.3E+003 N		
DIELDRIN	60571	5.00E-005 I	1.60E+001 I		1.60E+001 I		4.2E-003 C	3.9E-004 C	2.0E-004 C	3.6E-001 C	4.0E-002 C	1.1E-004	2.2E-003 C
DIESEL EMISSIONS				1.40E-003 I				5.1E+000 N					
DIETHYLPHTHALATE	84662	8.00E-001 I					2.9E+004 N	2.9E+003 N	1.1E+003 N	1.6E+006 N	6.3E+004 N	2.3E+001	4.5E+002 N
DIETHYLENE GLYCOL, MONOBUTYL ETHER	112345			5.70E-003 H				2.1E+001 N					
DIETHYLENE GLYCOL, MONOETHYL ETHER	111900	2.00E+000 H					7.3E+004 N	7.3E+003 N	2.7E+003 N	4.1E+006 N	1.6E+005 N		
DI(2-ETHYLHEXYL)ADIPATE	103231	6.00E-001 I	1.20E-003 I				5.6E+001 C	5.2E+000 C	2.6E+000 C	4.8E+003 C	5.3E+002 C		
DIETHYLSTILBESTROL	56531		4.70E+003 H				1.4E-005 C	1.3E-006 C	6.7E-007 C	1.2E-003 C	1.4E-004 C		
DIFENZOQUAT (AVENGE)	43222486	8.00E-002 I					2.9E+003 N	2.9E+002 N	1.1E+002 N	1.6E+005 N	6.3E+003 N		
1,1-DIFLUOROETHANE	75376			1.10E+001 I		y	8.0E+004 N	4.0E+004 N					
DIISOPROPYL METHYLPHOSPHONATE (DIMP)	1445756	8.00E-002 I					2.9E+003 N	2.9E+002 N	1.1E+002 N	1.6E+005 N	6.3E+003 N		
3,3'-DIMETHOXYBENZIDINE	119904		1.40E-002 H				4.8E+000 C	4.5E-001 C	2.3E-001 C	4.1E+002 C	4.6E+001 C		
DIMETHYLAMINE	124403			5.70E-006 W		y	4.2E-002 N	2.1E-002 N				8.5E-006	1.7E-004 N
2,4-DIMETHYLANILINE HYDROCHLORIDE	21436964		5.80E-001 H				1.2E-001 C	1.1E-002 C	5.4E-003 C	9.9E+000 C	1.1E+000 C		
2,4-DIMETHYLANILINE	95681		7.50E-001 H				8.9E-002 C	8.3E-003 C	4.2E-003 C	7.6E+000 C	8.5E-001 C		
N,N-DIMETHYLANILINE	121697	2.00E-003 I					7.3E+001 N	7.3E+000 N	2.7E+000 N	4.1E+003 N	1.6E+002 N		
3,3'-DIMETHYLBENZIDINE	119937		9.20E+000 H				7.3E-003 C	6.8E-004 C	3.4E-004 C	6.2E-001 C	6.9E-002 C		
1,1-DIMETHYLHYDRAZINE	57147		2.60E+000 W		3.50E+000 W		2.6E-002 C	1.8E-003 C	1.2E-003 C	2.2E+000 C	2.5E-001 C		
1,2-DIMETHYLHYDRAZINE	540738		3.70E+001 W		3.70E+001 W		1.8E-003 C	1.7E-004 C	8.5E-005 C	1.5E-001 C	1.7E-002 C		
2,4-DIMETHYLPHENOL	105679	2.00E-002 I					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N	3.4E-001	6.7E+000 N
2,6-DIMETHYLPHENOL	576261	6.00E-004 I					2.2E+001 N	2.2E+000 N	8.1E-001 N	1.2E+003 N	4.7E+001 N		
3,4-DIMETHYLPHENOL	95658	1.00E-003 I					3.7E+001 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N		
DIMETHYLPHTHALATE	131113	1.00E+001 W					3.7E+005 N	3.7E+004 N	1.4E+004 N	2.0E+007 N	7.8E+005 N		
1,2-DINITROBENZENE	528290	4.00E-004 H					1.5E+001 N	1.5E+000 N	5.4E-001 N	8.2E+002 N	3.1E+001 N		
1,3-DINITROBENZENE	99650	1.00E-004 I					3.7E+000 N	3.7E-001 N	1.4E-001 N	2.0E+002 N	7.8E+000 N	1.8E-003	3.7E-002 N
1,4-DINITROBENZENE	100254	4.00E-004 H					1.5E+001 N	1.5E+000 N	5.4E-001 N	8.2E+002 N	3.1E+001 N		
4,6-DINITRO-O-CYCLOHEXYL PHENOL	131895	2.00E-003 I					7.3E+001 N	7.3E+000 N	2.7E+000 N	4.1E+003 N	1.6E+002 N		
**4,6-DINITRO-2-METHYLPHENOL	534521	1.00E-003 E					3.7E+001 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N		
2,4-DINITROPHENOL	51285	2.00E-003 I					7.3E+001 N	7.3E+000 N	2.7E+000 N	4.1E+003 N	1.6E+002 N		
DINITROTOLUENE MIX			6.80E-001 I				9.8E-002 C	9.2E-003 C	4.6E-003 C	6.4E+000 C	9.4E-001 C		
2,4-DINITROTOLUENE	121142	2.00E-003 I					7.3E+001 N	7.3E+000 N	2.7E+000 N	4.1E+003 N	1.6E+002 N	2.9E-002	5.7E-001 N
2,6-DINITROTOLUENE	606202	1.00E-003 H					3.7E+001 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N	1.2E-002	2.5E-001 N
DINOSEB	88857	1.00E-003 I					3.7E+001 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N	8.7E-003	1.7E-001 N

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Basis: C = Carcinogenic effects N = Noncarcinogenic effects I = RBC at HI of 0.1 < RBC-c

Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Risk-based concentrations: Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg	Region III SSLs: Soil, for groundwater migration DAF 1 mg/kg	DAF 20 mg/kg
DIOCTYLPHTHALATE	117840	2.00E-002 H					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N	1.2E+005	2.4E+006 N
1,4-DIOXANE	123911		1.10E-002 I				6.1E+000 C	5.7E-001 C	2.9E-001 C	5.2E+002 C	5.8E+001 C	1.3E-003	2.6E-002 C
DIPHENYLAMINE	122394	2.50E-002 I					9.1E+002 N	9.1E+001 N	3.4E+001 N	5.1E+004 N	2.0E+003 N	1.3E+000	2.5E+001 N
1,2-DIPHENYLHYDRAZINE	122667		8.00E-001 I		8.00E-001 I		8.4E-002 C	7.8E-003 C	3.9E-003 C	7.2E+000 C	8.0E-001 C	1.3E-004	2.5E-003 C
DIQUAT	85007	2.20E-003 I					8.0E+001 N	8.0E+000 N	3.0E+000 N	4.5E+003 N	1.7E+002 N	1.7E-002	3.3E-001 N
DISULFOTON	298044	4.00E-005 I					1.5E+000 N	1.5E-001 N	5.4E-002 N	8.2E+001 N	3.1E+000 N	3.2E-003	6.4E-002 N
1,4-DITHIANE	505293	1.00E-002 I					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N		
DIURON	330541	2.00E-003 I					7.3E+001 N	7.3E+000 N	2.7E+000 N	4.1E+003 N	1.6E+002 N	5.8E-002	1.2E+000 N
ENDOSULFAN	115297	6.00E-003 I					2.2E+002 N	2.2E+001 N	8.1E+000 N	1.2E+004 N	4.7E+002 N	9.8E-001	2.0E+001 N
ENDRIN	72208	3.00E-004 I					1.1E+001 N	1.1E+000 N	4.1E-001 N	6.1E+002 N	2.3E+001 N	2.7E-001	5.4E+000 N
EPICHLOROHYDRIN	106898	2.00E-003 H	9.90E-003 I	2.86E-004 I	4.20E-003 I	y	2.0E+000 N	1.0E+000 N	3.2E-001 C I	5.8E+002 C I	6.5E+001 C I	4.2E-004	8.4E-003 N
ETHION	563122	5.00E-004 I					1.8E+001 N	1.8E+000 N	6.8E-001 N	1.0E+003 N	3.9E+001 N	3.2E-001	6.4E+000 N
2-ETHOXYETHANOL	110805	4.00E-001 H		5.70E-002 I			1.5E+004 N	2.1E+002 N	5.4E+002 N	8.2E+005 N	3.1E+004 N	3.3E+000	6.5E+001 N
ETHYL ACETATE	141786	9.00E-001 I				y	5.5E+003 N	3.3E+003 N	1.2E+003 N	1.8E+006 N	7.0E+004 N	1.7E+000	3.5E+001 N
ETHYLBENZENE	100414	1.00E-001 I		2.90E-001 I		y	1.3E+003 N	1.1E+003 N	1.4E+002 N	2.0E+005 N	7.8E+003 N	7.5E-001	1.5E+001 N
ETHYLENE DIAMINE	107153	2.00E-002 H					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N		
ETHYLENE GLYCOL	107211	2.00E+000 I					7.3E+004 N	7.3E+003 N	2.7E+003 N	4.1E+006 N	1.6E+005 N	1.5E+001	3.0E+002 N
ETHYLENE GLYCOL, MONOBUTYL ETHER	111762	5.00E-001 I		3.70E+000 I			1.8E+004 N	1.4E+004 N	6.8E+002 N	1.0E+006 N	3.9E+004 N		
ETHYLENE OXIDE	75218		1.00E+000 H		3.50E-001 H	y	2.3E-002 C	1.8E-002 C	3.2E-003 C	5.7E+000 C	6.4E-001 C	4.8E-006	9.5E-005 C
ETHYLENE THIOUREA	96457	8.00E-005 I	1.1E-001 H				6.1E-001 C I	5.7E-002 C I	2.9E-002 C I	5.2E+001 C I	5.8E+000 C I		
ETHYL ETHER	60297	2.00E-001 I				y	1.2E+003 N	7.3E+002 N	2.7E+002 N	4.1E+005 N	1.6E+004 N	4.2E-001	8.5E+000 N
ETHYL METHACRYLATE	97632	9.00E-002 H				y	5.5E+002 N	3.3E+002 N	1.2E+002 N	1.8E+005 N	7.0E+003 N	1.0E+000	2.1E+001 N
FENAMIPHOS	22224926	2.50E-004 I					9.1E+000 N	9.1E-001 N	3.4E-001 N	5.1E+002 N	2.0E+001 N	7.8E-003	1.6E-001 N
FLUOMETURON	2164172	1.30E-002 I					4.7E+002 N	4.7E+001 N	1.8E+001 N	2.7E+004 N	1.0E+003 N		
FLUORINE	7782414	6.00E-002 I					2.2E+003 N	2.2E+002 N	8.1E+001 N	1.2E+005 N	4.7E+003 N		
FOMESAFEN	72178020		1.90E-001 I				3.5E-001 C	3.3E-002 C	1.7E-002 C	3.0E+001 C	3.4E+000 C		
FONOFOS	944229	2.00E-003 I					7.3E+001 N	7.3E+000 N	2.7E+000 N	4.1E+003 N	1.6E+002 N	1.8E-001	3.5E+000 N
FORMALDEHYDE	50000	2.00E-001 I			4.50E-002 I		7.3E+003 N	1.4E-001 C	2.7E+002 N	4.1E+005 N	1.6E+004 N	1.5E+000	3.0E+001 N
FORMIC ACID	64186	2.00E+000 H					7.3E+004 N	7.3E+003 N	2.7E+003 N	4.1E+006 N	1.6E+005 N		
FURAN	110009	1.00E-003 I				y	6.1E+000 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N	1.5E-003	3.0E-002 N
FURAZOLIDONE	67458		3.80E+000 H				1.8E-002 C	1.6E-003 C	8.3E-004 C	1.5E+000 C	1.7E-001 C		
FURFURAL	98011	3.00E-003 I		1.00E-002 A			1.1E+002 N	3.7E+001 N	4.1E+000 N	6.1E+003 N	2.3E+002 N	2.3E-002	4.6E-001 N
GLYCIDALDEHYDE	765344	4.00E-004 I		2.90E-004 H			1.5E+001 N	1.1E+000 N	5.4E-001 N	8.2E+002 N	3.1E+001 N		
GLYPHOSATE	1071836	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N	2.6E+001	5.3E+002 N
HEPTACHLOR	76448	5.00E-004 I	4.50E+000 I		4.50E+000 I		1.5E-002 C	1.4E-003 C	7.0E-004 C	1.3E+000 C	1.4E-001 C	4.2E-002	8.4E-001 C
HEPTACHLOR EPOXIDE	1024573	1.30E-005 I	9.10E+000 I		9.10E+000 I		7.4E-003 C	6.9E-004 C	3.5E-004 C	6.3E-001 C	7.0E-002 C	1.2E-003	2.5E-002 C
HEXABROMOBENZENE	87821	2.00E-003 I					7.3E+001 N	7.3E+000 N	2.7E+000 N	4.1E+003 N	1.6E+002 N		
HEXACHLOROBENZENE	118741	8.00E-004 I	1.60E+000 I		1.60E+000 I		4.2E-002 C	3.9E-003 C	2.0E-003 C	3.6E+000 C	4.0E-001 C	2.6E-003	5.2E-002 C
HEXACHLOROBUTADIENE	87683	2.00E-004 H	7.80E-002 I		7.80E-002 I		8.6E-001 C I	8.0E-002 C I	4.0E-002 C I	7.3E+001 C I	8.2E+000 C I	9.2E-002	1.8E+000 C
ALPHA-HCH	319846		6.30E+000 I		6.30E+000 I		1.1E-002 C	9.9E-004 C	5.0E-004 C	9.1E-001 C	1.0E-001 C	4.5E-005	8.9E-004 C
BETA-HCH	319857		1.80E+000 I		1.80E+000 I		3.7E-002 C	3.5E-003 C	1.8E-003 C	3.2E+000 C	3.5E-001 C	1.6E-004	3.1E-003 C
GAMMA-HCH (LINDANE)	58899	3.00E-004 I	1.30E+000 H				5.2E-002 C	4.8E-003 C	2.4E-003 C	4.4E+000 C	4.9E-001 C	2.2E-004	4.3E-003 C
TECHNICAL HCH	608731		1.80E+000 I		1.80E+000 I		3.7E-002 C	3.5E-003 C	1.8E-003 C	3.2E+000 C	3.5E-001 C		
**HEXACHLOROCYCLOPENTADIENE	77474	6.00E-003 I		5.7E-005 I			2.2E+002 N	2.1E-001 N	8.1E+000 N	1.2E+004 N	4.7E+002 N	8.8E+001	1.8E+003 N
HEXACHLORODIBENZODIOXIN MIX	19408743		6.20E+003 I		4.55E+003 I		1.1E-005 C	1.4E-006 C	5.1E-007 C	9.2E-004 C	1.0E-004 C		

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Basis: C = Carcinogenic effects N = Noncarcinogenic effects ! = RBC at HI of 0.1 < RBC-c

Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Risk-based concentrations: Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg	Region III SSLs: Soil, for groundwater migration DAF 1 mg/kg	DAF 20 mg/kg
HEXACHLOROETHANE	67721	1.00E-003 I	1.40E-002 I		1.40E-002 I		4.8E+000 C !	4.5E-001 C !	2.3E-001 C !	4.1E+002 C !	4.6E+001 C !	1.8E-002	3.6E-001 C
HEXACHLOROPHENE	70304	3.00E-004 I					1.1E+001 N	1.1E+000 N	4.1E-001 N	6.1E+002 N	2.3E+001 N	1.0E+002	2.0E+003 N
1,6-HEXAMETHYLENE DIISOCYANATE	822060			2.90E-006 I				1.1E-002 N					
HEXANE	110543	6.00E-002 H		5.71E-002 I		y	3.5E+002 N	2.1E+002 N	8.1E+001 N	1.2E+005 N	4.7E+003 N	6.9E-001	1.4E+001 N
2-HEXANONE	591786	4.00E-002 E		1.4E-003 E			1.5E+003 N	5.1E+000 N	5.4E+001 N	8.2E+004 N	3.1E+003 N		
HEXAZINONE	51235042	3.30E-002 I					1.2E+003 N	1.2E+002 N	4.5E+001 N	6.7E+004 N	2.5E+003 N		
HMX	2691410	5.00E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N		
HYDRAZINE	302012		3.00E+000 I		1.70E+001 I		2.2E-002 C	3.7E-004 C	1.1E-003 C	1.9E+000 C	2.1E-001 C		
HYDROGEN CHLORIDE	7647010			5.70E-003 I				2.1E+001 N					
HYDROGEN SULFIDE	7783064	3.00E-003 I		2.85E-004 I			1.1E+002 N	1.0E+000 N	4.1E+000 N	6.1E+003 N	2.3E+002 N		
HYDROQUINONE	123319	4.00E-002 H					1.5E+003 N	1.5E+002 N	5.4E+001 N	8.2E+004 N	3.1E+003 N		
**IRON	7439896	6.00E-001 E					2.2E+004 N	2.2E+003 N	8.1E+002 N	1.2E+006 N	4.7E+004 N		
ISOBUTANOL	78831	3.00E-001 I				y	1.8E+003 N	1.1E+003 N	4.1E+002 N	6.1E+005 N	2.3E+004 N	5.9E-001	1.2E+001 N
ISOPHORONE	78591	2.00E-001 I	9.50E-004 I				7.0E+001 C	6.6E+000 C	3.3E+000 C	6.0E+003 C	6.7E+002 C	2.1E-002	4.1E-001 C
ISOPROPALIN	33820530	1.50E-002 I					5.5E+002 N	5.5E+001 N	2.0E+001 N	3.1E+004 N	1.2E+003 N		
ISOPROPYL METHYL PHOSPHONIC ACID	1832548	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N		
TETRAETHYLLEAD	78002	1.00E-007 I					3.7E-003 N	3.7E-004 N	1.4E-004 N	2.0E-001 N	7.8E-003 N	4.6E-005	9.2E-004 N
LITHIUM	7439932	2.00E-002 E					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N		
MALATHION	121755	2.00E-002 I					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N	4.0E-001	8.1E+000 N
MALEIC ANHYDRIDE	108316	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N		
MANGANESE-NONFOOD	7439965	2.00E-002 I		1.43E-005 I			7.3E+002 N	5.2E-002 N	2.7E+001 N	4.1E+004 N	1.6E+003 N	4.8E+001	9.5E+002 N
MANGANESE-FOOD	7439965	1.40E-001 I		1.43E-005 I			5.1E+003 N	5.2E-002 N	1.9E+002 N	2.9E+005 N	1.1E+004 N	3.3E+002	6.7E+003 N
MEPHOSFOLAN	950107	9.00E-005 H					3.3E+000 N	3.3E-001 N	1.2E-001 N	1.8E+002 N	7.0E+000 N		
MEPIQUAT CHLORIDE	24307264	3.00E-002 I					1.1E+003 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N		
MERCURIC CHLORIDE	7487947	3.00E-004 I					1.1E+001 N	1.1E+000 N	4.1E-001 N	6.1E+002 N	2.3E+001 N		
MERCURY (INORGANIC)	7439976			8.60E-005 I				3.1E-001 N					
METHYLMERCURY	22967926	1.00E-004 I					3.7E+000 N	3.7E-001 N	1.4E-001 N	2.0E+002 N	7.8E+000 N		
METHACRYLONITRILE	126987	1.00E-004 I		2.00E-004 A		y	1.0E+000 N	7.3E-001 N	1.4E-001 N	2.0E+002 N	7.8E+000 N	2.1E-004	4.2E-003 N
METHANOL	67561	5.00E-001 I					1.8E+004 N	1.8E+003 N	6.8E+002 N	1.0E+006 N	3.9E+004 N	3.8E+000	7.5E+001 N
METHIDATHION	950378	1.00E-003 I					3.7E+001 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N		
METHOXYCHLOR	72435	5.00E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N	1.5E+001	3.1E+002 N
METHYL ACETATE	79209	1.00E+000 H				y	6.1E+003 N	3.7E+003 N	1.4E+003 N	2.0E+006 N	7.8E+004 N	1.2E+000	2.5E+001 N
METHYL ACRYLATE	96333	3.00E-002 A				y	1.8E+002 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N	5.0E-001	1.0E+001 N
2-METHYLANILINE	95534		2.40E-001 H				2.8E-001 C	2.6E-002 C	1.3E-002 C	2.4E+001 C	2.7E+000 C	2.8E-004	5.7E-003 C
4-(2-METHYL-4-CHLOROPHENOXY) BUTYRIC ACID	94815	1.00E-002 I					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N		
2-METHYL-4-CHLOROPHENOXYACETIC ACID (MCPA)	94746	5.00E-004 I					1.8E+001 N	1.8E+000 N	6.8E-001 N	1.0E+003 N	3.9E+001 N		
2-(2-METHYL-4-CHLOROPHENOXY)PROPIONIC ACID (MCP	93652	1.00E-003 I					3.7E+001 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N		
METHYLCYCLOHEXANE	108872			8.50E-001 H		y	6.3E+003 N	3.1E+003 N					
METHYLENE BROMIDE	74953	1.00E-002 A				y	6.1E+001 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N	1.5E-002	3.0E-001 N
METHYLENE CHLORIDE	75092	6.00E-002 I	7.50E-003 I	8.60E-001 H	1.65E-003 I	y	4.1E+000 C	3.8E+000 C	4.2E-001 C	7.6E+002 C	8.5E+001 C	9.5E-004	1.9E-002 C
4,4'-METHYLENE BIS(2-CHLOROANILINE)	101144	7.00E-004 H	1.30E-001 H		1.30E-001 H		5.2E-001 C	4.8E-002 C	2.4E-002 C	4.4E+001 C	4.9E+000 C		
4,4'-METHYLENE BIS(N,N'-DIMETHYL)ANILINE	101611		4.60E-002 I				1.5E+000 C	1.4E-001 C	6.9E-002 C	1.2E+002 C	1.4E+001 C		
4,4'-METHYLENEDIPHENYL ISOCYANATE	101688			1.7E-004 I				6.2E-001 N					
METHYL ETHYL KETONE (2-BUTANONE)	78933	6.00E-001 I		2.86E-001 I		y	1.9E+003 N	1.0E+003 N	8.1E+002 N	1.2E+006 N	4.7E+004 N	4.0E-001	7.9E+000 N
METHYL HYDRAZINE	60344		1.10E+000 W				6.1E-002 C	5.7E-003 C	2.9E-003 C	5.2E+000 C	5.8E-001 C		

Sources: I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRIS or HEAST E = EPA-NCEA provisional value O = other							Basis: C = Carcinogenic effects N = Noncarcinogenic effects ! = RBC at HI of 0.1 < RBC-c Risk-based concentrations					Region III SSLs Soil, for groundwater migration	
Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg	DAF 1 mg/kg	DAF 20 mg/kg
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	108101	8.00E-002 H		2.00E-002 A		y	1.4E+002 N	7.3E+001 N	1.1E+002 N	1.6E+005 N	6.3E+003 N	6.5E-002	1.3E+000 N
METHYL METHACRYLATE	80626	1.40E+000 I		2.00E-001 I		y	1.4E+003 N	7.3E+002 N	1.9E+003 N	2.9E+006 N	1.1E+005 N	3.2E-001	6.5E+000 N
2-METHYL-5-NITROANILINE	99558		3.30E-002 H				2.0E+000 C	1.9E-001 C	9.6E-002 C	1.7E+002 C	1.9E+001 C		
METHYL PARATHION	298000	2.50E-004 I					9.1E+000 N	9.1E-001 N	3.4E-001 N	5.1E+002 N	2.0E+001 N	4.3E-003	8.5E-002 N
2-METHYLPHENOL	95487	5.00E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N		
3-METHYLPHENOL	108394	5.00E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N		
4-METHYLPHENOL	106445	5.00E-003 H					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N		
METHYLSTYRENE MIX	25013154	6.00E-003 A		1.00E-002 A		y	5.5E+001 N	3.7E+001 N	8.1E+000 N	1.2E+004 N	4.7E+002 N	5.1E-002	1.0E+000 N
ALPHA-METHYLSTYRENE	98839	7.00E-002 A				y	4.3E+002 N	2.6E+002 N	9.5E+001 N	1.4E+005 N	5.5E+003 N	4.0E-001	7.9E+000 N
METHYL TERT-BUTYL ETHER	1634044			8.57E-001 I		y	6.3E+003 N	3.1E+003 N				1.4E+000	2.8E+001 N
METOLACHLOR (DUAL)	51218452	1.50E-001 I					5.5E+003 N	5.5E+002 N	2.0E+002 N	3.1E+005 N	1.2E+004 N		
MIREX	2385855	2.00E-004 I					7.3E+000 N	7.3E-001 N	2.7E-001 N	4.1E+002 N	1.6E+001 N		
MOLYBDENUM	7439987	5E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N		
MONOCHLORAMINE	10599903	1E-001 I		1.00E-001 H			3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N		
NALED	300765	2E-003 I					7.3E+001 N	7.3E+000 N	2.7E+000 N	4.1E+003 N	1.6E+002 N		
NICKEL REFINERY DUST					8.4E-001 I			7.5E-003 C					
NICKEL	7440020	2.00E-002 I					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N		
NITRATE	14797558	1.60E+000 I					5.8E+004 N	5.8E+003 N	2.2E+003 N	3.3E+006 N	1.3E+005 N		
NITRIC OXIDE	10102439	1.00E-001 W				y	6.1E+002 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N		
NITRITE	14797650	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N		
2-NITROANILINE	88744			5.70E-005 H				2.1E-001 N					
NITROBENZENE	98953	5.00E-004 I		6.00E-004 A		y	3.5E+000 N	2.2E+000 N	6.8E-001 N	1.0E+003 N	3.9E+001 N	1.2E-003	2.3E-002 N
NITROFURANTOIN	67209	7.00E-002 H					2.6E+003 N	2.6E+002 N	9.5E+001 N	1.4E+005 N	5.5E+003 N		
NITROFURAZONE	59870		1.50E+000 H				4.5E-002 C	4.2E-003 C	2.1E-003 C	3.8E+000 C	4.3E-001 C		
NITROGEN DIOXIDE	10102440	1.00E+000 W				y	6.1E+003 N	3.7E+003 N	1.4E+003 N	2.0E+006 N	7.8E+004 N		
NITROGLYCERIN	55630		1.4E-002 E				4.8E+000 C	4.5E-001 C	2.3E-001 C	4.1E+002 C	4.6E+001 C		
4-NITROPHENOL	100027	8.00E-003 E					2.9E+002 N	2.9E+001 N	1.1E+001 N	1.6E+004 N	6.3E+002 N	8.7E-002	1.7E+000 N
2-NITROPROPANE	79469			5.70E-003 I	9.40E+000 H	y	1.3E-003 C	6.7E-004 C				3.2E-007	6.4E-006 C
N-NITROSO-DI-N-BUTYLAMINE	924163		5.40E+000 I		5.60E+000 I	y	1.9E-003 C	1.1E-003 C	5.8E-004 C	1.1E+000 C	1.2E-001 C	1.4E-006	2.7E-005 C
N-NITROSODIETHANOLAMINE	1116547		2.80E+000 I				2.4E-002 C	2.2E-003 C	1.1E-003 C	2.0E+000 C	2.3E-001 C		
N-NITROSODIETHYLAMINE	55185		1.50E+002 I		1.50E+002 I		4.5E-004 C	4.2E-005 C	2.1E-005 C	3.8E-002 C	4.3E-003 C	1.1E-007	2.3E-006 C
N-NITROSODIMETHYLAMINE	62759		5.10E+001 I		5.10E+001 I		1.3E-003 C	1.2E-004 C	6.2E-005 C	1.1E-001 C	1.3E-002 C	2.8E-007	5.7E-006 C
N-NITROSODIPHENYLAMINE	86306		4.90E-003 I				1.4E+001 C	1.3E+000 C	6.4E-001 C	1.2E+003 C	1.3E+002 C	3.8E-002	7.6E-001 C
N-NITROSODIPROPYLAMINE	621647		7.00E+000 I				9.6E-003 C	8.9E-004 C	4.5E-004 C	8.2E-001 C	9.1E-002 C	2.4E-006	4.7E-005 C
N-NITROSO-N-ETHYLUREA	759739		1.40E+002 H				4.8E-004 C	4.5E-005 C	2.3E-005 C	4.1E-002 C	4.6E-003 C		
N-NITROSO-N-METHYLETHYLAMINE	10595956		2.20E+001 I				3.0E-003 C	2.8E-004 C	1.4E-004 C	2.6E-001 C	2.9E-002 C		
N-NITROSOPYRROLIDINE	930552		2.10E+000 I		2.10E+000 I		3.2E-002 C	3.0E-003 C	1.5E-003 C	2.7E+000 C	3.0E-001 C		
M-NITROTOLUENE	99081	2.00E-002 E				y	1.2E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N		
O-NITROTOLUENE	88722	1.00E-002 H				y	6.1E+001 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N		
P-NITROTOLUENE	99990	1.00E-002 H				y	6.1E+001 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N		
NUSTAR	85509199	7.00E-004 I					2.6E+001 N	2.6E+000 N	9.5E-001 N	1.4E+003 N	5.5E+001 N		
ORYZALIN	19044883	5.00E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N		
OXADIAZON	19666309	5.00E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N		
OXAMYL	23135220	2.50E-002 I					9.1E+002 N	9.1E+001 N	3.4E+001 N	5.1E+004 N	2.0E+003 N	1.9E-001	3.8E+000 N
OXYFLUORFEN	42874033	3.00E-003 I					1.1E+002 N	1.1E+001 N	4.1E+000 N	6.1E+003 N	2.3E+002 N		

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Basis: C = Carcinogenic effects N = Noncarcinogenic effects ! = RBC at HI of 0.1 < RBC-c

Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Risk-based concentrations: Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg	Region III SSLs: Soil, for groundwater migration DAF 1 mg/kg	DAF 20 mg/kg
PARAQUAT DICHLORIDE	1910425	4.50E-003 I					1.6E+002 N	1.6E+001 N	6.1E+000 N	9.2E+003 N	3.5E+002 N		
PARATHION	56382	6.00E-003 H					2.2E+002 N	2.2E+001 N	8.1E+000 N	1.2E+004 N	4.7E+002 N	5.0E-001	1.0E+001 N
PENTACHLOROBENZENE	608935	8.00E-004 I					2.9E+001 N	2.9E+000 N	1.1E+000 N	1.6E+003 N	6.3E+001 N	1.0E+000	2.0E+001 N
PENTACHLORONITROBENZENE	82688	3.00E-003 I	2.60E-001 H				2.6E-001 C	2.4E-002 C	1.2E-002 C	2.2E+001 C	2.5E+000 C	4.1E-003	8.2E-002 C
PENTACHLOROPHENOL	87865	3.00E-002 I	1.20E-001 I				5.6E-001 C	5.2E-002 C	2.6E-002 C	4.8E+001 C	5.3E+000 C		
PERMETHRIN	52645531	5.00E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N	1.2E+002	2.4E+003 N
PHENOL	108952	6.00E-001 I					2.2E+004 N	2.2E+003 N	8.1E+002 N	1.2E+006 N	4.7E+004 N	6.7E+000	1.3E+002 N
M-PHENYLENEDIAMINE	108452	6.00E-003 I					2.2E+002 N	2.2E+001 N	8.1E+000 N	1.2E+004 N	4.7E+002 N	4.9E-002	9.8E-001 N
O-PHENYLENEDIAMINE	95545		4.70E-002 H				1.4E+000 C	1.3E-001 C	6.7E-002 C	1.2E+002 C	1.4E+001 C		
P-PHENYLENEDIAMINE	106503	1.90E-001 H					6.9E+003 N	6.9E+002 N	2.6E+002 N	3.9E+005 N	1.5E+004 N		
2-PHENYLPHENOL	90437		1.90E-003 H				3.5E+001 C	3.3E+000 C	1.7E+000 C	3.0E+003 C	3.4E+002 C		
PHOSPHINE	7803512	3.00E-004 I		8.60E-005 I			1.1E+001 N	3.1E-001 N	4.1E-001 N	6.1E+002 N	2.3E+001 N		
PHOSPHORIC ACID	7664382			2.90E-003 I				1.1E+001 N					
PHOSPHORUS (WHITE)	7723140	2.00E-005 I					7.3E-001 N	7.3E-002 N	2.7E-002 N	4.1E+001 N	1.6E+000 N		
P-PHTHALIC ACID	100210	1.00E+000 H					3.7E+004 N	3.7E+003 N	1.4E+003 N	2.0E+006 N	7.8E+004 N		
PHTHALIC ANHYDRIDE	85449	2.00E+000 I		3.43E-002 H			7.3E+004 N	1.3E+002 N	2.7E+003 N	4.1E+006 N	1.6E+005 N	2.6E+001	5.2E+002 N
POLYBROMINATED BIPHENYLS		7.00E-006 H	8.90E+000 H				7.5E-003 C	7.0E-004 C	3.5E-004 C	6.4E-001 C	7.2E-002 C !		
POLYCHLORINATED BIPHENYLS	1336363		2.00E+000 I		2.00E+000 I		3.3E-002 C	3.1E-003 C	1.6E-003 C	2.9E+000 C	3.2E-001 C	2.1E-002	4.1E-001 C
AROCLOR-1016	12674112	7.00E-005 I	7.00E-002 I		7.00E-002 I		9.6E-001 C !	8.9E-002 C !	4.5E-002 C !	8.2E+001 C !	5.5E+000 N	2.1E-001	4.2E+000 C
AROCLOR-1221	11104282		2.00E+000 I		2.00E+000 I		3.3E-002 C	3.1E-003 C	1.6E-003 C	2.9E+000 C	3.2E-001 C		
AROCLOR-1232	11141165		2.00E+000 I		2.00E+000 I		3.3E-002 C	3.1E-003 C	1.6E-003 C	2.9E+000 C	3.2E-001 C		
AROCLOR-1242	53469219		2.00E+000 I		2.00E+000 I		3.3E-002 C	3.1E-003 C	1.6E-003 C	2.9E+000 C	3.2E-001 C		
AROCLOR-1248	12672296		2.00E+000 I		2.00E+000 I		3.3E-002 C	3.1E-003 C	1.6E-003 C	2.9E+000 C	3.2E-001 C		
AROCLOR-1254	11097691	2.00E-005 I	2.00E+000 I		2.00E+000 I		3.3E-002 C	3.1E-003 C	1.6E-003 C	2.9E+000 C	3.2E-001 C !	5.4E-002	1.1E+000 C
AROCLOR-1260	11096825		2.00E+000 I		2.00E+000 I		3.3E-002 C	3.1E-003 C	1.6E-003 C	2.9E+000 C	3.2E-001 C		
POLYCHLORINATED TERPHENYLS	61788338		4.50E+000 E				1.5E-002 C	1.4E-003 C	7.0E-004 C	1.3E+000 C	1.4E-001 C		
POLYNUCLEAR AROMATIC HYDROCARBONS:													
ACENAPHTHENE	83329	6.00E-002 I				y	3.7E+002 N	2.2E+002 N	8.1E+001 N	1.2E+005 N	4.7E+003 N	5.2E+000	1.0E+002 N
ANTHRACENE	120127	3.00E-001 I				y	1.8E+003 N	1.1E+003 N	4.1E+002 N	6.1E+005 N	2.3E+004 N	2.3E+001	4.7E+002 N
BENZ[A]ANTHRACENE	56553		7.30E-001 E				9.2E-002 C	8.6E-003 C	4.3E-003 C	7.8E+000 C	8.7E-001 C	7.3E-002	1.5E+000 C
BENZO[B]FLUORANTHENE	205992		7.30E-001 E				9.2E-002 C	8.6E-003 C	4.3E-003 C	7.8E+000 C	8.7E-001 C	2.3E-001	4.5E+000 C
BENZO[K]FLUORANTHENE	207089		7.30E-002 E				9.2E-001 C	8.6E-002 C	4.3E-002 C	7.8E+001 C	8.7E+000 C	2.3E+000	4.5E+001 C
BENZO[A]PYRENE	50328		7.30E+000 I		3.10E+000 E		9.2E-003 C	2.0E-003 C	4.3E-004 C	7.8E-001 C	8.7E-002 C	1.9E-002	3.7E-001 C
CARBAZOLE	86748		2.00E-002 H				3.3E+000 C	3.1E-001 C	1.6E-001 C	2.9E+002 C	3.2E+001 C	2.3E-002	4.7E-001 C
CHRYSENE	218019		7.30E-003 E				9.2E+000 C	8.6E-001 C	4.3E-001 C	7.8E+002 C	8.7E+001 C	7.3E+000	1.5E+002 C
DIBENZ[A,H]ANTHRACENE	53703		7.30E+000 E				9.2E-003 C	8.6E-004 C	4.3E-004 C	7.8E-001 C	8.7E-002 C	7.0E-002	1.4E+000 C
DIBENZOFURAN	132649	4.00E-003 E				y	2.4E+001 N	1.5E+001 N	5.4E+000 N	8.2E+003 N	3.1E+002 N	3.8E-001	7.7E+000 N
FLUORANTHENE	206440	4.00E-002 I					1.5E+003 N	1.5E+002 N	5.4E+001 N	8.2E+004 N	3.1E+003 N	3.1E+002	6.3E+003 N
FLUORENE	86737	4.00E-002 I				y	2.4E+002 N	1.5E+002 N	5.4E+001 N	8.2E+004 N	3.1E+003 N	6.8E+000	1.4E+002 N
INDENO[1,2,3-C,D]PYRENE	193395		7.30E-001 E				9.2E-002 C	8.6E-003 C	4.3E-003 C	7.8E+000 C	8.7E-001 C	6.4E-001	1.3E+001 C
2-METHYLNAPHTHALENE	91576	2.00E-002 E				y	1.2E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N	1.1E+000	2.2E+001 N
NAPHTHALENE	91203	2.00E-002 I		9.00E-004 I		y	6.5E+000 N	3.3E+000 N	2.7E+001 N	4.1E+004 N	1.6E+003 N	7.7E-003	1.5E-001 N
PYRENE	129000	3.00E-002 I				y	1.8E+002 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N	3.4E+001	6.8E+002 N
PROMETON	1610180	1.50E-002 I					5.5E+002 N	5.5E+001 N	2.0E+001 N	3.1E+004 N	1.2E+003 N		
PROMETRYN	7287196	4.00E-003 I					1.5E+002 N	1.5E+001 N	5.4E+000 N	8.2E+003 N	3.1E+002 N		

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Basis: C = Carcinogenic effects N = Noncarcinogenic effects ! = RBC at HI of 0.1 < RBC-c

Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Risk-based concentrations: Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg	Region III SSLs: Soil, for groundwater migration DAF 1 mg/kg	DAF 20 mg/kg
PROPACHLOR	1918167	1.30E-002 I					4.7E+002 N	4.7E+001 N	1.8E+001 N	2.7E+004 N	1.0E+003 N		
PROPANIL	709988	5.00E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N		
PROPARGITE	2312358	2.00E-002 I					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N		
N-PROPYLBENZENE	103651	4.00E-002 E				y	2.4E+002 N	1.5E+002 N	5.4E+001 N	8.2E+004 N	3.1E+003 N	1.4E+000	2.8E+001 N
PROPYLENE GLYCOL	57556	2.00E+001 H					7.3E+005 N	7.3E+004 N	2.7E+004 N	4.1E+007 N	1.6E+006 N		
PROPYLENE GLYCOL, MONOETHYL ETHER	52125538	7.00E-001 H					2.6E+004 N	2.6E+003 N	9.5E+002 N	1.4E+006 N	5.5E+004 N		
PROPYLENE GLYCOL, MONOMETHYL ETHER	107982	7.00E-001 H		5.70E-001 I			2.6E+004 N	2.1E+003 N	9.5E+002 N	1.4E+006 N	5.5E+004 N		
PURSUIT	81335775	2.50E-001 I					9.1E+003 N	9.1E+002 N	3.4E+002 N	5.1E+005 N	2.0E+004 N		
PYRIDINE	110861	1.00E-003 I					3.7E+001 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N		
QUINOLINE	91225		1.20E+001 H				5.6E-003 C	5.2E-004 C	2.6E-004 C	4.8E-001 C	5.3E-002 C		
RDX	121824	3.00E-003 I	1.10E-001 I				6.1E-001 C	5.7E-002 C	2.9E-002 C	5.2E+001 C	5.8E+000 C		
RESMETHRIN	10453868	3.00E-002 I					1.1E+003 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N		
RONNEL	299843	5.00E-002 H					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N		
ROTENONE	83794	4.00E-003 I					1.5E+002 N	1.5E+001 N	5.4E+000 N	8.2E+003 N	3.1E+002 N		
SELENIOUS ACID	7783008	5.00E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N		
SELENIUM	7782492	5.00E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N	9.5E-001	1.9E+001 N
SILVER	7440224	5.00E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N	1.6E+000	3.1E+001 N
SIMAZINE	122349	5.00E-003 I	1.20E-001 H				5.6E-001 C	5.2E-002 C	2.6E-002 C	4.8E+001 C	5.3E+000 C	1.7E-004	3.3E-003 C
SODIUM AZIDE	26628228	4.00E-003 I					1.5E+002 N	1.5E+001 N	5.4E+000 N	8.2E+003 N	3.1E+002 N		
SODIUM DIETHYLDITHIOCARBAMATE	148185	3.00E-002 I	2.70E-001 H				2.5E-001 C	2.3E-002 C	1.2E-002 C	2.1E+001 C	2.4E+000 C		
STRONTIUM, STABLE	7440246	6.00E-001 I					2.2E+004 N	2.2E+003 N	8.1E+002 N	1.2E+006 N	4.7E+004 N	7.7E+002	1.5E+004 N
STRYCHNINE	57249	3.00E-004 I					1.1E+001 N	1.1E+000 N	4.1E-001 N	6.1E+002 N	2.3E+001 N	8.3E-003	1.7E-001 N
STYRENE	100425	2.00E-001 I		2.86E-001 I		y	1.6E+003 N	1.0E+003 N	2.7E+002 N	4.1E+005 N	1.6E+004 N	2.9E+000	5.7E+001 N
2,3,7,8-TETRACHLORODIBENZODIOXIN	1746016		1.50E+005 H		1.50E+005 H		4.5E-007 C	4.2E-008 C	2.1E-008 C	3.8E-005 C	4.3E-006 C	4.3E-007	8.6E-006 C
1,2,4,5-TETRACHLOROBENZENE	95943	3.00E-004 I					1.1E+001 N	1.1E+000 N	4.1E-001 N	6.1E+002 N	2.3E+001 N	3.3E-002	6.6E-001 N
1,1,1,2-TETRACHLOROETHANE	630206	3.00E-002 I	2.60E-002 I		2.60E-002 I	y	4.1E-001 C	2.4E-001 C	1.2E-001 C	2.2E+002 C	2.5E+001 C	2.0E-004	4.0E-003 C
1,1,2,2-TETRACHLOROETHANE	79345	6.00E-002 E	2.00E-001 I		2.00E-001 I	y	5.3E-002 C	3.1E-002 C	1.6E-002 C	2.9E+001 C	3.2E+000 C	3.4E-005	6.8E-004 C
TETRACHLOROETHENE	127184	1.00E-002 I	5.20E-002 E	1.4E-001 E	2.00E-003 E	y	1.1E+000 C	3.1E+000 C	6.1E-002 C	1.1E+002 C	1.2E+001 C	2.4E-003	4.8E-002 C
2,3,4,6-TETRACHLOROPHENOL	58902	3.00E-002 I					1.1E+003 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N		
P,A,A,A-TETRACHLOROTOLUENE	5216251		2.00E+001 H				3.3E-003 C	3.1E-004 C	1.6E-004 C	2.9E-001 C	3.2E-002 C		
1,1,1,2-TETRAFLUOROETHANE	811972			2.29E+001 I		y	1.7E+005 N	8.4E+004 N					
TETRAHYDROFURAN	109999	2.00E-001 E	7.6E-003 E	8.6E-002 E	6.8E-003 E		8.8E+000 C	9.2E-001 C	4.2E-001 C	7.5E+002 C	8.4E+001 C		
TETRYL	479458	1.00E-002 H					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N		
THALLIC OXIDE	1314325	7.00E-005 W					2.6E+000 N	2.6E-001 N	9.5E-002 N	1.4E+002 N	5.5E+000 N		
THALLIUM	7440280	7.00E-005 O					2.6E+000 N	2.6E-001 N	9.5E-002 N	1.4E+002 N	5.5E+000 N	1.8E-001	3.6E+000 N
THALLIUM ACETATE	563688	9.00E-005 I					3.3E+000 N	3.3E-001 N	1.2E-001 N	1.8E+002 N	7.0E+000 N		
THALLIUM CARBONATE	6533739	8.00E-005 I					2.9E+000 N	2.9E-001 N	1.1E-001 N	1.6E+002 N	6.3E+000 N		
THALLIUM CHLORIDE	7791120	8.00E-005 I					2.9E+000 N	2.9E-001 N	1.1E-001 N	1.6E+002 N	6.3E+000 N		
THALLIUM NITRATE	10102451	9.00E-005 I					3.3E+000 N	3.3E-001 N	1.2E-001 N	1.8E+002 N	7.0E+000 N		
THALLIUM SULFATE (2:1)	7446186	8.00E-005 I					2.9E+000 N	2.9E-001 N	1.1E-001 N	1.6E+002 N	6.3E+000 N		
THIOBENCARB	28249776	1.00E-002 I					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N		
TIN	7440315	6.00E-001 H					2.2E+004 N	2.2E+003 N	8.1E+002 N	1.2E+006 N	4.7E+004 N		

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Basis C = Carcinogenic effects N = Noncarcinogenic effects ! = RBC at HI of 0.1 < RBC-c

Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Risk-based concentrations: Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg	Region III SSLs: Soil, for groundwater migration DAF 1 mg/kg	DAF 20 mg/kg
TITANIUM	7440326	4.00E+000 E		8.60E-003 E			1.5E+005 N	3.1E+001 N	5.4E+003 N	8.2E+006 N	3.1E+005 N		
TITANIUM DIOXIDE	13463677	4.00E+000 E		8.60E-003 E			1.5E+005 N	3.1E+001 N	5.4E+003 N	8.2E+006 N	3.1E+005 N		
TOLUENE	108883	2.00E-001 I		1.14E-001 I		y	7.5E+002 N	4.2E+002 N	2.7E+002 N	4.1E+005 N	1.6E+004 N	4.4E-001	8.8E+000 N
TOLUENE-2,4-DIAMINE	95807		3.20E+000 H				2.1E-002 C	2.0E-003 C	9.9E-004 C	1.8E+000 C	2.0E-001 C		
TOLUENE-2,5-DIAMINE	95705	6.00E-001 H					2.2E+004 N	2.2E+003 N	8.1E+002 N	1.2E+006 N	4.7E+004 N		
TOLUENE-2,6-DIAMINE	823405	2.00E-001 H					7.3E+003 N	7.3E+002 N	2.7E+002 N	4.1E+005 N	1.6E+004 N		
P-TOLUIDINE	106490		1.90E-001 H				3.5E-001 C	3.3E-002 C	1.7E-002 C	3.0E+001 C	3.4E+000 C	3.0E-004	5.9E-003 C
TOXAPHENE	8001352		1.10E+000 I		1.10E+000 I		6.1E-002 C	5.7E-003 C	2.9E-003 C	5.2E+000 C	5.8E-001 C	3.1E-002	6.3E-001 C
1,2,4-TRIBROMOBENZENE	615543	5.00E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N		
TRIBUTYLTIN OXIDE	56359	3.00E-004 I					1.1E+001 N	1.1E+000 N	4.1E-001 N	6.1E+002 N	2.3E+001 N		
2,4,6-TRICHLOROANILINE	634935		3.40E-002 H				2.0E+000 C	1.8E-001 C	9.3E-002 C	1.7E+002 C	1.9E+001 C		
1,2,4-TRICHLOROBENZENE	120821	1.00E-002 I		5.70E-002 H		y	1.9E+002 N	2.1E+002 N	1.4E+001 N	2.0E+004 N	7.8E+002 N	3.8E-001	7.5E+000 N
1,1,1-TRICHLOROETHANE	71556	2.80E-001 E		6.30E-001 E		y	3.2E+003 N	2.3E+003 N	3.8E+002 N	5.7E+005 N	2.2E+004 N	3.0E+000	6.0E+001 N
1,1,2-TRICHLOROETHANE	79005	4.00E-003 I	5.70E-002 I		5.60E-002 I	y	1.9E-001 C	1.1E-001 C	5.5E-002 C	1.0E+002 C	1.1E+001 C	3.9E-005	7.8E-004 C
TRICHLOROETHENE	79016	6.00E-003 E	1.10E-002 E		6.00E-003 E	y	1.6E+000 C	1.0E+000 C	2.9E-001 C	5.2E+002 C	5.8E+001 C !	7.7E-004	1.5E-002 C
TRICHLOROFLUOROMETHANE	75694	3.00E-001 I		2.00E-001 A		y	1.3E+003 N	7.3E+002 N	4.1E+002 N	6.1E+005 N	2.3E+004 N	1.1E+000	2.3E+001 N
2,4,5-TRICHLOROPHENOL	95954	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N		
2,4,6-TRICHLOROPHENOL	88062		1.10E-002 I		1.00E-002 I		6.1E+000 C	6.3E-001 C	2.9E-001 C	5.2E+002 C	5.8E+001 C		
2,4,5-T	93765	1.00E-002 I					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N	9.8E-002	2.0E+000 N
2-(2,4,5-TRICHLOROPHENOXY)PROPIONIC ACID	93721	8.00E-003 I					2.9E+002 N	2.9E+001 N	1.1E+001 N	1.6E+004 N	6.3E+002 N	1.1E+000	2.1E+001 N
1,1,2-TRICHLOROPROPANE	598776	5.00E-003 I				y	3.0E+001 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N	1.2E-002	2.5E-001 N
1,2,3-TRICHLOROPROPANE	96184	6.00E-003 I	2.00E+000 E	1.4E-003 E		y	5.3E-003 C	3.1E-003 C	1.6E-003 C	2.9E+000 C	3.2E-001 C	1.8E-006	3.6E-005 C
1,2,3-TRICHLOROPROPENE	96195	5.00E-003 H				y	3.0E+001 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N	1.2E-002	2.5E-001 N
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76131	3.00E+001 I		8.60E+000 H		y	5.9E+004 N	3.1E+004 N	4.1E+004 N	6.1E+007 N	2.3E+006 N	1.2E+002	2.3E+003 N
1,2,4-TRIMETHYLBENZENE	95636	5.00E-002 E		1.70E-003 E		y	1.2E+001 N	6.2E+000 N	6.8E+001 N	1.0E+005 N	3.9E+003 N		
1,3,5-TRIMETHYLBENZENE	108678	5.00E-002 E		1.70E-003 E		y	1.2E+001 N	6.2E+000 N	6.8E+001 N	1.0E+005 N	3.9E+003 N		
TRIMETHYL PHOSPHATE	512561		3.70E-002 H				1.8E+000 C	1.7E-001 C	8.5E-002 C	1.5E+002 C	1.7E+001 C		
1,3,5-TRINITROBENZENE	99354	3.00E-002 I					1.1E+003 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N		
2,4,6-TRINITROTOLUENE	118967	5.00E-004 I	3.00E-002 I				2.2E+000 C !	2.1E-001 C !	1.1E-001 C !	1.9E+002 C !	2.1E+001 C !		
URANIUM (SOLUBLE SALTS; from IRIS)	7440611	3.00E-003 I					1.1E+002 N	1.1E+001 N	4.1E+000 N	6.1E+003 N	2.3E+002 N		
URANIUM (SOLUBLE SALTS; provisional)	7440611	2.00E-004 E					7.3E+000 N	7.3E-001 N	2.7E-001 N	4.1E+002 N	1.6E+001 N		
VANADIUM	7440622	7.00E-003 H					2.6E+002 N	2.6E+001 N	9.5E+000 N	1.4E+004 N	5.5E+002 N	2.6E+002	5.1E+003 N
VANADIUM PENTOXIDE	1314621	9.00E-003 I					3.3E+002 N	3.3E+001 N	1.2E+001 N	1.8E+004 N	7.0E+002 N		
VANADIUM SULFATE	16785812	2.00E-002 H					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N		
VINCLOZOLIN	50471448	2.50E-002 I					9.1E+002 N	9.1E+001 N	3.4E+001 N	5.1E+004 N	2.0E+003 N		
VINYL ACETATE	108054	1.00E+000 H		5.71E-002 I		y	4.1E+002 N	2.1E+002 N	1.4E+003 N	2.0E+006 N	7.8E+004 N	8.7E-002	1.7E+000 N
**VINYL CHLORIDE inc earlylife(see cover memos)	75014	3.00E-003 I	1.40E+000 I	2.8E-002 I	3.00E-002 I	y	1.5E-002 C	7.2E-002 C			9.0E-002 C	1.7E-005	3.3E-004 C
**VINYL CHLORIDE: adult (see cover memos)	75014	3.00E-003 I	7.20E-001 I	2.8E-002 I	1.5E-002 I	y			4.4E-003 C	7.9E+000 C			
WARFARIN	81812	3.00E-004 I					1.1E+001 N	1.1E+000 N	4.1E-001 N	6.1E+002 N	2.3E+001 N	2.2E-002	4.4E-001 N
M-XYLENE	108383	2.00E+000 H				y	1.2E+004 N	7.3E+003 N	2.7E+003 N	4.1E+006 N	1.6E+005 N	1.3E+001	2.5E+002 N
O-XYLENE	95476	2.00E+000 H				y	1.2E+004 N	7.3E+003 N	2.7E+003 N	4.1E+006 N	1.6E+005 N	1.1E+001	2.3E+002 N
P-XYLENE	106423					y							

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							Tap	Ambient		Soil		Soil, for groundwater migration	
Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	water ug/l	air ug/m3	Fish mg/kg	Industrial mg/kg	Residential mg/kg	DAF 1 mg/kg	DAF 20 mg/kg
XYLENES	1330207	2.00E+000 I				y	1.2E+004 N	7.3E+003 N	2.7E+003 N	4.1E+006 N	1.6E+005 N	8.5E+000	1.7E+002 N
ZINC	7440666	3.00E-001 I					1.1E+004 N	1.1E+003 N	4.1E+002 N	6.1E+005 N	2.3E+004 N	6.8E+002	1.4E+004 N
ZINC PHOSPHIDE	1314847	3E-004 I					1.1E+001 N	1.1E+000 N	4.1E-001 N	6.1E+002 N	2.3E+001 N		
ZINEB	12122677	5E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N		

Wagner, Glenn

From: Basinski, Ralph
Sent: Thursday, January 17, 2002 1:38 PM
To: Wagner, Glenn
Subject: Work Load

Glenn:

We will need to review your work load /commitments this afternoon during the Department workload meeting. Please have a list of the projects on which you are currently working. I believe these include:

- NAS Dallas
- NSWC Crane Air Dispersion Modeling Write-up
- Information Repositories
- Intern oversight
- Plaskolite

I realize NAS Dallas, the information repositories, Plaskoite, and intern oversight are ongoing projects. Please provide an estimate of the baseload hours that must be allocated to these activities. In the case of the NSWC Crane Air Dispersion Modeling Write-up provide the fast-track schedule.

Ralph

APPENDIX E-2-6

CONTAMINANT CONCENTRATION CALCULATIONS

CONTAMINANT CONCENTRATIONS

CALCULATION METHOD

Sheet:	Calculation of Ground Level Concentrations For All Target Compounds Using Carbon Monoxide							
	Modeling Results.							
Calculations:								
8-Hour TNT CO Concentration =			1-Hour TNT CO Concentration / 8					
8-Hour PETN CO Concentration =			1-Hour PETN CO Concentration / 8					
Sheets:	Table 1 - Maximum calculated 1_hr, 8-hr, and annual average carbon monoxide concentrations							
	for High-Heat-Content and Low-Heat-Content Treatment Scenarios							
	Table 2 - Open burning 1-hour average ground level concentrations at selected receptors							
	utilizing TNT (high heat content) modeling results.							
	Table 3 - Open burning 1-hour average ground level concentrations at selected receptors							
	utilizing PETN (low heat content) modeling results.							
	Table 4 - Open burning 8-hour average ground level concentrations at selected receptors							
	utilizing TNT (high heat content) modeling results.							
	Table 5 - Open burning 8-hour average ground level concentrations at selected receptors							
	utilizing PETN (low heat content) modeling results.							
	Table 6 - Open burning 24-hour average ground level concentrations at selected receptors							
	utilizing TNT (low heat content) modeling results.							
	Table 7 - Open burning 24-hour average ground level concentrations at selected receptors							
	utilizing PETN (low heat content) modeling results.							
	Table 8 - Open burning annual average ground level concentrations at selected receptors							
	utilizing the Annual Mix modeling results.							
Calculations:								
Each receptor (listed as a separate ROW in the "Concentrations" sheet) is associated with a COLUMN								
in these sheets. The ground level concentrations are calculated by multiplying the CO concentration listed								
in the "Concentrations" sheet by the ratio of the short- or long-term emission factor for a specific compound to								
that of CO. These emission factors are located in the MASTER.XLS workbook, Emission Factors sheet.								
The concentration and emission factors used must agree: 1-hour and 8-hour concentrations are calculated								
for both high-heat-content and low-heat-content cases (using TNT and PETN emission factors, respectively),								
using the 1-hour and 8-hour CO concentrations listed on the "Concentrations" sheet. Annual concentrations								
are calculated using the annual emission factors, and annual CO concentration from the model output.								
Example:	Compound:						1,3-Butadiene	
	1,3-Butadiene Short-Term (TNT) Emission Factor:						5.34E-07	
	CO Short-Term (TNT) Emission Factor:						7.23E-03	
	Ratio of 1,3-Butadiene Emission Factor to CO Emission Factor:						7.39E-05	
	1-Hour CO Concentration at the Maximum Receptor:						1.98E+01	
	1-Hour CO Conc. x Ratio of Emission Factors =							
		(1-Hour 1,3-Butadiene concentration)					1.44E-03	

SHORT TERM AND LONG TERM

RECEPTOR CONTAMINANT CONCENTRATIONS

MODELING RESULTS

TABLE 1
MAXIMUM 1-,8-,24, AND ANNUAL AVERAGE
CARBON MONOXIDE [1] CONCENTRATIONS FOR
HIGH (TNT), LOW (PETN), AND ANNUAL AVERAGE
TREATMENT SCENARIOS

Receptor	1-Hour TNT CO Concentration ($\mu g/m^3$)	1-Hour PETN CO Concentration ($\mu g/m^3$)	8-Hour TNT CO Concentration ($\mu g/m^3$)	8-Hour PETN CO Concentration ($\mu g/m^3$)	24-Hour TNT CO Concentration ($\mu g/m^3$)	24-Hour PETN CO Concentration ($\mu g/m^3$)	Annual CO Concentration ($\mu g/m^3$)
Maximum Offsite	1.98E+01	4.25E+01	2.48E+00	5.32E+00	8.26E-01	1.77E+00	4.29E-02
S1	2.45E+00	5.11E+00	3.06E-01	6.38E-01	1.02E-01	2.13E-01	2.89E-03
S2	2.17E+00	5.29E+00	2.71E-01	6.62E-01	9.05E-02	2.21E-01	3.90E-03
S3	2.40E+00	4.71E+00	3.00E-01	5.89E-01	9.98E-02	1.96E-01	2.84E-03
S4	2.33E+00	6.03E+00	2.91E-01	7.53E-01	9.69E-02	2.51E-01	5.04E-03
S5	1.53E+00	3.56E+00	1.91E-01	4.45E-01	6.38E-02	1.48E-01	2.82E-03
S6	4.79E+00	1.09E+01	5.99E-01	1.36E+00	2.00E-01	4.54E-01	6.51E-03
S7	6.06E+00	1.69E+01	7.57E-01	2.11E+00	2.52E-01	7.04E-01	5.08E-03
S8	2.53E+00	7.35E+00	3.16E-01	9.18E-01	1.05E-01	3.06E-01	2.37E-03
Hospital	2.06E+00	5.90E+00	2.57E-01	7.37E-01	8.57E-02	2.46E-01	4.21E-03
Long-Term HCC	4.00E+00	9.10E+00	5.00E-01	1.14E+00	1.67E-01	3.79E-01	7.68E-03
Day Care Center	5.17E+00	1.39E+01	6.46E-01	1.74E+00	2.15E-01	5.78E-01	7.57E-03
Closest Residence	7.55E+00	2.10E+01	9.44E-01	2.63E+00	3.15E-01	8.77E-01	2.42E-02
Maximum Onsite	7.34E+01	1.96E+02	9.17E+00	2.45E+01	3.06E+00	8.18E+00	2.10E-01

[1] - All OBODM modeling was conducted using carbon monoxide as the target compound. Carbon monoxide centrations were then used to calculate air concentrations for all other target compounds using the procedure described in Section E-2-4(c)(7).

TABLE 2
OPEN BURNING 1-HOUR AVERAGE GROUND LEVEL
CONCENTRATIONS AT SELECTED RECEPTORS
UTILIZING TNT (HIGH HEAT CONTENT) MODELING RESULTS

Receptor:	Maximum Offsite	S1	S2	S3	S4
Compound	($\mu g/m^3$)	1.8E+01	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1,2,4-Trimethylbenzene	1.46E-03	1.81E-04	1.60E-04	1.77E-04	1.72E-04
1,3 - Butadiene	7.90E-02	9.75E-03	8.65E-03	9.55E-03	9.27E-03
1,3,5-Trimethylbenzene	9.46E-02	1.17E-02	1.04E-02	1.14E-02	1.11E-02
1,3,5-Trinitrobenzene	2.07E-02	2.55E-03	2.27E-03	2.50E-03	2.43E-03
1,3-Dinitrobenzene	4.88E-03	6.02E-04	5.34E-04	5.90E-04	5.73E-04
2,4,6-Trinitrotoluene	1.45E-04	1.79E-05	1.59E-05	1.76E-05	1.71E-05
2,4-Dinitrotoluene	4.55E-04	5.62E-05	4.98E-05	5.50E-05	5.34E-05
2-Methylnapthalene	1.42E-02	1.75E-03	1.56E-03	1.72E-03	1.67E-03
3,4-Methylphenol (m- & p-cresol)	9.02E-03	1.11E-03	9.88E-04	1.09E-03	1.06E-03
Acenaphthylene	1.14E-01	1.40E-02	1.24E-02	1.37E-02	1.33E-02
Acetophenone	4.09E-04	5.04E-05	4.47E-05	4.94E-05	4.79E-05
Alkanes (Paraffins)	8.04E-03	9.91E-04	8.80E-04	9.71E-04	9.43E-04
Alkenes (Olefins)	1.97E-03	2.43E-04	2.16E-04	2.38E-04	2.31E-04
Anthracene	1.72E-02	2.13E-03	1.89E-03	2.08E-03	2.02E-03
Aromatics	1.27E-03	1.57E-04	1.39E-04	1.54E-04	1.49E-04
Benz(a)anthracene	2.27E-03	2.80E-04	2.49E-04	2.74E-04	2.66E-04
Benzene	4.17E-04	5.14E-05	4.56E-05	5.04E-05	4.89E-05
Benzo(a)pyrene	1.66E-03	2.05E-04	1.82E-04	2.01E-04	1.95E-04
Benzo(b)fluoranthene	1.21E-04	1.50E-05	1.33E-05	1.46E-05	1.42E-05
Benzo(g,h,i)perylene	9.43E-04	1.16E-04	1.03E-04	1.14E-04	1.11E-04
Benzo(k)fluoranthene	2.42E-03	2.98E-04	2.65E-04	2.92E-04	2.83E-04
Benzyl alcohol	7.98E-03	9.85E-04	8.74E-04	9.64E-04	9.36E-04
Biphenyl	3.89E+03	4.81E+02	4.26E+02	4.71E+02	4.57E+02
bis (2-Ethylhexyl)phthalate	1.98E+01	2.45E+00	2.17E+00	2.40E+00	2.33E+00
Butylbenzyl phthalate	6.88E-03	8.49E-04	7.54E-04	8.32E-04	8.08E-04
Carbon Dioxide	2.39E-03	2.94E-04	2.61E-04	2.88E-04	2.80E-04
Carbon Monoxide	1.88E-04	2.32E-05	2.06E-05	2.27E-05	2.21E-05
Carbon Tetrachloride	5.29E-03	6.53E-04	5.80E-04	6.40E-04	6.21E-04
Di-n-butyl phthalate	1.34E-02	1.65E-03	1.47E-03	1.62E-03	1.57E-03
Di-n-octyl phthalate	1.06E-04	1.31E-05	1.16E-05	1.28E-05	1.24E-05
Dibenzofuran	3.81E-03	4.70E-04	4.17E-04	4.61E-04	4.47E-04
Dichloromethane	6.47E-03	7.99E-04	7.09E-04	7.82E-04	7.59E-04
Diethyl phthalate	3.65E+01	4.50E+00	3.99E+00	4.41E+00	4.28E+00
Dimethyl phthalate	2.86E+02	3.53E+01	3.13E+01	3.46E+01	3.36E+01
Ethylbenzene	4.64E-04	5.72E-05	5.07E-05	5.60E-05	5.44E-05
Fluoranthene	5.02E-02	6.19E-03	5.50E-03	6.07E-03	5.89E-03
Fluorene	1.35E-03	1.67E-04	1.48E-04	1.64E-04	1.59E-04
Freon 11	2.39E-04	2.94E-05	2.61E-05	2.88E-05	2.80E-05
Freon 113	9.82E-03	1.21E-03	1.08E-03	1.19E-03	1.15E-03
Freon 12	1.81E-01	2.23E-02	1.98E-02	2.18E-02	2.12E-02
HMX	2.52E+01	3.11E+00	2.76E+00	3.05E+00	2.96E+00
Hydrogen Chloride					
Hydrogen Fluoride					
Indeno (1,2,3 - cd) pyrene					
m- & p-Xylene					
Methane					
Methyl chloride					
n-Nitrosodiphenylamine					
Naphthalene					
Nitrogen Dioxide (peroxide)					
Nitrogen Oxide					
o-Xylene					

TABLE 2
OPEN BURNING 1-HOUR AVERAGE GROUND LEVEL
CONCENTRATIONS AT SELECTED RECEPTORS
UTILIZING TNT (HIGH HEAT CONTENT) MODELING RESULTS
PAGE 2 OF 6

Receptor:	Maximum Offsite	S1	S2	S3	S4
Compound	($\mu g/m^3$)	1.8E+01	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
p-Ethyltoluene	1.23E-03	1.51E-04	1.34E-04	1.48E-04	1.44E-04
Phenanthrene	1.66E-03	2.05E-04	1.82E-04	2.01E-04	1.95E-04
Phenol	4.17E-03	5.14E-04	4.56E-04	5.04E-04	4.89E-04
PM10	7.68E+02	9.47E+01	8.41E+01	9.28E+01	9.01E+01
Pyrene	1.46E-02	1.80E-03	1.60E-03	1.76E-03	1.71E-03
RDX	2.63E-02	3.25E-03	2.88E-03	3.18E-03	3.09E-03
Styrene	4.00E-03	4.94E-04	4.38E-04	4.84E-04	4.70E-04
Tetrachloroethylene					
TO - 12 (NMOC)	2.31E-01	2.85E-02	2.53E-02	2.79E-02	2.71E-02
Toluene	4.00E-03	4.94E-04	4.38E-04	4.84E-04	4.70E-04
Total Non-methane Hydrocarbons	1.08E-01	1.33E-02	1.18E-02	1.30E-02	1.26E-02

TABLE 2
OPEN BURNING 1-HOUR AVERAGE GROUND LEVEL
CONCENTRATIONS AT SELECTED RECEPTORS
UTILIZING TNT (HIGH HEAT CONTENT) MODELING RESULTS

Receptor:	S5	S6	S7	S8	Hospital
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1,2,4-Trimethylbenzene	1.13E-04	3.54E-04	4.48E-04	1.87E-04	1.52E-04
1,3 - Butadiene	6.10E-03	1.91E-02	2.41E-02	1.01E-02	8.19E-03
1,3,5-Trimethylbenzene	7.30E-03	2.29E-02	2.89E-02	1.21E-02	9.81E-03
1,3,5-Trinitrobenzene	1.60E-03	5.00E-03	6.33E-03	2.64E-03	2.15E-03
1,3-Dinitrobenzene	3.77E-04	1.18E-03	1.49E-03	6.23E-04	5.06E-04
2,4,6-Trinitrotoluene	1.12E-05	3.51E-05	4.44E-05	1.85E-05	1.51E-05
2,4-Dinitrotoluene	3.51E-05	1.10E-04	1.39E-04	5.81E-05	4.72E-05
2-Methylnapthalene	1.10E-03	3.43E-03	4.34E-03	1.81E-03	1.47E-03
3,4-Methylphenol (m- & p-cresol)	6.96E-04	2.18E-03	2.76E-03	1.15E-03	9.35E-04
Acenaphthylene	8.76E-03	2.74E-02	3.47E-02	1.45E-02	1.18E-02
Acetophenone	3.15E-05	9.87E-05	1.25E-04	5.21E-05	4.24E-05
Alkanes (Paraffins)	6.20E-04	1.94E-03	2.46E-03	1.02E-03	8.33E-04
Alkenes (Olefins)	1.52E-04	4.76E-04	6.02E-04	2.51E-04	2.04E-04
Anthracene	1.33E-03	4.16E-03	5.26E-03	2.20E-03	1.79E-03
Aromatics	9.82E-05	3.07E-04	3.89E-04	1.62E-04	1.32E-04
Benz(a)anthracene	1.75E-04	5.48E-04	6.94E-04	2.90E-04	2.35E-04
Benzene	3.22E-05	1.01E-04	1.27E-04	5.32E-05	4.32E-05
Benzo(a)pyrene	1.28E-04	4.02E-04	5.09E-04	2.12E-04	1.73E-04
Benzo(b)fluoranthene	9.36E-06	2.93E-05	3.70E-05	1.55E-05	1.26E-05
Benzo(g,h,i)perylene	7.28E-05	2.28E-04	2.88E-04	1.20E-04	9.78E-05
Benzo(k)fluoranthene	1.87E-04	5.84E-04	7.38E-04	3.08E-04	2.51E-04
Benzyl alcohol	6.16E-04	1.93E-03	2.44E-03	1.02E-03	8.27E-04
Biphenyl	3.01E+02	9.41E+02	1.19E+03	4.97E+02	4.04E+02
bis (2-Ethylhexyl)phthalate	1.53E+00	4.79E+00	6.06E+00	2.53E+00	2.06E+00
Butylbenzyl phthalate	5.31E-04	1.66E-03	2.10E-03	8.78E-04	7.14E-04
Carbon Dioxide	1.84E-04	5.76E-04	7.29E-04	3.04E-04	2.47E-04
Carbon Monoxide	1.45E-05	4.54E-05	5.75E-05	2.40E-05	1.95E-05
Carbon Tetrachloride	4.09E-04	1.28E-03	1.62E-03	6.75E-04	5.49E-04
Di-n-butyl phthalate	1.03E-03	3.23E-03	4.09E-03	1.71E-03	1.39E-03
Di-n-octyl phthalate	8.17E-06	2.56E-05	3.24E-05	1.35E-05	1.10E-05
Dibenzofuran	2.94E-04	9.21E-04	1.16E-03	4.86E-04	3.95E-04
Dichloromethane	5.00E-04	1.56E-03	1.98E-03	8.25E-04	6.71E-04
Diethyl phthalate	2.82E+00	8.81E+00	1.11E+01	4.65E+00	3.78E+00
Dimethyl phthalate	2.21E+01	6.91E+01	8.74E+01	3.65E+01	2.97E+01
Ethylbenzene	3.58E-05	1.12E-04	1.42E-04	5.91E-05	4.81E-05
Fluoranthene	3.87E-03	1.21E-02	1.53E-02	6.40E-03	5.20E-03
Fluorene	1.05E-04	3.27E-04	4.14E-04	1.73E-04	1.40E-04
Freon 11	1.84E-05	5.76E-05	7.29E-05	3.04E-05	2.47E-05
Freon 113	7.58E-04	2.37E-03	3.00E-03	1.25E-03	1.02E-03
Freon 12	1.40E-02	4.36E-02	5.52E-02	2.31E-02	1.87E-02
HMX	1.95E+00	6.09E+00	7.71E+00	3.22E+00	2.62E+00
Hydrogen Chloride					
Hydrogen Fluoride					
Indeno (1,2,3 - cd) pyrene					
m- & p-Xylene					
Methane					
Methyl chloride					
n-Nitrosodiphenylamine					
Naphthalene					
Nitrogen Dioxide (peroxide)					
Nitrogen Oxide					
o-Xylene					

TABLE 2
OPEN BURNING 1-HOUR AVERAGE GROUND LEVEL
CONCENTRATIONS AT SELECTED RECEPTORS
UTILIZING TNT (HIGH HEAT CONTENT) MODELING RESULTS
PAGE 4 OF 6

Receptor:	S5	S6	S7	S8	Hospital
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
p-Ethyltoluene	9.46E-05	2.96E-04	3.75E-04	1.56E-04	1.27E-04
Phenanthrene	1.28E-04	4.02E-04	5.09E-04	2.12E-04	1.73E-04
Phenol	3.22E-04	1.01E-03	1.27E-03	5.32E-04	4.32E-04
PM10	5.93E+01	1.85E+02	2.35E+02	9.79E+01	7.96E+01
Pyrene	1.13E-03	3.52E-03	4.46E-03	1.86E-03	1.51E-03
RDX	2.03E-03	6.35E-03	8.04E-03	3.35E-03	2.73E-03
Styrene	3.09E-04	9.67E-04	1.22E-03	5.11E-04	4.15E-04
Tetrachloroethylene					
TO - 12 (NMOC)	1.78E-02	5.58E-02	7.06E-02	2.95E-02	2.39E-02
Toluene	3.09E-04	9.67E-04	1.22E-03	5.11E-04	4.15E-04
Total Non-methane Hydrocarbons	8.30E-03	2.60E-02	3.29E-02	1.37E-02	1.11E-02

TABLE 2
OPEN BURNING 1-HOUR AVERAGE GROUND LEVEL
CONCENTRATIONS AT SELECTED RECEPTORS
UTILIZING TNT (HIGH HEAT CONTENT) MODELING RESULTS

Receptor:	Long-Term HCC	Day Care Center	Closest Residence	Maximum Onsite
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1,2,4-Trimethylbenzene	2.95E-04	3.82E-04	5.58E-04	5.42E-03
1,3 - Butadiene	1.59E-02	2.06E-02	3.01E-02	2.92E-01
1,3,5-Trimethylbenzene	1.91E-02	2.47E-02	3.60E-02	3.50E-01
1,3,5-Trinitrobenzene	4.18E-03	5.40E-03	7.89E-03	7.66E-02
1,3-Dinitrobenzene	9.85E-04	1.27E-03	1.86E-03	1.81E-02
2,4,6-Trinitrotoluene	2.93E-05	3.79E-05	5.54E-05	5.38E-04
2,4-Dinitrotoluene	9.18E-05	1.19E-04	1.73E-04	1.68E-03
2-Methylnapthalene	2.87E-03	3.70E-03	5.41E-03	5.26E-02
3,4-Methylphenol (m- & p-cresol)	1.82E-03	2.35E-03	3.44E-03	3.34E-02
Acenaphthylene	2.29E-02	2.96E-02	4.33E-02	4.20E-01
Acetophenone	8.24E-05	1.07E-04	1.56E-04	1.51E-03
Alkanes (Paraffins)	1.62E-03	2.10E-03	3.06E-03	2.97E-02
Alkenes (Olefins)	3.97E-04	5.13E-04	7.50E-04	7.29E-03
Anthracene	3.47E-03	4.49E-03	6.56E-03	6.37E-02
Aromatics	2.57E-04	3.32E-04	4.85E-04	4.71E-03
Benz(a)anthracene	4.58E-04	5.92E-04	8.65E-04	8.40E-03
Benzene	8.41E-05	1.09E-04	1.59E-04	1.54E-03
Benzo(a)pyrene	3.36E-04	4.34E-04	6.34E-04	6.16E-03
Benzo(b)fluoranthene	2.45E-05	3.16E-05	4.62E-05	4.49E-04
Benzo(g,h,i)perylene	1.90E-04	2.46E-04	3.59E-04	3.49E-03
Benzo(k)fluoranthene	4.87E-04	6.30E-04	9.20E-04	8.94E-03
Benzyl alcohol	1.61E-03	2.08E-03	3.04E-03	2.95E-02
Biphenyl	7.86E+02	1.02E+03	1.48E+03	1.44E+04
bis (2-Ethylhexyl)phthalate	4.00E+00	5.17E+00	7.55E+00	7.34E+01
Butylbenzyl phthalate	1.39E-03	1.79E-03	2.62E-03	2.55E-02
Carbon Dioxide	4.81E-04	6.22E-04	9.09E-04	8.83E-03
Carbon Monoxide	3.80E-05	4.91E-05	7.17E-05	6.96E-04
Carbon Tetrachloride	1.07E-03	1.38E-03	2.02E-03	1.96E-02
Di-n-butyl phthalate	2.70E-03	3.49E-03	5.10E-03	4.95E-02
Di-n-octyl phthalate	2.14E-05	2.76E-05	4.03E-05	3.92E-04
Dibenzofuran	7.69E-04	9.94E-04	1.45E-03	1.41E-02
Dichloromethane	1.31E-03	1.69E-03	2.47E-03	2.40E-02
Diethyl phthalate	7.36E+00	9.51E+00	1.39E+01	1.35E+02
Dimethyl phthalate	5.77E+01	7.46E+01	1.09E+02	1.06E+03
Ethylbenzene	9.35E-05	1.21E-04	1.77E-04	1.72E-03
Fluoranthene	1.01E-02	1.31E-02	1.91E-02	1.86E-01
Fluorene	2.73E-04	3.53E-04	5.16E-04	5.01E-03
Freon 11	4.81E-05	6.22E-05	9.09E-05	8.83E-04
Freon 113	1.98E-03	2.56E-03	3.74E-03	3.63E-02
Freon 12	3.65E-02	4.71E-02	6.89E-02	6.69E-01
HMX	5.09E+00	6.58E+00	9.61E+00	9.34E+01
Hydrogen Chloride				
Hydrogen Fluoride				
Indeno (1,2,3 - cd) pyrene				
m- & p-Xylene				
Methane				
Methyl chloride				
n-Nitrosodiphenylamine				
Naphthalene				
Nitrogen Dioxide (peroxide)				
Nitrogen Oxide				
o-Xylene				

TABLE 2
OPEN BURNING 1-HOUR AVERAGE GROUND LEVEL
CONCENTRATIONS AT SELECTED RECEPTORS
UTILIZING TNT (HIGH HEAT CONTENT) MODELING RESULTS
PAGE 6 OF 6

Receptor:	Long-Term HCC	Day Care Center	Closest Residence	Maximum Onsite
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
p-Ethyltoluene	2.47E-04	3.20E-04	4.67E-04	4.54E-03
Phenanthrene	3.36E-04	4.34E-04	6.34E-04	6.16E-03
Phenol	8.41E-04	1.09E-03	1.59E-03	1.54E-02
PM10	1.55E+02	2.00E+02	2.93E+02	2.84E+03
Pyrene	2.94E-03	3.80E-03	5.56E-03	5.40E-02
RDX	5.31E-03	6.86E-03	1.00E-02	9.73E-02
Styrene	8.08E-04	1.04E-03	1.53E-03	1.48E-02
Tetrachloroethylene				
TO - 12 (NMOC)	4.66E-02	6.02E-02	8.80E-02	8.55E-01
Toluene	8.08E-04	1.04E-03	1.53E-03	1.48E-02
Total Non-methane Hydrocarbons	2.17E-02	2.80E-02	4.10E-02	3.98E-01

TABLE 3
OPEN BURNING 1-HOUR AVERAGE GROUND LEVEL CONCENTRATIONS AT SELECTED RECEPTORS
UTILIZING PETN (LOW HEAT CONTENT) MODELING RESULTS

Receptor:	Maximum Offsite	S1	S2	S3	S4
Compound	($\mu g/m^3$)	1.8E+01	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1,2,4-Trimethylbenzene	2.95E-03	3.54E-04	3.67E-04	3.26E-04	4.17E-04
1,3 - Butadiene	1.61E-03	1.93E-04	2.00E-04	1.78E-04	2.28E-04
1,3,5-Trimethylbenzene	1.10E-03	1.32E-04	1.37E-04	1.22E-04	1.56E-04
1,3,5-Trinitrobenzene	4.61E-02	5.54E-03	5.74E-03	5.11E-03	6.54E-03
1,3-Dinitrobenzene	8.52E-04	1.02E-04	1.06E-04	9.43E-05	1.21E-04
2,4,6-Trinitrotoluene	4.14E-02	4.97E-03	5.16E-03	4.59E-03	5.87E-03
2,4-Dinitrotoluene	7.81E-03	9.37E-04	9.72E-04	8.64E-04	1.11E-03
2-Methylnapthalene	1.88E-03	2.26E-04	2.34E-04	2.09E-04	2.67E-04
3,4-Methylphenol (m- & p-cresol)	1.60E-04	1.91E-05	1.98E-05	1.77E-05	2.26E-05
Acenaphthylene	5.00E-04	6.00E-05	6.22E-05	5.53E-05	7.08E-05
Acetophenone	5.36E-03	6.44E-04	6.67E-04	5.94E-04	7.60E-04
Alkanes (Paraffins)	1.47E-02	1.77E-03	1.83E-03	1.63E-03	2.09E-03
Alkenes (Olefins)	7.52E-02	9.03E-03	9.36E-03	8.33E-03	1.07E-02
Anthracene	4.48E-04	5.38E-05	5.58E-05	4.96E-05	6.35E-05
Aromatics	2.65E-02	3.18E-03	3.30E-03	2.94E-03	3.76E-03
Benz(a)anthracene	2.16E-03	2.59E-04	2.69E-04	2.39E-04	3.06E-04
Benzene	8.07E-02	9.69E-03	1.00E-02	8.93E-03	1.14E-02
Benzo(a)pyrene	1.40E-03	1.68E-04	1.74E-04	1.55E-04	1.98E-04
Benzo(b)fluoranthene	2.49E-03	2.99E-04	3.10E-04	2.76E-04	3.53E-04
Benzo(g,h,i)perylene	4.57E-04	5.49E-05	5.69E-05	5.06E-05	6.48E-05
Benzo(k)fluoranthene	1.83E-03	2.19E-04	2.27E-04	2.02E-04	2.59E-04
Benzyl alcohol	2.37E-04	2.84E-05	2.95E-05	2.62E-05	3.36E-05
Biphenyl	1.04E-03	1.24E-04	1.29E-04	1.15E-04	1.47E-04
bis (2-Ethylhexyl)phthalate	2.52E-03	3.02E-04	3.13E-04	2.79E-04	3.57E-04
Butylbenzyl phthalate	3.40E-03	4.09E-04	4.24E-04	3.77E-04	4.82E-04
Carbon Dioxide	3.25E+03	3.90E+02	4.04E+02	3.60E+02	4.61E+02
Carbon Monoxide	4.25E+01	5.11E+00	5.29E+00	4.71E+00	6.03E+00
Carbon Tetrachloride	1.10E-03	1.31E-04	1.36E-04	1.21E-04	1.55E-04
Di-n-butyl phthalate	2.73E-03	3.27E-04	3.39E-04	3.02E-04	3.86E-04
Di-n-octyl phthalate	3.18E-03	3.82E-04	3.96E-04	3.52E-04	4.51E-04
Dibenzofuran	2.06E-04	2.48E-05	2.57E-05	2.29E-05	2.93E-05
Dichloromethane	8.52E-01	1.02E-01	1.06E-01	9.43E-02	1.21E-01
Diethyl phthalate	2.12E-03	2.55E-04	2.64E-04	2.35E-04	3.01E-04
Dimethyl phthalate	8.61E-04	1.03E-04	1.07E-04	9.53E-05	1.22E-04
Ethylbenzene	5.90E-03	7.08E-04	7.34E-04	6.53E-04	8.36E-04
Fluoranthene	1.47E-02	1.76E-03	1.83E-03	1.63E-03	2.08E-03
Fluorene	1.16E-04	1.39E-05	1.45E-05	1.29E-05	1.65E-05
Freon 11	4.39E-03	5.27E-04	5.47E-04	4.86E-04	6.23E-04
Freon 113	1.10E-03	1.31E-04	1.36E-04	1.21E-04	1.55E-04
Freon 12	1.77E-03	2.12E-04	2.20E-04	1.96E-04	2.50E-04
HMX	7.10E-03	8.52E-04	8.84E-04	7.86E-04	1.01E-03
Hydrogen Chloride	4.00E+01	4.80E+00	4.98E+00	4.43E+00	5.67E+00
Hydrogen Fluoride	3.14E+02	3.77E+01	3.91E+01	3.48E+01	4.45E+01
Indeno (1,2,3 - cd) pyrene	5.09E-04	6.10E-05	6.33E-05	5.63E-05	7.21E-05
m- & p-Xylene	2.03E-02	2.43E-03	2.52E-03	2.25E-03	2.87E-03
Methane	2.19E-01	2.63E-02	2.72E-02	2.42E-02	3.10E-02
Methyl chloride	1.24E-03	1.48E-04	1.54E-04	1.37E-04	1.75E-04
n-Nitrosodiphenylamine	2.62E-04	3.14E-05	3.26E-05	2.90E-05	3.71E-05
Naphthalene	3.69E-03	4.43E-04	4.59E-04	4.09E-04	5.23E-04
Nitrogen Dioxide (peroxide)	8.61E-01	1.03E-01	1.07E-01	9.53E-02	1.22E-01
Nitrogen Oxide	1.94E+01	2.33E+00	2.42E+00	2.15E+00	2.75E+00
o-Xylene	8.13E-03	9.75E-04	1.01E-03	9.00E-04	1.15E-03
p-Ethyltoluene	1.19E-03	1.42E-04	1.48E-04	1.31E-04	1.68E-04
Phenanthrene	6.85E-04	8.22E-05	8.52E-05	7.58E-05	9.70E-05
Phenol	1.53E-03	1.83E-04	1.90E-04	1.69E-04	2.16E-04

TABLE 3
OPEN BURNING 1-HOUR AVERAGE GROUND LEVEL CONCENTRATIONS AT SELECTED RECEPTORS
UTILIZING PETN (LOW HEAT CONTENT) MODELING RESULTS
PAGE 2 OF 6

Receptor:	Maximum Offsite	S1	S2	S3	S4
Compound	($\mu g/m^3$)	1.8E+01	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
PM10	8.43E+02	1.01E+02	1.05E+02	9.33E+01	1.19E+02
Pyrene	5.40E-03	6.48E-04	6.72E-04	5.98E-04	7.65E-04
RDX	2.53E-02	3.03E-03	3.14E-03	2.80E-03	3.58E-03
Styrene	4.39E-03	5.27E-04	5.47E-04	4.86E-04	6.23E-04
Tetrachloroethylene	5.42E-02	6.50E-03	6.74E-03	6.00E-03	7.68E-03
TO - 12 (NMOC)	2.53E-01	3.04E-02	3.15E-02	2.81E-02	3.59E-02
Toluene	5.40E-03	6.48E-04	6.72E-04	5.98E-04	7.65E-04
Total Non-methane Hydrocarbons	1.46E+00	1.75E-01	1.81E-01	1.61E-01	2.07E-01
Total Non-methane Organic Compounds	8.73E-01	1.05E-01	1.09E-01	9.66E-02	1.24E-01
Total Unidentified Hydrocarbons	1.37E-01	1.64E-02	1.70E-02	1.51E-02	1.94E-02

TABLE 3
OPEN BURNING 1-HOUR AVERAGE GROUND LEVEL CONCENTRATIONS AT SELECTED RECEPTORS
UTILIZING PETN (LOW HEAT CONTENT) MODELING RESULTS

Receptor:	S5	S6	S7	S8	Hospital
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1,2,4-Trimethylbenzene	2.47E-04	7.55E-04	1.17E-03	5.09E-04	4.09E-04
1,3 - Butadiene	1.35E-04	4.12E-04	6.38E-04	2.78E-04	2.23E-04
1,3,5-Trimethylbenzene	9.22E-05	2.82E-04	4.38E-04	1.90E-04	1.53E-04
1,3,5-Trinitrobenzene	3.86E-03	1.18E-02	1.83E-02	7.97E-03	6.40E-03
1,3-Dinitrobenzene	7.13E-05	2.18E-04	3.38E-04	1.47E-04	1.18E-04
2,4,6-Trinitrotoluene	3.47E-03	1.06E-02	1.65E-02	7.16E-03	5.74E-03
2,4-Dinitrotoluene	6.54E-04	2.00E-03	3.10E-03	1.35E-03	1.08E-03
2-Methylnapthalene	1.58E-04	4.83E-04	7.48E-04	3.25E-04	2.61E-04
3,4-Methylphenol (m- & p-cresol)	1.34E-05	4.09E-05	6.34E-05	2.75E-05	2.21E-05
Acenaphthylene	4.18E-05	1.28E-04	1.98E-04	8.63E-05	6.93E-05
Acetophenone	4.49E-04	1.37E-03	2.13E-03	9.26E-04	7.44E-04
Alkanes (Paraffins)	1.23E-03	3.77E-03	5.85E-03	2.55E-03	2.04E-03
Alkenes (Olefins)	6.30E-03	1.93E-02	2.99E-02	1.30E-02	1.04E-02
Anthracene	3.75E-05	1.15E-04	1.78E-04	7.74E-05	6.22E-05
Aromatics	2.22E-03	6.79E-03	1.05E-02	4.58E-03	3.68E-03
Benz(a)anthracene	1.81E-04	5.53E-04	8.58E-04	3.73E-04	3.00E-04
Benzene	6.76E-03	2.07E-02	3.21E-02	1.39E-02	1.12E-02
Benzo(a)pyrene	1.17E-04	3.58E-04	5.55E-04	2.41E-04	1.94E-04
Benzo(b)fluoranthene	2.09E-04	6.38E-04	9.90E-04	4.30E-04	3.46E-04
Benzo(g,h,i)perylene	3.83E-05	1.17E-04	1.82E-04	7.90E-05	6.34E-05
Benzo(k)fluoranthene	1.53E-04	4.68E-04	7.26E-04	3.15E-04	2.53E-04
Benzyl alcohol	1.98E-05	6.07E-05	9.41E-05	4.09E-05	3.29E-05
Biphenyl	8.67E-05	2.65E-04	4.11E-04	1.79E-04	1.44E-04
bis (2-Ethylhexyl)phthalate	2.11E-04	6.45E-04	1.00E-03	4.35E-04	3.49E-04
Butylbenzyl phthalate	2.85E-04	8.72E-04	1.35E-03	5.88E-04	4.72E-04
Carbon Dioxide	2.72E+02	8.33E+02	1.29E+03	5.61E+02	4.51E+02
Carbon Monoxide	3.56E+00	1.09E+01	1.69E+01	7.35E+00	5.90E+00
Carbon Tetrachloride	9.17E-05	2.81E-04	4.35E-04	1.89E-04	1.52E-04
Di-n-butyl phthalate	2.28E-04	6.98E-04	1.08E-03	4.71E-04	3.78E-04
Di-n-octyl phthalate	2.66E-04	8.15E-04	1.26E-03	5.49E-04	4.41E-04
Dibenzofuran	1.73E-05	5.29E-05	8.20E-05	3.57E-05	2.86E-05
Dichloromethane	7.13E-02	2.18E-01	3.38E-01	1.47E-01	1.18E-01
Diethyl phthalate	1.78E-04	5.43E-04	8.43E-04	3.66E-04	2.94E-04
Dimethyl phthalate	7.21E-05	2.20E-04	3.42E-04	1.49E-04	1.19E-04
Ethylbenzene	4.94E-04	1.51E-03	2.34E-03	1.02E-03	8.18E-04
Fluoranthene	1.23E-03	3.76E-03	5.83E-03	2.54E-03	2.04E-03
Fluorene	9.73E-06	2.98E-05	4.61E-05	2.01E-05	1.61E-05
Freon 11	3.68E-04	1.13E-03	1.75E-03	7.59E-04	6.09E-04
Freon 113	9.17E-05	2.81E-04	4.35E-04	1.89E-04	1.52E-04
Freon 12	1.48E-04	4.53E-04	7.02E-04	3.05E-04	2.45E-04
HMX	5.95E-04	1.82E-03	2.82E-03	1.23E-03	9.85E-04
Hydrogen Chloride	3.35E+00	1.03E+01	1.59E+01	6.91E+00	5.55E+00
Hydrogen Fluoride	2.63E+01	8.04E+01	1.25E+02	5.42E+01	4.35E+01
Indeno (1,2,3 - cd) pyrene	4.26E-05	1.30E-04	2.02E-04	8.78E-05	7.05E-05
m- & p-Xylene	1.70E-03	5.20E-03	8.06E-03	3.50E-03	2.81E-03
Methane	1.83E-02	5.61E-02	8.70E-02	3.78E-02	3.04E-02
Methyl chloride	1.03E-04	3.17E-04	4.91E-04	2.13E-04	1.71E-04
n-Nitrosodiphenylamine	2.19E-05	6.71E-05	1.04E-04	4.52E-05	3.63E-05
Naphthalene	3.09E-04	9.45E-04	1.47E-03	6.37E-04	5.12E-04
Nitrogen Dioxide (peroxide)	7.21E-02	2.20E-01	3.42E-01	1.49E-01	1.19E-01
Nitrogen Oxide	1.63E+00	4.98E+00	7.72E+00	3.36E+00	2.70E+00
o-Xylene	6.80E-04	2.08E-03	3.23E-03	1.40E-03	1.13E-03
p-Ethyltoluene	9.94E-05	3.04E-04	4.71E-04	2.05E-04	1.65E-04
Phenanthrene	5.73E-05	1.75E-04	2.72E-04	1.18E-04	9.50E-05
Phenol	1.28E-04	3.91E-04	6.07E-04	2.64E-04	2.12E-04

TABLE 3
OPEN BURNING 1-HOUR AVERAGE GROUND LEVEL CONCENTRATIONS AT SELECTED RECEPTORS
UTILIZING PETN (LOW HEAT CONTENT) MODELING RESULTS

Receptor:	S5	S6	S7	S8	Hospital
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
PM10	7.06E+01	2.16E+02	3.35E+02	1.46E+02	1.17E+02
Pyrene	4.52E-04	1.38E-03	2.15E-03	9.33E-04	7.49E-04
RDX	2.12E-03	6.47E-03	1.00E-02	4.36E-03	3.50E-03
Styrene	3.68E-04	1.13E-03	1.75E-03	7.59E-04	6.09E-04
Tetrachloroethylene	4.54E-03	1.39E-02	2.15E-02	9.36E-03	7.51E-03
TO - 12 (NMOC)	2.12E-02	6.49E-02	1.01E-01	4.38E-02	3.51E-02
Toluene	4.52E-04	1.38E-03	2.14E-03	9.32E-04	7.48E-04
Total Non-methane Hydrocarbons	1.22E-01	3.73E-01	5.79E-01	2.52E-01	2.02E-01
Total Non-methane Organic Compounds	7.31E-02	2.24E-01	3.47E-01	1.51E-01	1.21E-01
Total Unidentified Hydrocarbons	1.14E-02	3.50E-02	5.43E-02	2.36E-02	1.89E-02

TABLE 3
OPEN BURNING 1-HOUR AVERAGE GROUND LEVEL CONCENTRATIONS AT SELECTED RECEPTORS
UTILIZING PETN (LOW HEAT CONTENT) MODELING RESULTS

Receptor:	Long-Term HCC	Day Care Center	Closest Residence
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1,2,4-Trimethylbenzene	6.31E-04	9.62E-04	1.46E-03
1,3 - Butadiene	3.44E-04	5.24E-04	7.95E-04
1,3,5-Trimethylbenzene	2.36E-04	3.59E-04	5.45E-04
1,3,5-Trinitrobenzene	9.88E-03	1.51E-02	2.28E-02
1,3-Dinitrobenzene	1.82E-04	2.78E-04	4.21E-04
2,4,6-Trinitrotoluene	8.87E-03	1.35E-02	2.05E-02
2,4-Dinitrotoluene	1.67E-03	2.55E-03	3.86E-03
2-Methylnapthalene	4.03E-04	6.15E-04	9.32E-04
3,4-Methylphenol (m- & p-cresol)	3.41E-05	5.21E-05	7.89E-05
Acenaphthylene	1.07E-04	1.63E-04	2.47E-04
Acetophenone	1.15E-03	1.75E-03	2.65E-03
Alkanes (Paraffins)	3.15E-03	4.81E-03	7.29E-03
Alkenes (Olefins)	1.61E-02	2.46E-02	3.72E-02
Anthracene	9.60E-05	1.46E-04	2.22E-04
Aromatics	5.68E-03	8.65E-03	1.31E-02
Benz(a)anthracene	4.63E-04	7.05E-04	1.07E-03
Benzene	1.73E-02	2.63E-02	3.99E-02
Benzo(a)pyrene	2.99E-04	4.56E-04	6.91E-04
Benzo(b)fluoranthene	5.33E-04	8.13E-04	1.23E-03
Benzo(g,h,i)perylene	9.79E-05	1.49E-04	2.26E-04
Benzo(k)fluoranthene	3.91E-04	5.96E-04	9.04E-04
Benzyl alcohol	5.07E-05	7.73E-05	1.17E-04
Biphenyl	2.22E-04	3.38E-04	5.12E-04
bis (2-Ethylhexyl)phthalate	5.39E-04	8.22E-04	1.25E-03
Butylbenzyl phthalate	7.29E-04	1.11E-03	1.68E-03
Carbon Dioxide	6.96E+02	1.06E+03	1.61E+03
Carbon Monoxide	9.10E+00	1.39E+01	2.10E+01
Carbon Tetrachloride	2.34E-04	3.58E-04	5.42E-04
Di-n-butyl phthalate	5.84E-04	8.90E-04	1.35E-03
Di-n-octyl phthalate	6.81E-04	1.04E-03	1.57E-03
Dibenzofuran	4.42E-05	6.74E-05	1.02E-04
Dichloromethane	1.82E-01	2.78E-01	4.21E-01
Diethyl phthalate	4.54E-04	6.92E-04	1.05E-03
Dimethyl phthalate	1.84E-04	2.81E-04	4.26E-04
Ethylbenzene	1.26E-03	1.93E-03	2.92E-03
Fluoranthene	3.14E-03	4.79E-03	7.27E-03
Fluorene	2.49E-05	3.79E-05	5.75E-05
Freon 11	9.41E-04	1.43E-03	2.17E-03
Freon 113	2.34E-04	3.58E-04	5.42E-04
Freon 12	3.78E-04	5.77E-04	8.74E-04
HMX	1.52E-03	2.32E-03	3.51E-03
Hydrogen Chloride	8.57E+00	1.31E+01	1.98E+01
Hydrogen Fluoride	6.72E+01	1.02E+02	1.55E+02
Indeno (1,2,3 - cd) pyrene	1.09E-04	1.66E-04	2.52E-04
m- & p-Xylene	4.34E-03	6.62E-03	1.00E-02
Methane	4.69E-02	7.15E-02	1.08E-01
Methyl chloride	2.65E-04	4.03E-04	6.12E-04
n-Nitrosodiphenylamine	5.60E-05	8.55E-05	1.30E-04
Naphthalene	7.90E-04	1.20E-03	1.83E-03
Nitrogen Dioxide (peroxide)	1.84E-01	2.81E-01	4.26E-01
Nitrogen Oxide	4.16E+00	6.34E+00	9.62E+00
o-Xylene	1.74E-03	2.65E-03	4.02E-03
p-Ethyltoluene	2.54E-04	3.87E-04	5.87E-04
Phenanthrene	1.47E-04	2.24E-04	3.39E-04
Phenol	3.27E-04	4.98E-04	7.56E-04

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TABLE 3
OPEN BURNING 1-HOUR AVERAGE GROUND LEVEL CONCENTRATIONS AT SELECTED RECEPTORS
UTILIZING PETN (LOW HEAT CONTENT) MODELING RESULTS

Receptor:	Long-Term HCC	Day Care Center	Closest Residence
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
PM10	1.80E+02	2.75E+02	4.17E+02
Pyrene	1.16E-03	1.76E-03	2.67E-03
RDX	5.41E-03	8.25E-03	1.25E-02
Styrene	9.41E-04	1.43E-03	2.17E-03
Tetrachloroethylene	1.16E-02	1.77E-02	2.68E-02
TO - 12 (NMOC)	5.42E-02	8.27E-02	1.25E-01
Toluene	1.16E-03	1.76E-03	2.67E-03
Total Non-methane Hydrocarbons	3.12E-01	4.76E-01	7.21E-01
Total Non-methane Organic Compounds	1.87E-01	2.85E-01	4.32E-01
Total Unidentified Hydrocarbons	2.92E-02	4.46E-02	6.76E-02

TABLE 4
OPEN BURNING 8-HOUR AVERAGE GROUND LEVEL CONCENTRATIONS AT
SELECTED RECEPTORS TILIZING TNT (HIGH HEAT CONTENT) MODELING RESULTS
PAGE 1 OF 6

Receptor:	Maximum Offsite	S1	S2	S3	S4
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1,2,4-Trimethylbenzene	1.83E-04	2.26E-05	2.00E-05	2.21E-05	2.15E-05
1,3 - Butadiene	9.87E-03	1.22E-03	1.08E-03	1.19E-03	1.16E-03
1,3,5-Trimethylbenzene	1.18E-02	1.46E-03	1.29E-03	1.43E-03	1.39E-03
1,3,5-Trinitrobenzene	2.59E-03	3.19E-04	2.83E-04	3.13E-04	3.04E-04
1,3-Dinitrobenzene	6.10E-04	7.53E-05	6.68E-05	7.37E-05	7.16E-05
2,4,6-Trinitrotoluene	1.82E-05	2.24E-06	1.99E-06	2.20E-06	2.13E-06
2,4-Dinitrotoluene	5.69E-05	7.02E-06	6.23E-06	6.88E-06	6.68E-06
2-Methylnapthalene	1.78E-03	2.19E-04	1.94E-04	2.15E-04	2.08E-04
3,4-Methylphenol (m- & p-cresol)	1.13E-03	1.39E-04	1.23E-04	1.36E-04	1.32E-04
Acenaphthylene	1.42E-02	1.75E-03	1.55E-03	1.72E-03	1.67E-03
Acetophenone	5.11E-05	6.30E-06	5.59E-06	6.17E-06	5.99E-06
Alkanes (Paraffins)	1.00E-03	1.24E-04	1.10E-04	1.21E-04	1.18E-04
Alkenes (Olefins)	2.46E-04	3.04E-05	2.70E-05	2.97E-05	2.89E-05
Anthracene	2.15E-03	2.66E-04	2.36E-04	2.60E-04	2.53E-04
Aromatics	1.59E-04	1.96E-05	1.74E-05	1.92E-05	1.87E-05
Benz(a)anthracene	2.84E-04	3.50E-05	3.11E-05	3.43E-05	3.33E-05
Benzene	5.21E-05	6.43E-06	5.71E-06	6.30E-06	6.11E-06
Benzo(a)pyrene	2.08E-04	2.57E-05	2.28E-05	2.51E-05	2.44E-05
Benzo(b)fluoranthene	1.52E-05	1.87E-06	1.66E-06	1.83E-06	1.78E-06
Benzo(g,h,i)perylene	1.18E-04	1.46E-05	1.29E-05	1.43E-05	1.38E-05
Benzo(k)fluoranthene	3.02E-04	3.73E-05	3.31E-05	3.65E-05	3.54E-05
Benzyl alcohol	9.98E-04	1.23E-04	1.09E-04	1.21E-04	1.17E-04
Biphenyl	4.87E+02	6.01E+01	5.33E+01	5.88E+01	5.71E+01
bis (2-Ethylhexyl)phthalate	2.48E+00	3.06E-01	2.71E-01	3.00E-01	2.91E-01
Butylbenzyl phthalate	8.61E-04	1.06E-04	9.42E-05	1.04E-04	1.01E-04
Carbon Dioxide	2.98E-04	3.68E-05	3.27E-05	3.60E-05	3.50E-05
Carbon Monoxide	2.35E-05	2.90E-06	2.57E-06	2.84E-06	2.76E-06
Carbon Tetrachloride	6.62E-04	8.16E-05	7.24E-05	8.00E-05	7.76E-05
Di-n-butyl phthalate	1.67E-03	2.06E-04	1.83E-04	2.02E-04	1.96E-04
Di-n-octyl phthalate	1.32E-05	1.63E-06	1.45E-06	1.60E-06	1.55E-06
Dibenzofuran	4.77E-04	5.88E-05	5.22E-05	5.76E-05	5.59E-05
Dichloromethane	8.09E-04	9.98E-05	8.86E-05	9.78E-05	9.49E-05
Diethyl phthalate	4.56E+00	5.63E-01	4.99E-01	5.51E-01	5.35E-01
Dimethyl phthalate	3.58E+01	4.41E+00	3.91E+00	4.32E+00	4.20E+00
Ethylbenzene	5.79E-05	7.15E-06	6.34E-06	7.00E-06	6.80E-06
Fluoranthene	6.27E-03	7.74E-04	6.87E-04	7.58E-04	7.36E-04
Fluorene	1.69E-04	2.09E-05	1.85E-05	2.05E-05	1.99E-05
Freon 11	2.98E-05	3.68E-06	3.27E-06	3.60E-06	3.50E-06
Freon 113	1.23E-03	1.51E-04	1.34E-04	1.48E-04	1.44E-04
Freon 12	2.26E-02	2.79E-03	2.47E-03	2.73E-03	2.65E-03
HMX	3.15E+00	3.89E-01	3.45E-01	3.81E-01	3.70E-01
Hydrogen Chloride	1.53E-04	1.89E-05	1.68E-05	1.85E-05	1.80E-05
Hydrogen Fluoride	2.08E-04	2.57E-05	2.28E-05	2.51E-05	2.44E-05
Indeno (1,2,3 - cd) pyrene	5.21E-04	6.43E-05	5.71E-05	6.30E-05	6.11E-05
m- & p-Xylene					
Methane					
Methyl chloride					
n-Nitrosodiphenylamine					
Naphthalene					
Nitrogen Dioxide (peroxide)					
Nitrogen Oxide					
o-Xylene					
p-Ethyltoluene					
Phenanthrene					
Phenol					

TABLE 4
OPEN BURNING 8-HOUR AVERAGE GROUND LEVEL CONCENTRATIONS AT
SELECTED RECEPTORS TILIZING TNT (HIGH HEAT CONTENT) MODELING RESULTS
PAGE 2 OF 6

Receptor:	Maximum Offsite	S1	S2	S3	S4
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
PM10	9.60E+01	1.18E+01	1.05E+01	1.16E+01	1.13E+01
Pyrene	1.82E-03	2.25E-04	2.00E-04	2.20E-04	2.14E-04
RDX	3.29E-03	4.06E-04	3.60E-04	3.97E-04	3.86E-04
Styrene	5.01E-04	6.18E-05	5.48E-05	6.05E-05	5.87E-05
Tetrachloroethylene					
TO - 12 (NMOC)	2.89E-02	3.56E-03	3.16E-03	3.49E-03	3.39E-03
Toluene	5.01E-04	6.18E-05	5.48E-05	6.05E-05	5.87E-05
Total Non-methane Hydrocarbons	1.34E-02	1.66E-03	1.47E-03	1.62E-03	1.58E-03
Total Non-methane Organic Compounds					
Total Unidentified Hydrocarbons					

TABLE 4
OPEN BURNING 8-HOUR AVERAGE GROUND LEVEL CONCENTRATIONS AT
SELECTED RECEPTORS TILIZING TNT (HIGH HEAT CONTENT) MODELING RESULTS

Receptor:	S5	S6	S7	S8	Hospital
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1,2,4-Trimethylbenzene	1.41E-05	4.42E-05	5.59E-05	2.33E-05	1.90E-05
1,3 - Butadiene	7.62E-04	2.38E-03	3.02E-03	1.26E-03	1.02E-03
1,3,5-Trimethylbenzene	9.13E-04	2.86E-03	3.61E-03	1.51E-03	1.23E-03
1,3,5-Trinitrobenzene	2.00E-04	6.25E-04	7.91E-04	3.30E-04	2.68E-04
1,3-Dinitrobenzene	4.71E-05	1.47E-04	1.86E-04	7.78E-05	6.33E-05
2,4,6-Trinitrotoluene	1.40E-06	4.39E-06	5.55E-06	2.32E-06	1.88E-06
2,4-Dinitrotoluene	4.39E-06	1.37E-05	1.74E-05	7.26E-06	5.90E-06
2-Methylnapthalene	1.37E-04	4.29E-04	5.43E-04	2.26E-04	1.84E-04
3,4-Methylphenol (m- & p-cresol)	8.71E-05	2.72E-04	3.45E-04	1.44E-04	1.17E-04
Acenaphthylene	1.10E-03	3.43E-03	4.34E-03	1.81E-03	1.47E-03
Acetophenone	3.94E-06	1.23E-05	1.56E-05	6.51E-06	5.30E-06
Alkanes (Paraffins)	7.75E-05	2.43E-04	3.07E-04	1.28E-04	1.04E-04
Alkenes (Olefins)	1.90E-05	5.94E-05	7.52E-05	3.14E-05	2.55E-05
Anthracene	1.66E-04	5.20E-04	6.58E-04	2.75E-04	2.23E-04
Aromatics	1.23E-05	3.84E-05	4.86E-05	2.03E-05	1.65E-05
Benz(a)anthracene	2.19E-05	6.86E-05	8.67E-05	3.62E-05	2.94E-05
Benzene	4.02E-06	1.26E-05	1.59E-05	6.65E-06	5.40E-06
Benzo(a)pyrene	1.61E-05	5.03E-05	6.36E-05	2.65E-05	2.16E-05
Benzo(b)fluoranthene	1.17E-06	3.66E-06	4.63E-06	1.93E-06	1.57E-06
Benzo(g,h,i)perylene	9.10E-06	2.85E-05	3.60E-05	1.50E-05	1.22E-05
Benzo(k)fluoranthene	2.33E-05	7.29E-05	9.23E-05	3.85E-05	3.13E-05
Benzyl alcohol	7.70E-05	2.41E-04	3.05E-04	1.27E-04	1.03E-04
Biphenyl	3.76E+01	1.18E+02	1.49E+02	6.21E+01	5.05E+01
bis (2-Ethylhexyl)phthalate	1.91E-01	5.99E-01	7.57E-01	3.16E-01	2.57E-01
Butylbenzyl phthalate	6.64E-05	2.08E-04	2.63E-04	1.10E-04	8.92E-05
Carbon Dioxide	2.30E-05	7.20E-05	9.11E-05	3.80E-05	3.09E-05
Carbon Monoxide	1.82E-06	5.68E-06	7.19E-06	3.00E-06	2.44E-06
Carbon Tetrachloride	5.11E-05	1.60E-04	2.02E-04	8.44E-05	6.86E-05
Di-n-butyl phthalate	1.29E-04	4.04E-04	5.11E-04	2.13E-04	1.73E-04
Di-n-octyl phthalate	1.02E-06	3.20E-06	4.04E-06	1.69E-06	1.37E-06
Dibenzofuran	3.68E-05	1.15E-04	1.46E-04	6.08E-05	4.94E-05
Dichloromethane	6.24E-05	1.95E-04	2.47E-04	1.03E-04	8.39E-05
Diethyl phthalate	3.52E-01	1.10E+00	1.39E+00	5.82E-01	4.73E-01
Dimethyl phthalate	2.76E+00	8.64E+00	1.09E+01	4.56E+00	3.71E+00
Ethylbenzene	4.47E-06	1.40E-05	1.77E-05	7.39E-06	6.01E-06
Fluoranthene	4.84E-04	1.52E-03	1.92E-03	8.00E-04	6.50E-04
Fluorene	1.31E-05	4.09E-05	5.18E-05	2.16E-05	1.76E-05
Freon 11	2.30E-06	7.20E-06	9.11E-06	3.80E-06	3.09E-06
Freon 113	9.47E-05	2.96E-04	3.75E-04	1.57E-04	1.27E-04
Freon 12	1.74E-03	5.46E-03	6.90E-03	2.88E-03	2.34E-03
HMX	2.43E-01	7.62E-01	9.64E-01	4.02E-01	3.27E-01
Hydrogen Chloride	1.18E-05	3.70E-05	4.68E-05	1.95E-05	1.59E-05
Hydrogen Fluoride	1.61E-05	5.03E-05	6.36E-05	2.65E-05	2.16E-05
Indeno (1,2,3 - cd) pyrene	4.02E-05	1.26E-04	1.59E-04	6.65E-05	5.40E-05
m- & p-Xylene					
Methane					
Methyl chloride					
n-Nitrosodiphenylamine					
Naphthalene					
Nitrogen Dioxide (peroxide)					
Nitrogen Oxide					
o-Xylene					
p-Ethyltoluene					
Phenanthrene					
Phenol					

TABLE 4
OPEN BURNING 8-HOUR AVERAGE GROUND LEVEL CONCENTRATIONS AT
SELECTED RECEPTORS TILIZING TNT (HIGH HEAT CONTENT) MODELING RESULTS
PAGE 4 OF 6

Receptor:	S5	S6	S7	S8	Hospital
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
PM10	7.41E+00	2.32E+01	2.93E+01	1.22E+01	9.95E+00
Pyrene	1.41E-04	4.40E-04	5.57E-04	2.33E-04	1.89E-04
RDX	2.54E-04	7.94E-04	1.00E-03	4.19E-04	3.41E-04
Styrene	3.86E-05	1.21E-04	1.53E-04	6.38E-05	5.19E-05
Tetrachloroethylene					
TO - 12 (NMOC)	2.23E-03	6.97E-03	8.82E-03	3.68E-03	2.99E-03
Toluene	3.86E-05	1.21E-04	1.53E-04	6.38E-05	5.19E-05
Total Non-methane Hydrocarbons	1.04E-03	3.25E-03	4.11E-03	1.71E-03	1.39E-03
Total Non-methane Organic Compounds					
Total Unidentified Hydrocarbons					

TABLE 4
OPEN BURNING 8-HOUR AVERAGE GROUND LEVEL CONCENTRATIONS AT
SELECTED RECEPTORS TILIZING TNT (HIGH HEAT CONTENT) MODELING RESULTS

Receptor:	Long-Term HCC	Day Care Center	Closest Residence
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1,2,4-Trimethylbenzene	3.69E-05	4.77E-05	6.97E-05
1,3 - Butadiene	1.99E-03	2.57E-03	3.76E-03
1,3,5-Trimethylbenzene	2.39E-03	3.08E-03	4.51E-03
1,3,5-Trinitrobenzene	5.22E-04	6.75E-04	9.86E-04
1,3-Dinitrobenzene	1.23E-04	1.59E-04	2.32E-04
2,4,6-Trinitrotoluene	3.67E-06	4.74E-06	6.92E-06
2,4-Dinitrotoluene	1.15E-05	1.48E-05	2.17E-05
2-Methylnapthalene	3.58E-04	4.63E-04	6.76E-04
3,4-Methylphenol (m- & p-cresol)	2.28E-04	2.94E-04	4.30E-04
Acenaphthylene	2.86E-03	3.70E-03	5.41E-03
Acetophenone	1.03E-05	1.33E-05	1.95E-05
Alkanes (Paraffins)	2.03E-04	2.62E-04	3.83E-04
Alkenes (Olefins)	4.97E-05	6.42E-05	9.38E-05
Anthracene	4.34E-04	5.61E-04	8.20E-04
Aromatics	3.21E-05	4.15E-05	6.06E-05
Benz(a)anthracene	5.73E-05	7.40E-05	1.08E-04
Benzene	1.05E-05	1.36E-05	1.99E-05
Benzo(a)pyrene	4.20E-05	5.43E-05	7.93E-05
Benzo(b)fluoranthene	3.06E-06	3.95E-06	5.77E-06
Benzo(g,h,i)perylene	2.38E-05	3.07E-05	4.49E-05
Benzo(k)fluoranthene	6.09E-05	7.87E-05	1.15E-04
Benzyl alcohol	2.01E-04	2.60E-04	3.80E-04
Biphenyl	9.82E+01	1.27E+02	1.85E+02
bis (2-Ethylhexyl)phthalate	5.00E-01	6.46E-01	9.44E-01
Butylbenzyl phthalate	1.74E-04	2.24E-04	3.28E-04
Carbon Dioxide	6.02E-05	7.78E-05	1.14E-04
Carbon Monoxide	4.74E-06	6.13E-06	8.96E-06
Carbon Tetrachloride	1.33E-04	1.73E-04	2.52E-04
Di-n-butyl phthalate	3.37E-04	4.36E-04	6.37E-04
Di-n-octyl phthalate	2.67E-06	3.45E-06	5.04E-06
Dibenzofuran	9.61E-05	1.24E-04	1.82E-04
Dichloromethane	1.63E-04	2.11E-04	3.08E-04
Diethyl phthalate	9.20E-01	1.19E+00	1.74E+00
Dimethyl phthalate	7.21E+00	9.32E+00	1.36E+01
Ethylbenzene	1.17E-05	1.51E-05	2.21E-05
Fluoranthene	1.27E-03	1.64E-03	2.39E-03
Fluorene	3.42E-05	4.42E-05	6.45E-05
Freon 11	6.02E-06	7.78E-06	1.14E-05
Freon 113	2.48E-04	3.20E-04	4.68E-04
Freon 12	4.56E-03	5.89E-03	8.61E-03
HMX	6.36E-01	8.22E-01	1.20E+00
Hydrogen Chloride	3.09E-05	4.00E-05	5.84E-05
Hydrogen Fluoride	4.20E-05	5.43E-05	7.93E-05
Indeno (1,2,3 - cd) pyrene	1.05E-04	1.36E-04	1.99E-04
m- & p-Xylene			
Methane			
Methyl chloride			
n-Nitrosodiphenylamine			
Naphthalene			
Nitrogen Dioxide (peroxide)			
Nitrogen Oxide			
o-Xylene			
p-Ethyltoluene			
Phenanthrene			
Phenol			

TABLE 4
OPEN BURNING 8-HOUR AVERAGE GROUND LEVEL CONCENTRATIONS AT
SELECTED RECEPTORS TILIZING TNT (HIGH HEAT CONTENT) MODELING RESULTS
PAGE 6 OF 6

Receptor:	Long-Term HCC	Day Care Center	Closest Residence
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
PM10	1.94E+01	2.50E+01	3.66E+01
Pyrene	3.68E-04	4.76E-04	6.95E-04
RDX	6.63E-04	8.57E-04	1.25E-03
Styrene	1.01E-04	1.31E-04	1.91E-04
Tetrachloroethylene			
TO - 12 (NMOC)	5.82E-03	7.53E-03	1.10E-02
Toluene	1.01E-04	1.31E-04	1.91E-04
Total Non-methane Hydrocarbons	2.71E-03	3.50E-03	5.12E-03
Total Non-methane Organic Compounds			
Total Unidentified Hydrocarbons			

TABLE 5
OPEN BURNING 8-HOUR AVERAGE GROUND LEVEL CONCENTRATIONS AT
SELECTED RECEPTORS UTILIZING PETN (LOW HEAT CONTENT) MODELING RESULTS

Receptor:	Maximum Offsite	S1	S2	S3	S4
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1,2,4-Trimethylbenzene	3.68E-04	4.42E-05	4.58E-05	4.08E-05	5.22E-05
1,3 - Butadiene	2.01E-04	2.41E-05	2.50E-05	2.22E-05	2.85E-05
1,3,5-Trimethylbenzene	1.38E-04	1.65E-05	1.71E-05	1.52E-05	1.95E-05
1,3,5-Trinitrobenzene	5.77E-03	6.92E-04	7.18E-04	6.39E-04	8.17E-04
1,3-Dinitrobenzene	1.06E-04	1.28E-05	1.32E-05	1.18E-05	1.51E-05
2,4,6-Trinitrotoluene	5.18E-03	6.22E-04	6.44E-04	5.73E-04	7.34E-04
2,4-Dinitrotoluene	9.76E-04	1.17E-04	1.21E-04	1.08E-04	1.38E-04
2-Methylnapthalene	2.36E-04	2.83E-05	2.93E-05	2.61E-05	3.34E-05
3,4-Methylphenol (m- & p-cresol)	1.99E-05	2.39E-06	2.48E-06	2.21E-06	2.83E-06
Acenaphthylene	6.25E-05	7.50E-06	7.77E-06	6.91E-06	8.85E-06
Acetophenone	6.71E-04	8.05E-05	8.34E-05	7.42E-05	9.50E-05
Alkanes (Paraffins)	1.84E-03	2.21E-04	2.29E-04	2.04E-04	2.61E-04
Alkenes (Olefins)	9.41E-03	1.13E-03	1.17E-03	1.04E-03	1.33E-03
Anthracene	5.61E-05	6.73E-06	6.97E-06	6.21E-06	7.94E-06
Aromatics	3.31E-03	3.98E-04	4.12E-04	3.67E-04	4.70E-04
Benz(a)anthracene	2.70E-04	3.24E-05	3.36E-05	2.99E-05	3.83E-05
Benzene	1.01E-02	1.21E-03	1.26E-03	1.12E-03	1.43E-03
Benzo(a)pyrene	1.75E-04	2.10E-05	2.17E-05	1.93E-05	2.47E-05
Benzo(b)fluoranthene	3.12E-04	3.74E-05	3.88E-05	3.45E-05	4.41E-05
Benzo(g,h,i)perylene	5.72E-05	6.86E-06	7.12E-06	6.33E-06	8.10E-06
Benzo(k)fluoranthene	2.28E-04	2.74E-05	2.84E-05	2.53E-05	3.24E-05
Benzyl alcohol	2.96E-05	3.56E-06	3.69E-06	3.28E-06	4.20E-06
Biphenyl	1.29E-04	1.55E-05	1.61E-05	1.43E-05	1.83E-05
bis (2-Ethylhexyl)phthalate	3.15E-04	3.78E-05	3.92E-05	3.49E-05	4.46E-05
Butylbenzyl phthalate	4.25E-04	5.11E-05	5.29E-05	4.71E-05	6.03E-05
Carbon Dioxide	4.06E+02	4.88E+01	5.06E+01	4.50E+01	5.76E+01
Carbon Monoxide	5.32E+00	6.38E-01	6.62E-01	5.89E-01	7.53E-01
Carbon Tetrachloride	1.37E-04	1.64E-05	1.70E-05	1.52E-05	1.94E-05
Di-n-butyl phthalate	3.41E-04	4.09E-05	4.24E-05	3.77E-05	4.83E-05
Di-n-octyl phthalate	3.98E-04	4.77E-05	4.95E-05	4.40E-05	5.63E-05
Dibenzofuran	2.58E-05	3.10E-06	3.21E-06	2.86E-06	3.66E-06
Dichloromethane	1.06E-01	1.28E-02	1.32E-02	1.18E-02	1.51E-02
Diethyl phthalate	2.65E-04	3.18E-05	3.30E-05	2.94E-05	3.76E-05
Dimethyl phthalate	1.08E-04	1.29E-05	1.34E-05	1.19E-05	1.52E-05
Ethylbenzene	7.37E-04	8.85E-05	9.17E-05	8.16E-05	1.04E-04
Fluoranthene	1.84E-03	2.20E-04	2.28E-04	2.03E-04	2.60E-04
Fluorene	1.45E-05	1.74E-06	1.81E-06	1.61E-06	2.06E-06
Freon 11	5.49E-04	6.59E-05	6.83E-05	6.08E-05	7.78E-05
Freon 113	1.37E-04	1.64E-05	1.70E-05	1.52E-05	1.94E-05
Freon 12	2.21E-04	2.65E-05	2.75E-05	2.44E-05	3.13E-05
HMX	8.88E-04	1.07E-04	1.10E-04	9.83E-05	1.26E-04
Hydrogen Chloride	5.00E+00	6.01E-01	6.23E-01	5.54E-01	7.09E-01
Hydrogen Fluoride	3.92E+01	4.71E+00	4.88E+00	4.34E+00	5.56E+00
Indeno (1,2,3 - cd) pyrene	6.36E-05	7.63E-06	7.91E-06	7.04E-06	9.01E-06
m- & p-Xylene	2.54E-03	3.04E-04	3.15E-04	2.81E-04	3.59E-04
Methane	2.74E-02	3.29E-03	3.41E-03	3.03E-03	3.88E-03
Methyl chloride	1.54E-04	1.85E-05	1.92E-05	1.71E-05	2.19E-05
n-Nitrosodiphenylamine	3.27E-05	3.93E-06	4.07E-06	3.62E-06	4.64E-06
Naphthalene	4.61E-04	5.54E-05	5.74E-05	5.11E-05	6.54E-05
Nitrogen Dioxide (peroxide)	1.08E-01	1.29E-02	1.34E-02	1.19E-02	1.52E-02
Nitrogen Oxide	2.43E+00	2.92E-01	3.02E-01	2.69E-01	3.44E-01
o-Xylene	1.02E-03	1.22E-04	1.26E-04	1.12E-04	1.44E-04
p-Ethyltoluene	1.48E-04	1.78E-05	1.85E-05	1.64E-05	2.10E-05
Phenanthrene	8.56E-05	1.03E-05	1.07E-05	9.48E-06	1.21E-05
Phenol	1.91E-04	2.29E-05	2.38E-05	2.11E-05	2.70E-05

TABLE 5
OPEN BURNING 8-HOUR AVERAGE GROUND LEVEL CONCENTRATIONS AT
SELECTED RECEPTORS UTILIZING PETN (LOW HEAT CONTENT) MODELING RESULTS

Receptor:	Maximum Offsite	S1	S2	S3	S4
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
PM10	1.05E+02	1.26E+01	1.31E+01	1.17E+01	1.49E+01
Pyrene	6.75E-04	8.10E-05	8.40E-05	7.47E-05	9.57E-05
RDX	3.16E-03	3.79E-04	3.93E-04	3.50E-04	4.48E-04
Styrene	5.49E-04	6.59E-05	6.83E-05	6.08E-05	7.78E-05
Tetrachloroethylene	6.77E-03	8.13E-04	8.43E-04	7.50E-04	9.59E-04
TO - 12 (NMOC)	3.17E-02	3.80E-03	3.94E-03	3.51E-03	4.49E-03
Toluene	6.75E-04	8.10E-05	8.39E-05	7.47E-05	9.56E-05
Total Non-methane Hydrocarbons	1.82E-01	2.19E-02	2.27E-02	2.02E-02	2.58E-02
Total Non-methane Organic Compounds	1.09E-01	1.31E-02	1.36E-02	1.21E-02	1.55E-02
Total Unidentified Hydrocarbons	1.71E-02	2.05E-03	2.13E-03	1.89E-03	2.42E-03

TABLE 5
OPEN BURNING 8-HOUR AVERAGE GROUND LEVEL CONCENTRATIONS AT
SELECTED RECEPTORS UTILIZING PETN (LOW HEAT CONTENT) MODELING RESULTS

Receptor:	S5	S6	S7	S8	Hospital
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1,2,4-Trimethylbenzene	3.08E-05	9.43E-05	1.46E-04	6.36E-05	5.11E-05
1,3 - Butadiene	1.68E-05	5.15E-05	7.98E-05	3.47E-05	2.79E-05
1,3,5-Trimethylbenzene	1.15E-05	3.53E-05	5.47E-05	2.38E-05	1.91E-05
1,3,5-Trinitrobenzene	4.83E-04	1.48E-03	2.29E-03	9.96E-04	8.00E-04
1,3-Dinitrobenzene	8.91E-06	2.73E-05	4.23E-05	1.84E-05	1.48E-05
2,4,6-Trinitrotoluene	4.34E-04	1.33E-03	2.06E-03	8.94E-04	7.18E-04
2,4-Dinitrotoluene	8.17E-05	2.50E-04	3.88E-04	1.69E-04	1.35E-04
2-Methylnapthalene	1.97E-05	6.03E-05	9.35E-05	4.07E-05	3.27E-05
3,4-Methylphenol (m- & p-cresol)	1.67E-06	5.11E-06	7.92E-06	3.44E-06	2.76E-06
Acenaphthylene	5.23E-06	1.60E-05	2.48E-05	1.08E-05	8.66E-06
Acetophenone	5.61E-05	1.72E-04	2.66E-04	1.16E-04	9.30E-05
Alkanes (Paraffins)	1.54E-04	4.72E-04	7.32E-04	3.18E-04	2.55E-04
Alkenes (Olefins)	7.87E-04	2.41E-03	3.74E-03	1.62E-03	1.30E-03
Anthracene	4.69E-06	1.44E-05	2.23E-05	9.68E-06	7.77E-06
Aromatics	2.77E-04	8.49E-04	1.32E-03	5.72E-04	4.60E-04
Benz(a)anthracene	2.26E-05	6.92E-05	1.07E-04	4.66E-05	3.75E-05
Benzene	8.45E-04	2.58E-03	4.01E-03	1.74E-03	1.40E-03
Benzo(a)pyrene	1.46E-05	4.47E-05	6.93E-05	3.01E-05	2.42E-05
Benzo(b)fluoranthene	2.61E-05	7.98E-05	1.24E-04	5.38E-05	4.32E-05
Benzo(g,h,i)perylene	4.79E-06	1.46E-05	2.27E-05	9.88E-06	7.93E-06
Benzo(k)fluoranthene	1.91E-05	5.85E-05	9.07E-05	3.94E-05	3.17E-05
Benzyl alcohol	2.48E-06	7.59E-06	1.18E-05	5.12E-06	4.11E-06
Biphenyl	1.08E-05	3.31E-05	5.14E-05	2.23E-05	1.79E-05
bis (2-Ethylhexyl)phthalate	2.64E-05	8.07E-05	1.25E-04	5.44E-05	4.37E-05
Butylbenzyl phthalate	3.56E-05	1.09E-04	1.69E-04	7.35E-05	5.90E-05
Carbon Dioxide	3.40E+01	1.04E+02	1.61E+02	7.02E+01	5.63E+01
Carbon Monoxide	4.45E-01	1.36E+00	2.11E+00	9.18E-01	7.37E-01
Carbon Tetrachloride	1.15E-05	3.51E-05	5.44E-05	2.36E-05	1.90E-05
Di-n-butyl phthalate	2.85E-05	8.73E-05	1.35E-04	5.89E-05	4.73E-05
Di-n-octyl phthalate	3.33E-05	1.02E-04	1.58E-04	6.86E-05	5.51E-05
Dibenzofuran	2.16E-06	6.61E-06	1.03E-05	4.46E-06	3.58E-06
Dichloromethane	8.91E-03	2.73E-02	4.23E-02	1.84E-02	1.48E-02
Diethyl phthalate	2.22E-05	6.79E-05	1.05E-04	4.58E-05	3.68E-05
Dimethyl phthalate	9.01E-06	2.76E-05	4.27E-05	1.86E-05	1.49E-05
Ethylbenzene	6.17E-05	1.89E-04	2.93E-04	1.27E-04	1.02E-04
Fluoranthene	1.54E-04	4.70E-04	7.29E-04	3.17E-04	2.55E-04
Fluorene	1.22E-06	3.72E-06	5.77E-06	2.51E-06	2.01E-06
Freon 11	4.60E-05	1.41E-04	2.18E-04	9.49E-05	7.62E-05
Freon 113	1.15E-05	3.51E-05	5.44E-05	2.36E-05	1.90E-05
Freon 12	1.85E-05	5.66E-05	8.77E-05	3.81E-05	3.06E-05
HMX	7.43E-05	2.27E-04	3.53E-04	1.53E-04	1.23E-04
Hydrogen Chloride	4.19E-01	1.28E+00	1.99E+00	8.64E-01	6.94E-01
Hydrogen Fluoride	3.29E+00	1.01E+01	1.56E+01	6.78E+00	5.44E+00
Indeno (1,2,3 - cd) pyrene	5.32E-06	1.63E-05	2.53E-05	1.10E-05	8.81E-06
m- & p-Xylene	2.12E-04	6.49E-04	1.01E-03	4.38E-04	3.52E-04
Methane	2.29E-03	7.01E-03	1.09E-02	4.73E-03	3.80E-03
Methyl chloride	1.29E-05	3.96E-05	6.14E-05	2.67E-05	2.14E-05
n-Nitrosodiphenylamine	2.74E-06	8.38E-06	1.30E-05	5.65E-06	4.54E-06
Naphthalene	3.86E-05	1.18E-04	1.83E-04	7.97E-05	6.39E-05
Nitrogen Dioxide (peroxide)	9.01E-03	2.76E-02	4.27E-02	1.86E-02	1.49E-02
Nitrogen Oxide	2.03E-01	6.22E-01	9.65E-01	4.20E-01	3.37E-01
o-Xylene	8.50E-05	2.60E-04	4.03E-04	1.75E-04	1.41E-04
p-Ethyltoluene	1.24E-05	3.80E-05	5.89E-05	2.56E-05	2.06E-05
Phenanthrene	7.17E-06	2.19E-05	3.40E-05	1.48E-05	1.19E-05
Phenol	1.60E-05	4.89E-05	7.58E-05	3.30E-05	2.65E-05

TABLE 5
OPEN BURNING 8-HOUR AVERAGE GROUND LEVEL CONCENTRATIONS AT
SELECTED RECEPTORS UTILIZING PETN (LOW HEAT CONTENT) MODELING RESULTS

Receptor:	S5	S6	S7	S8	Hospital
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
PM10	8.82E+00	2.70E+01	4.18E+01	1.82E+01	1.46E+01
Pyrene	5.65E-05	1.73E-04	2.68E-04	1.17E-04	9.36E-05
RDX	2.64E-04	8.09E-04	1.25E-03	5.46E-04	4.38E-04
Styrene	4.60E-05	1.41E-04	2.18E-04	9.49E-05	7.62E-05
Tetrachloroethylene	5.67E-04	1.73E-03	2.69E-03	1.17E-03	9.39E-04
TO - 12 (NMOC)	2.65E-03	8.11E-03	1.26E-02	5.47E-03	4.39E-03
Toluene	5.65E-05	1.73E-04	2.68E-04	1.17E-04	9.35E-05
Total Non-methane Hydrocarbons	1.53E-02	4.67E-02	7.24E-02	3.15E-02	2.53E-02
Total Non-methane Organic Compounds	9.13E-03	2.79E-02	4.33E-02	1.88E-02	1.51E-02
Total Unidentified Hydrocarbons	1.43E-03	4.37E-03	6.78E-03	2.95E-03	2.37E-03

TABLE 5
OPEN BURNING 8-HOUR AVERAGE GROUND LEVEL CONCENTRATIONS AT SELECTED RECEPTORS UTILIZING PETN (LOW HEAT CONTENT) MODELING RESULTS

Receptor:	Long-Term HCC	Day Care Center	Closest Residence
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1,2,4-Trimethylbenzene	7.88E-05	1.20E-04	1.82E-04
1,3 - Butadiene	4.30E-05	6.56E-05	9.94E-05
1,3,5-Trimethylbenzene	2.95E-05	4.49E-05	6.81E-05
1,3,5-Trinitrobenzene	1.23E-03	1.88E-03	2.85E-03
1,3-Dinitrobenzene	2.28E-05	3.47E-05	5.27E-05
2,4,6-Trinitrotoluene	1.11E-03	1.69E-03	2.56E-03
2,4-Dinitrotoluene	2.09E-04	3.19E-04	4.83E-04
2-Methylnapthalene	5.04E-05	7.69E-05	1.17E-04
3,4-Methylphenol (m- & p-cresol)	4.27E-06	6.51E-06	9.87E-06
Acenaphthylene	1.34E-05	2.04E-05	3.09E-05
Acetophenone	1.44E-04	2.19E-04	3.32E-04
Alkanes (Paraffins)	3.94E-04	6.01E-04	9.12E-04
Alkenes (Olefins)	2.01E-03	3.07E-03	4.65E-03
Anthracene	1.20E-05	1.83E-05	2.77E-05
Aromatics	7.09E-04	1.08E-03	1.64E-03
Benz(a)anthracene	5.78E-05	8.82E-05	1.34E-04
Benzene	2.16E-03	3.29E-03	4.99E-03
Benzo(a)pyrene	3.74E-05	5.70E-05	8.64E-05
Benzo(b)fluoranthene	6.67E-05	1.02E-04	1.54E-04
Benzo(g,h,i)perylene	1.22E-05	1.87E-05	2.83E-05
Benzo(k)fluoranthene	4.89E-05	7.45E-05	1.13E-04
Benzyl alcohol	6.34E-06	9.67E-06	1.47E-05
Biphenyl	2.77E-05	4.22E-05	6.40E-05
bis.(2-Ethylhexyl)phthalate	6.74E-05	1.03E-04	1.56E-04
Butylbenzyl phthalate	9.11E-05	1.39E-04	2.11E-04
Carbon Dioxide	8.70E+01	1.33E+02	2.01E+02
Carbon Monoxide	1.14E+00	1.74E+00	2.63E+00
Carbon Tetrachloride	2.93E-05	4.47E-05	6.78E-05
Di-n-butyl phthalate	7.30E-05	1.11E-04	1.69E-04
Di-n-octyl phthalate	8.51E-05	1.30E-04	1.97E-04
Dibenzofuran	5.52E-06	8.42E-06	1.28E-05
Dichloromethane	2.28E-02	3.47E-02	5.27E-02
Diethyl phthalate	5.68E-05	8.66E-05	1.31E-04
Dimethyl phthalate	2.30E-05	3.51E-05	5.32E-05
Ethylbenzene	1.58E-04	2.41E-04	3.65E-04
Fluoranthene	3.93E-04	5.99E-04	9.08E-04
Fluorene	3.11E-06	4.74E-06	7.19E-06
Freon 11	1.18E-04	1.79E-04	2.72E-04
Freon 113	2.93E-05	4.47E-05	6.78E-05
Freon 12	4.73E-05	7.21E-05	1.09E-04
HMX	1.90E-04	2.90E-04	4.39E-04
Hydrogen Chloride	1.07E+00	1.63E+00	2.48E+00
Hydrogen Fluoride	8.40E+00	1.28E+01	1.94E+01
Indeno (1,2,3 - cd) pyrene	1.36E-05	2.07E-05	3.15E-05
m- & p-Xylene	5.43E-04	8.27E-04	1.25E-03
Methane	5.86E-03	8.93E-03	1.35E-02
Methyl chloride	3.31E-05	5.04E-05	7.64E-05
n-Nitrosodiphenylamine	7.01E-06	1.07E-05	1.62E-05
Naphthalene	9.87E-05	1.51E-04	2.28E-04
Nitrogen Dioxide (peroxide)	2.30E-02	3.51E-02	5.32E-02
Nitrogen Oxide	5.20E-01	7.93E-01	1.20E+00
o-Xylene	2.17E-04	3.31E-04	5.03E-04
p-Ethyltoluene	3.18E-05	4.84E-05	7.34E-05
Phenanthrene	1.83E-05	2.79E-05	4.24E-05
Phenol	4.09E-05	6.23E-05	9.45E-05

TABLE 5
OPEN BURNING 8-HOUR AVERAGE GROUND LEVEL CONCENTRATIONS AT
SELECTED RECEPTORS UTILIZING PETN (LOW HEAT CONTENT) MODELING RESULTS

Receptor:	Long-Term HCC	Day Care Center	Closest Residence
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
PM10	2.25E+01	3.44E+01	5.21E+01
Pyrene	1.44E-04	2.20E-04	3.34E-04
RDX	6.76E-04	1.03E-03	1.56E-03
Styrene	1.18E-04	1.79E-04	2.72E-04
Tetrachloroethylene	1.45E-03	2.21E-03	3.35E-03
TO - 12 (NMOC)	6.78E-03	1.03E-02	1.57E-02
Toluene	1.44E-04	2.20E-04	3.34E-04
Total Non-methane Hydrocarbons	3.90E-02	5.95E-02	9.02E-02
Total Non-methane Organic Compounds	2.34E-02	3.56E-02	5.40E-02
Total Unidentified Hydrocarbons	3.66E-03	5.57E-03	8.45E-03

TABLE 6
OPEN BURNING 24-HOUR AVERAGE GROUND LEVEL CONCENTRATIONS
AT SELECTED RECEPTOR UTILIZING TNT (HIGH HEAT CONTENT) MODELING RESULTS

Receptor:	Maximum Offsite	S1	S2	S3	S4	S5	S6	S7
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1,2,4-Trimethylbenzene	6.10E-05	7.53E-06	6.68E-06	7.37E-06	7.16E-06	4.71E-06	1.47E-05	1.86E-05
1,3 - Butadiene	3.29E-03	4.06E-04	3.60E-04	3.98E-04	3.86E-04	2.54E-04	7.95E-04	1.01E-03
1,3,5-Trimethylbenzene	3.94E-03	4.86E-04	4.32E-04	4.76E-04	4.63E-04	3.04E-04	9.52E-04	1.20E-03
1,3,5-Trinitrobenzene	8.63E-04	1.06E-04	9.45E-05	1.04E-04	1.01E-04	6.66E-05	2.08E-04	2.64E-04
1,3-Dinitrobenzene	2.03E-04	2.51E-05	2.23E-05	2.46E-05	2.39E-05	1.57E-05	4.91E-05	6.22E-05
2,4,6-Trinitrotoluene	6.06E-06	7.47E-07	6.63E-07	7.32E-07	7.11E-07	4.67E-07	1.46E-06	1.85E-06
2,4-Dinitrotoluene	1.90E-05	2.34E-06	2.08E-06	2.29E-06	2.23E-06	1.46E-06	4.58E-06	5.80E-06
2-Methylnapthalene	5.92E-04	7.30E-05	6.48E-05	7.15E-05	6.94E-05	4.57E-05	1.43E-04	1.81E-04
3,4-Methylphenol (m- & p-cresol)	3.76E-04	4.64E-05	4.12E-05	4.54E-05	4.41E-05	2.90E-05	9.08E-05	1.15E-04
Acenaphthylene	4.73E-03	5.84E-04	5.18E-04	5.72E-04	5.55E-04	3.65E-04	1.14E-03	1.45E-03
Acetophenone	1.70E-05	2.10E-06	1.86E-06	2.06E-06	2.00E-06	1.31E-06	4.11E-06	5.20E-06
Alkanes (Paraffins)	3.35E-04	4.13E-05	3.67E-05	4.05E-05	3.93E-05	2.58E-05	8.09E-05	1.02E-04
Alkenes (Olefins)	8.21E-05	1.01E-05	8.98E-06	9.92E-06	9.63E-06	6.33E-06	1.98E-05	2.51E-05
Anthracene	7.18E-04	8.85E-05	7.86E-05	8.67E-05	8.42E-05	5.54E-05	1.73E-04	2.19E-04
Aromatics	5.30E-05	6.54E-06	5.81E-06	6.41E-06	6.22E-06	4.09E-06	1.28E-05	1.62E-05
Benz(a)anthracene	9.46E-05	1.17E-05	1.04E-05	1.14E-05	1.11E-05	7.30E-06	2.29E-05	2.89E-05
Benzene	1.74E-05	2.14E-06	1.90E-06	2.10E-06	2.04E-06	1.34E-06	4.19E-06	5.31E-06
Benzo(a)pyrene	6.94E-05	8.56E-06	7.59E-06	8.38E-06	8.14E-06	5.35E-06	1.68E-05	2.12E-05
Benzo(b)fluoranthene	5.05E-06	6.23E-07	5.53E-07	6.10E-07	5.93E-07	3.90E-07	1.22E-06	1.54E-06
Benzo(g,h,i)perylene	3.93E-05	4.85E-06	4.30E-06	4.75E-06	4.61E-06	3.03E-06	9.49E-06	1.20E-05
Benzo(k)fluoranthene	1.01E-04	1.24E-05	1.10E-05	1.22E-05	1.18E-05	7.77E-06	2.43E-05	3.08E-05
Benzyl alcohol	3.33E-04	4.10E-05	3.64E-05	4.02E-05	3.90E-05	2.57E-05	8.03E-05	1.02E-04
Biphenyl	1.62E+02	2.00E+01	1.78E+01	1.96E+01	1.90E+01	1.25E+01	3.92E+01	4.96E+01
bis (2-Ethylhexyl)phthalate	8.26E-01	1.02E-01	9.05E-02	9.98E-02	9.69E-02	6.38E-02	2.00E-01	2.52E-01
Butylbenzyl phthalate	2.87E-04	3.54E-05	3.14E-05	3.47E-05	3.37E-05	2.21E-05	6.93E-05	8.77E-05
Carbon Dioxide	9.94E-05	1.23E-05	1.09E-05	1.20E-05	1.17E-05	7.67E-06	2.40E-05	3.04E-05
Carbon Monoxide	7.84E-06	9.67E-07	8.58E-07	9.47E-07	9.20E-07	6.05E-07	1.89E-06	2.40E-06
Carbon Tetrachloride	2.21E-04	2.72E-05	2.41E-05	2.67E-05	2.59E-05	1.70E-05	5.33E-05	6.74E-05
Di-n-butyl phthalate	5.58E-04	6.88E-05	6.11E-05	6.74E-05	6.54E-05	4.30E-05	1.35E-04	1.70E-04
Di-n-octyl phthalate	4.41E-06	5.44E-07	4.83E-07	5.33E-07	5.18E-07	3.40E-07	1.07E-06	1.35E-06
Dibenzofuran	1.59E-04	1.96E-05	1.74E-05	1.92E-05	1.86E-05	1.23E-05	3.84E-05	4.85E-05
Dichloromethane	2.70E-04	3.33E-05	2.95E-05	3.26E-05	3.16E-05	2.08E-05	6.51E-05	8.24E-05
Diethyl phthalate	1.52E+00	1.88E-01	1.66E-01	1.84E-01	1.78E-01	1.17E-01	3.67E-01	4.64E-01
Dimethyl phthalate	1.19E+01	1.47E+00	1.30E+00	1.44E+00	1.40E+00	9.20E-01	2.88E+00	3.64E+00
Ethylbenzene	1.93E-05	2.38E-06	2.11E-06	2.33E-06	2.27E-06	1.49E-06	4.66E-06	5.90E-06
Fluoranthene	2.09E-03	2.58E-04	2.29E-04	2.53E-04	2.45E-04	1.61E-04	5.05E-04	6.39E-04
Fluorene	5.65E-05	6.97E-06	6.18E-06	6.82E-06	6.62E-06	4.36E-06	1.36E-05	1.73E-05
Freon 11	9.94E-06	1.23E-06	1.09E-06	1.20E-06	1.17E-06	7.67E-07	2.40E-06	3.04E-06
Freon 113	4.09E-04	5.05E-05	4.48E-05	4.94E-05	4.80E-05	3.16E-05	9.88E-05	1.25E-04
Freon 12	7.53E-03	9.29E-04	8.25E-04	9.10E-04	8.84E-04	5.81E-04	1.82E-03	2.30E-03
HMX	1.05E+00	1.30E-01	1.15E-01	1.27E-01	1.23E-01	8.11E-02	2.54E-01	3.21E-01
Hydrogen Chloride	5.11E-05	6.30E-06	5.59E-06	6.17E-06	5.99E-06	3.94E-06	1.23E-05	1.56E-05
Hydrogen Fluoride	6.94E-05	8.56E-06	7.59E-06	8.38E-06	8.14E-06	5.35E-06	1.68E-05	2.12E-05
Indeno (1,2,3 - cd) pyrene	1.74E-04	2.14E-05	1.90E-05	2.10E-05	2.04E-05	1.34E-05	4.19E-05	5.31E-05
m- & p-Xylene								
Methane								
Methyl chloride								
n-Nitrosodiphenylamine								
Naphthalene								
Nitrogen Dioxide (peroxide)								
Nitrogen Oxide								
o-Xylene								
p-Ethyltoluene								
Phenanthrene								
Phenol								

TABLE 6
OPEN BURNING 24-HOUR AVERAGE GROUND LEVEL CONCENTRATIONS
AT SELECTED RECEPTOR UTILIZING TNT (HIGH HEAT CONTENT) MODELING RESULTS

Receptor:	Maximum Offsite	S1	S2	S3	S4	S5	S6	S7
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
PM10	3.20E+01	3.95E+00	3.50E+00	3.87E+00	3.75E+00	2.47E+00	7.73E+00	9.78E+00
Pyrene	6.08E-04	7.50E-05	6.66E-05	7.35E-05	7.13E-05	4.69E-05	1.47E-04	1.86E-04
RDX	1.10E-03	1.35E-04	1.20E-04	1.32E-04	1.29E-04	8.46E-05	2.65E-04	3.35E-04
Styrene	1.67E-04	2.06E-05	1.83E-05	2.02E-05	1.96E-05	1.29E-05	4.03E-05	5.10E-05
Tetrachloroethylene								
TO - 12 (NMOC)	9.62E-03	1.19E-03	1.05E-03	1.16E-03	1.13E-03	7.43E-04	2.32E-03	2.94E-03
Toluene	1.67E-04	2.06E-05	1.83E-05	2.02E-05	1.96E-05	1.29E-05	4.03E-05	5.10E-05
Total Non-methane Hydrocarbons	4.48E-03	5.53E-04	4.90E-04	5.41E-04	5.26E-04	3.46E-04	1.08E-03	1.37E-03

TABLE 6
OPEN BURNING 24-HOUR AVERAGE GROUND LEVEL CONCENTRATIONS
AT SELECTED RECEPTOR UTILIZING TNT (HIGH HEAT CONTENT) MODELING RESULTS

Receptor:	S8	Hospital	Long-Term HCC	Day Care Center	Closest Residence	Maximum Onsite
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1,2,4-Trimethylbenzene	7.78E-06	6.33E-06	1.23E-05	1.59E-05	2.32E-05	2.26E-04
1,3 - Butadiene	4.20E-04	3.41E-04	6.64E-04	8.58E-04	1.25E-03	1.22E-02
1,3,5-Trimethylbenzene	5.03E-04	4.09E-04	7.95E-04	1.03E-03	1.50E-03	1.46E-02
1,3,5-Trinitrobenzene	1.10E-04	8.95E-05	1.74E-04	2.25E-04	3.29E-04	3.19E-03
1,3-Dinitrobenzene	2.59E-05	2.11E-05	4.10E-05	5.30E-05	7.75E-05	7.53E-04
2,4,6-Trinitrotoluene	7.72E-07	6.28E-07	1.22E-06	1.58E-06	2.31E-06	2.24E-05
2,4-Dinitrotoluene	2.42E-06	1.97E-06	3.83E-06	4.95E-06	7.23E-06	7.02E-05
2-Methylnapthalene	7.55E-05	6.14E-05	1.19E-04	1.54E-04	2.25E-04	2.19E-03
3,4-Methylphenol (m- & p-cresol)	4.79E-05	3.90E-05	7.58E-05	9.80E-05	1.43E-04	1.39E-03
Acenaphthylene	6.03E-04	4.90E-04	9.54E-04	1.23E-03	1.80E-03	1.75E-02
Acetophenone	2.17E-06	1.77E-06	3.43E-06	4.44E-06	6.49E-06	6.30E-05
Alkanes (Paraffins)	4.27E-05	3.47E-05	6.75E-05	8.73E-05	1.28E-04	1.24E-03
Alkenes (Olefins)	1.05E-05	8.51E-06	1.66E-05	2.14E-05	3.13E-05	3.04E-04
Anthracene	9.15E-05	7.44E-05	1.45E-04	1.87E-04	2.73E-04	2.66E-03
Aromatics	6.76E-06	5.50E-06	1.07E-05	1.38E-05	2.02E-05	1.96E-04
Benz(a)anthracene	1.21E-05	9.81E-06	1.91E-05	2.47E-05	3.60E-05	3.50E-04
Benzene	2.22E-06	1.80E-06	3.50E-06	4.53E-06	6.62E-06	6.43E-05
Benzo(a)pyrene	8.85E-06	7.19E-06	1.40E-05	1.81E-05	2.64E-05	2.57E-04
Benzo(b)fluoranthene	6.44E-07	5.24E-07	1.02E-06	1.32E-06	1.92E-06	1.87E-05
Benzo(g,h,i)perylene	5.01E-06	4.08E-06	7.93E-06	1.02E-05	1.50E-05	1.45E-04
Benzo(k)fluoranthene	1.28E-05	1.04E-05	2.03E-05	2.62E-05	3.84E-05	3.73E-04
Benzyl alcohol	4.24E-05	3.45E-05	6.71E-05	8.67E-05	1.27E-04	1.23E-03
Biphenyl	2.07E+01	1.68E+01	3.27E+01	4.23E+01	6.18E+01	6.00E+02
bis (2-Ethylhexyl)phthalate	1.05E-01	8.57E-02	1.67E-01	2.15E-01	3.15E-01	3.06E+00
Butylbenzyl phthalate	3.66E-05	2.97E-05	5.79E-05	7.48E-05	1.09E-04	1.06E-03
Carbon Dioxide	1.27E-05	1.03E-05	2.01E-05	2.59E-05	3.79E-05	3.68E-04
Carbon Monoxide	1.00E-06	8.13E-07	1.58E-06	2.04E-06	2.99E-06	2.90E-05
Carbon Tetrachloride	2.81E-05	2.29E-05	4.45E-05	5.75E-05	8.40E-05	8.16E-04
Di-n-butyl phthalate	7.11E-05	5.78E-05	1.12E-04	1.45E-04	2.12E-04	2.06E-03
Di-n-octyl phthalate	5.63E-07	4.57E-07	8.90E-07	1.15E-06	1.68E-06	1.63E-05
Dibenzofuran	2.03E-05	1.65E-05	3.20E-05	4.14E-05	6.05E-05	5.88E-04
Dichloromethane	3.44E-05	2.80E-05	5.44E-05	7.03E-05	1.03E-04	9.98E-04
Diethyl phthalate	1.94E-01	1.58E-01	3.07E-01	3.96E-01	5.79E-01	5.62E+00
Dimethyl phthalate	1.52E+00	1.24E+00	2.40E+00	3.11E+00	4.54E+00	4.41E+01
Ethylbenzene	2.46E-06	2.00E-06	3.90E-06	5.04E-06	7.36E-06	7.15E-05
Fluoranthene	2.67E-04	2.17E-04	4.22E-04	5.45E-04	7.97E-04	7.74E-03
Fluorene	7.20E-06	5.85E-06	1.14E-05	1.47E-05	2.15E-05	2.09E-04
Freon 11	1.27E-06	1.03E-06	2.01E-06	2.59E-06	3.79E-06	3.68E-05
Freon 113	5.22E-05	4.24E-05	8.25E-05	1.07E-04	1.56E-04	1.51E-03
Freon 12	9.60E-04	7.81E-04	1.52E-03	1.96E-03	2.87E-03	2.79E-02
HMX	1.34E-01	1.09E-01	2.12E-01	2.74E-01	4.00E-01	3.89E+00
Hydrogen Chloride	6.51E-06	5.30E-06	1.03E-05	1.33E-05	1.95E-05	1.89E-04
Hydrogen Fluoride	8.85E-06	7.19E-06	1.40E-05	1.81E-05	2.64E-05	2.57E-04
Indeno (1,2,3 - cd) pyrene	2.22E-05	1.80E-05	3.50E-05	4.53E-05	6.62E-05	6.43E-04
m- & p-Xylene						
Methane						
Methyl chloride						
n-Nitrosodiphenylamine						
Naphthalene						
Nitrogen Dioxide (peroxide)						
Nitrogen Oxide						
o-Xylene						
p-Ethyltoluene						
Phenanthrene						
Phenol						

TABLE 6
OPEN BURNING 24-HOUR AVERAGE GROUND LEVEL CONCENTRATIONS
AT SELECTED RECEPTOR UTILIZING TNT (HIGH HEAT CONTENT) MODELING RESULTS
PAGE 4 OF 4

Receptor:	S8	Hospital	Long-Term HCC	Day Care Center	Closest Residence	Maximum Onsite
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
PM10	4.08E+00	3.32E+00	6.45E+00	8.34E+00	1.22E+01	1.18E+02
Pyrene	7.75E-05	6.30E-05	1.23E-04	1.59E-04	2.32E-04	2.25E-03
RDX	1.40E-04	1.14E-04	2.21E-04	2.86E-04	4.17E-04	4.06E-03
Styrene	2.13E-05	1.73E-05	3.37E-05	4.35E-05	6.36E-05	6.17E-04
Tetrachloroethylene						
TO - 12 (NMOC)	1.23E-03	9.98E-04	1.94E-03	2.51E-03	3.67E-03	3.56E-02
Toluene	2.13E-05	1.73E-05	3.37E-05	4.35E-05	6.36E-05	6.17E-04
Total Non-methane Hydrocarbons	5.71E-04	4.64E-04	9.04E-04	1.17E-03	1.71E-03	1.66E-02

TABLE 7
OPEN BURNING 24-HOUR AVERFAGE GROUND LEVEL
CONCENTRATIONS AT SELECTED RECEPTORS
UTILIZING PETN (LOW HEAT CONTENT) MODELING RESULTS

Receptor:	Maximum Offsite	S1	S2	S3	S4	S5	S6	S7
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1,2,4-Trimethylbenzene	1.23E-04	1.47E-05	1.53E-05	1.36E-05	1.74E-05	1.03E-05	3.14E-05	4.88E-05
1,3 - Butadiene	6.70E-05	8.04E-06	8.33E-06	7.41E-06	9.49E-06	5.61E-06	1.72E-05	2.66E-05
1,3,5-Trimethylbenzene	4.59E-05	5.51E-06	5.71E-06	5.08E-06	6.50E-06	3.84E-06	1.18E-05	1.82E-05
1,3,5-Trinitrobenzene	1.92E-03	2.31E-04	2.39E-04	2.13E-04	2.72E-04	1.61E-04	4.93E-04	7.64E-04
1,3-Dinitrobenzene	3.55E-05	4.26E-06	4.42E-06	3.93E-06	5.03E-06	2.97E-06	9.09E-06	1.41E-05
2,4,6-Trinitrotoluene	1.73E-03	2.07E-04	2.15E-04	1.91E-04	2.45E-04	1.45E-04	4.42E-04	6.86E-04
2,4-Dinitrotoluene	3.25E-04	3.90E-05	4.05E-05	3.60E-05	4.61E-05	2.72E-05	8.33E-05	1.29E-04
2-Methylnapthalene	7.85E-05	9.42E-06	9.77E-06	8.69E-06	1.11E-05	6.57E-06	2.01E-05	3.12E-05
3,4-Methylphenol (m- & p-cresol)	6.65E-06	7.98E-07	8.27E-07	7.36E-07	9.42E-07	5.56E-07	1.70E-06	2.64E-06
Acenaphthylene	2.08E-05	2.50E-06	2.59E-06	2.30E-06	2.95E-06	1.74E-06	5.33E-06	8.27E-06
Acetophenone	2.24E-04	2.68E-05	2.78E-05	2.47E-05	3.17E-05	1.87E-05	5.72E-05	8.88E-05
Alkanes (Paraffins)	6.14E-04	7.37E-05	7.64E-05	6.80E-05	8.70E-05	5.14E-05	1.57E-04	2.44E-04
Alkenes (Olefins)	3.14E-03	3.76E-04	3.90E-04	3.47E-04	4.44E-04	2.62E-04	8.03E-04	1.25E-03
Anthracene	1.87E-05	2.24E-06	2.32E-06	2.07E-06	2.65E-06	1.56E-06	4.79E-06	7.42E-06
Aromatics	1.10E-03	1.33E-04	1.37E-04	1.22E-04	1.57E-04	9.25E-05	2.83E-04	4.39E-04
Benz(a)anthracene	9.00E-05	1.08E-05	1.12E-05	9.97E-06	1.28E-05	7.54E-06	2.31E-05	3.58E-05
Benzene	3.36E-03	4.04E-04	4.18E-04	3.72E-04	4.76E-04	2.82E-04	8.61E-04	1.34E-03
Benzo(a)pyrene	5.82E-05	6.98E-06	7.24E-06	6.44E-06	8.24E-06	4.87E-06	1.49E-05	2.31E-05
Benzo(b)fluoranthene	1.04E-04	1.25E-05	1.29E-05	1.15E-05	1.47E-05	8.69E-06	2.66E-05	4.12E-05
Benzo(g,h,i)perylene	1.91E-05	2.29E-06	2.37E-06	2.11E-06	2.70E-06	1.60E-06	4.88E-06	7.57E-06
Benzo(k)fluoranthene	7.61E-05	9.14E-06	9.47E-06	8.43E-06	1.08E-05	6.37E-06	1.95E-05	3.02E-05
Benzyl alcohol	9.87E-06	1.19E-06	1.23E-06	1.09E-06	1.40E-06	8.27E-07	2.53E-06	3.92E-06
Biphenyl	4.31E-05	5.18E-06	5.37E-06	4.78E-06	6.11E-06	3.61E-06	1.10E-05	1.71E-05
bis (2-Ethylhexyl)phthalate	1.05E-04	1.26E-05	1.31E-05	1.16E-05	1.49E-05	8.79E-06	2.69E-05	4.17E-05
Butylbenzyl phthalate	1.42E-04	1.70E-05	1.76E-05	1.57E-05	2.01E-05	1.19E-05	3.63E-05	5.63E-05
Carbon Dioxide	1.35E+02	1.63E+01	1.69E+01	1.50E+01	1.92E+01	1.13E+01	3.47E+01	5.38E+01
Carbon Monoxide	1.77E+00	2.13E-01	2.21E-01	1.96E-01	2.51E-01	1.48E-01	4.54E-01	7.04E-01
Carbon Tetrachloride	4.56E-05	5.48E-06	5.68E-06	5.05E-06	6.47E-06	3.82E-06	1.17E-05	1.81E-05
Di-n-butyl phthalate	1.14E-04	1.36E-05	1.41E-05	1.26E-05	1.61E-05	9.51E-06	2.91E-05	4.51E-05
Di-n-octyl phthalate	1.33E-04	1.59E-05	1.65E-05	1.47E-05	1.88E-05	1.11E-05	3.39E-05	5.26E-05
Dibenzofuran	8.60E-06	1.03E-06	1.07E-06	9.52E-07	1.22E-06	7.20E-07	2.20E-06	3.42E-06
Dichloromethane	3.55E-02	4.26E-03	4.42E-03	3.93E-03	5.03E-03	2.97E-03	9.09E-03	1.41E-02
Diethyl phthalate	8.84E-05	1.06E-05	1.10E-05	9.79E-06	1.25E-05	7.40E-06	2.26E-05	3.51E-05
Dimethyl phthalate	3.59E-05	4.30E-06	4.46E-06	3.97E-06	5.08E-06	3.00E-06	9.19E-06	1.42E-05
Ethylbenzene	2.46E-04	2.95E-05	3.06E-05	2.72E-05	3.48E-05	2.06E-05	6.30E-05	9.76E-05
Fluoranthene	6.12E-04	7.34E-05	7.61E-05	6.78E-05	8.67E-05	5.12E-05	1.57E-04	2.43E-04
Fluorene	4.84E-06	5.81E-07	6.02E-07	5.36E-07	6.86E-07	4.05E-07	1.24E-06	1.92E-06
Freon 11	1.83E-04	2.20E-05	2.28E-05	2.03E-05	2.59E-05	1.53E-05	4.69E-05	7.27E-05
Freon 113	4.56E-05	5.48E-06	5.68E-06	5.05E-06	6.47E-06	3.82E-06	1.17E-05	1.81E-05
Freon 12	7.36E-05	8.83E-06	9.16E-06	8.15E-06	1.04E-05	6.16E-06	1.89E-05	2.92E-05
HMX	2.96E-04	3.55E-05	3.68E-05	3.28E-05	4.19E-05	2.48E-05	7.58E-05	1.18E-04
Hydrogen Chloride	1.67E+00	2.00E-01	2.08E-01	1.85E-01	2.36E-01	1.40E-01	4.27E-01	6.62E-01
Hydrogen Fluoride	1.31E+01	1.57E+00	1.63E+00	1.45E+00	1.85E+00	1.10E+00	3.35E+00	5.19E+00
Indeno (1,2,3 - cd) pyrene	2.12E-05	2.54E-06	2.64E-06	2.35E-06	3.00E-06	1.77E-06	5.43E-06	8.42E-06
m- & p-Xylene	8.45E-04	1.01E-04	1.05E-04	9.36E-05	1.20E-04	7.08E-05	2.16E-04	3.36E-04
Methane	9.13E-03	1.10E-03	1.14E-03	1.01E-03	1.29E-03	7.64E-04	2.34E-03	3.62E-03
Methyl chloride	5.15E-05	6.18E-06	6.41E-06	5.70E-06	7.30E-06	4.31E-06	1.32E-05	2.05E-05
n-Nitrosodiphenylamine	1.09E-05	1.31E-06	1.36E-06	1.21E-06	1.55E-06	9.13E-07	2.79E-06	4.33E-06
Naphthalene	1.54E-04	1.85E-05	1.91E-05	1.70E-05	2.18E-05	1.29E-05	3.94E-05	6.11E-05
Nitrogen Dioxide (peroxide)	3.59E-02	4.30E-03	4.46E-03	3.97E-03	5.08E-03	3.00E-03	9.19E-03	1.42E-02
Nitrogen Oxide	8.10E-01	9.72E-02	1.01E-01	8.97E-02	1.15E-01	6.78E-02	2.07E-01	3.22E-01
o-Xylene	3.39E-04	4.06E-05	4.21E-05	3.75E-05	4.80E-05	2.83E-05	8.67E-05	1.34E-04
p-Ethyltoluene	4.95E-05	5.94E-06	6.15E-06	5.47E-06	7.01E-06	4.14E-06	1.27E-05	1.96E-05
Phenanthrene	2.85E-05	3.43E-06	3.55E-06	3.16E-06	4.04E-06	2.39E-06	7.31E-06	1.13E-05
Phenol	6.36E-05	7.64E-06	7.92E-06	7.04E-06	9.02E-06	5.33E-06	1.63E-05	2.53E-05

TABLE 7
OPEN BURNING 24-HOUR AVERFAGE GROUND LEVEL
CONCENTRATIONS AT SELECTED RECEPTORS
UTILIZING PETN (LOW HEAT CONTENT) MODELING RESULTS

Receptor:	Maximum Offsite	S1	S2	S3	S4	S5	S6	S7
PM10	3.51E+01	4.21E+00	4.37E+00	3.89E+00	4.98E+00	2.94E+00	8.99E+00	1.39E+01
Pyrene	2.25E-04	2.70E-05	2.80E-05	2.49E-05	3.19E-05	1.88E-05	5.76E-05	8.94E-05
RDX	1.05E-03	1.26E-04	1.31E-04	1.17E-04	1.49E-04	8.82E-05	2.70E-04	4.18E-04
Styrene	1.83E-04	2.20E-05	2.28E-05	2.03E-05	2.59E-05	1.53E-05	4.69E-05	7.27E-05
Tetrachloroethylene	2.26E-03	2.71E-04	2.81E-04	2.50E-04	3.20E-04	1.89E-04	5.78E-04	8.97E-04
TO - 12 (NMOC)	1.06E-02	1.27E-03	1.31E-03	1.17E-03	1.50E-03	8.84E-04	2.70E-03	4.19E-03
Toluene	2.25E-04	2.70E-05	2.80E-05	2.49E-05	3.19E-05	1.88E-05	5.76E-05	8.93E-05
Total Non-methane Hydrocarbons	6.07E-02	7.29E-03	7.56E-03	6.73E-03	8.61E-03	5.09E-03	1.56E-02	2.41E-02
Total Non-methane Organic Comp	3.64E-02	4.36E-03	4.52E-03	4.03E-03	5.15E-03	3.04E-03	9.31E-03	1.44E-02
Total Unidentified Hydrocarbons	5.69E-03	6.83E-04	7.08E-04	6.30E-04	8.07E-04	4.77E-04	1.46E-03	2.26E-03

TABLE 7
OPEN BURNING 24-HOUR AVERFAGE GROUND LEVEL
CONCENTRATIONS AT SELECTED RECEPTORS
UTILIZING PETN (LOW HEAT CONTENT) MODELING RESULTS

Receptor:	S8	Hospital	Long-Term HCC	Day Care Center	Closest Residence	Maximum Onsite
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1,2,4-Trimethylbenzene	2.12E-05	1.70E-05	2.63E-05	4.01E-05	6.07E-05	5.67E-04
1,3 - Butadiene	1.16E-05	9.28E-06	1.43E-05	2.19E-05	3.31E-05	3.09E-04
1,3,5-Trimethylbenzene	7.93E-06	6.36E-06	9.82E-06	1.50E-05	2.27E-05	2.12E-04
1,3,5-Trinitrobenzene	3.32E-04	2.67E-04	4.12E-04	6.28E-04	9.51E-04	8.88E-03
1,3-Dinitrobenzene	6.13E-06	4.92E-06	7.60E-06	1.16E-05	1.76E-05	1.64E-04
2,4,6-Trinitrotoluene	2.98E-04	2.39E-04	3.70E-04	5.63E-04	8.54E-04	7.97E-03
2,4-Dinitrotoluene	5.62E-05	4.51E-05	6.96E-05	1.06E-04	1.61E-04	1.50E-03
2-Methylnapthalene	1.36E-05	1.09E-05	1.68E-05	2.56E-05	3.88E-05	3.62E-04
3,4-Methylphenol (m- & p-cresol)	1.15E-06	9.21E-07	1.42E-06	2.17E-06	3.29E-06	3.07E-05
Acenaphthylene	3.59E-06	2.89E-06	4.46E-06	6.79E-06	1.03E-05	9.61E-05
Acetophenone	3.86E-05	3.10E-05	4.78E-05	7.29E-05	1.11E-04	1.03E-03
Alkanes (Paraffins)	1.06E-04	8.51E-05	1.31E-04	2.00E-04	3.04E-04	2.83E-03
Alkenes (Olefins)	5.41E-04	4.35E-04	6.71E-04	1.02E-03	1.55E-03	1.45E-02
Anthracene	3.23E-06	2.59E-06	4.00E-06	6.10E-06	9.25E-06	8.62E-05
Aromatics	1.91E-04	1.53E-04	2.36E-04	3.61E-04	5.47E-04	5.10E-03
Benz(a)anthracene	1.55E-05	1.25E-05	1.93E-05	2.94E-05	4.46E-05	4.16E-04
Benzene	5.81E-04	4.66E-04	7.20E-04	1.10E-03	1.66E-03	1.55E-02
Benzo(a)pyrene	1.00E-05	8.07E-06	1.25E-05	1.90E-05	2.88E-05	2.69E-04
Benzo(b)fluoranthene	1.79E-05	1.44E-05	2.22E-05	3.39E-05	5.14E-05	4.79E-04
Benzo(g,h,i)perylene	3.29E-06	2.64E-06	4.08E-06	6.22E-06	9.43E-06	8.80E-05
Benzo(k)fluoranthene	1.31E-05	1.06E-05	1.63E-05	2.48E-05	3.77E-05	3.51E-04
Benzyl alcohol	1.71E-06	1.37E-06	2.11E-06	3.22E-06	4.89E-06	4.56E-05
Biphenyl	7.45E-06	5.98E-06	9.23E-06	1.41E-05	2.13E-05	1.99E-04
bis (2-Ethylhexyl)phthalate	1.81E-05	1.46E-05	2.25E-05	3.43E-05	5.19E-05	4.84E-04
Butylbenzyl phthalate	2.45E-05	1.97E-05	3.04E-05	4.63E-05	7.02E-05	6.55E-04
Carbon Dioxide	2.34E+01	1.88E+01	2.90E+01	4.42E+01	6.70E+01	6.25E+02
Carbon Monoxide	3.06E-01	2.46E-01	3.79E-01	5.78E-01	8.77E-01	8.18E+00
Carbon Tetrachloride	7.88E-06	6.33E-06	9.77E-06	1.49E-05	2.26E-05	2.11E-04
Di-n-butyl phthalate	1.96E-05	1.58E-05	2.43E-05	3.71E-05	5.62E-05	5.24E-04
Di-n-octyl phthalate	2.29E-05	1.84E-05	2.84E-05	4.32E-05	6.56E-05	6.12E-04
Dibenzofuran	1.49E-06	1.19E-06	1.84E-06	2.81E-06	4.26E-06	3.97E-05
Dichloromethane	6.13E-03	4.92E-03	7.60E-03	1.16E-02	1.76E-02	1.64E-01
Diethyl phthalate	1.53E-05	1.23E-05	1.89E-05	2.89E-05	4.37E-05	4.08E-04
Dimethyl phthalate	6.19E-06	4.97E-06	7.68E-06	1.17E-05	1.77E-05	1.66E-04
Ethylbenzene	4.24E-05	3.41E-05	5.26E-05	8.02E-05	1.22E-04	1.13E-03
Fluoranthene	1.06E-04	8.48E-05	1.31E-04	2.00E-04	3.03E-04	2.82E-03
Fluorene	8.36E-07	6.71E-07	1.04E-06	1.58E-06	2.40E-06	2.23E-05
Freon 11	3.16E-05	2.54E-05	3.92E-05	5.97E-05	9.06E-05	8.45E-04
Freon 113	7.88E-06	6.33E-06	9.77E-06	1.49E-05	2.26E-05	2.11E-04
Freon 12	1.27E-05	1.02E-05	1.58E-05	2.40E-05	3.64E-05	3.40E-04
HMX	5.11E-05	4.10E-05	6.33E-05	9.66E-05	1.46E-04	1.37E-03
Hydrogen Chloride	2.88E-01	2.31E-01	3.57E-01	5.44E-01	8.25E-01	7.70E+00
Hydrogen Fluoride	2.26E+00	1.81E+00	2.80E+00	4.27E+00	6.47E+00	6.04E+01
Indeno (1,2,3 - cd) pyrene	3.66E-06	2.94E-06	4.54E-06	6.92E-06	1.05E-05	9.78E-05
m- & p-Xylene	1.46E-04	1.17E-04	1.81E-04	2.76E-04	4.18E-04	3.90E-03
Methane	1.58E-03	1.27E-03	1.95E-03	2.98E-03	4.52E-03	4.21E-02
Methyl chloride	8.89E-06	7.14E-06	1.10E-05	1.68E-05	2.55E-05	2.38E-04
n-Nitrosodiphenylamine	1.88E-06	1.51E-06	2.34E-06	3.56E-06	5.40E-06	5.04E-05
Naphthalene	2.66E-05	2.13E-05	3.29E-05	5.02E-05	7.61E-05	7.10E-04
Nitrogen Dioxide (peroxide)	6.19E-03	4.97E-03	7.68E-03	1.17E-02	1.77E-02	1.66E-01
Nitrogen Oxide	1.40E-01	1.12E-01	1.73E-01	2.64E-01	4.01E-01	3.74E+00
o-Xylene	5.85E-05	4.69E-05	7.25E-05	1.10E-04	1.68E-04	1.56E-03
p-Ethyltoluene	8.54E-06	6.86E-06	1.06E-05	1.61E-05	2.45E-05	2.28E-04
Phenanthrene	4.93E-06	3.96E-06	6.11E-06	9.31E-06	1.41E-05	1.32E-04
Phenol	1.10E-05	8.82E-06	1.36E-05	2.08E-05	3.15E-05	2.94E-04

TABLE 7
OPEN BURNING 24-HOUR AVERFAGE GROUND LEVEL
CONCENTRATIONS AT SELECTED RECEPTORS
UTILIZING PETN (LOW HEAT CONTENT) MODELING RESULTS

Receptor:	S8	Hospital	Long-Term HCC	Day Care Center	Closest Residence	Maximum Onsite
PM10	6.06E+00	4.87E+00	7.52E+00	1.15E+01	1.74E+01	1.62E+02
Pyrene	3.89E-05	3.12E-05	4.82E-05	7.34E-05	1.11E-04	1.04E-03
RDX	1.82E-04	1.46E-04	2.25E-04	3.44E-04	5.21E-04	4.86E-03
Styrene	3.16E-05	2.54E-05	3.92E-05	5.97E-05	9.06E-05	8.45E-04
Tetrachloroethylene	3.90E-04	3.13E-04	4.83E-04	7.37E-04	1.12E-03	1.04E-02
TO - 12 (NMOC)	1.82E-03	1.46E-03	2.26E-03	3.45E-03	5.22E-03	4.87E-02
Toluene	3.88E-05	3.12E-05	4.81E-05	7.34E-05	1.11E-04	1.04E-03
Total Non-methane Hydrocarbons	1.05E-02	8.42E-03	1.30E-02	1.98E-02	3.01E-02	2.80E-01
Total Non-methane Organic Comp	6.28E-03	5.04E-03	7.78E-03	1.19E-02	1.80E-02	1.68E-01
Total Unidentified Hydrocarbons	9.83E-04	7.89E-04	1.22E-03	1.86E-03	2.82E-03	2.63E-02

TABLE 8
OPEN BURNING ANNUAL AVERAGE GROUND LEVEL CONCENTRATIONS
AT SELECTED RECEPTORS UTILIZING THE ANNUAL MIX MODELING RESULTS

Receptor:	Maximum Offsite	S1	S2	S3	S4
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1,2,4-Trimethylbenzene	1.50E-06	1.01E-07	1.36E-07	9.92E-08	1.76E-07
1,3 - Butadiene	6.92E-07	4.67E-08	6.29E-08	4.58E-08	8.14E-08
1,3,5-Trimethylbenzene	5.61E-07	3.78E-08	5.09E-08	3.71E-08	6.59E-08
1,3,5-Trinitrobenzene	2.57E-05	1.73E-06	2.34E-06	1.70E-06	3.03E-06
1,3-Dinitrobenzene	4.34E-07	2.92E-08	3.94E-08	2.87E-08	5.10E-08
2,4,6-Trinitrotoluene	2.11E-05	1.42E-06	1.91E-06	1.39E-06	2.48E-06
2,4-Dinitrotoluene	3.72E-06	2.51E-07	3.38E-07	2.46E-07	4.38E-07
2-Methylnapthalene	9.08E-07	6.12E-08	8.25E-08	6.01E-08	1.07E-07
3,4-Methylphenol (m- & p-cresol)	6.87E-08	4.63E-09	6.24E-09	4.54E-09	8.08E-09
Acenaphthylene	2.15E-07	1.45E-08	1.96E-08	1.42E-08	2.53E-08
Acetophenone	2.56E-06	1.73E-07	2.33E-07	1.69E-07	3.01E-07
Alkanes (Paraffins)	9.61E-06	6.48E-07	8.73E-07	6.36E-07	1.13E-06
Alkenes (Olefins)	4.33E-05	2.92E-06	3.93E-06	2.86E-06	5.09E-06
Anthracene	1.93E-07	1.30E-08	1.76E-08	1.28E-08	2.27E-08
Aromatics	1.80E-05	1.21E-06	1.64E-06	1.19E-06	2.12E-06
Benz(a)anthracene	9.31E-07	6.27E-08	8.46E-08	6.16E-08	1.09E-07
Benzene	8.79E-05	5.93E-06	7.99E-06	5.82E-06	1.03E-05
Benzo(a)pyrene	6.02E-07	4.05E-08	5.47E-08	3.98E-08	7.07E-08
Benzo(b)fluoranthene	1.07E-06	7.23E-08	9.75E-08	7.10E-08	1.26E-07
Benzo(g,h,i)perylene	1.97E-07	1.33E-08	1.79E-08	1.30E-08	2.32E-08
Benzo(k)fluoranthene	7.87E-07	5.30E-08	7.15E-08	5.20E-08	9.25E-08
Benzyl alcohol	1.57E-07	1.06E-08	1.42E-08	1.04E-08	1.84E-08
Biphenyl	4.46E-07	3.01E-08	4.05E-08	2.95E-08	5.24E-08
bis (2-Ethylhexyl)phthalate	1.57E-06	1.06E-07	1.42E-07	1.04E-07	1.84E-07
Butylbenzyl phthalate	1.71E-06	1.15E-07	1.56E-07	1.13E-07	2.01E-07
Carbon Dioxide	2.23E+00	1.50E-01	2.02E-01	1.47E-01	2.62E-01
Carbon Monoxide	4.29E-02	2.89E-03	3.90E-03	2.84E-03	5.04E-03
Carbon Tetrachloride	5.58E-07	3.76E-08	5.07E-08	3.69E-08	6.56E-08
Di-n-butyl phthalate	1.33E-06	8.97E-08	1.21E-07	8.80E-08	1.56E-07
Di-n-octyl phthalate	2.04E-06	1.37E-07	1.85E-07	1.35E-07	2.39E-07
Dibenzofuran	8.89E-08	5.99E-09	8.08E-09	5.88E-09	1.05E-08
Dichloromethane	4.34E-04	2.92E-05	3.94E-05	2.87E-05	5.10E-05
Diethyl phthalate	1.04E-06	7.01E-08	9.46E-08	6.88E-08	1.22E-07
Dimethyl phthalate	4.38E-07	2.95E-08	3.98E-08	2.90E-08	5.15E-08
Ethylbenzene	3.00E-06	2.02E-07	2.73E-07	1.99E-07	3.53E-07
Fluoranthene	6.33E-06	4.26E-07	5.75E-07	4.18E-07	7.44E-07
Fluorene	5.00E-08	3.37E-09	4.55E-09	3.31E-09	5.88E-09
Freon 11	2.24E-06	1.51E-07	2.03E-07	1.48E-07	2.63E-07
Freon 113	5.58E-07	3.76E-08	5.07E-08	3.69E-08	6.56E-08
Freon 12	9.18E-07	6.18E-08	8.34E-08	6.07E-08	1.08E-07
HMX	3.06E-06	2.06E-07	2.78E-07	2.02E-07	3.60E-07
Hydrogen Chloride	1.45E-03	9.80E-05	1.32E-04	9.62E-05	1.71E-04
Hydrogen Fluoride	2.14E-02	1.44E-03	1.94E-03	1.41E-03	2.51E-03
Indeno (1,2,3 - cd) pyrene	2.19E-07	1.48E-08	1.99E-08	1.45E-08	2.58E-08
m- & p-Xylene	1.03E-05	6.96E-07	9.38E-07	6.83E-07	1.21E-06
Methane	2.44E-04	1.65E-05	2.22E-05	1.62E-05	2.87E-05
Methyl chloride	7.55E-07	5.09E-08	6.86E-08	4.99E-08	8.88E-08
n-Nitrosodiphenylamine	1.13E-07	7.60E-09	1.02E-08	7.46E-09	1.33E-08
Naphthalene	1.76E-06	1.18E-07	1.60E-07	1.16E-07	2.07E-07
Nitrogen Dioxide (peroxide)	8.74E-04	5.89E-05	7.94E-05	5.78E-05	1.03E-04
Nitrogen Oxide	1.20E-02	8.06E-04	1.09E-03	7.91E-04	1.41E-03
o-Xylene	4.14E-06	2.79E-07	3.76E-07	2.74E-07	4.86E-07
p-Ethyltoluene	7.31E-07	4.93E-08	6.64E-08	4.84E-08	8.60E-08
Phenanthrene	3.40E-07	2.29E-08	3.09E-08	2.25E-08	3.99E-08
Phenol	7.18E-07	4.84E-08	6.52E-08	4.75E-08	8.44E-08

TABLE 8
OPEN BURNING ANNUAL AVERAGE GROUND LEVEL CONCENTRATIONS
AT SELECTED RECEPTORS UTILIZING THE ANNUAL MIX MODELING RESULTS
PAGE 2 OF 6

Receptor:	Maximum Offsite	S1	S2	S3	S4
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
PM10	6.60E-01	4.45E-02	6.00E-02	4.36E-02	7.76E-02
Pyrene	2.55E-06	1.72E-07	2.32E-07	1.69E-07	3.00E-07
RDX	2.03E-05	1.37E-06	1.84E-06	1.34E-06	2.38E-06
Styrene	1.89E-06	1.28E-07	1.72E-07	1.25E-07	2.23E-07
Tetrachloroethylene	2.76E-05	1.86E-06	2.51E-06	1.82E-06	3.24E-06
TO - 12 (NMOC)	1.09E-04	7.36E-06	9.92E-06	7.22E-06	1.28E-05
Toluene	3.46E-06	2.33E-07	3.14E-07	2.29E-07	4.07E-07
Total Non-methane Hydrocarbons	1.63E-03	1.10E-04	1.48E-04	1.08E-04	1.92E-04
Total Non-methane Organic Compounds	4.44E-04	2.99E-05	4.04E-05	2.94E-05	5.23E-05
Total Unidentified Hydrocarbons	6.96E-05	4.69E-06	6.32E-06	4.60E-06	8.18E-06

TABLE 8
OPEN BURNING ANNUAL AVERAGE GROUND LEVEL CONCENTRATIONS
AT SELECTED RECEPTORS UTILIZING THE ANNUAL MIX MODELING RESULTS
PAGE 3 OF 6

Receptor:	S5	S6	S7	S8	Hospital
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1,2,4-Trimethylbenzene	9.86E-08	2.28E-07	1.78E-07	8.28E-08	1.47E-07
1,3 - Butadiene	4.55E-08	1.05E-07	8.20E-08	3.82E-08	6.79E-08
1,3,5-Trimethylbenzene	3.68E-08	8.51E-08	6.64E-08	3.09E-08	5.50E-08
1,3,5-Trinitrobenzene	1.69E-06	3.91E-06	3.05E-06	1.42E-06	2.52E-06
1,3-Dinitrobenzene	2.85E-08	6.58E-08	5.14E-08	2.39E-08	4.25E-08
2,4,6-Trinitrotoluene	1.38E-06	3.20E-06	2.50E-06	1.16E-06	2.07E-06
2,4-Dinitrotoluene	2.45E-07	5.65E-07	4.41E-07	2.06E-07	3.65E-07
2-Methylnapthalene	5.97E-08	1.38E-07	1.08E-07	5.01E-08	8.91E-08
3,4-Methylphenol (m- & p-cresol)	4.52E-09	1.04E-08	8.14E-09	3.79E-09	6.74E-09
Acenaphthylene	1.41E-08	3.27E-08	2.55E-08	1.19E-08	2.11E-08
Acetophenone	1.68E-07	3.89E-07	3.03E-07	1.41E-07	2.51E-07
Alkanes (Paraffins)	6.32E-07	1.46E-06	1.14E-06	5.30E-07	9.43E-07
Alkenes (Olefins)	2.84E-06	6.57E-06	5.13E-06	2.39E-06	4.24E-06
Anthracene	1.27E-08	2.93E-08	2.29E-08	1.07E-08	1.89E-08
Aromatics	1.18E-06	2.73E-06	2.13E-06	9.93E-07	1.77E-06
Benz(a)anthracene	6.12E-08	1.41E-07	1.10E-07	5.14E-08	9.13E-08
Benzene	5.78E-06	1.34E-05	1.04E-05	4.85E-06	8.62E-06
Benzo(a)pyrene	3.95E-08	9.13E-08	7.13E-08	3.32E-08	5.90E-08
Benzo(b)fluoranthene	7.05E-08	1.63E-07	1.27E-07	5.92E-08	1.05E-07
Benzo(g,h,i)perylene	1.29E-08	2.99E-08	2.33E-08	1.09E-08	1.93E-08
Benzo(k)fluoranthene	5.17E-08	1.19E-07	9.32E-08	4.34E-08	7.72E-08
Benzyl alcohol	1.03E-08	2.38E-08	1.86E-08	8.64E-09	1.54E-08
Biphenyl	2.93E-08	6.77E-08	5.28E-08	2.46E-08	4.37E-08
bis (2-Ethylhexyl)phthalate	1.03E-07	2.38E-07	1.86E-07	8.65E-08	1.54E-07
Butylbenzyl phthalate	1.13E-07	2.60E-07	2.03E-07	9.46E-08	1.68E-07
Carbon Dioxide	1.46E-01	3.38E-01	2.64E-01	1.23E-01	2.18E-01
Carbon Monoxide	2.82E-03	6.51E-03	5.08E-03	2.37E-03	4.21E-03
Carbon Tetrachloride	3.66E-08	8.47E-08	6.61E-08	3.08E-08	5.47E-08
Di-n-butyl phthalate	8.74E-08	2.02E-07	1.58E-07	7.34E-08	1.30E-07
Di-n-octyl phthalate	1.34E-07	3.09E-07	2.41E-07	1.12E-07	2.00E-07
Dibenzofuran	5.84E-09	1.35E-08	1.05E-08	4.91E-09	8.72E-09
Dichloromethane	2.85E-05	6.58E-05	5.14E-05	2.39E-05	4.25E-05
Diethyl phthalate	6.84E-08	1.58E-07	1.23E-07	5.74E-08	1.02E-07
Dimethyl phthalate	2.88E-08	6.65E-08	5.19E-08	2.42E-08	4.30E-08
Ethylbenzene	1.97E-07	4.56E-07	3.56E-07	1.66E-07	2.94E-07
Fluoranthene	4.16E-07	9.61E-07	7.50E-07	3.49E-07	6.20E-07
Fluorene	3.29E-09	7.60E-09	5.93E-09	2.76E-09	4.91E-09
Freon 11	1.47E-07	3.40E-07	2.65E-07	1.23E-07	2.19E-07
Freon 113	3.66E-08	8.47E-08	6.61E-08	3.08E-08	5.47E-08
Freon 12	6.03E-08	1.39E-07	1.09E-07	5.06E-08	9.00E-08
HMX	2.01E-07	4.65E-07	3.63E-07	1.69E-07	3.00E-07
Hydrogen Chloride	9.56E-05	2.21E-04	1.72E-04	8.03E-05	1.43E-04
Hydrogen Fluoride	1.40E-03	3.24E-03	2.53E-03	1.18E-03	2.09E-03
Indeno (1,2,3 - cd) pyrene	1.44E-08	3.33E-08	2.60E-08	1.21E-08	2.15E-08
m- & p-Xylene	6.79E-07	1.57E-06	1.22E-06	5.70E-07	1.01E-06
Methane	1.61E-05	3.71E-05	2.90E-05	1.35E-05	2.40E-05
Methyl chloride	4.96E-08	1.15E-07	8.94E-08	4.17E-08	7.40E-08
n-Nitrosodiphenylamine	7.41E-09	1.71E-08	1.34E-08	6.22E-09	1.11E-08
Naphthalene	1.15E-07	2.67E-07	2.08E-07	9.70E-08	1.72E-07
Nitrogen Dioxide (peroxide)	5.74E-05	1.33E-04	1.04E-04	4.82E-05	8.57E-05
Nitrogen Oxide	7.86E-04	1.82E-03	1.42E-03	6.60E-04	1.17E-03
o-Xylene	2.72E-07	6.28E-07	4.90E-07	2.28E-07	4.06E-07
p-Ethyltoluene	4.80E-08	1.11E-07	8.66E-08	4.04E-08	7.17E-08
Phenanthrene	2.23E-08	5.16E-08	4.02E-08	1.87E-08	3.33E-08
Phenol	4.72E-08	1.09E-07	8.51E-08	3.96E-08	7.04E-08

TABLE 8
OPEN BURNING ANNUAL AVERAGE GROUND LEVEL CONCENTRATIONS
AT SELECTED RECEPTORS UTILIZING THE ANNUAL MIX MODELING RESULTS
PAGE 4 OF 6

Receptor:	S5	S6	S7	S8	Hospital
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
PM10	4.34E-02	1.00E-01	7.82E-02	3.64E-02	6.47E-02
Pyrene	1.68E-07	3.88E-07	3.02E-07	1.41E-07	2.50E-07
RDX	1.33E-06	3.08E-06	2.40E-06	1.12E-06	1.99E-06
Styrene	1.24E-07	2.87E-07	2.24E-07	1.04E-07	1.86E-07
Tetrachloroethylene	1.81E-06	4.19E-06	3.27E-06	1.52E-06	2.70E-06
TO - 12 (NMOC)	7.17E-06	1.66E-05	1.29E-05	6.02E-06	1.07E-05
Toluene	2.27E-07	5.25E-07	4.10E-07	1.91E-07	3.39E-07
Total Non-methane Hydrocarbons	1.07E-04	2.48E-04	1.93E-04	9.00E-05	1.60E-04
Total Non-methane Organic Compounds	2.92E-05	6.75E-05	5.26E-05	2.45E-05	4.36E-05
Total Unidentified Hydrocarbons	4.57E-06	1.06E-05	8.24E-06	3.84E-06	6.82E-06

TABLE 8
OPEN BURNING ANNUAL AVERAGE GROUND LEVEL CONCENTRATIONS
AT SELECTED RECEPTORS UTILIZING THE ANNUAL MIX MODELING RESULTS

Receptor:	Long-Term HCC	Day Care Center	Closest Residence
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
1,2,4-Trimethylbenzene	2.69E-07	2.65E-07	8.46E-07
1,3 - Butadiene	1.24E-07	1.22E-07	3.91E-07
1,3,5-Trimethylbenzene	1.00E-07	9.89E-08	3.16E-07
1,3,5-Trinitrobenzene	4.61E-06	4.54E-06	1.45E-05
1,3-Dinitrobenzene	7.76E-08	7.65E-08	2.45E-07
2,4,6-Trinitrotoluene	3.77E-06	3.72E-06	1.19E-05
2,4-Dinitrotoluene	6.67E-07	6.57E-07	2.10E-06
2-Methylnapthalene	1.63E-07	1.60E-07	5.12E-07
3,4-Methylphenol (m- & p-cresol)	1.23E-08	1.21E-08	3.88E-08
Acenaphthylene	3.85E-08	3.80E-08	1.21E-07
Acetophenone	4.58E-07	4.52E-07	1.44E-06
Alkanes (Paraffins)	1.72E-06	1.70E-06	5.42E-06
Alkenes (Olefins)	7.75E-06	7.64E-06	2.44E-05
Anthracene	3.46E-08	3.41E-08	1.09E-07
Aromatics	3.22E-06	3.18E-06	1.02E-05
Benz(a)anthracene	1.67E-07	1.64E-07	5.25E-07
Benzene	1.57E-05	1.55E-05	4.96E-05
Benzo(a)pyrene	1.08E-07	1.06E-07	3.39E-07
Benzo(b)fluoranthene	1.92E-07	1.89E-07	6.06E-07
Benzo(g,h,i)perylene	3.53E-08	3.48E-08	1.11E-07
Benzo(k)fluoranthene	1.41E-07	1.39E-07	4.44E-07
Benzyl alcohol	2.80E-08	2.76E-08	8.83E-08
Biphenyl	7.98E-08	7.87E-08	2.52E-07
bis (2-Ethylhexyl)phthalate	2.81E-07	2.77E-07	8.84E-07
Butylbenzyl phthalate	3.07E-07	3.02E-07	9.66E-07
Carbon Dioxide	3.98E-01	3.93E-01	1.26E+00
Carbon Monoxide	7.68E-03	7.57E-03	2.42E-02
Carbon Tetrachloride	9.98E-08	9.84E-08	3.15E-07
Di-n-butyl phthalate	2.38E-07	2.35E-07	7.50E-07
Di-n-octyl phthalate	3.65E-07	3.59E-07	1.15E-06
Dibenzofuran	1.59E-08	1.57E-08	5.02E-08
Dichloromethane	7.76E-05	7.65E-05	2.45E-04
Diethyl phthalate	1.86E-07	1.84E-07	5.87E-07
Dimethyl phthalate	7.84E-08	7.73E-08	2.47E-07
Ethylbenzene	5.38E-07	5.30E-07	1.69E-06
Fluoranthene	1.13E-06	1.12E-06	3.57E-06
Fluorene	8.96E-09	8.83E-09	2.82E-08
Freon 11	4.00E-07	3.95E-07	1.26E-06
Freon 113	9.98E-08	9.84E-08	3.15E-07
Freon 12	1.64E-07	1.62E-07	5.18E-07
HMX	5.48E-07	5.40E-07	1.73E-06
Hydrogen Chloride	2.60E-04	2.57E-04	8.20E-04
Hydrogen Fluoride	3.82E-03	3.77E-03	1.20E-02
Indeno (1,2,3 - cd) pyrene	3.92E-08	3.87E-08	1.24E-07
m- & p-Xylene	1.85E-06	1.82E-06	5.83E-06
Methane	4.37E-05	4.31E-05	1.38E-04
Methyl chloride	1.35E-07	1.33E-07	4.26E-07
n-Nitrosodiphenylamine	2.02E-08	1.99E-08	6.36E-08
Naphthalene	3.15E-07	3.10E-07	9.91E-07
Nitrogen Dioxide (peroxide)	1.56E-04	1.54E-04	4.93E-04
Nitrogen Oxide	2.14E-03	2.11E-03	6.75E-03
o-Xylene	7.41E-07	7.30E-07	2.33E-06
p-Ethyltoluene	1.31E-07	1.29E-07	4.12E-07
Phenanthrene	6.08E-08	5.99E-08	1.92E-07
Phenol	1.29E-07	1.27E-07	4.05E-07

TABLE 8
OPEN BURNING ANNUAL AVERAGE GROUND LEVEL CONCENTRATIONS
AT SELECTED RECEPTORS UTILIZING THE ANNUAL MIX MODELING RESULTS
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Receptor:	Long-Term HCC	Day Care Center	Closest Residence
Compound	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
PM10	1.18E-01	1.16E-01	3.72E-01
Pyrene	4.57E-07	4.50E-07	1.44E-06
RDX	3.63E-06	3.58E-06	1.14E-05
Styrene	3.39E-07	3.34E-07	1.07E-06
Tetrachloroethylene	4.94E-06	4.87E-06	1.56E-05
TO - 12 (NMOC)	1.95E-05	1.93E-05	6.16E-05
Toluene	6.19E-07	6.11E-07	1.95E-06
Total Non-methane Hydrocarbons	2.92E-04	2.88E-04	9.20E-04
Total Non-methane Organic Compounds	7.95E-05	7.84E-05	2.51E-04
Total Unidentified Hydrocarbons	1.25E-05	1.23E-05	3.92E-05

APPENDIX E-2-7

LONG TERM ANNUAL RISK
AND HAZARD QUOTIENT CALCULATIONS

LONG-TERM CARCINOGENIC

RISK FACTORS

LONG-TERM CARCINOGENIC RISKS FOR MAXIMUM RECEPTOR

Receptor:	**Maximum Offsite**		
	Reference Concentration	Average Annual Concentration	Risk
Compound	($\mu g/m^3$)	($\mu g/m^3$)	(unitless)
1,2,4-Trimethylbenzene		1.50E-06	
1,3 - Butadiene	3.50E-03	6.92E-07	1.98E-10
1,3,5-Trimethylbenzene		5.61E-07	
1,3,5-Trinitrobenzene		2.57E-05	
1,3-Dinitrobenzene		4.34E-07	
2,4,6-Trinitrotoluene	2.10E-01	2.11E-05	1.00E-10
2,4-Dinitrotoluene		3.72E-06	
2-Methylnaphthalene		9.08E-07	
3,4-Methylphenol (m- & p-cresol)		6.87E-08	
Acenaphthylene		2.15E-07	
Acetophenone		2.56E-06	
Alkanes (Paraffins)		9.61E-06	
Alkenes (Olefins)		4.33E-05	
Anthracene		1.93E-07	
Aromatics		1.80E-05	
Benz(a)anthracene	8.60E-03	9.31E-07	1.08E-10
Benzene	2.20E-01	8.79E-05	4.00E-10
Benzo(a)pyrene	2.00E-03	6.02E-07	3.01E-10
Benzo(b)fluoranthene	8.60E-03	1.07E-06	1.25E-10
Benzo(g,h,i)perylene		1.97E-07	
Benzo(k)fluoranthene	8.60E-02	7.87E-07	9.15E-12
Benzyl alcohol		1.57E-07	
Biphenyl		4.46E-07	
bis (2-Ethylhexyl)phthalate	4.50E-01	1.57E-06	3.48E-12
Butylbenzyl phthalate		1.71E-06	
Carbon Dioxide		2.23E+00	
Carbon Monoxide		4.29E-02	
Carbon Tetrachloride	1.20E-01	5.58E-07	4.65E-12
Di-n-butyl phthalate		1.33E-06	
Di-n-octyl phthalate		2.04E-06	
Dibenzofuran		8.89E-08	
Dichloromethane	3.80E+00	4.34E-04	1.14E-10
Diethyl phthalate		1.04E-06	
Dimethyl phthalate		4.38E-07	
Ethylbenzene		3.00E-06	
Fluoranthene		6.33E-06	
Fluorene		5.00E-08	
Freon 11		2.24E-06	
Freon 113		5.58E-07	
Freon 12		9.18E-07	
HMX		3.06E-06	
Hydrogen Chloride		1.45E-03	
Hydrogen Fluoride		2.14E-02	
Indeno (1,2,3 - cd) pyrene	8.60E-03	2.19E-07	2.55E-11
m- & p-Xylene		1.03E-05	
Methane		2.44E-04	
Methyl chloride	1.80E+00	7.55E-07	4.19E-13
n-Nitrosodiphenylamine	1.30E+00	1.13E-07	8.68E-14

LONG-TERM CARCINOGENIC RISKS FOR MAXIMUM RECEPTOR

Receptor:	**Maximum Offsite**		
	Reference	Average Annual	
	Concentration	Concentration	Risk
Compound	($\mu g/m^3$)	($\mu g/m^3$)	(unitless)
Naphthalene		1.76E-06	
Nitrogen Dioxide (peroxide)		8.74E-04	
Nitrogen Oxide		1.20E-02	
o-Xylene		4.14E-06	
p-Ethyltoluene		7.31E-07	
Phenanthrene		3.40E-07	
Phenol		7.18E-07	
PM10		6.60E-01	
Pyrene		2.55E-06	
RDX	5.70E-02	2.03E-05	3.56E-10
Styrene		1.89E-06	
Tetrachloroethylene	3.10E+00	2.76E-05	8.90E-12
TO - 12 (NMOC)		1.09E-04	
Toluene		3.46E-06	
Total Non-methane Hydrocarbons		1.63E-03	
Total Non-methane Organic Compounds		4.44E-04	
Total Unidentified Hydrocarbons		6.96E-05	
Total Risk			1.75E-09

LONG-TERM CARCINOGENIC RISKS FOR SULLIVAN MIDDLE SCHOOL RECEPTOR

Receptor:	S1	Sullivan Middle School	
	Reference Concentration	Average Annual Concentration	Risk
Compound	($\mu g/m^3$)	($\mu g/m^3$)	(unitless)
1,2,4-Trimethylbenzene		1.01E-07	
1,3 - Butadiene	3.50E-03	4.67E-08	1.33E-11
1,3,5-Trimethylbenzene		3.78E-08	
1,3,5-Trinitrobenzene		1.73E-06	
1,3-Dinitrobenzene		2.92E-08	
2,4,6-Trinitrotoluene	2.10E-01	1.42E-06	6.76E-12
2,4-Dinitrotoluene		2.51E-07	
2-Methylnaphthalene		6.12E-08	
3,4-Methylphenol (m- & p-cresol)		4.63E-09	
Acenaphthylene		1.45E-08	
Acetophenone		1.73E-07	
Alkanes (Paraffins)		6.48E-07	
Alkenes (Olefins)		2.92E-06	
Anthracene		1.30E-08	
Aromatics		1.21E-06	
Benz(a)anthracene	8.60E-03	6.27E-08	7.29E-12
Benzene	2.20E-01	5.93E-06	2.69E-11
Benzo(a)pyrene	2.00E-03	4.05E-08	2.03E-11
Benzo(b)fluoranthene	8.60E-03	7.23E-08	8.41E-12
Benzo(g,h,i)perylene		1.33E-08	
Benzo(k)fluoranthene	8.60E-02	5.30E-08	6.17E-13
Benzyl alcohol		1.06E-08	
Biphenyl		3.01E-08	
bis (2-Ethylhexyl)phthalate	4.50E-01	1.06E-07	2.35E-13
Butylbenzyl phthalate		1.15E-07	
Carbon Dioxide		1.50E-01	
Carbon Monoxide		2.89E-03	
Carbon Tetrachloride	1.20E-01	3.76E-08	3.13E-13
Di-n-butyl phthalate		8.97E-08	
Di-n-octyl phthalate		1.37E-07	
Dibenzofuran		5.99E-09	
Dichloromethane	3.80E+00	2.92E-05	7.69E-12
Diethyl phthalate		7.01E-08	
Dimethyl phthalate		2.95E-08	
Ethylbenzene		2.02E-07	
Fluoranthene		4.26E-07	
Fluorene		3.37E-09	
Freon 11		1.51E-07	
Freon 113		3.76E-08	
Freon 12		6.18E-08	
HMX		2.06E-07	
Hydrogen Chloride		9.80E-05	
Hydrogen Fluoride		1.44E-03	
Indeno (1,2,3 - cd) pyrene	8.60E-03	1.48E-08	1.72E-12
m- & p-Xylene		6.96E-07	
Methane		1.65E-05	
Methyl chloride	1.80E+00	5.09E-08	2.83E-14
n-Nitrosodiphenylamine	1.30E+00	7.60E-09	5.85E-15

LONG-TERM CARCINOGENIC RISKS FOR SULLIVAN MIDDLE SCHOOL RECEPTOR

Receptor:	S1	Sullivan Middle School	
	Reference Concentration	Average Annual Concentration	Risk
Compound	($\mu g/m^3$)	($\mu g/m^3$)	(unitless)
Naphthalene		1.18E-07	
Nitrogen Dioxide (peroxide)		5.89E-05	
Nitrogen Oxide		8.06E-04	
o-Xylene		2.79E-07	
p-Ethyltoluene		4.93E-08	
Phenanthrene		2.29E-08	
Phenol		4.84E-08	
PM10		4.45E-02	
Pyrene		1.72E-07	
RDX	5.70E-02	1.37E-06	2.40E-11
Styrene		1.28E-07	
Tetrachloroethylene	3.10E+00	1.86E-06	6.00E-13
TO - 12 (NMOC)		7.36E-06	
Toluene		2.33E-07	
Total Non-methane Hydrocarbons		1.10E-04	
Total Non-methane Organic Compounds		2.99E-05	
Total Unidentified Hydrocarbons		4.69E-06	
Total Risk			1.18E-10

LONG-TERM CARCINOGENIC RISKS FOR SEVIER MIDDLE SCHOOL RECEPTOR

Receptor:	S2	Sevier Middle School	
	Reference Concentration	Average Annual Concentration	Risk
Compound	($\mu g/m^3$)	($\mu g/m^3$)	(unitless)
1,2,4-Trimethylbenzene		1.36E-07	
1,3 - Butadiene	3.50E-03	6.29E-08	1.80E-11
1,3,5-Trimethylbenzene		5.09E-08	
1,3,5-Trinitrobenzene		2.34E-06	
1,3-Dinitrobenzene		3.94E-08	
2,4,6-Trinitrotoluene	2.10E-01	1.91E-06	9.12E-12
2,4-Dinitrotoluene		3.38E-07	
2-Methylnaphthalene		8.25E-08	
3,4-Methylphenol (m- & p-cresol)		6.24E-09	
Acenaphthylene		1.96E-08	
Acetophenone		2.33E-07	
Alkanes (Paraffins)		8.73E-07	
Alkenes (Olefins)		3.93E-06	
Anthracene		1.76E-08	
Aromatics		1.64E-06	
Benz(a)anthracene	8.60E-03	8.46E-08	9.83E-12
Benzene	2.20E-01	7.99E-06	3.63E-11
Benzo(a)pyrene	2.00E-03	5.47E-08	2.73E-11
Benzo(b)fluoranthene	8.60E-03	9.75E-08	1.13E-11
Benzo(g,h,i)perylene		1.79E-08	
Benzo(k)fluoranthene	8.60E-02	7.15E-08	8.31E-13
Benzyl alcohol		1.42E-08	
Biphenyl		4.05E-08	
bis (2-Ethylhexyl)phthalate	4.50E-01	1.42E-07	3.17E-13
Butylbenzyl phthalate		1.56E-07	
Carbon Dioxide		2.02E-01	
Carbon Monoxide		3.90E-03	
Carbon Tetrachloride	1.20E-01	5.07E-08	4.22E-13
Di-n-butyl phthalate		1.21E-07	
Di-n-octyl phthalate		1.85E-07	
Dibenzofuran		8.08E-09	
Dichloromethane	3.80E+00	3.94E-05	1.04E-11
Diethyl phthalate		9.46E-08	
Dimethyl phthalate		3.98E-08	
Ethylbenzene		2.73E-07	
Fluoranthene		5.75E-07	
Fluorene		4.55E-09	
Freon 11		2.03E-07	
Freon 113		5.07E-08	
Freon 12		8.34E-08	
HMX		2.78E-07	
Hydrogen Chloride		1.32E-04	
Hydrogen Fluoride		1.94E-03	
Indeno (1,2,3 - cd) pyrene	8.60E-03	1.99E-08	2.31E-12
m- & p-Xylene		9.38E-07	
Methane		2.22E-05	
Methyl chloride	1.80E+00	6.86E-08	3.81E-14
n-Nitrosodiphenylamine	1.30E+00	1.02E-08	7.88E-15

LONG-TERM CARCINOGENIC RISKS FOR SEVIER MIDDLE SCHOOL RECEPTOR

Receptor:	S2	Sevier Middle School	
	Reference Concentration	Average Annual Concentration	Risk
Compound	($\mu g/m^3$)	($\mu g/m^3$)	(unitless)
Naphthalene		1.60E-07	
Nitrogen Dioxide (peroxide)		7.94E-05	
Nitrogen Oxide		1.09E-03	
o-Xylene		3.76E-07	
p-Ethyltoluene		6.64E-08	
Phenanthrene		3.09E-08	
Phenol		6.52E-08	
PM10		6.00E-02	
Pyrene		2.32E-07	
RDX	5.70E-02	1.84E-06	3.23E-11
Styrene		1.72E-07	
Tetrachloroethylene	3.10E+00	2.51E-06	8.08E-13
TO - 12 (NMOC)		9.92E-06	
Toluene		3.14E-07	
Total Non-methane Hydrocarbons		1.48E-04	
Total Non-methane Organic Compounds		4.04E-05	
Total Unidentified Hydrocarbons		6.32E-06	
Total Risk			1.59E-10

LONG-TERM CARCINOGENIC RISKS FOR ROBINSON MIDDLE SCHOOL RECEPTOR

Receptor:	S3	Robinson Middle School	
	Reference	Average Annual	
	Concentration	Concentration	Risk
Compound	($\mu g/m^3$)	($\mu g/m^3$)	(unitless)
1,2,4-Trimethylbenzene		9.92E-08	
1,3 - Butadiene	3.50E-03	4.58E-08	1.31E-11
1,3,5-Trimethylbenzene		3.71E-08	
1,3,5-Trinitrobenzene		1.70E-06	
1,3-Dinitrobenzene		2.87E-08	
2,4,6-Trinitrotoluene	2.10E-01	1.39E-06	6.64E-12
2,4-Dinitrotoluene		2.46E-07	
2-Methylnaphthalene		6.01E-08	
3,4-Methylphenol (m- & p-cresol)		4.54E-09	
Acenaphthylene		1.42E-08	
Acetophenone		1.69E-07	
Alkanes (Paraffins)		6.36E-07	
Alkenes (Olefins)		2.86E-06	
Anthracene		1.28E-08	
Aromatics		1.19E-06	
Benz(a)anthracene	8.60E-03	6.16E-08	7.16E-12
Benzene	2.20E-01	5.82E-06	2.64E-11
Benzo(a)pyrene	2.00E-03	3.98E-08	1.99E-11
Benzo(b)fluoranthene	8.60E-03	7.10E-08	8.25E-12
Benzo(g,h,i)perylene		1.30E-08	
Benzo(k)fluoranthene	8.60E-02	5.20E-08	6.05E-13
Benzyl alcohol		1.04E-08	
Biphenyl		2.95E-08	
bis (2-Ethylhexyl)phthalate	4.50E-01	1.04E-07	2.30E-13
Butylbenzyl phthalate		1.13E-07	
Carbon Dioxide		1.47E-01	
Carbon Monoxide		2.84E-03	
Carbon Tetrachloride	1.20E-01	3.69E-08	3.07E-13
Di-n-butyl phthalate		8.80E-08	
Di-n-octyl phthalate		1.35E-07	
Dibenzofuran		5.88E-09	
Dichloromethane	3.80E+00	2.87E-05	7.55E-12
Diethyl phthalate		6.88E-08	
Dimethyl phthalate		2.90E-08	
Ethylbenzene		1.99E-07	
Fluoranthene		4.18E-07	
Fluorene		3.31E-09	
Freon 11		1.48E-07	
Freon 113		3.69E-08	
Freon 12		6.07E-08	
HMX		2.02E-07	
Hydrogen Chloride		9.62E-05	
Hydrogen Fluoride		1.41E-03	
Indeno (1,2,3 - cd) pyrene	8.60E-03	1.45E-08	1.68E-12
m- & p-Xylene		6.83E-07	
Methane		1.62E-05	
Methyl chloride	1.80E+00	4.99E-08	2.77E-14
n-Nitrosodiphenylamine	1.30E+00	7.46E-09	5.74E-15

LONG-TERM CARCINOGENIC RISKS FOR ROBINSON MIDDLE SCHOOL RECEPTOR

Receptor:	S3	Robinson Middle School	
	Reference Concentration	Average Annual Concentration	Risk
Compound	($\mu g/m^3$)	($\mu g/m^3$)	(unitless)
Naphthalene		1.16E-07	
Nitrogen Dioxide (peroxide)		5.78E-05	
Nitrogen Oxide		7.91E-04	
o-Xylene		2.74E-07	
p-Ethyltoluene		4.84E-08	
Phenanthrene		2.25E-08	
Phenol		4.75E-08	
PM10		4.36E-02	
Pyrene		1.69E-07	
RDX	5.70E-02	1.34E-06	2.35E-11
Styrene		1.25E-07	
Tetrachloroethylene	3.10E+00	1.82E-06	5.88E-13
TO - 12 (NMOC)		7.22E-06	
Toluene		2.29E-07	
Total Non-methane Hydrocarbons		1.08E-04	
Total Non-methane Organic Compounds		2.94E-05	
Total Unidentified Hydrocarbons		4.60E-06	
Total Risk			1.16E-10

LONG-TERM CARCINOGENIC RISKS FOR ROOSEVELT ELEMENTARY SCHOOL RECEPTOR

Receptor:	S4	Roosevelt Elementary School	
	Reference Concentration	Average Annual Concentration	Risk
Compound	($\mu g/m^3$)	($\mu g/m^3$)	(unitless)
1,2,4-Trimethylbenzene		1.76E-07	
1,3 - Butadiene	3.50E-03	8.14E-08	2.33E-11
1,3,5-Trimethylbenzene		6.59E-08	
1,3,5-Trinitrobenzene		3.03E-06	
1,3-Dinitrobenzene		5.10E-08	
2,4,6-Trinitrotoluene	2.10E-01	2.48E-06	1.18E-11
2,4-Dinitrotoluene		4.38E-07	
2-Methylnaphthalene		1.07E-07	
3,4-Methylphenol (m- & p-cresol)		8.08E-09	
Acenaphthylene		2.53E-08	
Acetophenone		3.01E-07	
Alkanes (Paraffins)		1.13E-06	
Alkenes (Olefins)		5.09E-06	
Anthracene		2.27E-08	
Aromatics		2.12E-06	
Benz(a)anthracene	8.60E-03	1.09E-07	1.27E-11
Benzene	2.20E-01	1.03E-05	4.70E-11
Benzo(a)pyrene	2.00E-03	7.07E-08	3.54E-11
Benzo(b)fluoranthene	8.60E-03	1.26E-07	1.47E-11
Benzo(g,h,i)perylene		2.32E-08	
Benzo(k)fluoranthene	8.60E-02	9.25E-08	1.08E-12
Benzyl alcohol		1.84E-08	
Biphenyl		5.24E-08	
bis (2-Ethylhexyl)phthalate	4.50E-01	1.84E-07	4.10E-13
Butylbenzyl phthalate		2.01E-07	
Carbon Dioxide		2.62E-01	
Carbon Monoxide		5.04E-03	
Carbon Tetrachloride	1.20E-01	6.56E-08	5.47E-13
Di-n-butyl phthalate		1.56E-07	
Di-n-octyl phthalate		2.39E-07	
Dibenzofuran		1.05E-08	
Dichloromethane	3.80E+00	5.10E-05	1.34E-11
Diethyl phthalate		1.22E-07	
Dimethyl phthalate		5.15E-08	
Ethylbenzene		3.53E-07	
Fluoranthene		7.44E-07	
Fluorene		5.88E-09	
Freon 11		2.63E-07	
Freon 113		6.56E-08	
Freon 12		1.08E-07	
HMX		3.60E-07	
Hydrogen Chloride		1.71E-04	
Hydrogen Fluoride		2.51E-03	
Indeno (1,2,3 - cd) pyrene	8.60E-03	2.58E-08	3.00E-12
m- & p-Xylene		1.21E-06	
Methane		2.87E-05	
Methyl chloride	1.80E+00	8.88E-08	4.93E-14
n-Nitrosodiphenylamine	1.30E+00	1.33E-08	1.02E-14

LONG-TERM CARCINOGENIC RISKS FOR ROOSEVELT ELEMENTARY SCHOOL RECEPTOR

Receptor:	S4	Roosevelt Elementary School	
	Reference	Average Annual	
	Concentration	Concentration	Risk
	($\mu g/m^3$)	($\mu g/m^3$)	(unitless)
Compound			
Naphthalene		2.07E-07	
Nitrogen Dioxide (peroxide)		1.03E-04	
Nitrogen Oxide		1.41E-03	
o-Xylene		4.86E-07	
p-Ethyltoluene		8.60E-08	
Phenanthrene		3.99E-08	
Phenol		8.44E-08	
PM10		7.76E-02	
Pyrene		3.00E-07	
RDX	5.70E-02	2.38E-06	4.18E-11
Styrene		2.23E-07	
Tetrachloroethylene	3.10E+00	3.24E-06	1.05E-12
TO - 12 (NMOC)		1.28E-05	
Toluene		4.07E-07	
Total Non-methane Hydrocarbons		1.92E-04	
Total Non-methane Organic Compounds		5.23E-05	
Total Unidentified Hydrocarbons		8.18E-06	
Total Risk			2.06E-10

LONG-TERM CARCINOGENIC RISKS FOR LYNN VIEW MIDDLE SCHOOL RECEPTOR

Receptor:	S5	Lynn View Middle School	
	Reference Concentration	Average Annual Concentration	Risk
Compound	($\mu g/m^3$)	($\mu g/m^3$)	(unitless)
1,2,4-Trimethylbenzene		9.86E-08	
1,3 - Butadiene	3.50E-03	4.55E-08	1.30E-11
1,3,5-Trimethylbenzene		3.68E-08	
1,3,5-Trinitrobenzene		1.69E-06	
1,3-Dinitrobenzene		2.85E-08	
2,4,6-Trinitrotoluene	2.10E-01	1.38E-06	6.59E-12
2,4-Dinitrotoluene		2.45E-07	
2-Methylnaphthalene		5.97E-08	
3,4-Methylphenol (m- & p-cresol)		4.52E-09	
Acenaphthylene		1.41E-08	
Acetophenone		1.68E-07	
Alkanes (Paraffins)		6.32E-07	
Alkenes (Olefins)		2.84E-06	
Anthracene		1.27E-08	
Aromatics		1.18E-06	
Benz(a)anthracene	8.60E-03	6.12E-08	7.11E-12
Benzene	2.20E-01	5.78E-06	2.63E-11
Benzo(a)pyrene	2.00E-03	3.95E-08	1.98E-11
Benzo(b)fluoranthene	8.60E-03	7.05E-08	8.20E-12
Benzo(g,h,i)perylene		1.29E-08	
Benzo(k)fluoranthene	8.60E-02	5.17E-08	6.01E-13
Benzyl alcohol		1.03E-08	
Biphenyl		2.93E-08	
bis (2-Ethylhexyl)phthalate	4.50E-01	1.03E-07	2.29E-13
Butylbenzyl phthalate		1.13E-07	
Carbon Dioxide		1.46E-01	
Carbon Monoxide		2.82E-03	
Carbon Tetrachloride	1.20E-01	3.66E-08	3.05E-13
Di-n-butyl phthalate		8.74E-08	
Di-n-octyl phthalate		1.34E-07	
Dibenzofuran		5.84E-09	
Dichloromethane	3.80E+00	2.85E-05	7.50E-12
Diethyl phthalate		6.84E-08	
Dimethyl phthalate		2.88E-08	
Ethylbenzene		1.97E-07	
Fluoranthene		4.16E-07	
Fluorene		3.29E-09	
Freon 11		1.47E-07	
Freon 113		3.66E-08	
Freon 12		6.03E-08	
HMX		2.01E-07	
Hydrogen Chloride		9.56E-05	
Hydrogen Fluoride		1.40E-03	
Indeno (1,2,3 - cd) pyrene	8.60E-03	1.44E-08	1.67E-12
m- & p-Xylene		6.79E-07	
Methane		1.61E-05	
Methyl chloride	1.80E+00	4.96E-08	2.76E-14
n-Nitrosodiphenylamine	1.30E+00	7.41E-09	5.70E-15

LONG-TERM CARCINOGENIC RISKS FOR LYNN VIEW MIDDLE SCHOOL RECEPTOR

Receptor:	S5	Lynn View Middle School	
	Reference Concentration ($\mu g/m^3$)	Average Annual Concentration ($\mu g/m^3$)	Risk (unitless)
Compound			
Naphthalene		1.15E-07	
Nitrogen Dioxide (peroxide)		5.74E-05	
Nitrogen Oxide		7.86E-04	
o-Xylene		2.72E-07	
p-Ethyltoluene		4.80E-08	
Phenanthrene		2.23E-08	
Phenol		4.72E-08	
PM10		4.34E-02	
Pyrene		1.68E-07	
RDX	5.70E-02	1.33E-06	2.34E-11
Styrene		1.24E-07	
Tetrachloroethylene	3.10E+00	1.81E-06	5.85E-13
TO - 12 (NMOC)		7.17E-06	
Toluene		2.27E-07	
Total Non-methane Hydrocarbons		1.07E-04	
Total Non-methane Organic Compounds		2.92E-05	
Total Unidentified Hydrocarbons		4.57E-06	
Total Risk			1.15E-10

LONG-TERM CARCINOGENIC RISKS FOR WASHINGTON ELEMENTARY SCHOOL RECEPTOR

Receptor:	S6	Washington Elementary School	
	Reference Concentration	Average Annual Concentration	Risk
Compound	($\mu g/m^3$)	($\mu g/m^3$)	(unitless)
1,2,4-Trimethylbenzene		2.28E-07	
1,3 - Butadiene	3.50E-03	1.05E-07	3.00E-11
1,3,5-Trimethylbenzene		8.51E-08	
1,3,5-Trinitrobenzene		3.91E-06	
1,3-Dinitrobenzene		6.58E-08	
2,4,6-Trinitrotoluene	2.10E-01	3.20E-06	1.52E-11
2,4-Dinitrotoluene		5.65E-07	
2-Methylnaphthalene		1.38E-07	
3,4-Methylphenol (m- & p-cresol)		1.04E-08	
Acenaphthylene		3.27E-08	
Acetophenone		3.89E-07	
Alkanes (Paraffins)		1.46E-06	
Alkenes (Olefins)		6.57E-06	
Anthracene		2.93E-08	
Aromatics		2.73E-06	
Benz(a)anthracene	8.60E-03	1.41E-07	1.64E-11
Benzene	2.20E-01	1.34E-05	6.07E-11
Benzo(a)pyrene	2.00E-03	9.13E-08	4.57E-11
Benzo(b)fluoranthene	8.60E-03	1.63E-07	1.90E-11
Benzo(g,h,i)perylene		2.99E-08	
Benzo(k)fluoranthene	8.60E-02	1.19E-07	1.39E-12
Benzyl alcohol		2.38E-08	
Biphenyl		6.77E-08	
bis (2-Ethylhexyl)phthalate	4.50E-01	2.38E-07	5.29E-13
Butylbenzyl phthalate		2.60E-07	
Carbon Dioxide		3.38E-01	
Carbon Monoxide		6.51E-03	
Carbon Tetrachloride	1.20E-01	8.47E-08	7.06E-13
Di-n-butyl phthalate		2.02E-07	
Di-n-octyl phthalate		3.09E-07	
Dibenzofuran		1.35E-08	
Dichloromethane	3.80E+00	6.58E-05	1.73E-11
Diethyl phthalate		1.58E-07	
Dimethyl phthalate		6.65E-08	
Ethylbenzene		4.56E-07	
Fluoranthene		9.61E-07	
Fluorene		7.60E-09	
Freon 11		3.40E-07	
Freon 113		8.47E-08	
Freon 12		1.39E-07	
HMX		4.65E-07	
Hydrogen Chloride		2.21E-04	
Hydrogen Fluoride		3.24E-03	
Indeno (1,2,3 - cd) pyrene	8.60E-03	3.33E-08	3.87E-12
m- & p-Xylene		1.57E-06	
Methane		3.71E-05	
Methyl chloride	1.80E+00	1.15E-07	6.37E-14
n-Nitrosodiphenylamine	1.30E+00	1.71E-08	1.32E-14

LONG-TERM CARCINOGENIC RISKS FOR WASHINGTON ELEMENTARY SCHOOL RECEPTOR

Receptor:	S6	Washington Elementary School	
	Reference Concentration	Average Annual Concentration	Risk
Compound	($\mu g/m^3$)	($\mu g/m^3$)	(unitless)
Naphthalene		2.67E-07	
Nitrogen Dioxide (peroxide)		1.33E-04	
Nitrogen Oxide		1.82E-03	
o-Xylene		6.28E-07	
p-Ethyltoluene		1.11E-07	
Phenanthrene		5.16E-08	
Phenol		1.09E-07	
PM10		1.00E-01	
Pyrene		3.88E-07	
RDX	5.70E-02	3.08E-06	5.40E-11
Styrene		2.87E-07	
Tetrachloroethylene	3.10E+00	4.19E-06	1.35E-12
TO - 12 (NMOC)		1.66E-05	
Toluene		5.25E-07	
Total Non-methane Hydrocarbons		2.48E-04	
Total Non-methane Organic Compounds		6.75E-05	
Total Unidentified Hydrocarbons		1.06E-05	
Total Risk			2.66E-10

LONG-TERM CARCINOGENIC RISKS FOR MT. CARMEL SCHOOL RECEPTOR

Receptor:	S7	Mt. Carmel School	
	Reference Concentration	Average Annual Concentration	Risk
Compound	($\mu g/m^3$)	($\mu g/m^3$)	(unitless)
1,2,4-Trimethylbenzene		1.78E-07	
1,3 - Butadiene	3.50E-03	8.20E-08	2.34E-11
1,3,5-Trimethylbenzene		6.64E-08	
1,3,5-Trinitrobenzene		3.05E-06	
1,3-Dinitrobenzene		5.14E-08	
2,4,6-Trinitrotoluene	2.10E-01	2.50E-06	1.19E-11
2,4-Dinitrotoluene		4.41E-07	
2-Methylnaphthalene		1.08E-07	
3,4-Methylphenol (m- & p-cresol)		8.14E-09	
Acenaphthylene		2.55E-08	
Acetophenone		3.03E-07	
Alkanes (Paraffins)		1.14E-06	
Alkenes (Olefins)		5.13E-06	
Anthracene		2.29E-08	
Aromatics		2.13E-06	
Benz(a)anthracene	8.60E-03	1.10E-07	1.28E-11
Benzene	2.20E-01	1.04E-05	4.74E-11
Benzo(a)pyrene	2.00E-03	7.13E-08	3.56E-11
Benzo(b)fluoranthene	8.60E-03	1.27E-07	1.48E-11
Benzo(g,h,i)perylene		2.33E-08	
Benzo(k)fluoranthene	8.60E-02	9.32E-08	1.08E-12
Benzyl alcohol		1.86E-08	
Biphenyl		5.28E-08	
bis (2-Ethylhexyl)phthalate	4.50E-01	1.86E-07	4.13E-13
Butylbenzyl phthalate		2.03E-07	
Carbon Dioxide		2.64E-01	
Carbon Monoxide		5.08E-03	
Carbon Tetrachloride	1.20E-01	6.61E-08	5.51E-13
Di-n-butyl phthalate		1.58E-07	
Di-n-octyl phthalate		2.41E-07	
Dibenzofuran		1.05E-08	
Dichloromethane	3.80E+00	5.14E-05	1.35E-11
Diethyl phthalate		1.23E-07	
Dimethyl phthalate		5.19E-08	
Ethylbenzene		3.56E-07	
Fluoranthene		7.50E-07	
Fluorene		5.93E-09	
Freon 11		2.65E-07	
Freon 113		6.61E-08	
Freon 12		1.09E-07	
HMX		3.63E-07	
Hydrogen Chloride		1.72E-04	
Hydrogen Fluoride		2.53E-03	
Indeno (1,2,3 - cd) pyrene	8.60E-03	2.60E-08	3.02E-12
m- & p-Xylene		1.22E-06	
Methane		2.90E-05	
Methyl chloride	1.80E+00	8.94E-08	4.97E-14
n-Nitrosodiphenylamine	1.30E+00	1.34E-08	1.03E-14

LONG-TERM CARCINOGENIC RISKS FOR MT. CARMEL SCHOOL RECEPTOR

Receptor:	S7	Mt. Carmel School	
	Reference	Average Annual	
	Concentration	Concentration	Risk
Compound	($\mu g/m^3$)	($\mu g/m^3$)	(unitless)
Naphthalene		2.08E-07	
Nitrogen Dioxide (peroxide)		1.04E-04	
Nitrogen Oxide		1.42E-03	
o-Xylene		4.90E-07	
p-Ethyltoluene		8.66E-08	
Phenanthrene		4.02E-08	
Phenol		8.51E-08	
PM10		7.82E-02	
Pyrene		3.02E-07	
RDX	5.70E-02	2.40E-06	4.21E-11
Styrene		2.24E-07	
Tetrachloroethylene	3.10E+00	3.27E-06	1.05E-12
TO - 12 (NMOC)		1.29E-05	
Toluene		4.10E-07	
Total Non-methane Hydrocarbons		1.93E-04	
Total Non-methane Organic Compounds		5.26E-05	
Total Unidentified Hydrocarbons		8.24E-06	
Total Risk			2.08E-10

LONG-TERM CARCINOGENIC RISKS FOR CHURCH HILL ELEMENTARY SCHOOL RECEPTOR

Receptor:	S8	Church Hill Elementary School	
	Reference Concentration	Average Annual Concentration	Risk
Compound	($\mu g/m^3$)	($\mu g/m^3$)	(unitless)
1,2,4-Trimethylbenzene		8.28E-08	
1,3 - Butadiene	3.50E-03	3.82E-08	1.09E-11
1,3,5-Trimethylbenzene		3.09E-08	
1,3,5-Trinitrobenzene		1.42E-06	
1,3-Dinitrobenzene		2.39E-08	
2,4,6-Trinitrotoluene	2.10E-01	1.16E-06	5.54E-12
2,4-Dinitrotoluene		2.06E-07	
2-Methylnaphthalene		5.01E-08	
3,4-Methylphenol (m- & p-cresol)		3.79E-09	
Acenaphthylene		1.19E-08	
Acetophenone		1.41E-07	
Alkanes (Paraffins)		5.30E-07	
Alkenes (Olefins)		2.39E-06	
Anthracene		1.07E-08	
Aromatics		9.93E-07	
Benz(a)anthracene	8.60E-03	5.14E-08	5.97E-12
Benzene	2.20E-01	4.85E-06	2.21E-11
Benzo(a)pyrene	2.00E-03	3.32E-08	1.66E-11
Benzo(b)fluoranthene	8.60E-03	5.92E-08	6.89E-12
Benzo(g,h,i)perylene		1.09E-08	
Benzo(k)fluoranthene	8.60E-02	4.34E-08	5.05E-13
Benzyl alcohol		8.64E-09	
Biphenyl		2.46E-08	
bis (2-Ethylhexyl)phthalate	4.50E-01	8.65E-08	1.92E-13
Butylbenzyl phthalate		9.46E-08	
Carbon Dioxide		1.23E-01	
Carbon Monoxide		2.37E-03	
Carbon Tetrachloride	1.20E-01	3.08E-08	2.56E-13
Di-n-butyl phthalate		7.34E-08	
Di-n-octyl phthalate		1.12E-07	
Dibenzofuran		4.91E-09	
Dichloromethane	3.80E+00	2.39E-05	6.30E-12
Diethyl phthalate		5.74E-08	
Dimethyl phthalate		2.42E-08	
Ethylbenzene		1.66E-07	
Fluoranthene		3.49E-07	
Fluorene		2.76E-09	
Freon 11		1.23E-07	
Freon 113		3.08E-08	
Freon 12		5.06E-08	
HMX		1.69E-07	
Hydrogen Chloride		8.03E-05	
Hydrogen Fluoride		1.18E-03	
Indeno (1,2,3 - cd) pyrene	8.60E-03	1.21E-08	1.41E-12
m- & p-Xylene		5.70E-07	
Methane		1.35E-05	
Methyl chloride	1.80E+00	4.17E-08	2.31E-14
n-Nitrosodiphenylamine	1.30E+00	6.22E-09	4.79E-15

LONG-TERM CARCINOGENIC RISKS FOR CHURCH HILL ELEMENTARY SCHOOL RECEPTOR

Receptor:	S8	Church Hill Elementary School	
	Reference Concentration ($\mu g/m^3$)	Average Annual Concentration ($\mu g/m^3$)	Risk (unitless)
Compound			
Naphthalene		9.70E-08	
Nitrogen Dioxide (peroxide)		4.82E-05	
Nitrogen Oxide		6.60E-04	
o-Xylene		2.28E-07	
p-Ethyltoluene		4.04E-08	
Phenanthrene		1.87E-08	
Phenol		3.96E-08	
PM10		3.64E-02	
Pyrene		1.41E-07	
RDX	5.70E-02	1.12E-06	1.96E-11
Styrene		1.04E-07	
Tetrachloroethylene	3.10E+00	1.52E-06	4.91E-13
TO - 12 (NMOC)		6.02E-06	
Toluene		1.91E-07	
Total Non-methane Hydrocarbons		9.00E-05	
Total Non-methane Organic Compounds		2.45E-05	
Total Unidentified Hydrocarbons		3.84E-06	
Total Risk			9.68E-11

LONG-TERM CARCINOGENIC RISKS FOR HOLSTON VALLEY COMMUNITY HOSPITAL RECEPTOR

Receptor:	**Holston Valley Community Hospital**		
	Reference Concentration	Average Annual Concentration	Risk
Compound	($\mu g/m^3$)	($\mu g/m^3$)	(unitless)
1,2,4-Trimethylbenzene		1.47E-07	
1,3 - Butadiene	3.50E-03	6.79E-08	1.94E-11
1,3,5-Trimethylbenzene		5.50E-08	
1,3,5-Trinitrobenzene		2.52E-06	
1,3-Dinitrobenzene		4.25E-08	
2,4,6-Trinitrotoluene	2.10E-01	2.07E-06	9.84E-12
2,4-Dinitrotoluene		3.65E-07	
2-Methylnaphthalene		8.91E-08	
3,4-Methylphenol (m- & p-cresol)		6.74E-09	
Acenaphthylene		2.11E-08	
Acetophenone		2.51E-07	
Alkanes (Paraffins)		9.43E-07	
Alkenes (Olefins)		4.24E-06	
Anthracene		1.89E-08	
Aromatics		1.77E-06	
Benz(a)anthracene	8.60E-03	9.13E-08	1.06E-11
Benzene	2.20E-01	8.62E-06	3.92E-11
Benzo(a)pyrene	2.00E-03	5.90E-08	2.95E-11
Benzo(b)fluoranthene	8.60E-03	1.05E-07	1.22E-11
Benzo(g,h,i)perylene		1.93E-08	
Benzo(k)fluoranthene	8.60E-02	7.72E-08	8.97E-13
Benzyl alcohol		1.54E-08	
Biphenyl		4.37E-08	
bis (2-Ethylhexyl)phthalate	4.50E-01	1.54E-07	3.42E-13
Butylbenzyl phthalate		1.68E-07	
Carbon Dioxide		2.18E-01	
Carbon Monoxide		4.21E-03	
Carbon Tetrachloride	1.20E-01	5.47E-08	4.56E-13
Di-n-butyl phthalate		1.30E-07	
Di-n-octyl phthalate		2.00E-07	
Dibenzofuran		8.72E-09	
Dichloromethane	3.80E+00	4.25E-05	1.12E-11
Diethyl phthalate		1.02E-07	
Dimethyl phthalate		4.30E-08	
Ethylbenzene		2.94E-07	
Fluoranthene		6.20E-07	
Fluorene		4.91E-09	
Freon 11		2.19E-07	
Freon 113		5.47E-08	
Freon 12		9.00E-08	
HMX		3.00E-07	
Hydrogen Chloride		1.43E-04	
Hydrogen Fluoride		2.09E-03	
Indeno (1,2,3 - cd) pyrene	8.60E-03	2.15E-08	2.50E-12
m- & p-Xylene		1.01E-06	
Methane		2.40E-05	
Methyl chloride	1.80E+00	7.40E-08	4.11E-14
n-Nitrosodiphenylamine	1.30E+00	1.11E-08	8.51E-15

LONG-TERM CARCINOGENIC RISKS FOR HOLSTON VALLEY COMMUNITY HOSPITAL RECEPTOR

Receptor:	**Holston Valley Community Hospital**		
	Reference Concentration ($\mu g/m^3$)	Average Annual Concentration ($\mu g/m^3$)	Risk (unitless)
Compound			
Naphthalene		1.72E-07	
Nitrogen Dioxide (peroxide)		8.57E-05	
Nitrogen Oxide		1.17E-03	
o-Xylene		4.06E-07	
p-Ethyltoluene		7.17E-08	
Phenanthrene		3.33E-08	
Phenol		7.04E-08	
PM10		6.47E-02	
Pyrene		2.50E-07	
RDX	5.70E-02	1.99E-06	3.49E-11
Styrene		1.86E-07	
Tetrachloroethylene	3.10E+00	2.70E-06	8.72E-13
TO - 12 (NMOC)		1.07E-05	
Toluene		3.39E-07	
Total Non-methane Hydrocarbons		1.60E-04	
Total Non-methane Organic Compounds		4.36E-05	
Total Unidentified Hydrocarbons		6.82E-06	
Total Risk			1.72E-10

LONG-TERM CARCINOGENIC RISKS FOR ASBURY CENTER LONG-TERM HEALTH CARE CENTER RECEPTOR

Receptor:	**Asbury Center Long-Term Health Care Center**		
	Reference Concentration	Average Annual Concentration	Risk
Compound	($\mu g/m^3$)	($\mu g/m^3$)	(unitless)
1,2,4-Trimethylbenzene		2.69E-07	
1,3 - Butadiene	3.50E-03	1.24E-07	3.54E-11
1,3,5-Trimethylbenzene		1.00E-07	
1,3,5-Trinitrobenzene		4.61E-06	
1,3-Dinitrobenzene		7.76E-08	
2,4,6-Trinitrotoluene	2.10E-01	3.77E-06	1.80E-11
2,4-Dinitrotoluene		6.67E-07	
2-Methylnaphthalene		1.63E-07	
3,4-Methylphenol (m- & p-cresol)		1.23E-08	
Acenaphthylene		3.85E-08	
Acetophenone		4.58E-07	
Alkanes (Paraffins)		1.72E-06	
Alkenes (Olefins)		7.75E-06	
Anthracene		3.46E-08	
Aromatics		3.22E-06	
Benz(a)anthracene	8.60E-03	1.67E-07	1.94E-11
Benzene	2.20E-01	1.57E-05	7.15E-11
Benzo(a)pyrene	2.00E-03	1.08E-07	5.38E-11
Benzo(b)fluoranthene	8.60E-03	1.92E-07	2.23E-11
Benzo(g,h,i)perylene		3.53E-08	
Benzo(k)fluoranthene	8.60E-02	1.41E-07	1.64E-12
Benzyl alcohol		2.80E-08	
Biphenyl		7.98E-08	
bis (2-Ethylhexyl)phthalate	4.50E-01	2.81E-07	6.24E-13
Butylbenzyl phthalate		3.07E-07	
Carbon Dioxide		3.98E-01	
Carbon Monoxide		7.68E-03	
Carbon Tetrachloride	1.20E-01	9.98E-08	8.32E-13
Di-n-butyl phthalate		2.38E-07	
Di-n-octyl phthalate		3.65E-07	
Dibenzofuran		1.59E-08	
Dichloromethane	3.80E+00	7.76E-05	2.04E-11
Diethyl phthalate		1.86E-07	
Dimethyl phthalate		7.84E-08	
Ethylbenzene		5.38E-07	
Fluoranthene		1.13E-06	
Fluorene		8.96E-09	
Freon 11		4.00E-07	
Freon 113		9.98E-08	
Freon 12		1.64E-07	
HMX		5.48E-07	
Hydrogen Chloride		2.60E-04	
Hydrogen Fluoride		3.82E-03	
Indeno (1,2,3 - cd) pyrene	8.60E-03	3.92E-08	4.56E-12
m- & p-Xylene		1.85E-06	
Methane		4.37E-05	
Methyl chloride	1.80E+00	1.35E-07	7.51E-14
n-Nitrosodiphenylamine	1.30E+00	2.02E-08	1.55E-14

LONG-TERM CARCINOGENIC RISKS FOR ASBURY CENTER LONG-TERM HEALTH CARE CENTER RECEPTOR

Receptor:	Asbury Center Long-Term Health Care Center		
	Reference Concentration	Average Annual Concentration	Risk
Compound	($\mu g/m^3$)	($\mu g/m^3$)	(unitless)
Naphthalene		3.15E-07	
Nitrogen Dioxide (peroxide)		1.56E-04	
Nitrogen Oxide		2.14E-03	
o-Xylene		7.41E-07	
p-Ethyltoluene		1.31E-07	
Phenanthrene		6.08E-08	
Phenol		1.29E-07	
PM10		1.18E-01	
Pyrene		4.57E-07	
RDX	5.70E-02	3.63E-06	6.36E-11
Styrene		3.39E-07	
Tetrachloroethylene	3.10E+00	4.94E-06	1.59E-12
TO - 12 (NMOC)		1.95E-05	
Toluene		6.19E-07	
Total Non-methane Hydrocarbons		2.92E-04	
Total Non-methane Organic Compounds		7.95E-05	
Total Unidentified Hydrocarbons		1.25E-05	
Total Risk			3.14E-10

LONG-TERM CARCINOGENIC RISKS FOR ALLENDALE CHILD CARE CENTER RECEPTOR

Receptor:	**Allendale Child Care Center**		
	Reference	Average Annual	
	Concentration	Concentration	Risk
Compound	($\mu g/m^3$)	($\mu g/m^3$)	(unitless)
1,2,4-Trimethylbenzene		2.65E-07	
1,3 - Butadiene	3.50E-03	1.22E-07	3.49E-11
1,3,5-Trimethylbenzene		9.89E-08	
1,3,5-Trinitrobenzene		4.54E-06	
1,3-Dinitrobenzene		7.65E-08	
2,4,6-Trinitrotoluene	2.10E-01	3.72E-06	1.77E-11
2,4-Dinitrotoluene		6.57E-07	
2-Methylnaphthalene		1.60E-07	
3,4-Methylphenol (m- & p-cresol)		1.21E-08	
Acenaphthylene		3.80E-08	
Acetophenone		4.52E-07	
Alkanes (Paraffins)		1.70E-06	
Alkenes (Olefins)		7.64E-06	
Anthracene		3.41E-08	
Aromatics		3.18E-06	
Benz(a)anthracene	8.60E-03	1.64E-07	1.91E-11
Benzene	2.20E-01	1.55E-05	7.05E-11
Benzo(a)pyrene	2.00E-03	1.06E-07	5.31E-11
Benzo(b)fluoranthene	8.60E-03	1.89E-07	2.20E-11
Benzo(g,h,i)perylene		3.48E-08	
Benzo(k)fluoranthene	8.60E-02	1.39E-07	1.61E-12
Benzyl alcohol		2.76E-08	
Biphenyl		7.87E-08	
bis (2-Ethylhexyl)phthalate	4.50E-01	2.77E-07	6.15E-13
Butylbenzyl phthalate		3.02E-07	
Carbon Dioxide		3.93E-01	
Carbon Monoxide		7.57E-03	
Carbon Tetrachloride	1.20E-01	9.84E-08	8.20E-13
Di-n-butyl phthalate		2.35E-07	
Di-n-octyl phthalate		3.59E-07	
Dibenzofuran		1.57E-08	
Dichloromethane	3.80E+00	7.65E-05	2.01E-11
Diethyl phthalate		1.84E-07	
Dimethyl phthalate		7.73E-08	
Ethylbenzene		5.30E-07	
Fluoranthene		1.12E-06	
Fluorene		8.83E-09	
Freon 11		3.95E-07	
Freon 113		9.84E-08	
Freon 12		1.62E-07	
HMX		5.40E-07	
Hydrogen Chloride		2.57E-04	
Hydrogen Fluoride		3.77E-03	
Indeno (1,2,3 - cd) pyrene	8.60E-03	3.87E-08	4.50E-12
m- & p-Xylene		1.82E-06	
Methane		4.31E-05	
Methyl chloride	1.80E+00	1.33E-07	7.40E-14
n-Nitrosodiphenylamine	1.30E+00	1.99E-08	1.53E-14

LONG-TERM CARCINOGENIC RISKS FOR ALLENDALE CHILD CARE CENTER RECEPTOR

Receptor:	**Allendale Child Care Center**		
	Reference Concentration	Average Annual Concentration	Risk
Compound	($\mu g/m^3$)	($\mu g/m^3$)	(unitless)
Naphthalene		3.10E-07	
Nitrogen Dioxide (peroxide)		1.54E-04	
Nitrogen Oxide		2.11E-03	
o-Xylene		7.30E-07	
p-Ethyltoluene		1.29E-07	
Phenanthrene		5.99E-08	
Phenol		1.27E-07	
PM10		1.16E-01	
Pyrene		4.50E-07	
RDX	5.70E-02	3.58E-06	6.27E-11
Styrene		3.34E-07	
Tetrachloroethylene	3.10E+00	4.87E-06	1.57E-12
TO - 12 (NMOC)		1.93E-05	
Toluene		6.11E-07	
Total Non-methane Hydrocarbons		2.88E-04	
Total Non-methane Organic Compounds		7.84E-05	
Total Unidentified Hydrocarbons		1.23E-05	
Total Risk			3.09E-10

LONG-TERM CARCINOGENIC RISKS FOR CLOSEST RESIDENCE RECEPTOR

Receptor:	Closest Residence		
	Reference Concentration	Average Annual Concentration	Risk
Compound	($\mu g/m^3$)	($\mu g/m^3$)	(unitless)
1,2,4-Trimethylbenzene		8.46E-07	
1,3 - Butadiene	3.50E-03	3.91E-07	1.12E-10
1,3,5-Trimethylbenzene		3.16E-07	
1,3,5-Trinitrobenzene		1.45E-05	
1,3-Dinitrobenzene		2.45E-07	
2,4,6-Trinitrotoluene	2.10E-01	1.19E-05	5.66E-11
2,4-Dinitrotoluene		2.10E-06	
2-Methylnaphthalene		5.12E-07	
3,4-Methylphenol (m- & p-cresol)		3.88E-08	
Acenaphthylene		1.21E-07	
Acetophenone		1.44E-06	
Alkanes (Paraffins)		5.42E-06	
Alkenes (Olefins)		2.44E-05	
Anthracene		1.09E-07	
Aromatics		1.02E-05	
Benz(a)anthracene	8.60E-03	5.25E-07	6.11E-11
Benzene	2.20E-01	4.96E-05	2.25E-10
Benzo(a)pyrene	2.00E-03	3.39E-07	1.70E-10
Benzo(b)fluoranthene	8.60E-03	6.06E-07	7.04E-11
Benzo(g,h,i)perylene		1.11E-07	
Benzo(k)fluoranthene	8.60E-02	4.44E-07	5.16E-12
Benzyl alcohol		8.83E-08	
Biphenyl		2.52E-07	
bis (2-Ethylhexyl)phthalate	4.50E-01	8.84E-07	1.97E-12
Butylbenzyl phthalate		9.66E-07	
Carbon Dioxide		1.26E+00	
Carbon Monoxide		2.42E-02	
Carbon Tetrachloride	1.20E-01	3.15E-07	2.62E-12
Di-n-butyl phthalate		7.50E-07	
Di-n-octyl phthalate		1.15E-06	
Dibenzofuran		5.02E-08	
Dichloromethane	3.80E+00	2.45E-04	6.44E-11
Diethyl phthalate		5.87E-07	
Dimethyl phthalate		2.47E-07	
Ethylbenzene		1.69E-06	
Fluoranthene		3.57E-06	
Fluorene		2.82E-08	
Freon 11		1.26E-06	
Freon 113		3.15E-07	
Freon 12		5.18E-07	
HMX		1.73E-06	
Hydrogen Chloride		8.20E-04	
Hydrogen Fluoride		1.20E-02	
Indeno (1,2,3 - cd) pyrene	8.60E-03	1.24E-07	1.44E-11
m- & p-Xylene		5.83E-06	
Methane		1.38E-04	
Methyl chloride	1.80E+00	4.26E-07	2.37E-13
n-Nitrosodiphenylamine	1.30E+00	6.36E-08	4.89E-14
Naphthalene		9.91E-07	
Nitrogen Dioxide (peroxide)		4.93E-04	
Nitrogen Oxide		6.75E-03	
o-Xylene		2.33E-06	
p-Ethyltoluene		4.12E-07	
Phenanthrene		1.92E-07	
Phenol		4.05E-07	
PM10		3.72E-01	
Pyrene		1.44E-06	
RDX	5.70E-02	1.14E-05	2.01E-10
Styrene		1.07E-06	
Tetrachloroethylene	3.10E+00	1.56E-05	5.02E-12

LONG-TERM CARCINOGENIC RISKS FOR CLOSEST RESIDENCE RECEPTOR

Receptor:	**Closest Residence**		
	Reference Concentration	Average Annual Concentration	Risk
Compound	($\mu g/m^3$)	($\mu g/m^3$)	(unitless)
TO - 12 (NMOC)		6.16E-05	
Toluene		1.95E-06	
Total Non-methane Hydrocarbons		9.20E-04	
Total Non-methane Organic Compounds		2.51E-04	
Total Unidentified Hydrocarbons		3.92E-05	
Total Risk			9.89E-10

LONG-TERM NONCARCINOGENIC

HAZARD QUOTIENTS

LONG-TERM NONCARCINOGENIC HAZARD QUOTIENTS FOR MAXIMUM RECEPTOR

Receptor:	**Maximum Offsite**		
	Reference Concentration	Average Annual Concentration	Annual Hazard
Compound	($\mu g/m^3$)	($\mu g/m^3$)	Quotient
1,2,4-Trimethylbenzene 7.3+00	6.20E+00	1.50E-06	2.42E-07 2.05E-07
1,3 - Butadiene		6.92E-07	
1,3,5-Trimethylbenzene	~~6.20E+00~~	~~5.61E-07~~	~~9.04E-08~~
1,3,5-Trinitrobenzene	1.10E+02	2.57E-05	2.34E-07
1,3-Dinitrobenzene	~~3.70E-01~~	4.34E-07	1.17E-06
2,4,6-Trinitrotoluene		2.11E-05	
2,4-Dinitrotoluene	~~7.30E+00~~	3.72E-06	5.10E-07
2-Methylnapthalene 4.1E+03	~~7.30E+01~~	9.08E-07	1.24E-08
3,4-Methylphenol (m- & p-cresol) 6.3E+02	~~1.80E+02~~	6.87E-08	3.82E-10
Acenaphthylene	2.20E+02	2.15E-07	9.78E-10
Acetophenone	2.10E-02	2.56E-06	1.22E-04
Alkanes (Paraffins)		9.61E-06	
Alkenes (Olefins)		4.33E-05	
Anthracene	~~1.10E+03~~	1.93E-07	1.76E-10
Aromatics		1.80E-05	
Benz(a)anthracene		9.31E-07	
Benzene		8.79E-05	
Benzo(a)pyrene		6.02E-07	
Benzo(b)fluoranthene		1.07E-06	
Benzo(g,h,i)perylene		1.97E-07	
Benzo(k)fluoranthene		7.87E-07	
Benzyl alcohol	~~1.10E+03~~	1.57E-07	1.42E-10
Biphenyl 4.2E-01 ?	~~1.80E+02~~	4.46E-07	2.48E-09
bis (2-Ethylhexyl)phthalate		1.57E-06	
Butylbenzyl phthalate	~~7.30E+02~~	1.71E-06	2.35E-09
Carbon Dioxide		2.23E+00	
Carbon Monoxide		4.29E-02	
Carbon Tetrachloride		5.58E-07	
Di-n-butyl phthalate	~~3.70E+02~~	1.33E-06	3.60E-09
Di-n-octyl phthalate	~~7.30E+01~~	2.04E-06	2.79E-08
Dibenzofuran	1.50E+01	8.89E-08	5.93E-09
Dichloromethane		4.34E-04	
Diethyl phthalate	~~2.90E+03~~	1.04E-06	3.59E-10
Dimethyl phthalate	~~3.70E+04~~	4.38E-07	1.18E-11
Ethylbenzene	~~1.10E+03~~	3.00E-06	2.73E-09
Fluoranthene	~~1.50E+02~~	6.33E-06	4.22E-08
Fluorene	~~1.50E+02~~	5.00E-08	3.34E-10
Freon 11		2.24E-06	
Freon 113		5.58E-07	
Freon 12		9.18E-07	
HMX	~~1.80E+02~~	3.06E-06	1.70E-08
Hydrogen Chloride 2.1+01	2.10E+01	1.45E-03	6.93E-05
Hydrogen Fluoride 1.5E+01		2.14E-02	
Indeno (1,2,3 - cd) pyrene		2.19E-07	
m- & p-Xylene *	~~7.30E+03~~	1.03E-05	1.41E-09
Methane		2.44E-04	
Methyl chloride		7.55E-07	
n-Nitrosodiphenylamine		1.13E-07	

LONG-TERM NONCARCINOGENIC HAZARD QUOTIENTS FOR MAXIMUM RECEPTOR

Receptor:	**Maximum Offsite**		
	Reference Concentration ($\mu g/m^3$)	Average Annual Concentration ($\mu g/m^3$)	Annual Hazard Quotient
Compound			
Naphthalene	~~3.30E+00~~	1.76E-06	5.32E-07
Nitrogen Dioxide (peroxide)	~~3.70E+03~~	8.74E-04	2.36E-07
Nitrogen Oxide	~~3.70E+02~~	1.20E-02	3.23E-05
o-Xylene 1.0E+02	7.30E+03	4.14E-06	5.67E-10
p-Ethyltoluene		7.31E-07	
Phenanthrene		3.40E-07	
Phenol 2.1E+02	2.20E+03	7.18E-07	3.26E-10
PM10		6.60E-01	
Pyrene	~~1.10E+02~~	2.55E-06	2.32E-08
RDX		2.03E-05	
Styrene	1.00E+03	1.89E-06	1.89E-09
Tetrachloroethylene		2.76E-05	
TO - 12 (NMOC)		1.09E-04	
Toluene 5.2E+03	~~4.20E+02~~	3.46E-06	8.24E-09
Total Non-methane Hydrocarbons		1.63E-03	
Total Non-methane Organic Compounds		4.44E-04	
Total Unidentified Hydrocarbons		6.96E-05	
Total (Hazard Index)			2.27E-04
* Used lower reference concentration of m-xylene and p-xylene.			

LONG-TERM NONCARCINOGENIC HAZARD QUOTIENT FOR SULLIVAN MIDDLE SCHOOL RECEPTOR

Receptor:	S1	Sullivan Middle School	
	Reference Concentration	Average Annual Concentration	Annual Hazard
Compound	($\mu g/m^3$)	($\mu g/m^3$)	Quotient
1,2,4-Trimethylbenzene	6.20E+00	1.01E-07	1.63E-08
1,3 - Butadiene		4.67E-08	
1,3,5-Trimethylbenzene	6.20E+00	3.78E-08	6.10E-09
1,3,5-Trinitrobenzene	1.10E+02	1.73E-06	1.58E-08
1,3-Dinitrobenzene	3.70E-01	2.92E-08	7.90E-08
2,4,6-Trinitrotoluene		1.42E-06	
2,4-Dinitrotoluene	7.30E+00	2.51E-07	3.44E-08
2-Methylnapthalene	7.30E+01	6.12E-08	8.39E-10
3,4-Methylphenol (m- & p-cresol)	1.80E+02	4.63E-09	2.57E-11
Acenaphthylene	2.20E+02	1.45E-08	6.59E-11
Acetophenone	2.10E-02	1.73E-07	8.22E-06
Alkanes (Paraffins)		6.48E-07	
Alkenes (Olefins)		2.92E-06	
Anthracene	1.10E+03	1.30E-08	1.18E-11
Aromatics		1.21E-06	
Benz(a)anthracene		6.27E-08	
Benzene		5.93E-06	
Benzo(a)pyrene		4.05E-08	
Benzo(b)fluoranthene		7.23E-08	
Benzo(g,h,i)perylene		1.33E-08	
Benzo(k)fluoranthene		5.30E-08	
Benzyl alcohol	1.10E+03	1.06E-08	9.60E-12
Biphenyl	1.80E+02	3.01E-08	1.67E-10
bis (2-Ethylhexyl)phthalate		1.06E-07	
Butylbenzyl phthalate	7.30E+02	1.15E-07	1.58E-10
Carbon Dioxide		1.50E-01	
Carbon Monoxide		2.89E-03	
Carbon Tetrachloride		3.76E-08	
Di-n-butyl phthalate	3.70E+02	8.97E-08	2.42E-10
Di-n-octyl phthalate	7.30E+01	1.37E-07	1.88E-09
Dibenzofuran	1.50E+01	5.99E-09	4.00E-10
Dichloromethane		2.92E-05	
Diethyl phthalate	2.90E+03	7.01E-08	2.42E-11
Dimethyl phthalate	3.70E+04	2.95E-08	7.98E-13
Ethylbenzene	1.10E+03	2.02E-07	1.84E-10
Fluoranthene	1.50E+02	4.26E-07	2.84E-09
Fluorene	1.50E+02	3.37E-09	2.25E-11
Freon 11		1.51E-07	
Freon 113		3.76E-08	
Freon 12		6.18E-08	
HMX	1.80E+02	2.06E-07	1.15E-09
Hydrogen Chloride	2.10E+01	9.80E-05	4.67E-06
Hydrogen Fluoride		1.44E-03	
Indeno (1,2,3 - cd) pyrene		1.48E-08	
m- & p-Xylene *	7.30E+03	6.96E-07	9.53E-11
Methane		1.65E-05	
Methyl chloride		5.09E-08	
n-Nitrosodiphenylamine		7.60E-09	

LONG-TERM NONCARCINOGENIC HAZARD QUOTIENT FOR SULLIVAN MIDDLE SCHOOL RECEPTOR

Receptor:	S1	Sullivan Middle School	
	Reference Concentration ($\mu g/m^3$)	Average Annual Concentration ($\mu g/m^3$)	Annual Hazard Quotient
Compound			
Naphthalene	3.30E+00	1.18E-07	3.59E-08
Nitrogen Dioxide (peroxide)	3.70E+03	5.89E-05	1.59E-08
Nitrogen Oxide	3.70E+02	8.06E-04	2.18E-06
o-Xylene	7.30E+03	2.79E-07	3.82E-11
p-Ethyltoluene		4.93E-08	
Phenanthrene		2.29E-08	
Phenol	2.20E+03	4.84E-08	2.20E-11
PM10		4.45E-02	
Pyrene	1.10E+02	1.72E-07	1.56E-09
RDX		1.37E-06	
Styrene	1.00E+03	1.28E-07	1.28E-10
Tetrachloroethylene		1.86E-06	
TO - 12 (NMOC)		7.36E-06	
Toluene	4.20E+02	2.33E-07	5.55E-10
Total Non-methane Hydrocarbons		1.10E-04	
Total Non-methane Organic Compounds		2.99E-05	
Total Unidentified Hydrocarbons		4.69E-06	
Total (Hazard Index)			1.53E-05
* Used lower reference concentration of m-xylene and p-xylene.			

LONG-TERM NONCARCINOGENIC HAZARD QUOTIENTS FOR SEVIER MIDDLE SCHOOL RECEPTOR

Receptor:	S2	Sevier Middle School	
	Reference Concentration	Average Annual Concentration	Annual Hazard
Compound	($\mu g/m^3$)	($\mu g/m^3$)	Quotient
1,2,4-Trimethylbenzene	6.20E+00	1.36E-07	2.20E-08
1,3 - Butadiene		6.29E-08	
1,3,5-Trimethylbenzene	6.20E+00	5.09E-08	8.22E-09
1,3,5-Trinitrobenzene	1.10E+02	2.34E-06	2.13E-08
1,3-Dinitrobenzene	3.70E-01	3.94E-08	1.06E-07
2,4,6-Trinitrotoluene		1.91E-06	
2,4-Dinitrotoluene	7.30E+00	3.38E-07	4.64E-08
2-Methylnapthalene	7.30E+01	8.25E-08	1.13E-09
3,4-Methylphenol (m- & p-cresol)	1.80E+02	6.24E-09	3.47E-11
Acenaphthylene	2.20E+02	1.96E-08	8.89E-11
Acetophenone	2.10E-02	2.33E-07	1.11E-05
Alkanes (Paraffins)		8.73E-07	
Alkenes (Olefins)		3.93E-06	
Anthracene	1.10E+03	1.76E-08	1.60E-11
Aromatics		1.64E-06	
Benz(a)anthracene		8.46E-08	
Benzene		7.99E-06	
Benzo(a)pyrene		5.47E-08	
Benzo(b)fluoranthene		9.75E-08	
Benzo(g,h,i)perylene		1.79E-08	
Benzo(k)fluoranthene		7.15E-08	
Benzyl alcohol	1.10E+03	1.42E-08	1.29E-11
Biphenyl	1.80E+02	4.05E-08	2.25E-10
bis (2-Ethylhexyl)phthalate		1.42E-07	
Butylbenzyl phthalate	7.30E+02	1.56E-07	2.13E-10
Carbon Dioxide		2.02E-01	
Carbon Monoxide		3.90E-03	
Carbon Tetrachloride		5.07E-08	
Di-n-butyl phthalate	3.70E+02	1.21E-07	3.27E-10
Di-n-octyl phthalate	7.30E+01	1.85E-07	2.53E-09
Dibenzofuran	1.50E+01	8.08E-09	5.39E-10
Dichloromethane		3.94E-05	
Diethyl phthalate	2.90E+03	9.46E-08	3.26E-11
Dimethyl phthalate	3.70E+04	3.98E-08	1.08E-12
Ethylbenzene	1.10E+03	2.73E-07	2.48E-10
Fluoranthene	1.50E+02	5.75E-07	3.83E-09
Fluorene	1.50E+02	4.55E-09	3.03E-11
Freon 11		2.03E-07	
Freon 113		5.07E-08	
Freon 12		8.34E-08	
HMX	1.80E+02	2.78E-07	1.54E-09
Hydrogen Chloride	2.10E+01	1.32E-04	6.29E-06
Hydrogen Fluoride		1.94E-03	
Indeno (1,2,3 - cd) pyrene		1.99E-08	
m- & p-Xylene *	7.30E+03	9.38E-07	1.29E-10
Methane		2.22E-05	
Methyl chloride		6.86E-08	
n-Nitrosodiphenylamine		1.02E-08	

LONG-TERM NONCARCINOGENIC HAZARD QUOTIENTS FOR SEVIER MIDDLE SCHOOL RECEPTOR

Receptor:	S2	Sevier Middle School	
	Reference	Average Annual	Annual
	Concentration	Concentration	Hazard
Compound	($\mu g/m^3$)	($\mu g/m^3$)	Quotient
Naphthalene	3.30E+00	1.60E-07	4.84E-08
Nitrogen Dioxide (peroxide)	3.70E+03	7.94E-05	2.15E-08
Nitrogen Oxide	3.70E+02	1.09E-03	2.94E-06
o-Xylene	7.30E+03	3.76E-07	5.15E-11
p-Ethyltoluene		6.64E-08	
Phenanthrene		3.09E-08	
Phenol	2.20E+03	6.52E-08	2.97E-11
PM10		6.00E-02	
Pyrene	1.10E+02	2.32E-07	2.11E-09
RDX		1.84E-06	
Styrene	1.00E+03	1.72E-07	1.72E-10
Tetrachloroethylene		2.51E-06	
TO - 12 (NMOC)		9.92E-06	
Toluene	4.20E+02	3.14E-07	7.49E-10
Total Non-methane Hydrocarbons		1.48E-04	
Total Non-methane Organic Compounds		4.04E-05	
Total Unidentified Hydrocarbons		6.32E-06	
Total (Hazard Index)			2.06E-05
* Used lower reference concentration of m-xylene and p-xylene.			

LONG-TERM NONCARCINOGENIC HAZARD QUOTIENTS FOR ROBINSON MIDDLE SCHOOL RECEPTOR

Receptor:	S3	Robinson Middle School	
	Reference Concentration	Average Annual Concentration	Annual Hazard
Compound	($\mu g/m^3$)	($\mu g/m^3$)	Quotient
1,2,4-Trimethylbenzene	6.20E+00	9.92E-08	1.60E-08
1,3 - Butadiene		4.58E-08	
1,3,5-Trimethylbenzene	6.20E+00	3.71E-08	5.98E-09
1,3,5-Trinitrobenzene	1.10E+02	1.70E-06	1.55E-08
1,3-Dinitrobenzene	3.70E-01	2.87E-08	7.75E-08
2,4,6-Trinitrotoluene		1.39E-06	
2,4-Dinitrotoluene	7.30E+00	2.46E-07	3.37E-08
2-Methylnapthalene	7.30E+01	6.01E-08	8.23E-10
3,4-Methylphenol (m- & p-cresol)	1.80E+02	4.54E-09	2.52E-11
Acenaphthylene	2.20E+02	1.42E-08	6.47E-11
Acetophenone	2.10E-02	1.69E-07	8.06E-06
Alkanes (Paraffins)		6.36E-07	
Alkenes (Olefins)		2.86E-06	
Anthracene	1.10E+03	1.28E-08	1.16E-11
Aromatics		1.19E-06	
Benz(a)anthracene		6.16E-08	
Benzene		5.82E-06	
Benzo(a)pyrene		3.98E-08	
Benzo(b)fluoranthene		7.10E-08	
Benzo(g,h,i)perylene		1.30E-08	
Benzo(k)fluoranthene		5.20E-08	
Benzyl alcohol	1.10E+03	1.04E-08	9.42E-12
Biphenyl	1.80E+02	2.95E-08	1.64E-10
bis (2-Ethylhexyl)phthalate		1.04E-07	
Butylbenzyl phthalate	7.30E+02	1.13E-07	1.55E-10
Carbon Dioxide		1.47E-01	
Carbon Monoxide		2.84E-03	
Carbon Tetrachloride		3.69E-08	
Di-n-butyl phthalate	3.70E+02	8.80E-08	2.38E-10
Di-n-octyl phthalate	7.30E+01	1.35E-07	1.85E-09
Dibenzofuran	1.50E+01	5.88E-09	3.92E-10
Dichloromethane		2.87E-05	
Diethyl phthalate	2.90E+03	6.88E-08	2.37E-11
Dimethyl phthalate	3.70E+04	2.90E-08	7.83E-13
Ethylbenzene	1.10E+03	1.99E-07	1.81E-10
Fluoranthene	1.50E+02	4.18E-07	2.79E-09
Fluorene	1.50E+02	3.31E-09	2.21E-11
Freon 11		1.48E-07	
Freon 113		3.69E-08	
Freon 12		6.07E-08	
HMX	1.80E+02	2.02E-07	1.12E-09
Hydrogen Chloride	2.10E+01	9.62E-05	4.58E-06
Hydrogen Fluoride		1.41E-03	
Indeno (1,2,3 - cd) pyrene		1.45E-08	
m- & p-Xylene *	7.30E+03	6.83E-07	9.36E-11
Methane		1.62E-05	
Methyl chloride		4.99E-08	
n-Nitrosodiphenylamine		7.46E-09	

LONG-TERM NONCARCINOGENIC HAZARD QUOTIENTS FOR ROBINSON MIDDLE SCHOOL RECEPTOR

Receptor:	S3	Robinson Middle School	
	Reference	Average Annual	Annual
	Concentration	Concentration	Hazard
Compound	($\mu g/m^3$)	($\mu g/m^3$)	Quotient
Naphthalene	3.30E+00	1.16E-07	3.52E-08
Nitrogen Dioxide (peroxide)	3.70E+03	5.78E-05	1.56E-08
Nitrogen Oxide	3.70E+02	7.91E-04	2.14E-06
o-Xylene	7.30E+03	2.74E-07	3.75E-11
p-Ethyltoluene		4.84E-08	
Phenanthrene		2.25E-08	
Phenol	2.20E+03	4.75E-08	2.16E-11
PM10		4.36E-02	
Pyrene	1.10E+02	1.69E-07	1.53E-09
RDX		1.34E-06	
Styrene	1.00E+03	1.25E-07	1.25E-10
Tetrachloroethylene		1.82E-06	
TO - 12 (NMOC)		7.22E-06	
Toluene	4.20E+02	2.29E-07	5.45E-10
Total Non-methane Hydrocarbons		1.08E-04	
Total Non-methane Organic Compounds		2.94E-05	
Total Unidentified Hydrocarbons		4.60E-06	
Total (Hazard Index)			1.50E-05
* Used lower reference concentration of m-xylene and p-xylene.			

LONG-TERM NONCARCINOGENIC HAZARD QUOTIENTS FOR ROOSEVELT ELEMENTARY SCHOOL RECEPTOR

Receptor:	S4	Roosevelt Elementary School	
	Reference	Average Annual	Annual
	Concentration	Concentration	Hazard
Compound	($\mu g/m^3$)	($\mu g/m^3$)	Quotient
1,2,4-Trimethylbenzene	6.20E+00	1.76E-07	2.84E-08
1,3 - Butadiene		8.14E-08	
1,3,5-Trimethylbenzene	6.20E+00	6.59E-08	1.06E-08
1,3,5-Trinitrobenzene	1.10E+02	3.03E-06	2.75E-08
1,3-Dinitrobenzene	3.70E-01	5.10E-08	1.38E-07
2,4,6-Trinitrotoluene		2.48E-06	
2,4-Dinitrotoluene	7.30E+00	4.38E-07	6.00E-08
2-Methylnapthalene	7.30E+01	1.07E-07	1.46E-09
3,4-Methylphenol (m- & p-cresol)	1.80E+02	8.08E-09	4.49E-11
Acenaphthylene	2.20E+02	2.53E-08	1.15E-10
Acetophenone	2.10E-02	3.01E-07	1.43E-05
Alkanes (Paraffins)		1.13E-06	
Alkenes (Olefins)		5.09E-06	
Anthracene	1.10E+03	2.27E-08	2.07E-11
Aromatics		2.12E-06	
Benz(a)anthracene		1.09E-07	
Benzene		1.03E-05	
Benzo(a)pyrene		7.07E-08	
Benzo(b)fluoranthene		1.26E-07	
Benzo(g,h,i)perylene		2.32E-08	
Benzo(k)fluoranthene		9.25E-08	
Benzyl alcohol	1.10E+03	1.84E-08	1.67E-11
Biphenyl	1.80E+02	5.24E-08	2.91E-10
bis (2-Ethylhexyl)phthalate		1.84E-07	
Butylbenzyl phthalate	7.30E+02	2.01E-07	2.76E-10
Carbon Dioxide		2.62E-01	
Carbon Monoxide		5.04E-03	
Carbon Tetrachloride		6.56E-08	
Di-n-butyl phthalate	3.70E+02	1.56E-07	4.23E-10
Di-n-octyl phthalate	7.30E+01	2.39E-07	3.28E-09
Dibenzofuran	1.50E+01	1.05E-08	6.97E-10
Dichloromethane		5.10E-05	
Diethyl phthalate	2.90E+03	1.22E-07	4.22E-11
Dimethyl phthalate	3.70E+04	5.15E-08	1.39E-12
Ethylbenzene	1.10E+03	3.53E-07	3.21E-10
Fluoranthene	1.50E+02	7.44E-07	4.96E-09
Fluorene	1.50E+02	5.88E-09	3.92E-11
Freon 11		2.63E-07	
Freon 113		6.56E-08	
Freon 12		1.08E-07	
HMX	1.80E+02	3.60E-07	2.00E-09
Hydrogen Chloride	2.10E+01	1.71E-04	8.14E-06
Hydrogen Fluoride		2.51E-03	
Indeno (1,2,3 - cd) pyrene		2.58E-08	
m- & p-Xylene *	7.30E+03	1.21E-06	1.66E-10
Methane		2.87E-05	
Methyl chloride		8.88E-08	
n-Nitrosodiphenylamine		1.33E-08	

LONG-TERM NONCARCINOGENIC HAZARD QUOTIENTS FOR ROOSEVELT ELEMENTARY SCHOOL RECEPTOR

Receptor:	S4	Roosevelt Elementary School	
	Reference	Average Annual	Annual
	Concentration	Concentration	Hazard
Compound	($\mu g/m^3$)	($\mu g/m^3$)	Quotient
Naphthalene	3.30E+00	2.07E-07	6.26E-08
Nitrogen Dioxide (peroxide)	3.70E+03	1.03E-04	2.78E-08
Nitrogen Oxide	3.70E+02	1.41E-03	3.80E-06
o-Xylene	7.30E+03	4.86E-07	6.66E-11
p-Ethyltoluene		8.60E-08	
Phenanthrene		3.99E-08	
Phenol	2.20E+03	8.44E-08	3.84E-11
PM10		7.76E-02	
Pyrene	1.10E+02	3.00E-07	2.73E-09
RDX		2.38E-06	
Styrene	1.00E+03	2.23E-07	2.23E-10
Tetrachloroethylene		3.24E-06	
TO - 12 (NMOC)		1.28E-05	
Toluene	4.20E+02	4.07E-07	9.69E-10
Total Non-methane Hydrocarbons		1.92E-04	
Total Non-methane Organic Compounds		5.23E-05	
Total Unidentified Hydrocarbons		8.18E-06	
Total (Hazard Index)			2.67E-05
* Used lower reference concentration of m-xylene and p-xylene.			

LONG-TERM NONCARCINOGENIC HAZARD QUOTIENTS FOR LYNN VIEW MIDDLE SCHOOL RECEPTOR

Receptor:	S5	Lynn View Middle School	
	Reference Concentration	Average Annual Concentration	Annual Hazard
Compound	($\mu g/m^3$)	($\mu g/m^3$)	Quotient
1,2,4-Trimethylbenzene	6.20E+00	9.86E-08	1.59E-08
1,3 - Butadiene		4.55E-08	
1,3,5-Trimethylbenzene	6.20E+00	3.68E-08	5.94E-09
1,3,5-Trinitrobenzene	1.10E+02	1.69E-06	1.54E-08
1,3-Dinitrobenzene	3.70E-01	2.85E-08	7.70E-08
2,4,6-Trinitrotoluene		1.38E-06	
2,4-Dinitrotoluene	7.30E+00	2.45E-07	3.35E-08
2-Methylnapthalene	7.30E+01	5.97E-08	8.18E-10
3,4-Methylphenol (m- & p-cresol)	1.80E+02	4.52E-09	2.51E-11
Acenaphthylene	2.20E+02	1.41E-08	6.43E-11
Acetophenone	2.10E-02	1.68E-07	8.01E-06
Alkanes (Paraffins)		6.32E-07	
Alkenes (Olefins)		2.84E-06	
Anthracene	1.10E+03	1.27E-08	1.15E-11
Aromatics		1.18E-06	
Benz(a)anthracene		6.12E-08	
Benzene		5.78E-06	
Benzo(a)pyrene		3.95E-08	
Benzo(b)fluoranthene		7.05E-08	
Benzo(g,h,i)perylene		1.29E-08	
Benzo(k)fluoranthene		5.17E-08	
Benzyl alcohol	1.10E+03	1.03E-08	9.36E-12
Biphenyl	1.80E+02	2.93E-08	1.63E-10
bis (2-Ethylhexyl)phthalate		1.03E-07	
Butylbenzyl phthalate	7.30E+02	1.13E-07	1.54E-10
Carbon Dioxide		1.46E-01	
Carbon Monoxide		2.82E-03	
Carbon Tetrachloride		3.66E-08	
Di-n-butyl phthalate	3.70E+02	8.74E-08	2.36E-10
Di-n-octyl phthalate	7.30E+01	1.34E-07	1.83E-09
Dibenzofuran	1.50E+01	5.84E-09	3.90E-10
Dichloromethane		2.85E-05	
Diethyl phthalate	2.90E+03	6.84E-08	2.36E-11
Dimethyl phthalate	3.70E+04	2.88E-08	7.78E-13
Ethylbenzene	1.10E+03	1.97E-07	1.79E-10
Fluoranthene	1.50E+02	4.16E-07	2.77E-09
Fluorene	1.50E+02	3.29E-09	2.19E-11
Freon 11		1.47E-07	
Freon 113		3.66E-08	
Freon 12		6.03E-08	
HMX	1.80E+02	2.01E-07	1.12E-09
Hydrogen Chloride	2.10E+01	9.56E-05	4.55E-06
Hydrogen Fluoride		1.40E-03	
Indeno (1,2,3 - cd) pyrene		1.44E-08	
m- & p-Xylene *	7.30E+03	6.79E-07	9.30E-11
Methane		1.61E-05	
Methyl chloride		4.96E-08	
n-Nitrosodiphenylamine		7.41E-09	

LONG-TERM NONCARCINOGENIC HAZARD QUOTIENTS FOR LYNN VIEW MIDDLE SCHOOL RECEPTOR

Receptor:	S5	Lynn View Middle School	
	Reference	Average Annual	Annual
	Concentration	Concentration	Hazard
Compound	($\mu g/m^3$)	($\mu g/m^3$)	Quotient
Naphthalene	3.30E+00	1.15E-07	3.50E-08
Nitrogen Dioxide (peroxide)	3.70E+03	5.74E-05	1.55E-08
Nitrogen Oxide	3.70E+02	7.86E-04	2.12E-06
o-Xylene	7.30E+03	2.72E-07	3.72E-11
p-Ethyltoluene		4.80E-08	
Phenanthrene		2.23E-08	
Phenol	2.20E+03	4.72E-08	2.14E-11
PM10		4.34E-02	
Pyrene	1.10E+02	1.68E-07	1.52E-09
RDX		1.33E-06	
Styrene	1.00E+03	1.24E-07	1.24E-10
Tetrachloroethylene		1.81E-06	
TO - 12 (NMOC)		7.17E-06	
Toluene	4.20E+02	2.27E-07	5.41E-10
Total Non-methane Hydrocarbons		1.07E-04	
Total Non-methane Organic Compounds		2.92E-05	
Total Unidentified Hydrocarbons		4.57E-06	
Total (Hazard Index)			1.49E-05
* Used lower reference concentration of m-xylene and p-xylene.			

LONG-TERM NONCARCINOGENIC HAZARD QUOTIENTS FOR WASHINGTON ELEMENTARY SCHOOL RECEPTOR

Receptor:	S6	Washington Elementary School	
	Reference Concentration	Average Annual Concentration	Annual Hazard
Compound	($\mu g/m^3$)	($\mu g/m^3$)	Quotient
1,2,4-Trimethylbenzene	6.20E+00	2.28E-07	3.67E-08
1,3 - Butadiene		1.05E-07	
1,3,5-Trimethylbenzene	6.20E+00	8.51E-08	1.37E-08
1,3,5-Trinitrobenzene	1.10E+02	3.91E-06	3.55E-08
1,3-Dinitrobenzene	3.70E-01	6.58E-08	1.78E-07
2,4,6-Trinitrotoluene		3.20E-06	
2,4-Dinitrotoluene	7.30E+00	5.65E-07	7.75E-08
2-Methylnapthalene	7.30E+01	1.38E-07	1.89E-09
3,4-Methylphenol (m- & p-cresol)	1.80E+02	1.04E-08	5.80E-11
Acenaphthylene	2.20E+02	3.27E-08	1.49E-10
Acetophenone	2.10E-02	3.89E-07	1.85E-05
Alkanes (Paraffins)		1.46E-06	
Alkenes (Olefins)		6.57E-06	
Anthracene	1.10E+03	2.93E-08	2.67E-11
Aromatics		2.73E-06	
Benz(a)anthracene		1.41E-07	
Benzene		1.34E-05	
Benzo(a)pyrene		9.13E-08	
Benzo(b)fluoranthene		1.63E-07	
Benzo(g,h,i)perylene		2.99E-08	
Benzo(k)fluoranthene		1.19E-07	
Benzyl alcohol	1.10E+03	2.38E-08	2.16E-11
Biphenyl	1.80E+02	6.77E-08	3.76E-10
bis (2-Ethylhexyl)phthalate		2.38E-07	
Butylbenzyl phthalate	7.30E+02	2.60E-07	3.56E-10
Carbon Dioxide		3.38E-01	
Carbon Monoxide		6.51E-03	
Carbon Tetrachloride		8.47E-08	
Di-n-butyl phthalate	3.70E+02	2.02E-07	5.46E-10
Di-n-octyl phthalate	7.30E+01	3.09E-07	4.24E-09
Dibenzofuran	1.50E+01	1.35E-08	9.00E-10
Dichloromethane		6.58E-05	
Diethyl phthalate	2.90E+03	1.58E-07	5.45E-11
Dimethyl phthalate	3.70E+04	6.65E-08	1.80E-12
Ethylbenzene	1.10E+03	4.56E-07	4.15E-10
Fluoranthene	1.50E+02	9.61E-07	6.40E-09
Fluorene	1.50E+02	7.60E-09	5.07E-11
Freon 11		3.40E-07	
Freon 113		8.47E-08	
Freon 12		1.39E-07	
HMX	1.80E+02	4.65E-07	2.58E-09
Hydrogen Chloride	2.10E+01	2.21E-04	1.05E-05
Hydrogen Fluoride		3.24E-03	
Indeno (1,2,3 - cd) pyrene		3.33E-08	
m- & p-Xylene *	7.30E+03	1.57E-06	2.15E-10
Methane		3.71E-05	
Methyl chloride		1.15E-07	
n-Nitrosodiphenylamine		1.71E-08	

LONG-TERM NONCARCINOGENIC HAZARD QUOTIENTS FOR WASHINGTON ELEMENTARY SCHOOL RECEPTOR

Receptor:	S6	Washington Elementary School	
	Reference	Average Annual	Annual
	Concentration	Concentration	Hazard
Compound	($\mu g/m^3$)	($\mu g/m^3$)	Quotient
Naphthalene	3.30E+00	2.67E-07	8.08E-08
Nitrogen Dioxide (peroxide)	3.70E+03	1.33E-04	3.59E-08
Nitrogen Oxide	3.70E+02	1.82E-03	4.91E-06
o-Xylene	7.30E+03	6.28E-07	8.60E-11
p-Ethyltoluene		1.11E-07	
Phenanthrene		5.16E-08	
Phenol	2.20E+03	1.09E-07	4.96E-11
PM10		1.00E-01	
Pyrene	1.10E+02	3.88E-07	3.52E-09
RDX		3.08E-06	
Styrene	1.00E+03	2.87E-07	2.87E-10
Tetrachloroethylene		4.19E-06	
TO - 12 (NMOC)		1.66E-05	
Toluene	4.20E+02	5.25E-07	1.25E-09
Total Non-methane Hydrocarbons		2.48E-04	
Total Non-methane Organic Compounds		6.75E-05	
Total Unidentified Hydrocarbons		1.06E-05	
Total (Hazard Index)			3.44E-05
* Used lower reference concentration of m-xylene and p-xylene.			

LONG-TERM NONCARCINOGENIC HAZARD QUOTIENTS FOR MT. CARMEL SCHOOL RECEPTOR

Receptor:	S7	Mt. Carmel School	
	Reference	Average Annual	Annual
	Concentration	Concentration	Hazard
Compound	($\mu g/m^3$)	($\mu g/m^3$)	Quotient
1,2,4-Trimethylbenzene	6.20E+00	1.78E-07	2.87E-08
1,3 - Butadiene		8.20E-08	
1,3,5-Trimethylbenzene	6.20E+00	6.64E-08	1.07E-08
1,3,5-Trinitrobenzene	1.10E+02	3.05E-06	2.77E-08
1,3-Dinitrobenzene	3.70E-01	5.14E-08	1.39E-07
2,4,6-Trinitrotoluene		2.50E-06	
2,4-Dinitrotoluene	7.30E+00	4.41E-07	6.04E-08
2-Methylnapthalene	7.30E+01	1.08E-07	1.47E-09
3,4-Methylphenol (m- & p-cresol)	1.80E+02	8.14E-09	4.52E-11
Acenaphthylene	2.20E+02	2.55E-08	1.16E-10
Acetophenone	2.10E-02	3.03E-07	1.44E-05
Alkanes (Paraffins)		1.14E-06	
Alkenes (Olefins)		5.13E-06	
Anthracene	1.10E+03	2.29E-08	2.08E-11
Aromatics		2.13E-06	
Benz(a)anthracene		1.10E-07	
Benzene		1.04E-05	
Benzo(a)pyrene		7.13E-08	
Benzo(b)fluoranthene		1.27E-07	
Benzo(g,h,i)perylene		2.33E-08	
Benzo(k)fluoranthene		9.32E-08	
Benzyl alcohol	1.10E+03	1.86E-08	1.69E-11
Biphenyl	1.80E+02	5.28E-08	2.94E-10
bis (2-Ethylhexyl)phthalate		1.86E-07	
Butylbenzyl phthalate	7.30E+02	2.03E-07	2.78E-10
Carbon Dioxide		2.64E-01	
Carbon Monoxide		5.08E-03	
Carbon Tetrachloride		6.61E-08	
Di-n-butyl phthalate	3.70E+02	1.58E-07	4.26E-10
Di-n-octyl phthalate	7.30E+01	2.41E-07	3.31E-09
Dibenzofuran	1.50E+01	1.05E-08	7.03E-10
Dichloromethane		5.14E-05	
Diethyl phthalate	2.90E+03	1.23E-07	4.25E-11
Dimethyl phthalate	3.70E+04	5.19E-08	1.40E-12
Ethylbenzene	1.10E+03	3.56E-07	3.23E-10
Fluoranthene	1.50E+02	7.50E-07	5.00E-09
Fluorene	1.50E+02	5.93E-09	3.95E-11
Freon 11		2.65E-07	
Freon 113		6.61E-08	
Freon 12		1.09E-07	
HMX	1.80E+02	3.63E-07	2.01E-09
Hydrogen Chloride	2.10E+01	1.72E-04	8.21E-06
Hydrogen Fluoride		2.53E-03	
Indeno (1,2,3 - cd) pyrene		2.60E-08	
m- & p-Xylene *	7.30E+03	1.22E-06	1.68E-10
Methane		2.90E-05	
Methyl chloride		8.94E-08	
n-Nitrosodiphenylamine		1.34E-08	

LONG-TERM NONCARCINOGENIC HAZARD QUOTIENTS FOR MT. CARMEL SCHOOL RECEPTOR

Receptor:	S7	Mt. Carmel School	
	Reference	Average Annual	Annual
	Concentration	Concentration	Hazard
Compound	($\mu g/m^3$)	($\mu g/m^3$)	Quotient
Naphthalene	3.30E+00	2.08E-07	6.31E-08
Nitrogen Dioxide (peroxide)	3.70E+03	1.04E-04	2.80E-08
Nitrogen Oxide	3.70E+02	1.42E-03	3.83E-06
o-Xylene	7.30E+03	4.90E-07	6.71E-11
p-Ethyltoluene		8.66E-08	
Phenanthrene		4.02E-08	
Phenol	2.20E+03	8.51E-08	3.87E-11
PM10		7.82E-02	
Pyrene	1.10E+02	3.02E-07	2.75E-09
RDX		2.40E-06	
Styrene	1.00E+03	2.24E-07	2.24E-10
Tetrachloroethylene		3.27E-06	
TO - 12 (NMOC)		1.29E-05	
Toluene	4.20E+02	4.10E-07	9.76E-10
Total Non-methane Hydrocarbons		1.93E-04	
Total Non-methane Organic Compounds		5.26E-05	
Total Unidentified Hydrocarbons		8.24E-06	
Total (Hazard Index)			2.69E-05
* Used lower reference concentration of m-xylene and p-xylene.			

LONG-TERM NONCARCINOGENIC HAZARD QUOTIENTS FOR CHURCH HILL ELEMENTARY SCHOOL RECEPTOR

Receptor:	S8	Church Hill Elementary School	
	Reference Concentration	Average Annual Concentration	Annual Hazard
Compound	($\mu g/m^3$)	($\mu g/m^3$)	Quotient
1,2,4-Trimethylbenzene	6.20E+00	8.28E-08	1.34E-08
1,3 - Butadiene		3.82E-08	
1,3,5-Trimethylbenzene	6.20E+00	3.09E-08	4.99E-09
1,3,5-Trinitrobenzene	1.10E+02	1.42E-06	1.29E-08
1,3-Dinitrobenzene	3.70E-01	2.39E-08	6.47E-08
2,4,6-Trinitrotoluene		1.16E-06	
2,4-Dinitrotoluene	7.30E+00	2.06E-07	2.82E-08
2-Methylnapthalene	7.30E+01	5.01E-08	6.87E-10
3,4-Methylphenol (m- & p-cresol)	1.80E+02	3.79E-09	2.11E-11
Acenaphthylene	2.20E+02	1.19E-08	5.40E-11
Acetophenone	2.10E-02	1.41E-07	6.73E-06
Alkanes (Paraffins)		5.30E-07	
Alkenes (Olefins)		2.39E-06	
Anthracene	1.10E+03	1.07E-08	9.69E-12
Aromatics		9.93E-07	
Benz(a)anthracene		5.14E-08	
Benzene		4.85E-06	
Benzo(a)pyrene		3.32E-08	
Benzo(b)fluoranthene		5.92E-08	
Benzo(g,h,i)perylene		1.09E-08	
Benzo(k)fluoranthene		4.34E-08	
Benzyl alcohol	1.10E+03	8.64E-09	7.86E-12
Biphenyl	1.80E+02	2.46E-08	1.37E-10
bis (2-Ethylhexyl)phthalate		8.65E-08	
Butylbenzyl phthalate	7.30E+02	9.46E-08	1.30E-10
Carbon Dioxide		1.23E-01	
Carbon Monoxide		2.37E-03	
Carbon Tetrachloride		3.08E-08	
Di-n-butyl phthalate	3.70E+02	7.34E-08	1.98E-10
Di-n-octyl phthalate	7.30E+01	1.12E-07	1.54E-09
Dibenzofuran	1.50E+01	4.91E-09	3.27E-10
Dichloromethane		2.39E-05	
Diethyl phthalate	2.90E+03	5.74E-08	1.98E-11
Dimethyl phthalate	3.70E+04	2.42E-08	6.54E-13
Ethylbenzene	1.10E+03	1.66E-07	1.51E-10
Fluoranthene	1.50E+02	3.49E-07	2.33E-09
Fluorene	1.50E+02	2.76E-09	1.84E-11
Freon 11		1.23E-07	
Freon 113		3.08E-08	
Freon 12		5.06E-08	
HMX	1.80E+02	1.69E-07	9.38E-10
Hydrogen Chloride	2.10E+01	8.03E-05	3.82E-06
Hydrogen Fluoride		1.18E-03	
Indeno (1,2,3 - cd) pyrene		1.21E-08	
m- & p-Xylene *	7.30E+03	5.70E-07	7.81E-11
Methane		1.35E-05	
Methyl chloride		4.17E-08	
n-Nitrosodiphenylamine		6.22E-09	

LONG-TERM NONCARCINOGENIC HAZARD QUOTIENTS FOR CHURCH HILL ELEMENTARY SCHOOL RECEPTOR

Receptor:	S8	Church Hill Elementary School	
	Reference	Average Annual	Annual
	Concentration	Concentration	Hazard
Compound	($\mu g/m^3$)	($\mu g/m^3$)	Quotient
Naphthalene	3.30E+00	9.70E-08	2.94E-08
Nitrogen Dioxide (peroxide)	3.70E+03	4.82E-05	1.30E-08
Nitrogen Oxide	3.70E+02	6.60E-04	1.78E-06
o-Xylene	7.30E+03	2.28E-07	3.13E-11
p-Ethyltoluene		4.04E-08	
Phenanthrene		1.87E-08	
Phenol	2.20E+03	3.96E-08	1.80E-11
PM10		3.64E-02	
Pyrene	1.10E+02	1.41E-07	1.28E-09
RDX		1.12E-06	
Styrene	1.00E+03	1.04E-07	1.04E-10
Tetrachloroethylene		1.52E-06	
TO - 12 (NMOC)		6.02E-06	
Toluene	4.20E+02	1.91E-07	4.55E-10
Total Non-methane Hydrocarbons		9.00E-05	
Total Non-methane Organic Compounds		2.45E-05	
Total Unidentified Hydrocarbons		3.84E-06	
Total (Hazard Index)			1.25E-05
* Used lower reference concentration of m-xylene and p-xylene.			

LONG-TERM NONCARCINOGENIC HAZARD QUOTIENTS FOR HOLSTON VALLEY COMMUNITY HOSPITAL RECEPTOR

Receptor:	**Holston Valley Community Hospital**		
	Reference Concentration	Average Annual Concentration	Annual Hazard
Compound	($\mu g/m^3$)	($\mu g/m^3$)	Quotient
1,2,4-Trimethylbenzene	6.20E+00	1.47E-07	2.37E-08
1,3 - Butadiene		6.79E-08	
1,3,5-Trimethylbenzene	6.20E+00	5.50E-08	8.87E-09
1,3,5-Trinitrobenzene	1.10E+02	2.52E-06	2.29E-08
1,3-Dinitrobenzene	3.70E-01	4.25E-08	1.15E-07
2,4,6-Trinitrotoluene		2.07E-06	
2,4-Dinitrotoluene	7.30E+00	3.65E-07	5.00E-08
2-Methylnapthalene	7.30E+01	8.91E-08	1.22E-09
3,4-Methylphenol (m- & p-cresol)	1.80E+02	6.74E-09	3.74E-11
Acenaphthylene	2.20E+02	2.11E-08	9.59E-11
Acetophenone	2.10E-02	2.51E-07	1.20E-05
Alkanes (Paraffins)		9.43E-07	
Alkenes (Olefins)		4.24E-06	
Anthracene	1.10E+03	1.89E-08	1.72E-11
Aromatics		1.77E-06	
Benz(a)anthracene		9.13E-08	
Benzene		8.62E-06	
Benzo(a)pyrene		5.90E-08	
Benzo(b)fluoranthene		1.05E-07	
Benzo(g,h,i)perylene		1.93E-08	
Benzo(k)fluoranthene		7.72E-08	
Benzyl alcohol	1.10E+03	1.54E-08	1.40E-11
Biphenyl	1.80E+02	4.37E-08	2.43E-10
bis (2-Ethylhexyl)phthalate		1.54E-07	
Butylbenzyl phthalate	7.30E+02	1.68E-07	2.30E-10
Carbon Dioxide		2.18E-01	
Carbon Monoxide		4.21E-03	
Carbon Tetrachloride		5.47E-08	
Di-n-butyl phthalate	3.70E+02	1.30E-07	3.53E-10
Di-n-octyl phthalate	7.30E+01	2.00E-07	2.74E-09
Dibenzofuran	1.50E+01	8.72E-09	5.81E-10
Dichloromethane		4.25E-05	
Diethyl phthalate	2.90E+03	1.02E-07	3.52E-11
Dimethyl phthalate	3.70E+04	4.30E-08	1.16E-12
Ethylbenzene	1.10E+03	2.94E-07	2.68E-10
Fluoranthene	1.50E+02	6.20E-07	4.14E-09
Fluorene	1.50E+02	4.91E-09	3.27E-11
Freon 11		2.19E-07	
Freon 113		5.47E-08	
Freon 12		9.00E-08	
HMX	1.80E+02	3.00E-07	1.67E-09
Hydrogen Chloride	2.10E+01	1.43E-04	6.79E-06
Hydrogen Fluoride		2.09E-03	
Indeno (1,2,3 - cd) pyrene		2.15E-08	
m- & p-Xylene *	7.30E+03	1.01E-06	1.39E-10
Methane		2.40E-05	
Methyl chloride		7.40E-08	
n-Nitrosodiphenylamine		1.11E-08	

LONG-TERM NONCARCINOGENIC HAZARD QUOTIENTS FOR HOLSTON VALLEY COMMUNITY HOSPITAL RECEPTOR

Receptor:	Holston Valley Community Hospital		
	Reference Concentration	Average Annual Concentration	Annual Hazard
Compound	($\mu g/m^3$)	($\mu g/m^3$)	Quotient
Naphthalene	3.30E+00	1.72E-07	5.22E-08
Nitrogen Dioxide (peroxide)	3.70E+03	8.57E-05	2.32E-08
Nitrogen Oxide	3.70E+02	1.17E-03	3.17E-06
o-Xylene	7.30E+03	4.06E-07	5.56E-11
p-Ethyltoluene		7.17E-08	
Phenanthrene		3.33E-08	
Phenol	2.20E+03	7.04E-08	3.20E-11
PM10		6.47E-02	
Pyrene	1.10E+02	2.50E-07	2.28E-09
RDX		1.99E-06	
Styrene	1.00E+03	1.86E-07	1.86E-10
Tetrachloroethylene		2.70E-06	
TO - 12 (NMOC)		1.07E-05	
Toluene	4.20E+02	3.39E-07	8.08E-10
Total Non-methane Hydrocarbons		1.60E-04	
Total Non-methane Organic Compounds		4.36E-05	
Total Unidentified Hydrocarbons		6.82E-06	
Total (Hazard Index)			2.22E-05

* Used lower reference concentration of m-xylene and p-xylene.

LONG-TERM NONCARCINOGENIC HAZARD QUOTIENTS FOR ASBURY CENTER LONG-TERM HEALTH CARE CENTER RECEPTOR

Receptor:	**Asbury Center Long-Term Health Care Center**		
	Reference	Average Annual	Annual
	Concentration	Concentration	Hazard
Compound	($\mu g/m^3$)	($\mu g/m^3$)	Quotient
1,2,4-Trimethylbenzene	6.20E+00	2.69E-07	4.33E-08
1,3 - Butadiene		1.24E-07	
1,3,5-Trimethylbenzene	6.20E+00	1.00E-07	1.62E-08
1,3,5-Trinitrobenzene	1.10E+02	4.61E-06	4.19E-08
1,3-Dinitrobenzene	3.70E-01	7.76E-08	2.10E-07
2,4,6-Trinitrotoluene		3.77E-06	
2,4-Dinitrotoluene	7.30E+00	6.67E-07	9.13E-08
2-Methylnapthalene	7.30E+01	1.63E-07	2.23E-09
3,4-Methylphenol (m- & p-cresol)	1.80E+02	1.23E-08	6.83E-11
Acenaphthylene	2.20E+02	3.85E-08	1.75E-10
Acetophenone	2.10E-02	4.58E-07	2.18E-05
Alkanes (Paraffins)		1.72E-06	
Alkenes (Olefins)		7.75E-06	
Anthracene	1.10E+03	3.46E-08	3.14E-11
Aromatics		3.22E-06	
Benz(a)anthracene		1.67E-07	
Benzene		1.57E-05	
Benzo(a)pyrene		1.08E-07	
Benzo(b)fluoranthene		1.92E-07	
Benzo(g,h,i)perylene		3.53E-08	
Benzo(k)fluoranthene		1.41E-07	
Benzyl alcohol	1.10E+03	2.80E-08	2.55E-11
Biphenyl	1.80E+02	7.98E-08	4.44E-10
bis (2-Ethylhexyl)phthalate		2.81E-07	
Butylbenzyl phthalate	7.30E+02	3.07E-07	4.20E-10
Carbon Dioxide		3.98E-01	
Carbon Monoxide		7.68E-03	
Carbon Tetrachloride		9.98E-08	
Di-n-butyl phthalate	3.70E+02	2.38E-07	6.44E-10
Di-n-octyl phthalate	7.30E+01	3.65E-07	4.99E-09
Dibenzofuran	1.50E+01	1.59E-08	1.06E-09
Dichloromethane		7.76E-05	
Diethyl phthalate	2.90E+03	1.86E-07	6.42E-11
Dimethyl phthalate	3.70E+04	7.84E-08	2.12E-12
Ethylbenzene	1.10E+03	5.38E-07	4.89E-10
Fluoranthene	1.50E+02	1.13E-06	7.55E-09
Fluorene	1.50E+02	8.96E-09	5.97E-11
Freon 11		4.00E-07	
Freon 113		9.98E-08	
Freon 12		1.64E-07	
HMX	1.80E+02	5.48E-07	3.04E-09
Hydrogen Chloride	2.10E+01	2.60E-04	1.24E-05
Hydrogen Fluoride		3.82E-03	
Indeno (1,2,3 - cd) pyrene		3.92E-08	
m- & p-Xylene *	7.30E+03	1.85E-06	2.53E-10
Methane		4.37E-05	
Methyl chloride		1.35E-07	
n-Nitrosodiphenylamine		2.02E-08	

LONG-TERM NONCARCINOGENIC HAZARD QUOTIENTS FOR ASBURY CENTER LONG-TERM HEALTH CARE CENTER RECEPTOR

Receptor:	**Asbury Center Long-Term Health Care Center**		
	Reference Concentration ($\mu g/m^3$)	Average Annual Concentration ($\mu g/m^3$)	Annual Hazard Quotient
Compound			
Naphthalene	3.30E+00	3.15E-07	9.53E-08
Nitrogen Dioxide (peroxide)	3.70E+03	1.56E-04	4.23E-08
Nitrogen Oxide	3.70E+02	2.14E-03	5.79E-06
o-Xylene	7.30E+03	7.41E-07	1.01E-10
p-Ethyltoluene		1.31E-07	
Phenanthrene		6.08E-08	
Phenol	2.20E+03	1.29E-07	5.84E-11
PM10		1.18E-01	
Pyrene	1.10E+02	4.57E-07	4.15E-09
RDX		3.63E-06	
Styrene	1.00E+03	3.39E-07	3.39E-10
Tetrachloroethylene		4.94E-06	
TO - 12 (NMOC)		1.95E-05	
Toluene	4.20E+02	6.19E-07	1.47E-09
Total Non-methane Hydrocarbons		2.92E-04	
Total Non-methane Organic Compounds		7.95E-05	
Total Unidentified Hydrocarbons		1.25E-05	
Total (Hazard Index)			4.06E-05

* Used lower reference concentration of m-xylene and p-xylene.

LONG-TERM NONCARCINOGENIC HAZARD QUOTIENTS FOR ALLENDALE CHILD CARE CENTER RECEPTOR

Receptor:	**Allendale Child Care Center**		
	Reference Concentration	Average Annual Concentration	Annual Hazard
Compound	($\mu g/m^3$)	($\mu g/m^3$)	Quotient
1,2,4-Trimethylbenzene	6.20E+00	2.65E-07	4.27E-08
1,3 - Butadiene		1.22E-07	
1,3,5-Trimethylbenzene	6.20E+00	9.89E-08	1.60E-08
1,3,5-Trinitrobenzene	1.10E+02	4.54E-06	4.13E-08
1,3-Dinitrobenzene	3.70E-01	7.65E-08	2.07E-07
2,4,6-Trinitrotoluene		3.72E-06	
2,4-Dinitrotoluene	7.30E+00	6.57E-07	9.00E-08
2-Methylnapthalene	7.30E+01	1.60E-07	2.20E-09
3,4-Methylphenol (m- & p-cresol)	1.80E+02	1.21E-08	6.74E-11
Acenaphthylene	2.20E+02	3.80E-08	1.73E-10
Acetophenone	2.10E-02	4.52E-07	2.15E-05
Alkanes (Paraffins)		1.70E-06	
Alkenes (Olefins)		7.64E-06	
Anthracene	1.10E+03	3.41E-08	3.10E-11
Aromatics		3.18E-06	
Benz(a)anthracene		1.64E-07	
Benzene		1.55E-05	
Benzo(a)pyrene		1.06E-07	
Benzo(b)fluoranthene		1.89E-07	
Benzo(g,h,i)perylene		3.48E-08	
Benzo(k)fluoranthene		1.39E-07	
Benzyl alcohol	1.10E+03	2.76E-08	2.51E-11
Biphenyl	1.80E+02	7.87E-08	4.37E-10
bis (2-Ethylhexyl)phthalate		2.77E-07	
Butylbenzyl phthalate	7.30E+02	3.02E-07	4.14E-10
Carbon Dioxide		3.93E-01	
Carbon Monoxide		7.57E-03	
Carbon Tetrachloride		9.84E-08	
Di-n-butyl phthalate	3.70E+02	2.35E-07	6.34E-10
Di-n-octyl phthalate	7.30E+01	3.59E-07	4.92E-09
Dibenzofuran	1.50E+01	1.57E-08	1.05E-09
Dichloromethane		7.65E-05	
Diethyl phthalate	2.90E+03	1.84E-07	6.33E-11
Dimethyl phthalate	3.70E+04	7.73E-08	2.09E-12
Ethylbenzene	1.10E+03	5.30E-07	4.82E-10
Fluoranthene	1.50E+02	1.12E-06	7.44E-09
Fluorene	1.50E+02	8.83E-09	5.89E-11
Freon 11		3.95E-07	
Freon 113		9.84E-08	
Freon 12		1.62E-07	
HMX	1.80E+02	5.40E-07	3.00E-09
Hydrogen Chloride	2.10E+01	2.57E-04	1.22E-05
Hydrogen Fluoride		3.77E-03	
Indeno (1,2,3 - cd) pyrene		3.87E-08	
m- & p-Xylene *	7.30E+03	1.82E-06	2.50E-10
Methane		4.31E-05	
Methyl chloride		1.33E-07	
n-Nitrosodiphenylamine		1.99E-08	
Naphthalene	3.30E+00	3.10E-07	9.39E-08
Nitrogen Dioxide (peroxide)	3.70E+03	1.54E-04	4.17E-08
Nitrogen Oxide	3.70E+02	2.11E-03	5.70E-06
o-Xylene	7.30E+03	7.30E-07	1.00E-10
p-Ethyltoluene		1.29E-07	
Phenanthrene		5.99E-08	
Phenol	2.20E+03	1.27E-07	5.76E-11
PM10		1.16E-01	
Pyrene	1.10E+02	4.50E-07	4.09E-09
RDX		3.58E-06	
Styrene	1.00E+03	3.34E-07	3.34E-10
Tetrachloroethylene		4.87E-06	

LONG-TERM NONCARCINOGENIC HAZARD QUOTIENTS FOR ALLENDALE CHILD CARE CENTER RECEPTOR

Receptor:	Allendale Child Care Center		
	Reference Concentration	Average Annual Concentration	Annual Hazard
Compound	($\mu g/m^3$)	($\mu g/m^3$)	Quotient
TO - 12 (NMOC)		1.93E-05	
Toluene	4.20E+02	6.11E-07	1.45E-09
Total Non-methane Hydrocarbons		2.88E-04	
Total Non-methane Organic Compounds		7.84E-05	
Total Unidentified Hydrocarbons		1.23E-05	
Total (Hazard Index)			4.00E-05
* Used lower reference concentration of m-xylene and p-xylene.			

LONG-TERM NONCARCINOGENIC HAZARD QUOTIENTS FOR CLOSEST RESIDENCE RECEPTOR

Receptor:	**Closest Residence**		
	Reference Concentration	Average Annual Concentration	Annual Hazard
Compound	($\mu g/m^3$)	($\mu g/m^3$)	Quotient
1,2,4-Trimethylbenzene	6.20E+00	8.46E-07	1.36E-07
1,3 - Butadiene		3.91E-07	
1,3,5-Trimethylbenzene	6.20E+00	3.16E-07	5.10E-08
1,3,5-Trinitrobenzene	1.10E+02	1.45E-05	1.32E-07
1,3-Dinitrobenzene	3.70E-01	2.45E-07	6.61E-07
2,4,6-Trinitrotoluene		1.19E-05	
2,4-Dinitrotoluene	7.30E+00	2.10E-06	2.88E-07
2-Methylnapthalene	7.30E+01	5.12E-07	7.02E-09
3,4-Methylphenol (m- & p-cresol)	1.80E+02	3.88E-08	2.15E-10
Acenaphthylene	2.20E+02	1.21E-07	5.52E-10
Acetophenone	2.10E-02	1.44E-06	6.88E-05
Alkanes (Paraffins)		5.42E-06	
Alkenes (Olefins)		2.44E-05	
Anthracene	1.10E+03	1.09E-07	9.91E-11
Aromatics		1.02E-05	
Benz(a)anthracene		5.25E-07	
Benzene		4.96E-05	
Benzo(a)pyrene		3.39E-07	
Benzo(b)fluoranthene		6.06E-07	
Benzo(g,h,i)perylene		1.11E-07	
Benzo(k)fluoranthene		4.44E-07	
Benzyl alcohol	1.10E+03	8.83E-08	8.03E-11
Biphenyl	1.80E+02	2.52E-07	1.40E-09
bis (2-Ethylhexyl)phthalate		8.84E-07	
Butylbenzyl phthalate	7.30E+02	9.66E-07	1.32E-09
Carbon Dioxide		1.26E+00	
Carbon Monoxide		2.42E-02	
Carbon Tetrachloride		3.15E-07	
Di-n-butyl phthalate	3.70E+02	7.50E-07	2.03E-09
Di-n-octyl phthalate	7.30E+01	1.15E-06	1.57E-08
Dibenzofuran	1.50E+01	5.02E-08	3.34E-09
Dichloromethane		2.45E-04	
Diethyl phthalate	2.90E+03	5.87E-07	2.02E-10
Dimethyl phthalate	3.70E+04	2.47E-07	6.68E-12
Ethylbenzene	1.10E+03	1.69E-06	1.54E-09
Fluoranthene	1.50E+02	3.57E-06	2.38E-08
Fluorene	1.50E+02	2.82E-08	1.88E-10
Freon 11		1.26E-06	
Freon 113		3.15E-07	
Freon 12		5.18E-07	
HMX	1.80E+02	1.73E-06	9.59E-09
Hydrogen Chloride	2.10E+01	8.20E-04	3.91E-05
Hydrogen Fluoride		1.20E-02	
Indeno (1,2,3 - cd) pyrene		1.24E-07	
m- & p-Xylene *	7.30E+03	5.83E-06	7.98E-10
Methane		1.38E-04	
Methyl chloride		4.26E-07	
n-Nitrosodiphenylamine		6.36E-08	
Naphthalene	3.30E+00	9.91E-07	3.00E-07
Nitrogen Dioxide (peroxide)	3.70E+03	4.93E-04	1.33E-07
Nitrogen Oxide	3.70E+02	6.75E-03	1.82E-05
o-Xylene	7.30E+03	2.33E-06	3.20E-10
p-Ethyltoluene		4.12E-07	
Phenanthrene		1.92E-07	
Phenol	2.20E+03	4.05E-07	1.84E-10
PM10		3.72E-01	
Pyrene	1.10E+02	1.44E-06	1.31E-08
RDX		1.14E-05	
Styrene	1.00E+03	1.07E-06	1.07E-09
Tetrachloroethylene		1.56E-05	

LONG-TERM NONCARCINOGENIC HAZARD QUOTIENTS FOR CLOSEST RESIDENCE RECEPTOR

Receptor:	**Closest Residence**		
	Reference Concentration	Average Annual Concentration	Annual Hazard
Compound	($\mu g/m^3$)	($\mu g/m^3$)	Quotient
TO - 12 (NMOC)		6.16E-05	
Toluene	4.20E+02	1.95E-06	4.65E-09
Total Non-methane Hydrocarbons		9.20E-04	
Total Non-methane Organic Compounds		2.51E-04	
Total Unidentified Hydrocarbons		3.92E-05	
Total (Hazard Index)			1.28E-04
* Used lower reference concentration of m-xylene and p-xylene.			

APPENDIX E-2-8

MAXIMUM DAILY TREATMENT
QUANTITIES FOR WASTE MATERIALS CONTAINING FLUORINE

APPEN -2-8

MAXIMUM DAILY TREATMENT QUANTITIES FOR
WASTE MATERIALS CONTAINING FLUORINE

Waste Material	Additive	Percent Additive	HF Emissions (lbs/5000 pounds new)	Emission Factor (lb/lb)	1-hour HF Concentration/5000 LBS	12-hour Concentration/5000 lbs NEW	Maximum Allowable Treatment Quantity to Meet HF Air Quality Standards (lbs NEW)	
LX-04	Viton-A	15	495.23	0.1043	3.14E+02	2.61E+01	707	
LX-07	Viton-A	10	331.8	0.0699	2.10E+02	1.75E+01	1,056	
LX-10-2	Viton-A	5.4	179.17	0.0377	1.14E+02	9.46E+00	1,955	
PBXN-7	Viton-A	5	165.9	0.0349	1.05E+02	8.76E+00	2,112	
PBXN-5	Viton-A	5	165.9	0.0349	1.05E+02	8.76E+00	2,112	
PBXN-6	Viton-A	5	165.9	0.0349	1.05E+02	8.76E+00	2,112	
LX-17	Kel-F	7.5	189.59	0.0399	1.20E+02	1.00E+01	1,848	
PBX-9502	Kel-F	5	126.39	0.0266	8.01E+01	6.67E+00	2,772	
HDX-106	Teflon	1.4	53.19	0.0112	3.37E+01	2.81E+00	5,000	
LX-09	FEFO	2.3	13.65	0.0029	8.65E+00	7.21E-01	5,000	
1-hr concentration = (Maximum Offsite 1-hour Unit Emission Rate Concentration for CO) x (HF emission factor/CO emission factor)								
12-hr concentration = 1-hour concentration/12								
Maximum Treatment Quantity = 5000 lbs x [(12-hour concentration @ 5,000 lbs)/(Highest 12-hour fluorine concentration/12 hr fluorine air quality standard)								
HF emission calculations for each additive are shown in Appendix E-2-4.								

APPENDIX E-2-9

ESTIMATION OF PM 2.5 SIZE DISTRIBUTION

FOR THE COMBUSTION OF WASTE MATERIALS

AT HSAAP

APPENDIX E-2-9

ESTIMATION OF PM2.5 SIZE DISTRIBUTION FOR THE COMBUSTION OF WASTE MATERIALS AT HSAAP

Particulate matter size distribution for HSAAP waste treatment emissions is not available. Due to the extreme exothermic reaction associated with open burn treatment, sample collection can not be accomplished using traditional sampling methods. Very high combustion temperatures present safely and potential equipment destruction issues presently prohibit the collection of sample emissions. As a result, a literature search was conducted to identify technical information or related emission studies that may provide an indication of the PM2.5 cumulative mass for waste burning at HSAAP.

The U.S. EPA maintains a database (AP-42) of air pollution emission factors for hundreds of stationary sources. The database is arranged in source category groups. The group that is most related to waste treatment at HSAAP is the External Combustion source group. Within Sections 1.1 and 1.2, PM2.5 cumulative mass percentages are presented for the uncontrolled combustion of Anthracite, Bituminous, and Subbituminous coal. The open burning of waste materials at HSAAP is also uncontrolled. The cumulative uncontrolled mass for each source category is shown in Table 1.

TABLE 1
PM2.5 CUMULATIVE MASS DISTRIBUTION FOR UNCONTROLLED SOURCES

Source Category	Uncontrolled PM2.5 Cumulative Mass (%)
Dry Bottom Boiler Burning Pulverized Anthracite Coal	6
Underfeed Stokers Burning Bituminous Coal	25
Overfeed Stokers Burning Bituminous Coal	14
Spreader Stokers Burning Bituminous Coal	7
Cyclone Furnaces Burning Bituminous Coal	5.5
Wet Bottom Boilers Burning Pulverized Bituminous Coal	21
NASA Aluminum Oxide Particulate Model Estimate[1]	10[a]

1 – National Aeronautics and Space Administration (NASA)/MSFC Multilayer Diffusion Models and Computer Program for Operational Prediction of Toxic Fuel Hazards", H.E. Cramer Company, TR-73-301-02, March 1973.
a – PM2.5 as a percentage of total particulate.

In a separate study, the National Aeronautics and Space Administration (NASA, 1973) estimated the size distribution of aluminum oxide particulate from the combustion exhaust of rocket propellants, which are in the same material category as the propellants treated at HSAAP. In this study, NASA develop source inputs for used in their Multilayer Diffusion Model Program use to predict ambient air concentrations. It was assumed that 98 percent of the mass of aluminum oxide particulate was associated with particulate diameters less than 150 micrometers (μm). A logarithmic size distribution was created over 10 size intervals. The estimated PM2.5 calculated by the model is shown in Table 1.

It is important to note that the 10 percent cumulative mass distribution shown in Table 1 for PM2.5 is the percent of total particulate. The NASA model estimated PM10 to be approximately 40 percent of total particulate. Assuming HSAAP waste emissions are entirely in the PM10 size fraction, as assumed in the HSAAP Air Pathway Analysis, PM2.5 would then be about 25 percent of the PM10 size fraction (10 percent/40 percent). This mass percent is equivalent to the largest percent mass for the coal combustion sources shown in Table 1. As a result, the most conservative estimate of the ratio of PM2.5 to PM10 would be 0.25. This ratio was then used to convert OBODM predicted PM10 concentrations to PM2.5 concentrations. The calculation used to make this conversion is shown below:

Estimated PM2.5 concentration = (OBODM PM10 concentration) x 0.25

The estimated PM2.5 concentrations were then compared to the PM2.5 NAAQS in Section E-2-4(d)(1).

REFERENCE

National Aeronautics and Space Administration (NASA), "NASA/MSFC Multilayer Diffusion Models and Computer Program for Operational Prediction of Toxic Fuel Hazards", H.E. Cramer Company, TR-73-301-02, March 1973."

APPENDIX E-2-10

A STUDY COMPARING THE USE OF AVERAGE EMISSION FACTORS VERSUS MAXIMUM EMISSION FACTORS IN THE HSAAP AIR PATHWAY ASSESSMENT

5. 0 MODELING ASSESSMENT EVALUATION CRITERIA

5.1 Ambient Air Quality Standards

Other than the state adopted National Ambient Air Quality Standards (NAAQS), the State of Tennessee does not have ambient criteria for hazardous air pollutants. The air dispersion modeling assessment will compare the calculated averaging period concentrations of all combustion species against applicable NAAQS. In addition, annual concentrations will be compared to ambient air concentrations developed for use with risk-based screening criteria. The risk based screening criteria were developed by USEPA Region III for use in identifying and focusing on dominant contaminants of concern and exposure routes in baseline risk assessments. The Region III risk-based criteria is given in Attachment III.

5.2 Risk Assessment

The risk assessment for the inhalation pathway will calculate compound specific risks and hazards and will be summed to determine the cumulative hazard and risk from the USEPA Region III screening values. Cumulative risk will be evaluated against a target cancer risk of 1.0 E-06 and a target hazard index of unity (1).

6.0 CONCENTRATION CALCULATION METHODOLOGY

The OBODM will be used to calculate short term and long term concentrations at all receptors identified in Section 3.0 for all combustion species having either an NAAQS or an associated risk-based screen air concentration. Short and long term air concentrations will be calculated for each of the 5 years of meteorological data and the highest calculated concentrations for each averaging period will be compared to the applicable NAAQS or risk-based air criteria.

In the case of combustion products having short term (24 hour or less) criteria, it will be assumed that the daily treatment limit of 5,000 pounds is treated in 1 hour and that no additional treatment takes place for the remaining hours in the averaging period. For example, if a combustion species has a 1-hour and an 8-hour NAAQS, the maximum 1-hour concentration will be used to calculate the maximum 8-hour concentration assuming the no additional treatment takes place during the remaining 7 hours in the 8-hour averaging period. The equation that would be used to calculate the maximum 8-hour average is as follows:

$$\text{Max Conc}_{8\text{-hr}} = (\text{Max Conc}_{1\text{-hr}})/8$$

Maximum annual average concentrations will be calculated by the OBODM using the 5 years of hourly meteorological data assuming that treatment is conducted 5 days per week, 50 weeks per year between the hours of Noon and 4:00 P.M. The OBODM will calculate the annual average based on daily calculations at the hours of Noon, 1:00 P. M., 2:00 P. M., and 3:00 P.M. The maximum annual average for the 5 years of data will then be adjusted to account for only 1 hour of treatment per day rather than 4 hours as calculated by the model. The adjustment will be made as follows:

$$\text{Max Annual}_{adj} = (\text{OBODM}_{annual})/4$$

APPENDIX E-2-10

A STUDY COMPARING THE USE OF AVERAGE EMISSION FACTORS VERSUS MAXIMUM EMISSION FACTORS IN THE HSAAP AIR PATHWAY ASSESSMENT

The RCRA Air Pathway Assessment (APA) conducted for the opening burning of waste materials at the HSAAP Burn Pan Unit used emission factors obtained from the Bang Box test studies conducted at the Dugway Proving Grounds located in Dugway, Utah. The emission factors were based on tests conducted using more than 20 military munitions items. Several of the munitions tested were similar to the propellant and explosive formulations treated at HSAAP. In certain cases, more than one test was conducted on selective formulations.

In the HSAAP APA, emission factors for individual chemical compounds were developed on the basis of averaging all test results, including non-detected values, which were assumed to be zero. After reviewing the initial permit application submittal, the Tennessee Department of Environment and Conservation (TDEC) commented that emission factor averaging is not considered to be a conservative approach and requested that HSAAP re-evaluate the OBODM results based on the maximum emission factor obtained in the Dugway Bang Box tests to determine maximum risk and hazard from treatment operations.

In order to demonstrate the impact of using the maximum Bang Box emission factors, Table 1 has been prepared showing a comparison between maximum compound emission factors for all Bang Box tests and the short term and long term average emission factors used in the HSAAP APA, and the ratio of the highest emission factor to the average emission factor used in the HSAAP APA. The compounds listed in Table 1 were used in the APA to calculate total annual risk and total annual hazard (see Tables E-2-7 and E-2-8). As shown in Table 1, the maximum ratio for short-term emission factors is about three times higher, and the maximum ratio for long-term emission factors almost five times higher, if the maximum emission factor is applied to the OBODM results.

Tables E-2-7 and E-2-8 show the total annual risk and hazard based on the use of average emission factor data. Based on the evaluation presented in Table 1, the results in Table E-2-7 and E-2-8 of the permit application were multiplied by a factor of five to obtain the maximum annual risk and hazard based on the maximum Bang Box emission factors. Tables 2 and 3 show the annual risk and annual hazard, respectively, based on the maximum emission factors. As shown in both tables, the annual risk and annual hazard are still well below the risk (1.0×10^{-6}) and hazard (1.0) target criteria after consideration of the maximum emission factor data. This result does not change the conclusions of the HSAAP APA.

New 2003

TABLE 1
A COMPARISON OF AVERAGE AND MAXIMUM SHORT TERM AND LONG TERM EMISSION FACTORS
HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TN

Compound	Maximum Emission Factor[1] (lb/lb)	Short-Term Average Emission Factor[2] (lb/lb)	Long-Term Average Emission Factor[3] (lb/lb)	Ratio Of Maximum Emission Factor To Short Term Average Emission Factor	Ratio Of Maximum Emission Factor To Long Term Average Emission Factor
1,2,4-Trimethylbenzene	9.79E-07	9.79E-07	6.36E-07	1.0	1.5
1,3 - Butadiene	5.34E-07	5.34E-07	2.94E-07	1.0	1.8
1,3,5-Trimethylbenzene	3.66E-07	3.66E-07	2.38E-07	1.0	1.5
1,3,5-Trinitrobenzene	2.88E-05	1.53E-05	1.09E-05	1.9	2.6
1,3-Dinitrobenzene	2.83E-07	2.83E-07	1.84E-07	1.0	1.5
2,4,6-Trinitrotoluene	3.45E-05	1.38E-05	8.94E-06	2.5	3.9
2,4-Dinitrotoluene	7.55E-06	2.59E-06	1.58E-06	2.9	4.8
2-Methylnapthalene	1.78E-06	6.26E-07	3.85E-07	2.8	4.6
3,4-Methylphenol (m- & p-cresol)	5.30E-08	5.30E-08	2.92E-08	1.0	1.8
Acenaphthylene	1.66E-07	1.66E-07	9.13E-08	1.0	1.8
Acetophenone	5.18E-06	1.78E-06	1.09E-06	2.9	4.8
Alkanes (Paraffins)	1.14E-05	4.90E-06	4.08E-06	2.3	2.8
Alkenes (Olefins)	4.14E-05	2.50E-05	1.84E-05	1.7	2.3
Anthracene	1.49E-07	1.49E-07	8.20E-08	1.0	1.8
Aromatics	2.35E-05	8.81E-06	7.64E-06	2.7	3.1
Benz(a)anthracene	7.18E-07	7.18E-07	3.95E-07	1.0	1.8
Benzene	6.90E-05	2.68E-05	3.73E-05	2.6	1.8
Benzo(a)pyrene	4.64E-07	4.64E-07	2.55E-07	1.0	1.8
Benzo(b)fluoranthene	8.28E-07	8.28E-07	4.55E-07	1.0	1.8
Benzo(g,h,i)perylene	1.52E-07	1.52E-07	8.36E-08	1.0	1.8
Benzo(k)fluoranthene	6.07E-07	6.07E-07	3.34E-07	1.0	1.8
Benzyl alcohol	1.92E-07	7.87E-08	6.64E-08	2.4	2.9
Biphenyl	3.44E-07	3.44E-07	1.89E-07	1.0	1.8
bis (2-Ethylhexyl)phthalate	1.69E-06	8.37E-07	6.65E-07	1.9	2.5
Butylbenzyl phthalate	2.91E-06	1.13E-06	7.27E-07	2.6	4.0
Carbon Dioxide	1.42E+00	1.08E+00	9.44E-01	1.3	1.5
Carbon Monoxide	3.10E-02	1.41E-02	1.82E-02	2.2	1.7
Carbon Tetrachloride	3.64E-07	3.64E-07	2.37E-07	1.0	1.5
Di-n-butyl phthalate	2.51E-06	9.06E-07	5.64E-07	2.8	4.4
Di-n-octyl phthalate	2.30E-06	1.06E-06	8.64E-07	2.2	2.7
Dibenzofuran	6.86E-08	6.86E-08	3.77E-08	1.0	1.8
Dichloromethane	2.83E-04	2.83E-04	1.84E-04	1.0	1.5
Diethyl phthalate	1.93E-06	7.05E-07	4.42E-07	2.7	4.4
Dimethyl phthalate	2.86E-07	2.86E-07	1.86E-07	1.0	1.5
Ethylbenzene	1.96E-06	1.96E-06	1.27E-06	1.0	1.5
Fluoranthene	4.88E-06	4.88E-06	2.68E-06	1.0	1.8
Fluorene	3.86E-08	3.86E-08	2.12E-08	1.0	1.8
Freon 11	1.46E-06	1.46E-06	9.49E-07	1.0	1.5
Freon 113	3.64E-07	3.64E-07	2.37E-07	1.0	1.5
Freon 12	1.39E-06	5.87E-07	3.89E-07	2.4	3.6
HMX	2.36E-06	2.36E-06	1.30E-06	1.0	1.8
Hydrogen Chloride[4]		1.33E-02	6.17E-04	1.0	1.0
Hydrogen Fluoride[5]		1.04E-01	9.06E-03	1.0	1.0
Indeno (1,2,3 - cd) pyrene	1.69E-07	1.69E-07	9.30E-08	1.0	1.8
m- & p-Xylene	6.74E-06	6.74E-06	4.38E-06	1.0	1.5
Methane	2.00E-04	7.28E-05	1.04E-04	2.7	1.9
Methyl chloride	7.38E-07	4.11E-07	3.20E-07	1.8	2.3
n-Nitrosodiphenylamine	8.70E-08	8.70E-08	4.79E-08	1.0	1.8
Naphthalene	3.58E-06	1.23E-06	7.45E-07	2.9	4.8
Nitrogen Dioxide (peroxide)	6.00E-04	2.86E-04	3.71E-04	2.1	1.6
Nitrogen Oxide	9.28E-03	6.46E-03	5.07E-03	1.4	1.8
o-Xylene	2.70E-06	2.70E-06	1.76E-06	1.0	1.5
p-Ethyltoluene	7.36E-07	3.94E-07	3.10E-07	1.9	2.4
Phenanthrene	6.07E-07	2.28E-07	1.44E-07	2.7	4.2
Phenol	1.52E-06	5.07E-07	3.05E-07	3.0	5.0
PM10[5]	2.80E-01	2.80E-01	2.80E-01	1.0	1.0
Pyrene	5.32E-06	1.79E-06	1.08E-06	3.0	4.9
RDX	1.00E-05	8.40E-06	8.60E-06	1.2	1.2
Styrene	1.46E-06	1.46E-06	8.03E-07	1.0	1.8
Tetrachloroethylene	1.80E-05	1.80E-05	1.17E-05	1.0	1.5
TO - 12 (NMOC)	8.42E-05	8.42E-05	4.63E-05	1.0	1.8
Toluene	3.92E-06	1.79E-06	1.47E-06	2.2	2.7
Total Non-methane Hydrocarbons	1.30E-03	4.84E-04	6.92E-04	2.7	1.9
Total Non-methane Organic Compounds	2.90E-04	2.90E-04	1.89E-04	1.0	1.5
Total Unidentified Hydrocarbons	4.54E-05	4.54E-05	2.95E-05	1.0	1.5

[1] Maximum emission factor for all Dugway Bang Box tests.

[2] Average short term emission factor used in the HSAAP APA.

[3] Average long ter emission factor used in the HSAAP APA.

[4] Hydrogen Chloride Emission Factor based on maximum (for short-term) and average (for long-term) chlorine content of items treated at HSAAP

[5] Hydrogen Fluoride Emission Factor based on maximum (for short-term) and average (for long-term) fluorine content of items treated at HSAAP

TOTAL RISK AND HAZARD CALCULATIONS FOR ALL RECEPTORS

Sheets:	Maximum Offsite - Carcinogens			Maximum Offsite - Noncarcinogens				
	S1 - Carcinogens			S1 - Noncarcinogens				
	S2 - Carcinogens			S2 - Noncarcinogens				
	S3 - Carcinogens			S3 - Noncarcinogens				
	S4 - Carcinogens			S4 - Noncarcinogens				
	S5 - Carcinogens			S5 - Noncarcinogens				
	S6 - Carcinogens			S6 - Noncarcinogens				
	S7 - Carcinogens			S7 - Noncarcinogens				
	S8 - Carcinogens			S8 - Noncarcinogens				
	Hospital - Carcinogens			Hospital - Noncarcinogens				
	LTHCC - Carcinogens			LTHCC - Noncarcinogens				
	Day Care - Carcinogens			Day Care - Noncarcinogens				
	Residence - Carcinogens			Residence - Noncarcinogens				
Calculations:								
Carcinogenic and noncarcinogenic hazard quotients are calculated separately for each receptor, using the annual ground-level concentrations (GLCs) calculated in the GLCS.XLS spreadsheet. Reference concentrations are from *EPA Region III Risk-Based Concentration Table*, April 13, 2000. The individual hazard quotients for each chemical (whether carcinogenic or noncarcinogenic) are calculated by taking a ratio of the GLC to the reference concentration. A hazard index for the receptor is calculated by summing the individual hazard quotients.								
Example:								
Sheet:				Maximum Offsite - Carcinogens				
Compound:				1,3-Butadiene				
Annual Average GLC:				6.92E-07				
Reference Concentration:				3.50E-03				
1,3-Butadiene Risk				1.98E-10				

TABLE 2

TOTAL ANNUAL RISK AT THE MAXIMUM OFFSITE
AND DISCRETE RECEPTORS BASED
ON MAXIMUM EMISSION FACTORS
FOR THE HSAAP BURN PAN UNIT
HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TN

Receptor - Identifier	Total Annual Risk
Maximum Offsite*	9.0 E-09
Sullivan Middle School - S1	6.0 E-10
Sevier Middle School - S2	8.0 E-10
Robinson Middle School – S3	6.0 E-10
Roosevelt Elementary School - S4	1.1 E-09
Lynn View Middle School - S5	6.0 E-10
Washington Elementary - S6	1.4 E-09
Mt. Carmel School - B/S7	1.9 E-09
Church Hill Elementary - S8	4.9 E-10
Holston Valley Hospital and Medical Center- H	8.5 E-10
Asbury Center Long Term Care - LT1	1.6 E-09
Allendale Child Care - B/DC1	1.6 E-09
Closest Public Residence - CR	5.0 E-09

* The maximum annual offsite receptor is located along the 129.6° radial at a distance of 1,506 meters from the Burn Pan Unit.

TABLE 3

TOTAL ANNUAL HAZARD INDEX AT THE MAXIMUM OFFSITE
AND DISCRETE RECEPTORS BASED
ON MAXIMUM EMISSION FACTORS
HSAAP BURN PAN UNIT
HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TN

Receptor - Identifier	Total Hazard Index
Maximum Offsite*	1.2 E-03
Sullivan Middle School - S1	7.5 E-05
Sevier Middle School - S2	1.1 E-04
Robinson Middle School - S3	7.5 E-05
Roosevelt Elementary School - S4	1.4 E-04
Lynn View Middle School - S5	7.5 E-05
Washington Elementary - S6	1.7 E-04
Mt. Carmel School - B/S7	1.4 E-04
Church Hill Elementary - S8	6.5 E-05
Holston Valley Hospital and Medical Center - H	1.1 E-04
Asbury Center Long Term Care - LT1	2.0 E-04
Allendale Child Care - B/DC1	2.0 E-04
Closest Public Residence - CR	6.5 E-04

* The maximum annual offsite receptor is located along the 129.6° radial at a distance of 1,506 meters from the Burn Pan Unit.

APPENDIX IV

Human Health and Ecological Conceptual Site Models

Transport Pathway Disposition

1) Contaminants become airborne during burning. Airborne dust can be deposited onto onsite and off-Site surface soils.

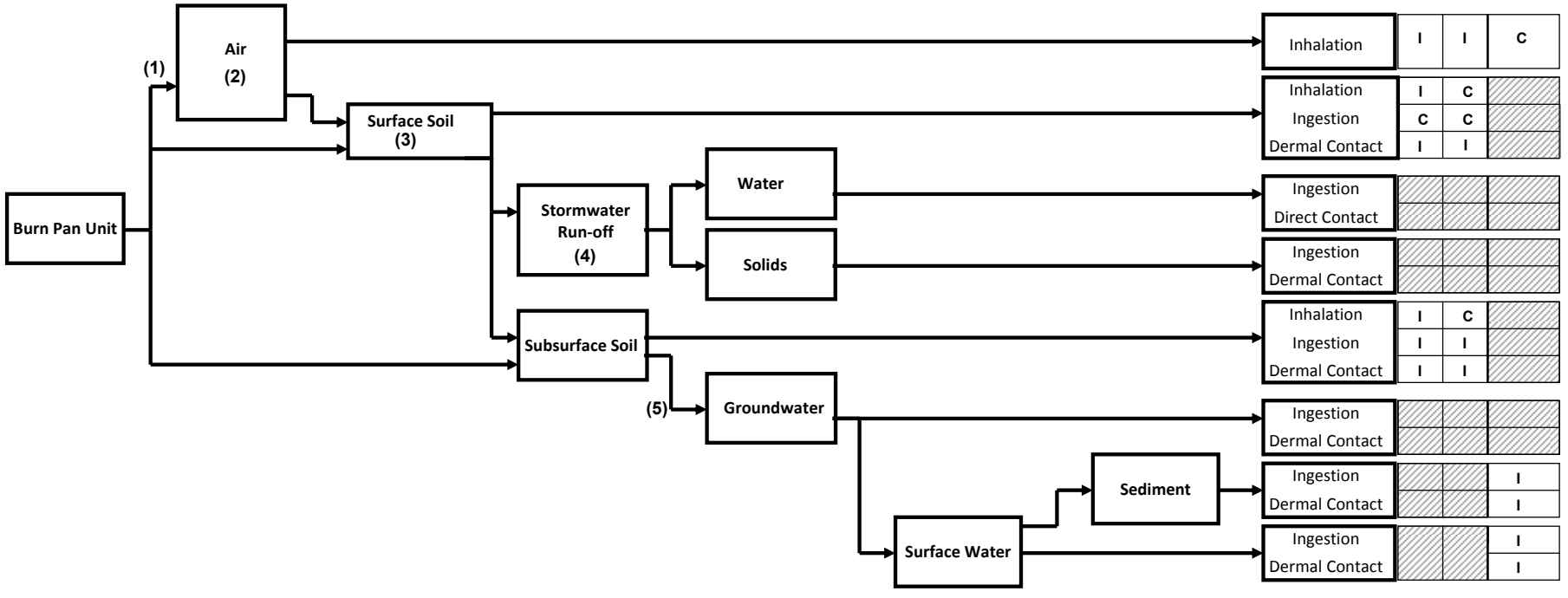
2) Inhalation pathway related to air emissions is potentially complete for off-Site residents but insignificant for on-Site worker since they are not present on the Site during burning.

3.) Incidental ingestion of surface soils is complete for on-Site workers and on-Site construction workers and incomplete for residents who have no access to the site.

Inhalation of constituents in soils are insignificant for the on-Site worker since a 3 to 4-inch gravel layer covers the Site, and complete for the construction worker who might be exposed to soils during excavation activities. Incomplete for off-Site residents since the Burn Pan Unit berm reduces soils from becoming windborne.

4.) Stormwater runoff is captured in basin within the Burn Pan unit and routed to the HSAAP wastewater treatment. Therefore, exposure to receptors is incomplete.

5.) Groundwater exposure is incomplete since drinking water is provided by a potable source and exposure to surface water is anticipated to be incomplete for on-Site worker and construction worker who will not be conducting work related activities in the Holston River, and insignificant for off-Site receptors due to limited recreational activities in the Holston River.



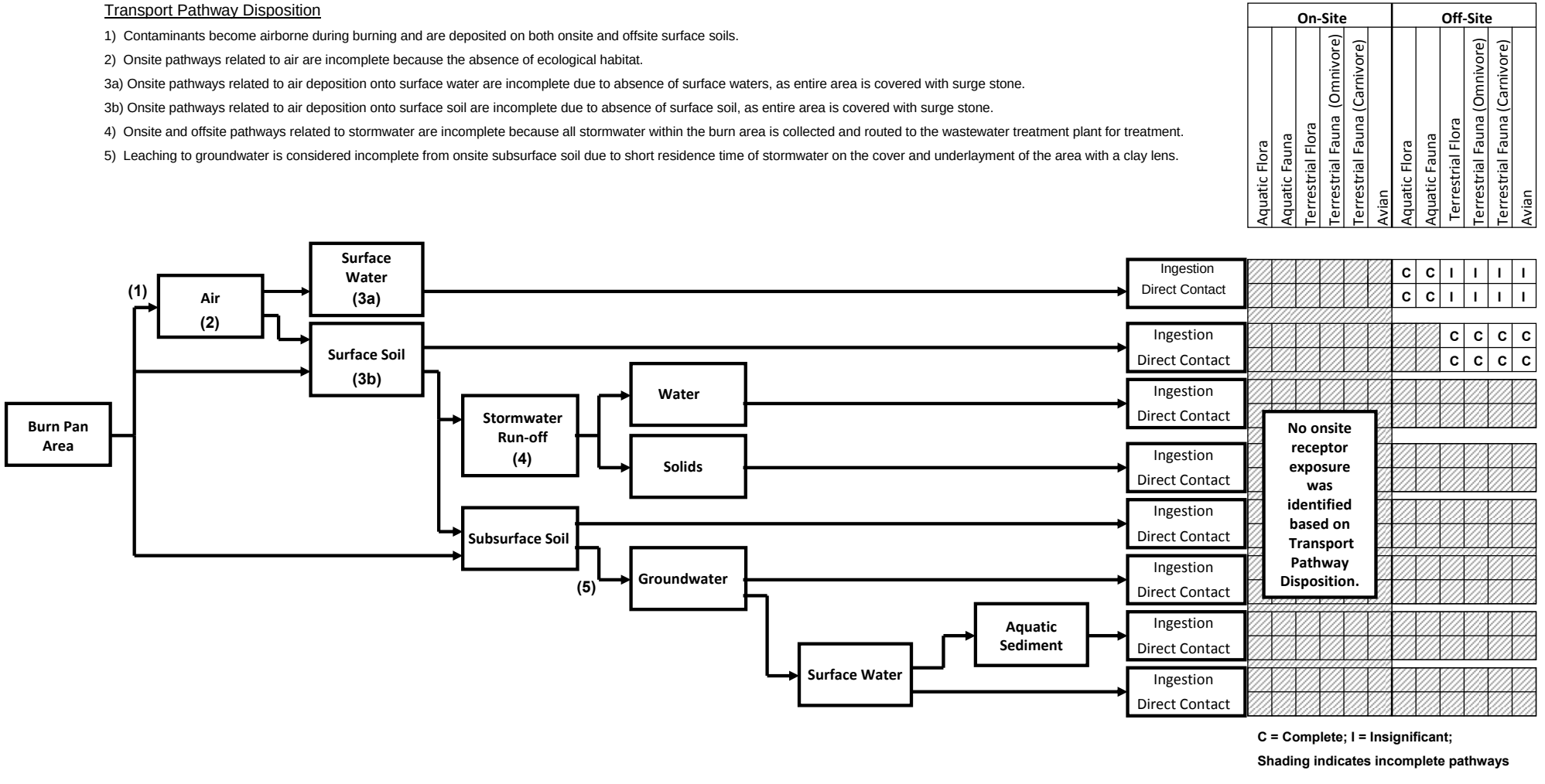
C = Complete; I = Insignificant;

Shading indicates incomplete pathways

S&ME Knoxville, TN	Conceptual Human Health Exposure Model Burn Pan Unit Holston Army Ammunition Plant Kingsport, Tennessee March 2012
Scale: NA	**PM:** LD
Drafted By: MM	**Project No:** 1437-11-347

Transport Pathway Disposition

1) Contaminants become airborne during burning and are deposited on both onsite and offsite surface soils.
2) Onsite pathways related to air are incomplete because the absence of ecological habitat.
3a) Onsite pathways related to air deposition onto surface water are incomplete due to absence of surface waters, as entire area is covered with surge stone.
3b) Onsite pathways related to air deposition onto surface soil are incomplete due to absence of surface soil, as entire area is covered with surge stone.
4) Onsite and offsite pathways related to stormwater are incomplete because all stormwater within the burn area is collected and routed to the wastewater treatment plant for treatment.
5) Leaching to groundwater is considered incomplete from onsite subsurface soil due to short residence time of stormwater on the cover and underlayment of the area with a clay lens.



S&ME, Knoxville, TN	Conceptual Ecological Exposure Model Burn Pan Unit Holston Army Ammunition Plant Kingsport, Tennessee March 2012
Scale: NA	**PM:** LD
Drafted By: MM	**Project No:** 1437-11-347

APPENDIX V

Tetra Tech 2000 Soil Screening-Level Ecological Risk Assessment

SECTION E-4

SCREENING ECOLOGICAL RISK ASSESSMENT

E-4 SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT (ERA)

This section presents the Screening-Level Ecological Risk Assessment (SERA) portion of the report. The goal of the SERA is to conduct an initial screening of the analytical data using very conservative screening values and very conservative assumptions to determine which contaminants and/or sites do not need to be further evaluated as part of a Baseline Ecological Risk Assessment (BERA). This SERA evaluates the likelihood of ecological effects due to site contamination at individual sites. A phased approach to the SERA was used, that relied on environmental chemistry data and field observations for the preliminary assessments.

This SERA consists of the first two of eight steps required by the Environmental Protection Agency (EPA) guidance (EPA, 1997 and 1998). The first two steps are the screening-level assessment. Step 3a further refines the screening level risk assessment. Steps 3b through 7 are conducted if additional evaluations or investigations are necessary. Finally, Step 8, Risk Management, is incorporated throughout the ERA process.

E-4-1 Problem Formulation

E-4-1(a) Environmental Setting

The topography in northeast Tennessee is typical of the Valley and Ridge physiographic province, with parallel ridges and valleys tending northeast to southwest. The Burn Pan Unit is located on the floodplain of the Holston River. The air quality study area extends ten kilometers from the unit. The study area includes all of the HSAAP military reservation, the city of Kingsport and the town of Church Hill. Kingsport borders HSAAP to the north and east. The study area is contained in the Holston River basin. The following description is based on characteristics of the HSAAP.

The following forest description is based on a study of forest management Compartment 6, which is the most natural area on the HSAAP (Caldwell and Copeland, 1992). Other areas south of the river have been logged, and the area north of the river is mainly developed land with some stands of planted pines. Elevations within the study area range from 1,160 feet above mean sea level (amsl) to 2,400 feet amsl. The study area contains a mixture of urban, rural and wooded areas. Most of the urban and rural land use is located north of the site, with possibly 40 percent wooded areas interspersed throughout. Approximately 75 percent of the area south of the site is wooded, with very dynamic relief, especially along the Bays Mountains range. In the study area, diverse geologic and hydrologic conditions have provided the opportunity for diversity in community development. The forest communities along the ridges have been classified as interior upland mesic forest of the calcareous mesophytic type. Upper slope wooded areas are mostly hardwood, consisting of chestnut, oak, red maple, sugar maple, northern red oak, sassafras, and mockernut hickory. Shrub layer trees include red maple, sugar maple, dogwood, basswood, blackgum, serviceberry, sassafras and chestnut oak. Hardwoods in the middle and low slope areas include sugar maple, basswood, tulip tree, red maple and blackgum along with shrub layer trees such as sugar maple, buckeye, dogwood, paw paw and green ash. Spice bush, maple leaf viburnum and wild hydrangea are also found in the low to mid slope hardwood forests. Along the Holston River is a wet-mesic river floodplain forest of the sycamore-American elm bottomland forest type. Box elder dominates the tree layer, and slippery elm, sycamore and black locust are also found interspersed along the Holston River.

Wetlands identified at HSAAP are documented in a report by Holston Defense Corporation dated December 1991 (see Appendix E-4-1). Wetlands were identified by observing hydrology

suitable for wetlands, hydric soils and hydrophytic vegetation. Twelve wetland areas were identified within the HSAAP boundary. Also, one wetland was identified nearby to the east. no wetlands were identified in the immediate vicinity of the burn pan unit.

Federal and State endangered and threatened species are identified for Hawkins County in Appendix E-4-1. The invertebrate species that have both federal and state status include birdwing pearlymussel, green-blossom (pearlymussel), tubercled blossom (pearlymussel), turgid-blossom (pearlymussel), fine-rayed pigtoe (mussel), shiny pigtoe (mussel), cumberland monkeyface (mussel) and purple bean (mussel). The spotfin chub is a federally threatened and state endangered fish. Also, the Indiana bat and the gray bat, are federal and state endangered mammals in the county. Finally, there are plants, birds, mammals, and fish that have state, but not federal, status. Roger McCoy of the Tennessee Division of Natural Heritage also provided species list specifically for the Church Hill and Kingsport 7.5 minute USGS quadrangles, where HSAAP is located (see Appendix E-4-1).

A biological survey was conducted at HSAAP in November 1992 by the Nature Conservancy (Appendix E-4-1). Some additional ecological data for HSAAP was obtained to update information in the biological survey. However, only limited information was available from the surrounding area. Also, the list of potential ecological receptors in the biological survey report are not expected to change significantly since the report was issued. Birds, mammals, invertebrates, reptiles, and amphibians were included in the species list from the biological survey. Specific occurrences of these groups can be found in Appendix E-4-1. The survey identifies the area south of the Holston River as the area of most biological significance, because this is where several natural communities intersect (i.e., floodplain, coves with small waterfalls, riparian corridor, and cliffs). The survey concentrated on this area since it was most likely to harbor rare, threatened, or endangered species.

Charles Saylor of the Tennessee Valley Authority provided fish community data from locations upstream and downstream from the HSAAP. These tables are presented in Appendix E-4-1.

E-4-1(a)(1) Site Description

The HSAAP Burn Pan Unit (the site) is used to burn hazardous waste explosives. The Burn Pan Unit contains four burn pans that are positioned in the northeast, southeast, southwest, and northwest quadrants of the Burn Pan Unit area. The Burn Pan Unit measures approximately 250 feet by 325 feet. Within this area, which is surrounded by a berm, is a stormwater drainage system, a small tool storage shed, a resistance heater igniter assembly, and two, 3/4-inch water spigots. The entire Burn Pan Unit has a 6- to 8-inch compacted-clay liner and is surrounded by a chain-link security fence and an intrusion detection system. The burn pan area is protected from run-on, run-off, precipitation, and flooding by a berm around the site and mobile covers on the individual burn pans.

Currently, there is no plan to change the use of the site.

E-4-1(a)(2) Contaminants of Potential Concern

Contaminants associated with the HSAAP burn pan include volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), alkanes, alkenes, cresols, phenols, petroleum hydrocarbons, halogens, TNT, RDX and HMX. The investigation used to derive this list is described in an earlier section of this report. See Section C for additional details.

E-4-1(b) Contaminant Fate and Transport

VOCs (including the lighter petroleum hydrocarbons, alkanes, alkenes and halogenated compounds) generally volatilize to the atmosphere from surface soil and surface water. VOCs in soil will dissolve in water to varying degrees and may be transported overland with runoff or via groundwater to surface waters. Photolysis and hydrolysis are not significant mechanisms for VOC degradation; however, aerobic biodegradation in soil, groundwater and surface water is significant, and anaerobic degradation can also occur in these media. VOCs are not known to bioaccumulate in ecological receptors.

SVOCs adsorb soils at varying degrees depending on the soil's organic carbon content and properties of the compound. SVOCs will leach to groundwater and there is some volatilization to the atmosphere from both soils and surface water. Surface water contamination from SVOCs will generally occur as a result of contaminated groundwater discharge and/or erosion of contaminated soil into surface water. Biodegradation of SVOCs is significant in groundwater, surface water and soil. Some SVOCs, like naphthalene, will experience significant photolysis in surface water. Hydroxyl and nitrate radicals generally degrade SVOCs released to air. SVOCs will moderately bioaccumulate in fish and aquatic invertebrates. However, SVOCs are not known to biomagnify in terrestrial or aquatic ecosystems.

Cresols are relatively mobile in soils and can leach to groundwater. They biodegrade in soils and surface water, with some reports of complete degradation in soils in as little as 7 days. Photolysis is significant in both air and surface water. Cresols will readily react with hydroxyl radicals and nitrate radicals in air, which gives cresols a short half-life in air (from 4 minutes at night to 10 hours during the day). Cresols have a low volatility from water.

Phenols are generally highly soluble with poor to moderate adsorption to soil. Therefore, they are highly mobile in soil. Biodegradation in soil and water are significant, and photolysis in air and water are also significant contributors to degradation. Phenols in air will exist primarily in vapor phase and can be washed from the air via rain. Also, phenols will react with hydroxyl and nitrate radicals in air.

TNT is relatively mobile in soil and will leach to groundwater. Photolysis in surface water is significant, and biodegradation in soil and water is slow.

RDX dissolves very slowly in water, and it also evaporates very slowly from water. It does not adsorb to soil very strongly and can leach to groundwater from soil. RDX can be broken down in air and water in a few hours, but it breaks down more slowly in soil. RDX does not significantly bioconcentrate.

Dust particles containing HMX may be carried by the wind for some distance. In surface water, HMX does not evaporate or bind to sediments to any large extent. HMX photolyzes in surface water, usually in a matter of days to weeks. HMX is very mobile in soil and will leach into groundwater, particularly in sandy soils. There is little data regarding bioconcentration of HMX in the environment.

Additional information on chemicals of interest for the Burn Pan Unit that have EPA Region IV screening values are in the appended chemical profiles.

E-4-1(c) Ecotoxicity and Potential Receptors [TN Rule 1200-1-11-.05(b)9(iii); 40 CFR 270.23]

The groups of chemicals for which there is concern are VOCs, SVOCs and explosives compounds in surface soil and surface water. Toxicological information on most of the chemicals that have screening values are listed in Appendix E-4-1. These are described because there is information on their toxicity and they may serve as examples for other chemicals in the same category.

Potential receptors include soil-dwelling organisms, terrestrial plants, sediment-dwelling organisms, aquatic animals, aquatic plants, and organisms that eat the aforementioned. The list of potential ecological species are presented in Appendix E-4-1. Based on environmental fate data indicating the lack of biomagnifying compounds in the list, higher level predators are not likely to be at risk.

E-4-1(d) Complete Exposure Pathways [TN Rule 1200-1-11-.05(b)9(iii); 40 CFR 270.23(c)]

For the Burn Pan Unit, the release mechanism is the combustion of waste explosives and the release is to the atmosphere. Exposure may occur to the contaminants in air, and they may be deposited on soil or surface water. Precipitation may enhance this deposition, and contaminants carried down with rain or snow may run off to surface water. Direct exposure of ecological receptors to airborne contaminants is very difficult to evaluate due to the very incomplete knowledge of factors affecting it. Therefore, it will not be treated in this assessment. Exposure to water- and soil-borne contaminants is better understood and these will be the primary pathways evaluated. Pathways that are secondary to these, such as leaching from soil to groundwater and subsequent seepage into surface water, will not be assessed unless the soil or surface water pathways indicate significant risk. For this assessment, potentially complete exposure pathways and routes of entry into the biota include:

- deposition and direct contact with soil,
- inhalation of emissions,
- overland transport to surface water and sediment,
- deposition and direct contact with water.

E-4-1(e) Assessment and Measurement Endpoints

Regarding contamination at a site, the goal of environmental protection is to ensure that the structure and function of the living system is similar to what it would be without contamination. This is very difficult to test or measure directly, so it is assumed that if populations of native organisms are reproducing successfully, the goal will be met. Therefore, the "assessment endpoints" of this assessment are the successful reproduction of:

- soil-dwelling organisms,
- terrestrial plants,
- sediment-dwelling organisms,
- aquatic animals, and
- aquatic plants.

The table in Appendix E-4-2 provides the ecological endpoints for Region IV soil screening levels. No table was created for Region IV freshwater screening levels because most water quality criteria are designed to protect most aquatic receptors as a group, no specific groups of aquatic receptors. Chronic toxicological data on the tendency of potential COCs to cause mortality or serious developmental or reproductive effects can be used to address the protection goal. For plants and invertebrates, toxicological data are typically expressed as a concentration associated with an effect (or the lack of an effect). Therefore, the "measurement endpoints" are the concentrations in soil and surface water that are associated with no effects to the biota.

E-4-2 Toxicity Evaluation

This screening level ecological risk assessment compares predicted worst-case concentrations of contaminants in soil and surface water to the EPA Region IV Ecological Screening Values (USEPA, 2001). At the screening level, the screening values are used to eliminate COPCs. The Region IV Ecological Screening Values are based on contaminant levels associated with a low probability of unacceptable risks to ecological receptors. The numbers are based on conservative endpoints and sensitive ecological effects data, and they represent a preliminary screening of site contaminant levels to determine the need for further investigation. The ecological screening levels do not represent remediation levels.

E-4-3 Exposure Estimate [TN1200-1-11-.05(b)9(iii); 40 CFR 270.23(c)]

For conservativeness at the screening step, maximum concentrations are used as exposure estimates for comparison to screening levels. The predicted maximum concentrations in soil were obtained as a result of modeling the deposition of emissions from the Burn Pan Unit both onsite and offsite.

Maximum concentrations in surface water were estimated by assuming that all emissions are deposited in the Holston River. The average flow rate for the river was calculated to be approximately 3120 cfs, as indicated by USGS data for nearby Church Hill, TN. After converting to metric mass and volume units and adjusting to the same time units, the emission rates in lbs/hr were converted to mg/L concentrations in the river.

Maximum concentrations for all chemicals in surface soil for onsite receptors and for offsite receptors are shown in Tables E-4-1 and E-4-2, respectively, while maxima for surface water are in Table E-4-3.

E-4-4 Risk Calculation [TN Rule 1200-1-11.06(6)(270(b)(ix) and .06(27)(b)2(xi); 40 CFR 264.601(a)(9) and (b)(11)] [TN Rule 1200-1-11-.06(27)(b)(3)(vii); 40 CFR 264.601(c)(7)]

Risk is estimated by dividing the maximum contaminant concentration by its EPA Region IV ecological screening level (USEPA, 2001). This results in a hazard quotient (HQ); HQs of one or more indicate potential risk. For surface water screening, the EPA Region IV chronic screening levels for freshwater environments was used. The results of the risk calculations are tabulated for the soil pathway for onsite and offsite receptors in Tables E-4-1 and E-4-2, and for the surface water receptors in Table E-4-3.

For surface soil, the EPA Region IV Soil Screening Values were compared to both the onsite and offsite maximum soil contaminant concentrations derived from the modeling discussed above. For contaminants for which there are EPA Region IV Soil Screening Values, none of the

TABLE E-4-1

ESTIMATED SOIL CONCENTRATIONS FOR EMITTED COMPOUNDS AT THE ONSITE MAXIMUM RECEPTOR
AND COMPARISON TO EPA REGION IV ECOLOGICAL SOIL SCREENING VALUES
HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TN
PAGE 1 OF 2

Receptor: Onsite Maximum (500 m, 135 degrees)						
	Average Annual	Daily Depostion	1-Year Soil	10-Year Soil		
	Concentration	Rate	Concentration	Concentration	Region IV Ecological Soil Screening Level	Hazard Quotient
Compound	($\mu g/m^3$)	($mg/m^2/day$)	(mg/kg)	(mg/kg)	(mg/kg)	
1,2,4-Trimethylbenzene	3.38E-06	1.46E-05	3.03E-05	3.03E-04	–	–
1,3 - Butadiene	1.23E-06	5.32E-06	1.10E-05	1.10E-04	–	–
1,3,5-Trimethylbenzene	1.27E-06	5.47E-06	1.13E-05	1.13E-04	–	–
1,3,5-Trinitrobenzene	1.26E-04	5.44E-04	1.13E-03	1.13E-02	–	–
1,3-Dinitrobenzene	9.78E-07	4.23E-06	8.76E-06	8.76E-05	–	–
2,4,6-Trinitrotoluene	1.03E-04	4.45E-04	9.23E-04	9.23E-03	–	–
2,4-Dinitrotoluene	1.82E-05	7.86E-05	1.63E-04	1.63E-03	–	–
2-Methylnapthalene	4.44E-06	1.92E-05	3.98E-05	3.98E-04	–	–
3,4-Methylphenol (m- & p-cresol)	1.22E-07	5.28E-07	1.09E-06	1.09E-05	0.5	2.19E-05
Acenaphthylene	3.83E-07	1.65E-06	3.43E-06	3.43E-05	–	–
Acetophenone	1.25E-05	5.41E-05	1.12E-04	1.12E-03	–	–
Alkanes (Paraffins)	4.70E-05	2.03E-04	4.21E-04	4.21E-03	–	–
Alkenes (Olefins)	2.12E-04	9.14E-04	1.90E-03	1.90E-02	–	–
Anthracene	3.43E-07	1.48E-06	3.08E-06	3.08E-05	0.1	3.08E-04
Aromatics	8.80E-05	3.80E-04	7.88E-04	7.88E-03	–	–
Benz(a)anthracene	1.65E-06	7.15E-06	1.48E-05	1.48E-04	–	–
Benzene	4.30E-04	1.86E-03	3.85E-03	3.85E-02	0.05	7.70E-01
Benzo(a)pyrene	1.07E-06	4.62E-06	9.58E-06	9.58E-05	0.1	9.58E-04
Benzo(b)fluoranthene	1.91E-06	8.24E-06	1.71E-05	1.71E-04	–	–
Benzo(g,h,i)perylene	3.50E-07	1.51E-06	3.14E-06	3.14E-05	–	–
Benzo(k)fluoranthene	1.40E-06	6.04E-06	1.25E-05	1.25E-04	–	–
Benzyl alcohol	7.66E-07	3.31E-06	6.86E-06	6.86E-05	–	–
Biphenyl	7.93E-07	3.42E-06	7.10E-06	7.10E-05	60	1.18E-06
bis (2-Ethylhexyl)phthalate	7.67E-06	3.31E-05	6.87E-05	6.87E-04	–	–
Butylbenzyl phthalate	8.38E-06	3.62E-05	7.50E-05	7.50E-04	–	–
Carbon Dioxide	1.09E+01	4.70E+01	9.75E+01	9.75E+02	–	–
Carbon Monoxide	2.10E-01	9.06E-01	1.88E+00	1.88E+01	–	–
Carbon Tetrachloride	1.26E-06	5.44E-06	1.13E-05	1.13E-04	1,000	1.13E-07
Di-n-butyl phthalate	6.50E-06	2.81E-05	5.83E-05	5.83E-04	sum 0.01	1.47E-01
Di-n-octyl phthalate	9.96E-06	4.30E-05	8.92E-05	8.92E-04	sum 0.01	1.47E-01
Dibenzofuran	1.58E-07	6.83E-07	1.42E-06	1.42E-05	–	–
Dichloromethane	9.78E-04	4.23E-03	8.76E-03	8.76E-02	2	4.38E-02
Diethyl phthalate	5.09E-06	2.20E-05	4.56E-05	4.56E-04	100	4.56E-06
Dimethyl phthalate	9.89E-07	4.27E-06	8.86E-06	8.86E-05	200	4.43E-07
Ethylbenzene	6.78E-06	2.93E-05	6.07E-05	6.07E-04	0.05	1.21E-02
Fluoranthene	1.12E-05	4.86E-05	1.01E-04	1.01E-03	0.1	1.01E-02
Fluorene	8.90E-08	3.84E-07	7.97E-07	7.97E-06	–	–
Freon 11	5.05E-06	2.18E-05	4.52E-05	4.52E-04	–	–
Freon 113	1.26E-06	5.44E-06	1.13E-05	1.13E-04	–	–
Freon 12	4.49E-06	1.94E-05	4.02E-05	4.02E-04	–	–
HMX	5.44E-06	2.35E-05	4.87E-05	4.87E-04	–	–
Hydrogen Chloride	7.11E-03	3.07E-02	6.37E-02	6.37E-01	–	–
Hydrogen Fluoride	2.18E-02	9.41E-02	1.95E-01	1.95E+00	–	–
Indeno (1,2,3 - cd) pyrene	3.89E-07	1.68E-06	3.49E-06	3.49E-05	–	–
m- & p-Xylene	2.33E-05	1.01E-04	2.09E-04	2.09E-03	0.05	4.18E-02
Methane	1.19E-03	5.16E-03	1.07E-02	1.07E-01	–	–
Methyl chloride	3.69E-06	1.59E-05	3.31E-05	3.31E-04	–	–
n-Nitrosodiphenylamine	2.00E-07	8.66E-07	1.80E-06	1.80E-05	–	–
Naphthalene	8.59E-06	3.71E-05	7.70E-05	7.70E-04	0.1	7.70E-03

TABLE E-4-1

ESTIMATED SOIL CONCENTRATIONS FOR EMITTED COMPOUNDS AT THE ONSITE MAXIMUM RECEPTOR
AND COMPARISON TO EPA REGION IV ECOLOGICAL SOIL SCREENING VALUES
HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TN

Receptor: Onsite Maximum (500 m, 135 degrees)						
	Average Annual	Daily Depostion	1-Year Soil	10-Year Soil		
	Concentration	Rate	Concentration	Concentration	Region IV Ecological Soil Screening Level	Hazard Quotient
Compound	($\mu g/m^3$)	($mg/m^2/day$)	(mg/kg)	(mg/kg)	(mg/kg)	
Nitrogen Dioxide (peroxide)	4.27E-03	1.85E-02	3.83E-02	3.83E-01	--	--
Nitrogen Oxide	5.85E-02	2.53E-01	5.24E-01	5.24E+00	--	--
o-Xylene	9.33E-06	4.03E-05	8.36E-05	8.36E-04	0.05	1.67E-02
p-Ethyltoluene	3.57E-06	1.54E-05	3.20E-05	3.20E-04	--	--
Phenanthrene	1.66E-06	7.17E-06	1.49E-05	1.49E-04	0.1	1.49E-03
Phenol	3.51E-06	1.52E-05	3.15E-05	3.15E-04	0.05	6.29E-03
Pyrene	1.25E-05	5.39E-05	1.12E-04	1.12E-03	0.1	1.12E-02
RDX	9.91E-05	4.28E-04	8.88E-04	8.88E-03	--	--
Styrene	3.36E-06	1.45E-05	3.01E-05	3.01E-04	0.1	3.01E-03
Tetrachloroethylene	6.22E-05	2.69E-04	5.57E-04	5.57E-03	--	--
TO - 12 (NMOC)	1.94E-04	8.38E-04	1.74E-03	1.74E-02	--	--
Toluene	1.69E-05	7.31E-05	1.52E-04	1.52E-03	0.05	3.03E-02
Total Non-methane Hydrocarbons	7.97E-03	3.44E-02	7.14E-02	7.14E-01	--	--
Total Non-methane Organic Comp	1.00E-03	4.33E-03	8.98E-03	8.98E-02	--	--
Total Unidentified Hydrocarbons	1.57E-04	6.78E-04	1.41E-03	1.41E-02	--	--

-- No EPA Ecological Screening Value available

TABLE E-4-2

ESTIMATED SOIL CONCENTRATIONS OF EMITTED COMPOUNDS AT THE OFFSITE MAXIMUM RECEPTOR LOCATION
AND COMPARISON TO EPA REGION IV ECOLOGICAL SOIL SCREENING VALUES
HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TN
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Receptor: Onsite Maximum (500 m, 135 degrees)						
	Average Annual	Daily Depostion	1-Year Soil	10-Year Soil		
Compound	Concentration ($\mu g/m^3$)	Rate ($\mu g/m^2/day$)	Concentration (mg/kg)	Concentration (mg/kg)	Region IV Ecological Soil Screening Level (mg/kg)	Hazard Quotient
1,2,4-Trimethylbenzene	6.92E-07	2.99E-06	6.20E-06	6.20E-05	--	--
1,3 - Butadiene	2.52E-07	1.09E-06	2.26E-06	2.26E-05	--	--
1,3,5-Trimethylbenzene	2.59E-07	1.12E-06	2.32E-06	2.32E-05	--	--
1,3,5-Trinitrobenzene	2.57E-05	1.11E-04	2.31E-04	2.31E-03	--	--
1,3-Dinitrobenzene	2.00E-07	8.64E-07	1.79E-06	1.79E-05	--	--
2,4,6-Trinitrotoluene	2.11E-05	9.10E-05	1.89E-04	1.89E-03	--	--
2,4-Dinitrotoluene	3.72E-06	1.61E-05	3.34E-05	3.34E-04	--	--
2-Methylnapthalene	9.08E-07	3.92E-06	8.14E-06	8.14E-05	--	--
3,4-Methylphenol (m- & p-cresol)	2.50E-08	1.08E-07	2.24E-07	2.24E-06	0.5	4.48E-06
Acenaphthylene	7.83E-08	3.38E-07	7.01E-07	7.01E-06	--	--
Acetophenone	2.56E-06	1.11E-05	2.29E-05	2.29E-04	--	--
Alkanes (Paraffins)	9.61E-06	4.15E-05	8.61E-05	8.61E-04	--	--
Alkenes (Olefins)	4.33E-05	1.87E-04	3.88E-04	3.88E-03	--	--
Anthracene	7.02E-08	3.03E-07	6.29E-07	6.29E-06	0.1	6.29E-05
Aromatics	1.80E-05	7.78E-05	1.61E-04	1.61E-03	--	--
Benz(a)anthracene	3.38E-07	1.46E-06	3.03E-06	3.03E-05	--	--
Benzene	8.79E-05	3.80E-04	7.88E-04	7.88E-03	0.05	1.58E-01
Benzo(a)pyrene	2.19E-07	9.45E-07	1.96E-06	1.96E-05	0.1	1.96E-04
Benzo(b)fluoranthene	3.90E-07	1.69E-06	3.50E-06	3.50E-05	--	--
Benzo(g,h,i)perylene	7.17E-08	3.10E-07	6.42E-07	6.42E-06	--	--
Benzo(k)fluoranthene	2.86E-07	1.24E-06	2.56E-06	2.56E-05	--	--
Benzyl alcohol	1.57E-07	6.77E-07	1.40E-06	1.40E-05	--	--
Biphenyl	1.62E-07	7.01E-07	1.45E-06	1.45E-05	60	2.42E-07
bis (2-Ethylhexyl)phthalate	1.57E-06	6.77E-06	1.40E-05	1.40E-04	--	--
Butylbenzyl phthalate	1.71E-06	7.40E-06	1.53E-05	1.53E-04	--	--
Carbon Dioxide	2.23E+00	9.61E+00	1.99E+01	1.99E+02	--	--
Carbon Monoxide	4.29E-02	1.85E-01	3.84E-01	3.84E+00	--	--
Carbon Tetrachloride	2.57E-07	1.11E-06	2.31E-06	2.31E-05	1,000	2.31E-08
Di-n-butyl phthalate	1.33E-06	5.75E-06	1.19E-05	1.19E-04	sum 0.01	3.02E-02
Di-n-octyl phthalate	2.04E-06	8.80E-06	1.82E-05	1.82E-04	sum 0.01	3.02E-02
Dibenzofuran	3.23E-08	1.40E-07	2.90E-07	2.90E-06	--	--
Dichloromethane	2.00E-04	8.64E-04	1.79E-03	1.79E-02	2	8.96E-03
Diethyl phthalate	1.04E-06	4.50E-06	9.32E-06	9.32E-05	100	9.32E-07
Dimethyl phthalate	2.02E-07	8.74E-07	1.81E-06	1.81E-05	200	9.06E-08
Ethylbenzene	1.39E-06	5.99E-06	1.24E-05	1.24E-04	0.05	2.48E-03
Fluoranthene	2.30E-06	9.94E-06	2.06E-05	2.06E-04	0.1	2.06E-03
Fluorene	1.82E-08	7.86E-08	1.63E-07	1.63E-06	--	--
Freon 11	1.03E-06	4.46E-06	9.25E-06	9.25E-05	--	--
Freon 113	2.57E-07	1.11E-06	2.31E-06	2.31E-05	--	--
Freon 12	9.18E-07	3.96E-06	8.22E-06	8.22E-05	--	--
HMX	1.11E-06	4.81E-06	9.97E-06	9.97E-05	--	--
Hydrogen Chloride	1.45E-03	6.28E-03	1.30E-02	1.30E-01	--	--
Hydrogen Fluoride	4.45E-03	1.92E-02	3.99E-02	3.99E-01	--	--
Indeno (1,2,3 - cd) pyrene	7.97E-08	3.44E-07	7.14E-07	7.14E-06	--	--
m- & p-Xylene	4.77E-06	2.06E-05	4.27E-05	4.27E-04	0.05	8.54E-03
Methane	2.44E-04	1.06E-03	2.19E-03	2.19E-02	--	--
Methyl chloride	7.55E-07	3.26E-06	6.76E-06	6.76E-05	--	--
n-Nitrosodiphenylamine	4.10E-08	1.77E-07	3.67E-07	3.67E-06	--	--
Naphthalene	1.76E-06	7.59E-06	1.57E-05	1.57E-04	0.1	1.57E-03
Nitrogen Dioxide (peroxide)	8.74E-04	3.78E-03	7.83E-03	7.83E-02	--	--

TABLE E-4-2

ESTIMATED SOIL CONCENTRATIONS OF EMITTED COMPOUNDS AT THE OFFSITE MAXIMUM RECEPTOR LOCATION
AND COMPARISON TO EPA REGION IV ECOLOGICAL SOIL SCREENING VALUES
HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TN
PAGE 2 OF 2

Receptor: Onsite Maximum (500 m, 135 degrees)						
	Average Annual	Daily Depostion	1-Year Soil	10-Year Soil		
	Concentration	Rate	Concentration	Concentration	Region IV Ecological Soil Screening Level	Hazard Quotient
Compound	($\mu g/m^3$)	($\mu g/m^2$/day)	(mg/kg)	(mg/kg)	(mg/kg)	
Nitrogen Oxide	1.20E-02	5.17E-02	1.07E-01	1.07E+00	--	--
o-Xylene	1.91E-06	8.25E-06	1.71E-05	1.71E-04	0.05	3.42E-03
p-Ethyltoluene	7.31E-07	3.16E-06	6.55E-06	6.55E-05	--	--
Phenanthrene	3.40E-07	1.47E-06	3.04E-06	3.04E-05	0.1	3.04E-04
Phenol	7.18E-07	3.10E-06	6.43E-06	6.43E-05	0.05	1.29E-03
Pyrene	2.55E-06	1.10E-05	2.29E-05	2.29E-04	0.1	2.29E-03
RDX	2.03E-05	8.75E-05	1.82E-04	1.82E-03	--	--
Styrene	6.88E-07	2.97E-06	6.17E-06	6.17E-05	0.1	6.17E-04
Tetrachloroethylene	1.27E-05	5.50E-05	1.14E-04	1.14E-03	--	--
TO - 12 (NMOC)	3.97E-05	1.71E-04	3.56E-04	3.56E-03	--	--
Toluene	3.46E-06	1.49E-05	3.10E-05	3.10E-04	0.05	6.20E-03
Total Non-methane Hydrocarbons	1.63E-03	7.05E-03	1.46E-02	1.46E-01	--	--
Total Non-methane Organic Comp	2.05E-04	8.86E-04	1.84E-03	1.84E-02	--	--
Total Unidentified Hydrocarbons	3.21E-05	1.39E-04	2.88E-04	2.88E-03	--	--

-- No EPA Ecological Screening Value available

TABLE E-4-3

ESTIMATED CONCENTRATIONS OF EMITTED COMPOUNDS IN SURFACE WATER
AND COMPARISON TO EPA REGION IV ECOLOGICAL FRESHWATER SCREENING VALUES
HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TN
PAGE 1 OF 2

Compound	Emissions (lb/hour)	Concentration (mg/l)	Region IV Ecological Screening Level (mg/l)	Hazard Quotient
1,2,4-Trimethylbenzene	4.90E-03	6.98E-06	--	--
1,3 - Butadiene	2.67E-03	3.81E-06	--	--
1,3,5-Trimethylbenzene	1.83E-03	2.61E-06	--	--
1,3,5-Trinitrobenzene	1.44E-01	2.05E-04	--	--
1,3-Dinitrobenzene	1.42E-03	2.02E-06	--	--
2,4,6-Trinitrotoluene	1.73E-01	2.46E-04	--	--
2,4-Dinitrotoluene	3.78E-02	5.38E-05	--	--
2-Methylnapthalene	8.90E-03	1.27E-05	--	--
3,4-Methylphenol (m- & p-cresol)	2.65E-04	3.78E-07	--	--
Acenaphthylene	8.30E-04	1.18E-06	--	--
Acetophenone	2.59E-02	3.69E-05	--	--
Alkanes (Paraffins)	2.45E-02	3.49E-05	--	--
Alkenes (Olefins)	2.07E-01	2.95E-04	--	--
Anthracene	7.45E-04	1.06E-06	--	--
Aromatics	4.41E-02	6.28E-05	--	--
Benz(a)anthracene	3.59E-03	5.12E-06	--	--
Benzene	1.34E-01	1.91E-04	0.053	3.61E-03
Benzo(a)pyrene	2.32E-03	3.31E-06	--	--
Benzo(b)fluoranthene	4.14E-03	5.91E-06	--	--
Benzo(g,h,i)perylene	7.60E-04	1.08E-06	--	--
Benzo(k)fluoranthene	3.04E-03	4.33E-06	--	--
Benzyl alcohol	3.94E-04	5.62E-07	--	--
Biphenyl	1.72E-03	2.45E-06	--	--
bis (2-Ethylhexyl)phthalate	4.41E-03	6.28E-06	0.0003	2.09E-02
Butylbenzyl phthalate	1.46E-02	2.08E-05	0.022	9.43E-04
Carbon Dioxide	7.10E+03	1.01E+01	--	--
Carbon Monoxide	7.07E+01	1.01E-01	--	--
Carbon Tetrachloride	1.82E-03	2.60E-06	0.352	7.38E-06
Di-n-butyl phthalate	1.26E-02	1.79E-05	--	--
Di-n-octyl phthalate	5.28E-03	7.54E-06	--	--
Dibenzofuran	3.43E-04	4.89E-07	--	--
Dichloromethane	1.42E+00	2.02E-03	--	--
Diethyl phthalate	9.65E-03	1.38E-05	0.521	2.64E-05
Dimethyl phthalate	1.43E-03	2.04E-06	0.33	6.18E-06

TABLE E-4-3

ESTIMATED CONCENTRATIONS OF EMITTED COMPOUNDS IN SURFACE WATER
AND COMPARISON TO EPA REGION IV ECOLOGICAL FRESHWATER SCREENING VALUES
HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TN
PAGE 2 OF 2

Compound	Emissions (lb/hour)	Concentration (mg/l)	Region IV Ecological Screening Level (mg/l)	Hazard Quotient
Ethylbenzene	9.80E-03	1.40E-05	0.453	3.09E-05
Fluoranthene	2.44E-02	3.48E-05	0.0398	8.74E-04
Fluorene	1.93E-04	2.75E-07	--	--
Freon 11	7.30E-03	1.04E-05	--	--
Freon 113	1.82E-03	2.60E-06	--	--
Freon 12	6.95E-03	9.91E-06	--	--
HMX	1.18E-02	1.68E-05	--	--
Hydrogen Chloride	6.65E+01	9.49E-02	--	--
Hydrogen Fluoride	1.74E+02	2.48E-01	--	--
Indeno (1,2,3 - cd) pyrene	8.45E-04	1.21E-06	--	--
m- & p-Xylene	3.37E-02	4.81E-05	--	--
Methane	3.64E-01	5.19E-04	--	--
Methyl chloride	2.47E-03	3.52E-06	5.5	6.41E-07
n-Nitrosodiphenylamine	4.35E-04	6.20E-07	--	--
Naphthalene	1.79E-02	2.55E-05	0.062	4.12E-04
Nitrogen Dioxide (peroxide)	1.43E+00	2.04E-03	--	--
Nitrogen Oxide	4.60E+01	6.56E-02	--	--
o-Xylene	1.35E-02	1.93E-05	--	--
p-Ethyltoluene	2.24E-03	3.19E-06	--	--
Phenanthrene	3.04E-03	4.33E-06	--	--
Phenol	7.60E-03	1.08E-05	0.256	4.23E-05
PM10	1.40E+03	2.00E+00	--	--
Pyrene	2.66E-02	3.79E-05	--	--
RDX	4.80E-02	6.84E-05	--	--
Styrene	7.30E-03	1.04E-05	--	--
Tetrachloroethylene	9.00E-02	1.28E-04	0.084	1.53E-03
TO - 12 (NMOC)	4.21E-01	6.01E-04	--	--
Toluene	8.97E-03	1.28E-05	0.175	7.31E-05
Total Non-methane Hydrocarbons	2.42E+00	3.45E-03	--	--
Total Non-methane Organic Compounds	1.45E+00	2.07E-03	--	--
Total Unidentified Hydrocarbons	2.27E-01	3.24E-04	--	--
			Total Hazard Index	2.85E-02

"--No EPA Region IV Ecological Screening Value

HQs were greater than 1.0. Additionally, the Hazard Index (HI), which is the sum of HQs for a given medium, was just slightly greater than the 1.0 for the onsite receptors with an HI of 1.08. The HI for the offsite receptors was less than 1.0. The chemical with the greatest HQ is benzene (HQ=0.77) which is unlikely to stay in the surficial soil very long because it is very volatile. Therefore, risk levels are low at maximum soil exposures. It should be noted that for many of the COPCs, there are no EPA Region IV Soil Screening Values (USEPA, 2001). Therefore the risks due to the toxicity of these chemicals were not determined.

None of the HQs were greater than 1.0 for contaminants that have EPA Region IV Surface Water Screening Values. Also, the HI for surface water contaminants was less than 1.0. This indicated that potential risk to aquatic receptors from contaminants in the surface water are low. For many of the COPCs, there were no EPA Region IV Surface Water Screening Values (USEPA, 2001) and their risks could not be directly evaluated.

E-4-5 Uncertainty

Uncertainty is associated with all aspects of the Ecological Assessment methodology presented in the preceding sections. This section provides a summary of uncertainties.

Once the risk assessment is complete, the results must be reviewed and evaluated to identify the type and magnitude of uncertainty involved. Reliance on results from a risk assessment without consideration of uncertainties, limitations, and assumptions inherent in the process can be misleading. For example, to account for uncertainties in the development of exposure assumptions, conservative estimates must be made to ensure that the assumptions are protective of receptors inhabiting the area of potential exposure. If a number of conservative assumptions are combined in an exposure model, the resulting calculations will propagate the uncertainties associated with those assumptions. This uncertainty is biased toward over predicting risks. Thus, both the results of the risk assessment and the uncertainties associated with those results must be considered when making risk management decisions.

Generally, risk assessments carry two types of uncertainty – measurement and informational. Measurement uncertainty refers to the variability inherent in measured data. For example, this type of uncertainty is associated with analytical data used to characterize contaminant concentrations present in various environmental media; the risk assessment reflects the accumulated variances of the individual values used. Informational uncertainty stems from the limited availability of information needed to complete various portions of the assessment. Often this gap is significant; information regarding the effects of industrial chemicals on wildlife receptors, on the biological mechanism of action of a chemical, the impact physiological differences on exposure pathways or the behavior of a chemical in various environmental media (e.g., soil) is often absent.

Uncertainty is associated with each of the steps of the risk assessment process, including:

- Uncertainty in problem definition arises from ambiguities in characterization of contaminant sources and migration pathways, as well as in the exposure pathway analysis.
- Uncertainty associated with the exposure assessment includes the methods used and the assumptions made to determine exposure point concentrations.
- Uncertainty in the ecological effects characterization includes the quality of the existing data to support a determination of potential adverse impacts to ecological receptors.

- Uncertainty in risk characterization includes that associated with the potential effects of exposure to multiple chemicals and the cumulative uncertainty from combining conservative assumptions made in earlier activities.

While these and other sources contribute to uncertainty, the manner ("direction") in which uncertainty impacts the final predictions produced by this assessment (i.e., over or under prediction) can be influenced by the assumptions made throughout the risk assessment process. As noted above, conservative assumptions were made so that the final calculated risk would result in an overestimation of potential risks attributable to conditions associated with HSAAP. Thus, uncertainty is associated with the degree to which the numerical values produced as a result of this process overestimate the actual risks.

E-4-5(a) Uncertainty in Problem Definition

Uncertainty in the problem definition can arise as a result of contaminant source evaluation. Data gaps and incomplete or vague information regarding contaminant fate and transport (migration pathways) and the environmental receptors present and their ecology may lead to uncertainty in determining complete exposure pathways. Appropriate and reasonable assumptions should be made concerning exposure pathways (sources, points, routes), as well as the use of appropriate and accepted sources of physico-chemical data for all preliminary COCs.

E-4-5(b) Uncertainty in the Exposure Assessment

Uncertainty in the exposure assessment arises for the methods used to establish exposure point concentrations. These concentrations were estimated by modeling deposition and subsequent mixing. The degree to which the modeled contaminant concentrations represent the contamination that may actual occur is uncertain. Moreover, the use of very conservative assumptions in the modeling overestimates risk. For example, the assumption that all of the emissions will become dissolved in surface water is extremely conservative.

E-4-5(c) Uncertainty in the Ecological Effects Characterization

Unlike human health risk assessments, ecological assessments must consider risks to many different species. However, calculation of risk values for each potential receptor species is not possible. For this assessment, conservative values, protective of a wide range of ecological receptors, were used for screening. The underlying assumptions associated with the use of these values is that contaminant concentrations in excess of these guidelines are indicative of potential impacts to actual receptors inhabiting a given area. However, species-specific physiological differences that may influence and organism's response to a contaminant or subtle behavioral differences that may increase/decrease a receptor's contact with a contaminant are seldom known. The use of screening values, while necessary, will introduce error into the results of an assessment.

In addition to uncertainty regarding risks associated with the degree to which screening values are exceeded, uncertainty in the results of the risk assessment process arises when extrapolations are made across levels of ecological organization, or from laboratory studies to field conditions in benchmark derivation. The majority of the currently available toxicological data rests on the response of individuals exposed to chemicals. Extrapolations from these simple endpoints to more complex, ecologically relevant endpoints such as impacts to

populations or communities introduce uncertainty into the results of the risk assessment. The uncertainty associated with extrapolations from results based on laboratory test conditions to field situations have long been acknowledged, but remains difficult to quantify.

In this assessment, the lack of screening levels for many of the potential COCs is an important source of uncertainty. Because the toxicity of these chemicals is not well known, their potential effects are unknown.

E-4-5(d) Uncertainty in the Risk Characterization

Uncertainty in risk characterization stems partially from not taking antagonistic or synergistic effects into account. Little or no information is available to determine the potential for antagonism or synergism for the chemicals of concern. Therefore, this uncertainty cannot be discussed in terms of its impact on the risk assessment, since it may either underestimate or overestimate potential ecological risk. Also, reasonable and appropriate conclusions must be drawn from the results. Often conservative conclusions are drawn, which may tend to overestimate risk. An example of this is the HI which is calculated for each media. The HI assumes that all the chemicals cause toxicity by the same mechanism and are therefore additive. It is possible that some of the chemicals are toxic via different mechanisms so the HI is actually overestimating potential risks. On the other hand, it is also possible that the HI is underestimating potential risks because some of the toxic mechanisms may be more than additive.

E-4-6 Summary and Conclusions

By using air modeling, maximum contaminant concentrations in soil were predicted for onsite and offsite receptors. In addition, maximum surface water contaminant concentrations were estimated assuming 100 percent contaminant deposition to the surface water.

After accounting for the uncertainties associated with the conservative models used to predict contaminant concentrations in the soil and surface water, no potential risks to ecological receptors from contaminants in the soil or surface water are expected to be negligible. The HI calculated for the soil contaminants was slightly greater than 1, indicating a very low potential risk to ecological receptors. The HI calculated for the surface water contaminants was less than 1.0, indicating no potential risks to ecological receptors from contaminants in the surface water.

E-4-7 Reference

Caldwell, R.S and J. Copeland, 1992. Biological Survey of the Holston Army Ammunition Plant, Kingsport, Tennessee. Conducted on behalf of The Nature Conservancy, Tennessee Field Office. Authors' address: Cumberland Mountain Research Center, Lincoln Memorial University.

USEPA (U.S. Environmental Protection Agency), 2001. Region 4 Ecological Risk Assessment Bulletins – Supplement to RAGS. Effective April 20.
http://www.epa.gov/region04/wastepgs/oftecser/ecolbul.htm

USEPA (U.S. Environmental Protection Agency), 1998. Final Guidelines for Ecological Risk Assessment. U.S. Environmental Protection Agency. Effective April 30.

USEPA (U.S. Environmental Protection Agency), 1997. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological risk Assessments, Interim Final. U.S. Environmental Protection Agency, Environmental Response Team. June 5.

APPENDIX VI

Ecological Risk Assessment Site Visit Checklist

Checklist for Screening Ecological Risk Assessment

I. SITE DESCRIPTION

Site Name: Burn Pan Unit

Location: Holston Army Ammunition Plant

County: Hawkins **City:** Kingsport **State:** TN

Latitude: _____ **Longitude:** _____

Approximate area of site: 250-ft. x 325-ft. (approx. 2-acres) on 6,117 acres of HAAP

Is this the first site visit? √ Yes ☐ No If no, attach trip report of previous site visit(s) if available.

Dates of previous site visit(s): not applicable (NA)

Please attach to the checklist USGS topographic map(s) of the site, if available. (

Are aerial or other site photographs available? ☐ Yes ☒ No If yes, please attach any available photo(s) to the site map at the conclusion of this section.

The land use on the site is:	**The area surrounding the site is:** 0.5mile radius
_____ % Urban	_____ % Urban
_____ % Rural	_____ % Rural
_____ % Residential	_____ % Residential
_____ % Industrial (light heavy)	50 % Industrial (light heavy)
_____ % Agricultural	50 % Agricultural
(Crops:_____)	(Crops:_____)
_____ % Recreational	_____ % Recreational
(Describe; not if it is a park, etc.	(Describe; not if it is a park, etc.
_____	_____
_____ % Undisturbed	_____ % Undisturbed
100 % Other (fenced haz waste area)	_____ % Other

Has any movement of soil taken place at the site? ☐ Yes ☒ No. If yes, please identify the most likely cause of this disturbance:

☐ Agricultural Use ☐ Heavy Equipment ☐ Mining

☐ Natural Events ☐ Erosion ☐ Other

Do any potentially sensitive environments exist adjacent to or in proximity to the site, e.g. Federal and State parks, National and State monuments, wetlands, prairie potholes? Remember, flood plains and wetlands are not always obvious; do not answer "no" without confirming information.

☒ Yes ☐ No. If yes, describe them briefly below, identify the source of information used in the determination and show on site map: Holston River

What type of facility is located on the site?

☐ Chemical ☐ Manufacturing ☐ Mining

☐ Waste disposal ☒ Other (specify): Permitted hazardous waste burn unit

What are the suspected contaminants of concern at the site? If known, what and where are the maximum contaminant levels?
See SLERA (2012)

_____

_____

_____

Check any potential routes of off-site migration of contaminants observed at the site:

☐ Swales ☐ Depressions ☐ Drainage ditches

☐ Runoff ☐ Windblown particulates ☐ Vehicular traffic

☒ Other (specify): air transport & potential deposition

If known, what is the approximate depth to the water table?

Is the direction of surface runoff apparent from site observations? ☒ Yes ☐ No. If yes, to which of the following does the surface water runoff discharge? Indicate all that apply.

☐ Surface water ☐ Groundwater ☐ Sewer ☒ Collection impoundment w/ treatment

Is there a waterbody anywhere on or in the vicinity of the site? (NOTE: If yes, also complete Section III: Aquatic Habitat Checklist – Non-Flowing Streams and/or Section IV: Aquatic Habitat Checklist – Flowing Systems) ☒ Yes ☐ No. If yes, identify the waterbody below and on the site map:

Holston River

Is there a navigable waterbody or a tributary to a navigable waterbody? ☒ Yes ☐ No. If yes, identify the waterbody below and on the site map:

Holston River

Is there evidence of flooding? (NOTE: If yes, also complete Section V: Wetland Habitat Checklist)

☐ Yes ☒ No.

How much time was spent at the site identifying flora and fauna? 1 hour

Please provide references for field guides used to aid in the identification of flora and fauna at the site:

Site totally covered by surge stone, including berms

Are there any threatened and/or endangered species (plant or animal) known to inhabit the area of the site? (NOTE: If yes, you are required to verify this information with the U.S. Fish and Wildlife Service). ☐ Yes ☒No. Some are present on the larger HAAP.

Sources of information consulted:

☐ U.S. Fish and Wildlife Service ☐State Natural Heritage Program

☒ Other (specify): 2001 Survey performed by USACE/Mobile District

Record the weather conditions at the time of this site investigation:

Date: January 2012

Upper 40's Temperature (°F)

Upper 40's Normal high temperature (°F)

0-5 Wind speed (mph)

no rain w/in past 24-hrs. Precipitation (form)

Overcast Cloud cover (clear, overcast, dense)

Please provide a map showing the site layout, photograph locations, the location of ecological features observed at the site as an attachment to this checklist.
See Risk Assessment Report; no ecological features on the site

Indicate which habitat checklists are included with this ecological checklist:

☒ Terrestrial Habitats

☐ Aquatic Habitats – Non-Flowing Systems

☒ Aquatic Habitats – Flowing Systems

☐ Wetland Habitat

Completed by: Marcus

Affiliation: S&ME

Additional Preparers: _____

Site Manager: Douthit

Date: January 2012

II. TERRESTRAL HABITAT CHECKLIST

IIA. WOODED HABITATS

Are there any wooded areas at the site? ☐ Yes ☒No. If no, go to Section IIB: Shrub/Scrub Habitats.

How much of the site is wooded? zero acres. Indicate the wooded area on the site map attached to this copy of the checklist.

What are the dominant types of vegetation in the wooded area? None… all surge stone

☐ Evergreen ☐ Deciduous ☐ Mixed

Dominant plant specie(s):

What is the predominant size of the trees at the site (DBH)?

☐ 0 to 6 inches ☐ 6 to 12 inches ☐ Greater than 12 inches

No trees present on the site

Is there a well-developed understory? ☐ Yes ☒ √No. If yes, what are the dominant plant species:

1. _____
2. _____

IIB. SHRUB/SCRUB HABITATS

Are there any shrub/scrub areas at the site? ☐ Yes ☒No. If no, go to Section IIC: Open Field Habitats.

How much of the site is covered by shrub/scrub vegetation? zero acres OR _____ %. Indicate the shrub/scrub area on the site map attached to this copy of the checklist.

What are the dominant species of shrub/scrub vegetation?

1. _____
2. _____
3. _____
4. _____

What is the average height of the shrub/scrub vegetation at the site?:

☐ 0 to 2 feet ☐ 2 to 5 feet ☐ Greater than 5 feet

Based on site observations, how dense is the shrub/scrub vegetation?

☐ Dense ☐ Patchy ☐ Sparse

IIC. OPEN FIELD HABITATS

Are there any open field areas at the site? ☐Yes ☒ No. If yes, please indicate the type below.

☐ Prairie/plains ☐ Savannah ☐ Old field

☐ Lawn ☐ Barren

☐ Other (specify):

How much of the site is open field? zero acres OR _____%. Indicate the open field areas on the site map attached to this copy of the checklist.

What are the dominant species of open field vegetation?

1. _____
2. _____
3. _____
4. _____

What is the average height of the open field vegetation at the site?:

☐ 0 to 6 inches ☐√ 6 to 24 inches ☐ Greater than 24 inches

Based on site observations, how dense is the open field vegetation?

☐ Dense ☐ Patchy ☐ Sparse

IID. MISCELLANEOUS

Are other types of terrestrial habitats present at the site, other than those identified above? ☐ Yes ☒ No. If yes, identify on the site map and describe them below:

1. _____
2. _____
3. _____

Were wildlife observations made in terrestrial habitats of the site? √Yes ☐ No. If yes, identify locations on the site map and identify the species (common or scientific names) below:

Insects	Herptiles	Birds	Mammals
1. _____	1. _____	1. _____	1. _____
2. _____	2. _____	2. _____	2. _____
3. _____	3. _____	3. _____	3. _____
4. _____	4. _____	4. _____	4. _____
5. _____	5. _____	5. _____	5. _____
6. _____	6. _____	6. _____	6. _____
7. _____	7. _____	7. _____	7. _____
8. _____	8. _____	8. _____	8. _____
9. _____	9. _____	9. _____	9. _____
10. _____	10. _____	10. _____	10. _____

III. AQUATIC HABITAT CHECKLIST – NON-FLOWING SYSTEMS

Note: Aquatic systems are often associated with wetland habitats. Please refer to Section V, Wetland Habitat Checklist if appropriate.

What types of open-water, non-flowing system are present at the site?

☐ Natural (pond, lake)

☐ Artificially created (lagoon, reservoir, canal, impoundment, quarry)

Complete the characteristics table below for each waterbody at or adjacent to the site?

Characteristic	Name: _____ _____	Name: _____ _____	Name: _____ _____	Name: _____ _____
Size (acres)	_____	_____	_____	_____
Average Depth (feet)	_____	_____	_____	_____
Aquatic vegetation type	☐ Emergent ☐ Submergent ☐ Floating	☐ Emergent ☐ Submergent ☐ Floating	☐ Emergent ☐ Submergent ☐ Floating	☐ Emergent ☐ Submergent ☐ Floating
Substrate	☐Bedrock ☐Boulder (>10 in.)	☐Bedrock ☐Boulder (>10 in.)	☐Bedrock ☐Boulder (>10 in.)	☐Bedrock ☐Boulder (>10 in.)

Characteristic	Name: _____ _____	Name: _____ _____	Name: _____ _____	Name: _____ _____
	☐Cobble (2½-10 in) ☐Gravel (0.1-2½ in) ☐Sand (coarse) ☐Silt (fine) ☐Marl (shells) ☐Clay (slick) ☐Muck (fine/black) ☐Debris ☐Detritis ☐Concrete ☐Other: _____ _____	☐Cobble (2½-10 in) ☐Gravel (0.1-2½ in) ☐Sand (coarse) ☐Silt (fine) ☐Marl (shells) ☐Clay (slick) ☐Muck (fine/black) ☐Debris ☐Detritis ☐Concrete ☐Other: _____ _____	☐Cobble (2½-10 in) ☐Gravel (0.1-2½ in) ☐Sand (coarse) ☐Silt (fine) ☐Marl (shells) ☐Clay (slick) ☐Muck (fine/black) ☐Debris ☐Detritis ☐Concrete ☐Other: _____ _____	☐Cobble (2½-10 in) ☐Gravel (0.1-2½ in) ☐Sand (coarse) ☐Silt (fine) ☐Marl (shells) ☐Clay (slick) ☐Muck (fine/black) ☐Debris ☐Detritis ☐Concrete ☐Other: _____ _____
Source of water in waterbody	☐River/Stream ☐Groundwater ☐Discharge ☐Surface runoff ☐Other:	☐River/Stream ☐Groundwater ☐Discharge ☐Surface runoff ☐Other:	☐River/Stream ☐Groundwater ☐Discharge ☐Surface runoff ☐Other:	☐River/Stream ☐Groundwater ☐Discharge ☐Surface runoff ☐Other:
Narrative description of flow path into waterbody	_____	_____	_____	_____
Waterbody discharges into:	☐No discharge ☐River/Stream ☐Groundwater ☐Discharge ☐Surface runoff ☐Other: _____	☐No discharge ☐River/Stream ☐Groundwater ☐Discharge ☐Surface runoff ☐Other: _____	☐No discharge ☐River/Stream ☐Groundwater ☐Discharge ☐Surface runoff ☐Other: _____	☐No discharge ☐River/Stream ☐Groundwater ☐Discharge ☐Surface runoff ☐Other: _____
Field measurements	____ water temp (°C) ____ pH ____ dissolved O_2	____ water temp (°C) ____ pH ____ dissolved O_2	____ water temp (°C) ____ pH ____ dissolved O_2	____ water temp (°C) ____ pH ____ dissolved O_2

Characteristic	Name: _____ _____	Name: _____ _____	Name: _____ _____	Name: _____ _____
	____ salinity ____ turbidity (clear-CL, opaque-OP, slihgtly turbid-ST, turbid-T) ____ Secchi depth Other: _____ _____	____ salinity ____ turbidity (clear-CL, opaque-OP, slihgtly turbid-ST, turbid-T) ____ Secchi depth Other: _____ _____	____ salinity ____ turbidity (clear-CL, opaque-OP, slihgtly turbid-ST, turbid-T) ____ Secchi depth Other: _____ _____	____ salinity ____ turbidity (clear-CL, opaque-OP, slihgtly turbid-ST, turbid-T) ____ Secchi depth Other: _____ _____
Color and area of coloration	_____ _____ _____ _____	_____ _____ _____ _____	_____ _____ _____ _____	_____ _____ _____ _____
Benthic invertebrates	☐EPT taxa ☐Chironomids ☐Worms Other invertebrates: 1. _____ 2. _____ 3. _____ 4. _____ 5. _____	☐EPT taxa ☐Chironomids ☐Worms Other invertebrates: 1. _____ 2. _____ 3. _____ 4. _____ 5. _____	☐EPT taxa ☐Chironomids ☐Worms Other invertebrates: 1. _____ 2. _____ 3. _____ 4. _____ 5. _____	☐EPT taxa ☐Chironomids ☐Worms Other invertebrates: 1. _____ 2. _____ 3. _____ 4. _____ 5. _____
Fish	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____
Herptiles	1. _____	1. _____	1. _____	1. _____

Characteristic	Name: _____ _____	Name: _____ _____	Name: _____ _____	Name: _____ _____
	2. _____ 3. _____ 4. _____ 5. _____ 6. _____	2. _____ 3. _____ 4. _____ 5. _____ 6. _____	2. _____ 3. _____ 4. _____ 5. _____ 6. _____	2. _____ 3. _____ 4. _____ 5. _____ 6. _____
Birds	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____
Mammals	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____

IV. AQUATIC HABITAT CHECKLIST – FLOWING SYSTEMS

Note: Aquatic systems are often associated with wetland habitats. Please refer to Section V, Wetland Habitat Checklist if appropriate.

What types of flowing water systems are present at the site?

☐ River ☐ Stream ☐ Creek

☐ Dry wash ☐ Arroyo ☐ Brook

☐ Artificial (ditch, canal) ☐ Intermittent stream ☐ Channeling

☐ Other (specify):

Complete the characteristics table below for each waterbody at or adjacent to the site?

Characteristic	Name: Holston River (Adjacent)	Name: _____	Name: _____	Name: _____
Width (feet)	_____	_____	_____	_____
Average Depth (feet)	_____	_____	_____	_____
Physical alterations	☐ Yes ☒ No _____ _____ _____	☐ Yes ☐ No _____ _____ _____	☐ Yes ☐No _____ _____ _____	☐ Yes ☐ No _____ _____ _____
Aquatic vegetation type	☐ Emergent ☐ Submergent ☐ Floating	☐ Emergent ☐ Submergent ☐ Floating	☐ Emergent ☐ Submergent ☐ Floating	☐ Emergent ☐ Submergent ☐ Floating
Tidal influence?	☐ Yes ☒ No MHWL: _____ Basis for determination: _____	☐Yes ☐ No MHWL: _____ Basis for determination: _____	☐ Yes ☐No MHWL: _____ Basis for determination: _____	☐ Yes ☐ No MHWL: _____ Basis for determination: _____
Bank conditions and cover	Bank hght: _____ft. Slope: _____ H:V Plant cover: _____	Bank hght: _____ft. Slope: _____ H:V Plant cover: _____	Bank hght: _____ft. Slope: _____ H:V Plant cover: _____	Bank hght: _____ft. Slope: _____ H:V Plant cover: _____

Characteristic	Name: Holston River (Adjacent)	Name: _____	Name: _____	Name: _____
	(Trees=T, shrub=S, herbs=H, barren=B)	(Trees=T, shrub=S, herbs=H, barren=B)	(Trees=T, shrub=S, herbs=H, barren=B)	(Trees=T, shrub=S, herbs=H, barren=B)
Perennial Flow?	☒ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Substrate	☐Bedrock ☐Boulder (>10 in.) ☐Cobble (2½-10 in) ☐Gravel (0.1-2½ in) ☐Sand (coarse) ☐Silt (fine) ☐Marl (shells) ☐Clay (slick) ☐Muck (fine/black) ☐Debris ☐Detritis ☐Concrete ☐Other: _____ _____	☐Bedrock ☐Boulder (>10 in.) ☐Cobble (2½-10 in) ☐Gravel (0.1-2½ in) ☐Sand (coarse) ☐Silt (fine) ☐Marl (shells) ☐Clay (slick) ☐Muck (fine/black) ☐Debris ☐Detritis ☐Concrete ☐Other: _____ _____	☐Bedrock ☐Boulder (>10 in.) ☐Cobble (2½-10 in) ☐Gravel (0.1-2½ in) ☐Sand (coarse) ☐Silt (fine) ☐Marl (shells) ☐Clay (slick) ☐Muck (fine/black) ☐Debris ☐Detritis ☐Concrete ☐Other: _____ _____	☐Bedrock ☐Boulder (>10 in.) ☐Cobble (2½-10 in) ☐Gravel (0.1-2½ in) ☐Sand (coarse) ☐Silt (fine) ☐Marl (shells) ☐Clay (slick) ☐Muck (fine/black) ☐Debris ☐Detritis ☐Concrete ☐Other: _____ _____
Discharge from the site into the waterbody and description	☒ Yes ☐ No Stormwater after collection and treatment at the WWTP	☐ Yes ☐ No _____ _____ _____	☐ Yes ☐ No _____ _____ _____	☐ Yes ☐ No _____ _____ _____
Waterbody discharges into:	☐No discharge ☒River/Stream ☐Groundwater ☐Discharge ☐Surface runoff	☐No discharge ☐River/Stream ☐Groundwater ☐Discharge ☐Surface runoff	☐No discharge √River/Stream ☐Groundwater ☐Discharge ☐Surface runoff	☐No discharge ☐River/Stream ☐Groundwater ☐Discharge ☐Surface runoff

Characteristic	Name: Holston River (Adjacent)	Name: _____	Name: _____	Name: _____
	☐Other: _____ _____	☐Other: _____ _____	☐Other: _____ _____	☐Other: _____ _____
Field measurements	____ velocity (mph) ____ water temp (°C) ____ pH ____ dissolved O_2 ____ salinity ____ turbidity (clear-CL, opaque-OP, slihgtly turbid-ST, turbid-T) ____ Secchi depth Other: ____ ____	____ velocity (mph) ____ water temp (°C) ____ pH ____ dissolved O_2 ____ salinity ____ turbidity (clear-CL, opaque-OP, slihgtly turbid-ST, turbid-T) ____ Secchi depth Other: ____ ____	____ velocity (mph) ____ water temp (°C) ____ pH ____ dissolved O_2 ____ salinity ____ turbidity (clear-CL, opaque-OP, slihgtly turbid-ST, turbid-T) ____ Secchi depth Other: ____ ____	____ velocity (mph) ____ water temp (°C) ____ pH ____ dissolved O_2 ____ salinity ____ turbidity (clear-CL, opaque-OP, slihgtly turbid-ST, turbid-T) ____ Secchi depth Other: ____ ____
Color and area of coloration	_____ _____ _____ _____	_____ _____ _____ _____	_____ _____ _____ _____	_____ _____ _____ _____
Benthic invertebrates	☐EPT taxa ☐Chironomids ☐Worms Other invertebrates: 1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____	☐EPT taxa ☐Chironomids ☐Worms Other invertebrates: 1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____	☐EPT taxa ☐Chironomids ☐Worms Other invertebrates: 1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____	☐EPT taxa ☐Chironomids ☐Worms Other invertebrates: 1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____

Characteristic	Name: Holston River (Adjacent)	Name: _____	Name: _____	Name: _____
Fish	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____
Herptiles	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____
Birds	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____
Mammals	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____

V. WETLAND HABITAT CHECKLIST

Are there designated or known areas of wetland definitely present at the site? ☐ Yes ☒ No.

Please indicate the sources of information used to make this determination?

☐ USGS Topo Map ☐ National Wetland Inventory Map ☐ State Agency

☐ Federal Agency ☐ Site Determination (specify method): _____

☒ Other (specify): Previous SLERA (Tetra Tech 2000)

How much of the site is wetland? zero acres OR 0.0 %. Indicate the wetland area on the site map attached to this copy of the checklist.

What types of wetland are preset at the site?

☐ Subtidal ☐ Intertidal ☐ Supratidal

☐ Palustrine forest ☐ Palustrine shrub/scrub ☐ Palustrine emergent

☐ Submergent ☐ Other (specify): _____

Dominant plant specie(s):

_____

_____

_____

_____

_____

Provide a general description of the physical characteristics (height, color, etc.) of each wetland system on the site. Include a photograph of each system if available.

_____

_____

_____

_____

Is standing water present in the wetland? ☐ Yes ☐ No. If yes, be sure to complete Checklist III – Aquatic Habitat – Non-Flowing Systems

If there is standing water, is it:

☐ Brackish ☐ Fresh

Is there evidence of flooding at the site? ☐ Yes ☒ √No. If yes, indicate the physical indicators that are present:

☐ Buttressing ☐ Water marks ☐ Mud cracks

☐ Debris lines ☐ Other (specify): _____

What are the sources of water for the wetlands at the site? Indicate the principal source with an asterisk.

☐ Stream/River/Lake ☐ Groundwater ☐ Flooding

☐ Surface runoff ☐ Other (specify): _____

Is there a discharge from the site into a known or suspected wetland? ☐ Yes ☒ No. If yes, please describe below:

_____

_____

Is there a discharge from the wetland? ☐ Yes ☐ No. If yes, indicate the area into which the discharge flows:

☐ Stream/River ☐ Groundwater ☐ Surface soil

☐ Marine/Estuary ☐ Other (specify): _____

Describe the appearance of soil in the wetland area using general color characteristics or Munsell designation:

_____ Color

_____ Water content (dry, wet, saturated)

Section 12. OTHER FEDERAL LAWS

This section presents information on other Federal laws applicable to HSAAP's Burn Pan Unit and is being provided pursuant to the general Part B permitting requirements specified in 40 CFR Part 270 Subpart B and TCRR 0400-12-01-.07(5)(a)1(xx). Specifically, this section identifies other applicable laws to the Burn Pan Unit operation as required under 40 CFR §270.14(b)(20).

At present, the Burn Pan Unit is subject to regulation under the following additional Federal laws:

- Resource Conservation and Recovery Act
- Clean Water Act
- Clean Air Act
- Emergency Planning and Community Right to Know Act
- Comprehensive Environmental Response, Compensation, and Liability
- Toxics Substance Control Act
- Occupational Safety and Health Act
- Safe Drinking Water Act
- Hazardous Waste Materials Transportation Act
- Chemical Facility Anti-Terrorism Standards
- Alcohol Tobacco and Firearms (ATF) Industrial Usage regulations
- International Traffic in Arms Regulations

Specific information regarding compliance with the applicable Federal laws will be provided at the request of the USEPA regional office.

Section 13. PART B CERTIFICATION

The following statement is being provided and signed by a responsible corporate officer of HSAAP per 40 CFR §270.11 and TCRR 0400-12-01-.07-2(a) for the renewal of the HSAAP Tennessee Hazardous Waste Management Facility Permit (EPA ID No. TN5210020421).

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Owner

R. Scott C

Signature

15 Oct 2020

Date

Randolph Scott Carpenter

Printed Name

Holston Commander, LTC

Title

Operator

Signature

21 Oct 2020

Date

Todd D. Hayes

Printed Name

General Manager - BAE Systems

Title

Section 15. PRE-APPLICATION MEETING MATERIALS AND COMMENTS

Pursuant to TRCC 0400-12-01-.07(m)(1) and TRCC 0400-12-02-.02, HSAAP held a pre-application meeting on Thursday, 24 September 2020, prior to submittal of this hazardous waste permit renewal application. The intent of this meeting was to solicit questions from the community and to inform the community of the proposed hazardous waste management activities. This section provides documentation of the public notices that were provided, a summary of the meeting, a list of attendees, and copies of any written comments or materials submitted at the meeting. A copy of the community impact statement that was provided to the public during the meeting is also provided in Attachment 15-1.

15.1 PUBLIC NOTICES

Public notice of the meeting was provided 30 days prior to the meeting via a variety of outlets:

- A newspaper advertisement was provided in the Kingsport Times News.
- A visible and accessible sign was posted on the exterior fence near the Holston Army Ammunition Plant entrance.
- A broadcast media announcement was provided on radio station WTFM 98.5.

See Attachment 15-1 for the Public Notice. In addition to the above locations, an electronic copy of the newspaper notice was provided to TDEC who posted the notice on their website. The Army also posted the notice on the HSAAP Facebook page. Additionally, there is a site distribution list which includes local government officials and anyone else who has notified TDEC of their interest in being notified about any hazardous waste activities involving HSAAP. This list is divided into an electronic distribution and a hard copy distribution. TDEC emailed the notice to those accepting information electronically and BAE Systems Ordnance Systems Inc. mailed the hard copies to the rest.

Each of the aforementioned notices provided the following:

- The date, time, and location of the meeting;
- A brief description of the purpose of the meeting;
- A brief description of the facility and proposed operations, including the address of the facility;
- A statement encouraging people to contact the facility at least 72 hours before the meeting if they need special access to participate in the meeting; and
- The name, address, and telephone number of a contact person for the applicant.

Due to a network disruption which occurred for BAE systems after the public meeting notice distribution, an additional communication was sent to TDEC for electronic distribution, mailed by BAE

Systems to recipients for hard copy distribution, and posted to the HSAAP Facebook site regarding an alternate contact for questions about the meeting. This notice has also been included in Attachment 15-1.

A special access accommodation was requested by three individuals who did not wish to participate in person. These requests were addressed by providing a remote access participation option that was outlined as a form included at the end of Attachment 15-2. Interested individuals could select the option that best suited their needs. All three individuals chose to receive the meeting content electronically.

15.2 MEETING SUMMARY

The meeting was held on September 24, 2020 at the Holston Business Development Center from 5:30 pm to 7:00 pm. Due to Covid-19 concerns, the meeting was held in a poster presentation format to limit the number of people present at a given time and to follow social distancing measures. The information on the posters contained the required elements of the community impact statement. A total of seven individuals attended the meeting. As a supplement to viewing the posters, attendees were provided a hard copy of the posters they could keep for reference along with instructions for sending questions and comments by e-mail if interested in that option. HSAAP representatives were present in a separate room from the posters to address attendee questions and comments. Additionally, attendees were provided the opportunity to write down questions and comments and place them in a drop box at the meeting; however, no comments were received by that method. For individuals who could not attend the meeting but were interested in participating, the poster content was provided by e-mail on September 24, 2020 at 5:30 pm with the requested deadline of noon on September 25, 2020 for submitting questions and comments. Three individuals requested the remote access option. Attachment 15-2 includes a copy of the hand-out provided to meeting attendees and the letter that accompanied the posters provided to the remote access attendees. Comments and questions were received by e-mail from three people who either attended the meeting in person or who selected the remote access option.

15.3 MEETING ATTENDEES

Seven members of the public were present at the pre-application meeting. As mentioned in Section 15.1, three members of the public requested the option to participate remotely. A copy of the sign-in sheet is provided in Attachment 15-3.

15.4 SUBMITTED COMMENTS

Written comments were submitted by e-mail from three members of the community to express their feelings on the proposed renewal application. Copies of the submitted comments and any associated materials are provided in Attachment 15-4.

Attachment 15-1: PUBLIC MEETING NOTICES

PUBLIC NOTICE

PRE-APPLICATION MEETING
RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) PERMIT RENEWAL
HOLSTON ARMY AMMUNITION PLANT, KINGSPORT, TENNESSEE

PURPOSE OF MEETING
Holston Army Ammunition Plant is applying for a renewal of its RCRA hazardous waste management facility permit with the Tennessee Department of Environment and Conservation (TDEC) to operate the Burn Pan Unit. The purpose of this pre-application meeting is to solicit questions from the community and inform the community of the proposed permit renewal activity.

DATE, TIME, LOCATION OF MEETING
The pre-application meeting will be held on September 24, 2020 at 5:30 – 7:00 p.m. at the Holston Business Development Center at 2005 Venture Park Drive, Kingsport, TN 37660.

BRIEF DESCRIPTION OF FACILITY AND PROPOSED OPERATIONS
Holston Army Ammunition Plant (HSAAP) is a government-owned, contractor-operated facility used for the manufacturing of explosive compounds and formulations. HSAAP treats explosive wastes onsite via open burning at the Burn Pan Unit. HSAAP is located in Hawkins and Sullivan Counties at 4509 West Stone Drive, Kingsport, Tennessee, 37660.

SPECIAL INFORMATION
In response to COVID-19, the public meeting will be conducted with limited capacity in the room at one time, temperature checks prior to entry will be conducted, and face coverings will be required.

SPECIAL ACCESS STATEMENT & CONTACT INFORMATION
If you have special access needs to participate in the meeting or require further information, please contact Claire Powell, Communications Manager at BAE Systems, at least 72 hours prior to the meeting. Phone: 540.529.5867. Email: claire.h.powell@baesystems.com.

KINGSPORT TIMES-NEWS

PUBLICATION CERTIFICATE

1526889

Kingsport, TN 8/26/2020

This is to certify that the Legal Notice hereto attached was published in the Kingsport Times-News, a daily newspaper published in the City of Kingsport, County of Sullivan, State of Tennessee, beginning in the issue of August 26, 2020, and appearing 1 consecutive weeks/times, as per order of

BAE Systems

Signed Sheryl Edwards

PUBLIC NOTICE
PRE-APPLICATION MEETING
RESOURCE CONSERVATION AND RECOVERY ACT (RCRA)
PERMIT RENEWAL
HOLSTON ARMY AMMUNITION PLANT,
KINGSPORT, TENNESSEE

PURPOSE OF MEETING
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PUB1T: 8/26/2020

STATE OF TENNESSEE, SULLIVAN COUNTY, TO-WIT:

Personally appeared before me this 26th day of August 2020, Sheryl Edwards of the Kingsport Times-News and in due form of law made oath that the foregoing statement was true to the best of my knowledge and belief.

ROSE LYNN BROOKS
STATE OF TENNESSEE NOTARY PUBLIC
SULLIVAN COUNTY

Rose Lynn Brooks
NOTARY PUBLIC

My commission expires July 11, 2021

Import Automobiles

Jaguar E-type
out of school and I
ire my passion of
m. We are looking
-Cooled Porsche,
pe or any interest-
Car or truck that
ave in any condi-
or not. I am a lo-
oxville area and a
r. Please call
21-4012

Trucks & Vans

SAN, runs well.
1700.
3-335-1852

Motorcycles & ATV's

aki Ninja ZX10R
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546-2211

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de, tags still on,
e used, a rare
n for H-D buffs.
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n back then. Not

960 Parts & Accessories

(4) 15X7 Jeep factory aluminum rims and centers. Honeycomb style. GC. $80. 423 833 1470 or 423 477 8082.

(4) 15X7 Jeep factory steel rims and centers. EC. $80. 423 833 1470 or 423 477 8082.

(4) 8 lug factory steel rims. EC. Off 2006 Chevy but should fit any 8 lug truck with 8X6.75 bolt pattern. $80. 423 833 1470 or 423 477 8082.

(4) Like new 2057014 radial tires. $100. Ranger and S10/ Camaro rims available. 423 833 1570 or 423 477 8082.

(4) 16X7 Dodge Ram factory aluminum rims. VGC. $70. 423 833 1470 or 423 477 8082.

Bumper end caps for 1984-1996 Jeep Cherokee. 2 sets, both for rear bumper. Brand new. $50.00 for both sets. Call 423-239-6404 or text 423-677-8060 for pics

Honda Front End Black
Perfect Condition $150 OBO
Wheels 6 Lug Chevy Truck
Wheel Beauty Ring $20 OBO
423-357-8558

Trailer Hitch for 2008 F150
$50.00
Call 423-282-1078 Leave Msg.

Trailer wire harness connector for 2015-2020 Chevy Colorado w/o tow package. New in box, never used. New cost $78 sell for $55.00 call: 423-202-3647

970 Antique Automobiles

'67 CHEVROLET CHEVELLE
400 CID, Dual Quad, 12 bolt Posi trac . New 5-speed Tremec transmission with less than 1000 miles on it. 2 door hardtop. All new interior including front seats, carpet and front door panels. Custom console and stereo. Owned for

Legals

PUBLIC NOTICE
PRE-APPLICATION MEETING
RESOURCE CONSERVATION AND RECOVERY ACT (RCRA)
PERMIT RENEWAL
HOLSTON ARMY AMMUNITION PLANT,
KINGSPORT, TENNESSEE

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PUB1T: 8/26/2020

Legals

IN THE CHANCERY COURT
OF SULLIVAN COUNTY,
TENNESSEE AT BLOUNTVILLE

NOTICE TO CREDITORS

PROBATE # 20-PR-23293

ESTATE OF
ELIZABETH CHRISTINE
TRAINHAM

Legals

IN THE CHANCERY COURT
OF SULLIVAN COUNTY,
TENNESSEE AT BLOUNTVILLE

NOTICE TO CREDITORS

PROBATE # 20-PR-23254

ESTATE OF
CHRISTINE LORRAINE
KING MITCHELL

Legals

INVITATION TO BID

Scott County Virginia is soliciting sealed bids to replace their current manually operated entry doors at the Community Services Building located at 190 Beech St., Gate City, Virginia with a new entry vestibule with automatic, sliding doors to limit the physical contact of entry into the facility and create an air lock at the building entrance.

Sealed bids labeled. CSB VESTIBULE, must be submitted to Penny Horton, Scott County Economic Development, 190 Beech Street, Suite 202, Gate City, VA 24251 no later than **4:00 PM on Thursday, September 10, 2020.**

Questions regarding the invitation to bid should be submitted in writing and directed to John Kilgore, EDA Director, jkilgore@scottcountyva.com or Bill Dingus, Assistant County Administrator/Public Works Director at bdingus@scottcountyva.com . The project narrative, design sheets, and specifications may be downloaded from the County's Web Site at www.scottcountyva.com under the link" **ITB CSB Vestibule**. A printed copy may also be picked up at the Scott County Administrative Offices at 1900 Beech St., Suite 201, Gate City, VA 24251. Phone: 276-386-6521.

PUB1T: 08/26/2020

Legals

TRUSTEE'S NOTICE OF SALE

WHEREAS, by Deed of Trust dated April 22, 2008, and recorded in the Register's Office for Sullivan County at Blountville, Tennessee, in Book 2662C, Page 0630, Mary L. Durham a/k/a Mary Lou Durham, conveyed to David W. Blankenship, Trustee, the hereinafter described real estate to secure the payment of a Note in the original principal amount of $71,000.00; and

WHEREAS, the undersigned was appointed and substituted as Substitute Trustee under this Deed of Trust by a substitution dated August 17, 2020, and recorded in the Office of the Register of Deeds for Sullivan County at Blountville, Tennessee in Book 3397, Page 1467; and

WHEREAS, default has been made in the payment of said indebtedness and other provisions of the Deed of Trust have been violated, and Eastman Credit Union, the holder of said indebtedness has declared the entire amount due and payable as provided in said Deed of Trust, and the Substitute Trustee has been directed to foreclose the Deed of Trust in accordance with the terms thereof; and

WHEREAS, the public is hereby notified that the undersigned Substitute Trustee will sell the hereinafter described real estate at public auction, to the highest and best bidder, for cash in hand, at the main entrance of City Hall Building, 225 West Center Street, Kingsport, Sullivan County, Tennessee, at 10:00 a.m. on September 16, 2020.
Located in the City of Kingsport, 11th Civil District of Sullivan County, Tennessee, to-wit:

Holston Valley Broadcasting Corp.
222 Commerce Street
Kingsport, TN 37660

BAE SYSTEMS
Advertiser ID: 4296 Amount Paid _____

4296-00005-0000	8/30/2020	1
Official Invoice	Date	Page

DETACH AND RETURN WITH PAYMENT

4296-00005-0000 O 8/30/2020 1

BAE SYSTEMS
Attn: CLAIRE POWELL
4509 WEST STONE DR.
KINGSPORT, TN 37660

Purchase Order Number:
Est. Number:
Co-Op:
Description: PUBLIC NOTICE
Salesperson: Team, Team

Date	Day	Length		Qty	Rate	Total
			ISCI Code: RENEWAL OF RCRA			
			Copy: RENEWAL OF RCRA			
8/26/2020	Wed	1:30	WTFM-FM 10:35:00 AM 02:20:00 PM 05:50:10 PM	3	$100.00	$300.00

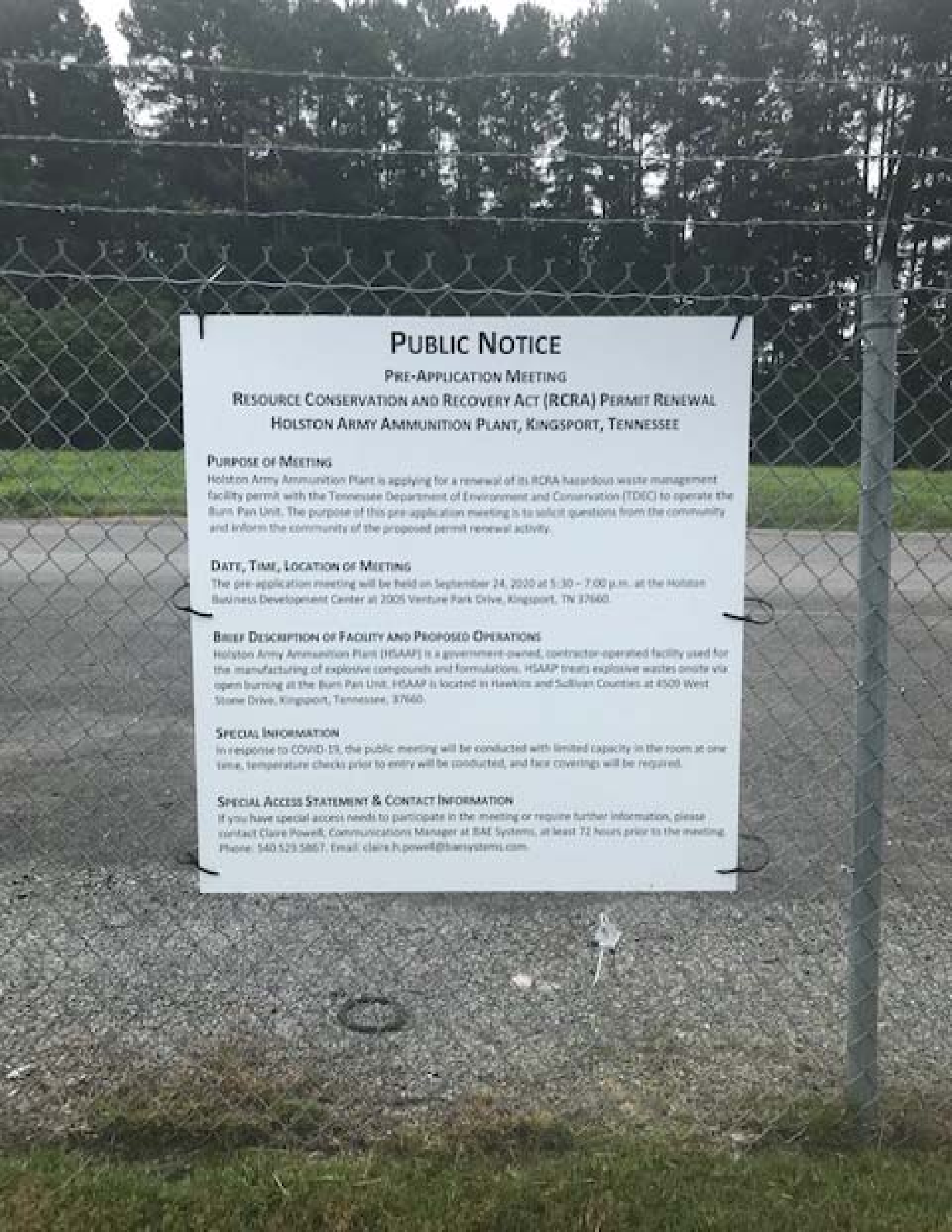
PAID

09/23/2020

Thank you for advertising!

This station does not discriminate on the basis of race, gender or ethnicity in the placement, scheduling and completion of purchase of advertising. Any order for advertising that includes such restriction will not be accepted.

Quantity 3 Total $300.00


PUBLIC NOTICE
PRE-APPLICATION MEETING
RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) PERMIT RENEWAL
HOLSTON ARMY AMMUNITION PLANT, KINGSPORT, TENNESSEE
PURPOSE OF MEETING
Holston Army Ammunition Plant is applying for a renewal of its RCRA hazardous waste management facility permit with the Tennessee Department of Environment and Conservation (TDEC) to operate the Burn Pan Unit. The purpose of this pre-application meeting is to solicit questions from the community and inform the community of the proposed permit renewal activity.
DATE, TIME, LOCATION OF MEETING
The pre-application meeting will be held on September 24, 2020 at 5:30 – 7:00 p.m. at the Holston Business Development Center at 2005 Venture Park Drive, Kingsport, TN 37660.
BRIEF DESCRIPTION OF FACILITY AND PROPOSED OPERATIONS
Holston Army Ammunition Plant (HSAAP) is a government-owned, contractor-operated facility used for the manufacturing of explosive compounds and formulations. HSAAP treats explosive wastes onsite via open burning at the Burn Pan Unit. HSAAP is located in Hawkins and Sullivan Counties at 4509 West Stone Drive, Kingsport, Tennessee, 37660.
SPECIAL INFORMATION
In response to COVID-19, the public meeting will be conducted with limited capacity in the room at one time, temperature checks prior to entry will be conducted, and face coverings will be required.
SPECIAL ACCESS STATEMENT & CONTACT INFORMATION
If you have special access needs to participate in the meeting or require further information, please contact Claire Powell, Communications Manager at BAE Systems, at least 72 hours prior to the meeting. Phone: 540.523.5867, Email: claire.h.powell@baesystems.com.

From: Kayse Smith <Kayse.Smith@tn.gov>
Sent: Tuesday, September 15, 2020 2:58 PM
Subject: [Non-DoD Source] RE: Notification of Alternate Contact for Holston Army Ammunition Plant Pre-Application Meeting RCRA Permit Renewal - Kingsport, Hawkins & Sullivan County

Notification of Alternate Contact

Pre-Application Meeting
Resource Conservation and Recovery Act (RCRA) Permit Renewal
Holston Army Ammunition Plant, Kingsport, Tennessee

Dear Community Members,

Due to a communications issue associated with non-Army internet services at Holston Army Ammunition Plant, an alternate point of contact for special access requests is being provided. If you have special access needs to participate in the meeting or require further information, please contact Justine Barati, Director of Public and Congressional Affairs at the Joint Munitions Command, least 72 hours prior to the meeting. Phone: 563.505.4359. Email: Justine.A.Barati.civ@mail.mil < Caution-mailto:Justine.A.Barati.civ@mail.mil > .

From: Kayse Smith
Sent: Wednesday, August 26, 2020 2:52 PM
Subject: Public Notice: Holston Army Ammunition Plant Pre-Application Meeting RCRA Permit Renewal - Kingsport, Hawkins & Sullivan County

PUBLIC NOTICE

PRE-APPLICATION MEETING
RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) PERMIT RENEWAL
HOLSTON ARMY AMMUNITION PLANT, KINGSPORT, TENNESSEE

PURPOSE OF MEETING

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Holston Army Ammunition Plant (HSAAP) is a government-owned, contractor-operated facility used for the manufacturing of explosive compounds and formulations. HSAAP treats explosive wastes onsite via open burning at the Burn Pan Unit. HSAAP is located in Hawkins and Sullivan Counties at 4509 West Stone Drive, Kingsport, Tennessee, 37660.

SPECIAL INFORMATION

In response to COVID-19, the public meeting will be conducted with limited capacity in the room at one time, temperature checks prior to entry will be conducted, and face coverings will be required.

SPECIAL ACCESS STATEMENT & CONTACT INFORMATION

If you have special access needs to participate in the meeting or require further information, please contact Claire Powell, Communications Manager at BAE Systems, at least 72 hours prior to the meeting. Phone: 540.529.5867. Email:claire.h.powell@baesystems.com < Caution-mailto:claire.h.powell@baesystems.com > .

NOTICE ISSUED: August 26, 2020

You are receiving this message as you have expressed interest in receiving public notices related to Hazardous Waste permitting activity permitting activity statewide or within Hawkins or Sullivan County. If you would like to update your preferences or contact information, please complete form CN-0837. VisitCaution-http://tdec.tn.gov/etdec/DownloadFile.aspx?row_id=CN-0837 < Caution-http://tdec.tn.gov/etdec/DownloadFile.aspx?row_id=CN-0837 > to download the form.

Attachment 15-2: COMMUNITY IMPACT STATEMENT

DEPARTMENT OF THE ARMY

Holston Army Ammunition Plant
4509 West Stone Drive
Kingsport, TN 37660

September 24, 2020

Dear Community Member,

Thank you for participating in the Holston Army Ammunition Plant (HSAAP) Subpart X Pre-Application Meeting. The information attached is an exact copy of the poster boards presented tonight. This is provided as a courtesy in order to support maintained social distancing, assisting you with viewing the materials, and to provide a reference for any questions or comments you may submit. Because the community members participating remotely were provided additional time to submit questions, all community members attending the meeting may submit additional questions or comments until 12 Noon Friday, September 25, 2020. Please note that hard copy mailed comments are also acceptable and must be postmarked by September 25. This will allow adequate time to compile all received comments and include them with the application package. Emailed comments should be submitted to Justine Barati (Justine.A.Barati.civ@mail.mil). Please note that the Army email system has a size limitation of 20MB. Any messages, inclusive of all attachments, that are sent with a cumulative content volume over this limit will not be received. Mailed comments should be submitted to Claire Powell, Communications Manager at BAE Systems, 4509 West Stone Dr.; Kingsport, TN 37660. If you have trouble submitting your comments or need to make other arrangements, please contact Ms. Barati via phone at 563.505.4359. Thank you again for your desire to participate in the pre-application meeting. We look forward to hearing from you.

Sincerely,

R. Scott Carpenter
LTC, U.S. Army
Commanding

Todd D. Hayes
Ordnance Systems Inc.
General Manager

MEETING LOGISTICS AND GROUND RULES

Steps and What to Expect

1. Temperature screening will occur for all guests wishing to enter the building
2. Participant Sign-In (address is optional)
3. In order to maintain social distancing, participants will be notified when it is their turn to enter
4. Prior to entering the presentation room, all participants will wait in the lobby until escorted into the room
5. Please start at the first station, immediately on your left
6. Please proceed to each station in a clockwise manner
7. If you need to write questions or comments, please do so on the table provided in the center of the room
8. Once you have completed your review of the information, a drop box is located down the hall to the left
9. If you need to discuss information further to better your understanding, please proceed to the question and comment room across the hall.

Notes and Guidelines

- ◊ Face coverings shall be worn at all times while in the building
- ◊ Cell phones should be placed on silent while inside building
- ◊ Please use dedicated entrance paths and exit paths
- ◊ Room coordinator will ensure social distancing recommendations are adhered to while moving through the various stations and occupancy limit of <= 10 is maintained in conference room
- ◊ If you need help with viewing some of the information or where to go next, please ask the room coordinator
- ◊ Once you have reviewed the presentation boards, you may exit the building or provide questions/comments

WELCOME

Thank you for participating in the Holston Army Ammunition Plant (HSAAP) Resource Conservation and Recovery Act (RCRA) Subpart X Permit renewal pre-application public meeting. HSAAP currently has a RCRA Subpart X permit to allow open burning of waste explosives. This permit has an expiration date of March 31, 2021. In order to request renewal of this permit from the state of Tennessee, HSAAP must hold a pre-application public meeting, collect comments or questions from the community, and request participants name and address to be submitted along with permit application. The purpose of this meeting is to meet those requirements as part of the renewal process.

The current permit allows for open air burning of waste explosives in pans during times and weather conditions specified by the permit. HSAAP is seeking to renew this permit without significant changes. Renewal of this permit will allow HSAAP to continue to safely dispose of waste explosives. HSAAP is also pursuing alternative technologies to open burning. However, that technology is currently in the planning/predesign phase and will not be constructed at HSAAP for several more years. Additionally, that technology may or may not be able to safely handle all of the explosive waste streams. Therefore, HSAAP must renew the existing permit to ensure the facility retains an ability to safely thermally treat explosive waste.

Holston Army Ammunition Plant (HSAAP)

RCRA Subpart X Hazardous Waste Treatment Permit TNHW-148 Renewal

Pre-Application Meeting

Effective Date: March 31, 2011

Expiration Date: March 31, 2021

Red line indicates plant boundary

What is HSAAP?

Operational Framework:

- Government-owned, contractor-operated Army Facility

Facility Mission:

- Manufactures explosive compounds and explosive formulations for the Department of Defense

Holston Army Ammunition Plant (HSAAP)

RCRA Subpart X Hazardous Waste Treatment Permit TNHW-148

What is the Burn Pan Unit?

- Open burning unit with four treatment pans that are used to thermally destroy waste explosives generated at HSAAP

- Unit includes berms, pans, fencing, clay liner, and all associated equipment necessary for operations

What types of waste do we treat at the Burn Pan Unit?

Four general categories of waste explosives

- Manufacturing explosive wastes
- Off-specification explosive product
- Laboratory explosive wastes
- Research and Development explosive wastes

Is there a waste stream from the Burn Pan Unit?

The residues (ash) remaining after treatment are tested prior to being normally disposed in the on-site Class II landfill

Holston Army Ammunition Plant (HSAAP)

RCRA Subpart X Hazardous Waste Treatment Permit TNHW-148

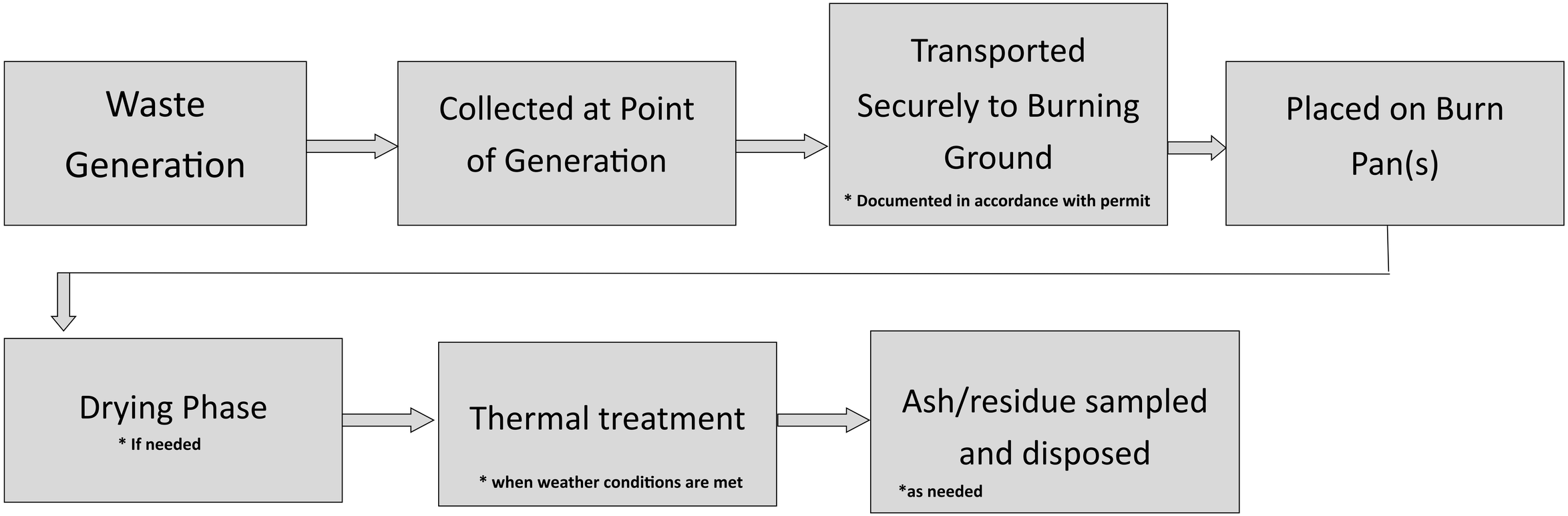
How has the Burn Pan Unit been designed to meet hazardous waste standards?

- Explosive wastes are loaded onto clay-lined pans that are designed to withstand the high treatment temperatures
- The pans are situated on top of metal rails above gravel and on a compacted clay liner that is designed to facilitate better inspections and prevent ejected material from contaminating the underlying soil and groundwater
- The pans are surrounded by clay-lined graveled berms with rip-rap that protect the area from a major flood event from the waters of the Holston River

Holston Army Ammunition Plant (HSAAP)

RCRA Subpart X Hazardous Waste Treatment Permit TNHW-148

Hazardous Waste Management General Flowchart



Holston Army Ammunition Plant (HSAAP)

RCRA Subpart X Hazardous Waste Treatment Permit TNHW-148

How is the Burn Pan Unit protected from seismic events and floods?

What happens when it rains?

- The Burn Pan Unit has no protective or design measures for seismic events because none of the political jurisdictions within Tennessee have been specified by USEAP as “at-risk” for seismic events

- The Unit is protected from a 100-year flood of the Holston River by the berms that surround it

- If weather forecasting is predicting a flood event, any explosives present on the pan(s) will be treated and no additional explosives will be loaded onto the pans

- Rainwater falling inside the Unit is routed through piping to the on-site industrial wastewater treatment plant

- The clay liner underneath the Unit minimizes potential infiltration of surface waters that may collect in the Unit into the groundwater

- Mobile covers are placed over the pans to prevent precipitation from collecting in the pans when they are not being used

Holston Army Ammunition Plant (HSAAP)

RCRA Subpart X Hazardous Waste Treatment Permit TNHW-148

What about emergency situations?

- Communication, emergency response, and spill cleanup equipment is maintained by the facility and the on-site Fire Department for responding to emergencies
- The on-site Fire Department and affected personnel have been trained to respond to explosive emergencies
- Mutual aid agreement with City of Kingsport and Kingsport Fire Department
- Contingency Plan was developed to identify potential emergency events, emergency contacts, necessary emergency equipment, and response procedures (distributed to Hawkins and Sullivan County Emergency Management Agencies)

Holston Army Ammunition Plant (HSAAP)

RCRA Subpart X Hazardous Waste Treatment Permit TNHW-148

What about security? How do you keep people from getting to the explosives and causing trouble?

- Four layers of fencing to separate the public and unauthorized personnel from the Unit
- Plant entrance gates staffed 24 hours per day, 7 days per week by security personnel
- Roving security teams
- Closed-circuit television systems throughout the site, at the Unit, and at the property boundaries along the river

- Single-access point to the Unit
- Access only to trained personnel or escorted and authorized visitors—all persons and vehicles must stop and check in with the Burning Ground Attendant
- Authorized traffic into the area—plant traffic is not routed in or around the Burn Pan Unit.

Holston Army Ammunition Plant (HSAAP)

RCRA Subpart X Hazardous Waste Treatment Permit TNHW-148

How do you protect people?

Workers

- Personnel are trained on how to handle explosives and explosive containers and how to safely load and ignite the burn pans
- Personnel are provided personal protective equipment as specified for the activity
- When the pans are being loaded, all vehicles are turned off and kept at a safe distance away
- The pans are ignited remotely from a safe distance away at the Burning Ground Office

Community

- The total volume of material to be treated is limited to 5,000 lbs per burn event
- Select burn times and days that meet specific permit conditions
- Pans are covered during inclement weather to prevent any loss
- The clay liner is sampled routinely and any identified contamination is removed so that soil contamination cannot migrate into the groundwater and away from the site

Holston Army Ammunition Plant (HSAAP)

Waste Explosives Alternative Technology Update

History

- 2019 HSAAP Open Burning Alternatives Report identified potentially safe alternatives for explosive waste disposal.

- The Government selected the Moving Bed Reactor (MBR) for further investigation as to the feasibility for HSAAP.

- However, the review of implementing the MBR technology revealed that it was not feasible for HSAAP at this time.

- Therefore, the Government pivoted to using the Static Detonation Chamber (SDC) as preferred technology for pan waste treatment on May 13, 2020.

Representative SDC Unit

https://www.dynasafe.com/demil-systems/safe-large-scale-munitions-destruction/static-detonation-chamber

Key Activities

- Site location evaluation (completed)

- Initial Design to 65%

- Permitting packages, including but not limited to: Resource Conservation and Recovery Act (12-24mo) Air Construction (6-9mo)

- Design- Build contract to cover final design, construction, and commissioning

Progress

- Army is finalizing scope of work to support initial design contract and permitting

- Initial design contract is planned for award in Fiscal Year (FY) 21*

- SDC Completion is currently planned for FY 26*^

**Subject to annual DoD budget approval*

^ Subject to timely permit approvals

HSAAP Subpart X Renewal Pre-Application Meeting
Remote Access Selection

Thank you for your interest in participating in the Holston Army Ammunition Plant (HSAAP) Subpart X Pre-Application Meeting. HSAAP currently has a Resource Conservation and Recovery Act (RCRA) Subpart X permit to allow open burning of waste explosives. This permit has an expiration date of March 31, 2021. In order to request renewal of this permit from the state of Tennessee, HSAAP must hold a pre-application public meeting, collect comments or questions from the community, and request participants name and address. The purpose of this meeting is to meet those requirements and request renewal of the existing permit.

We recognize that due to work schedules, summer vacations, and COVID-19 concerns that not all interested community members may have the opportunity to participate in-person at the scheduled meeting. Therefore, we have arranged for a remote participation selection.

The meeting scheduled for September 24, 2020 will take place in the format of a poster board session. All meeting instructions and site information will be presented on individual poster boards that will allow in-person participants to view the information at their leisure while maintaining social distancing. Participants will also have an opportunity to submit or ask questions in a separate area of the building. Because of this format, there are no speeches or other activities to record or broadcast live for distribution via a traditional electronic means. Therefore, we are offering community members an opportunity to participate remotely. This opportunity offers community members a series of options to participate and does not rely on the ability to travel or availability of internet access.

Community members wishing to participate remotely are requested to provide their name and address and select one of the participation options available. These options allow each community member to select how they may participate most effectively.

Options:

A. Holston will email a copy of the posters in PDF format to a specified email address at 5:30pm on September 24, 2020. Any questions or comments must be emailed back to Justine Barati (Justine.A.Barati.civ@mail.mil) by 11:59pm on September 24, 2020.

B. Holston will mail a hard copy of the posters on 8 ½ x 11 paper to the community member's address by September 24, 2020. Any questions or comments must be mailed or emailed back to Holston Army Ammunition Plant 4509 West Stone Dr.; Kingsport, TN 37660, Justine.A.Barati.civ@mail.mil. Any emailed comments must be received by 11:59pm on September 24, 2020. Any mailed comments must be postmarked by September 25, 2020.

C. Community members may choose to complete a drive-up option. This option is for community members who wish to come in-person, but do not wish to enter the building. Community members selecting this option can approach the registration table at the meeting and request a hard copy of the posters. The community member may then review the information during the time slot of the meeting and then provide questions in writing back to the registration table prior to the end of the meeting (7pm).

HSAAP Subpart X Renewal Pre-Application Meeting
Remote Access Selection

Please indicate the participation option that best suits your needs and provide your contact information to us no later than September 21, 2020. Thank you in advance for your participation in the HSAAP Subpart X Renewal Pre-Application Meeting.

Option Selected:

Community Member Name(s):

Community Member Address:

Attachment 15-3: MEETING SIGN-IN SHEET

Holston Army Ammunition Plant

RCRA Subpart X Permit TNHW-148 Renewal pre-Application Meeting

September 24, 2020, 5:30 pm – 7 pm at Holston Business Development Center

	Name	Address
1	Pat Shull	City of Kingsport
2	Bobbi Smith	Rutledge TN (432 Hodgetown Rd.)
3	Nancy Bell	3472 Hwy 66 N Rogersville
4	Eileen Queener	~~[illegible] Regency Dr~~ Rogersville
5	Ryan McReynolds	City of Kingsport
6	Ray Peters	Rogersville
7	Dan Firth	Kingsport
8		
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17		

Holston Army Ammunition Plant

RCRA Subpart X Permit TNHW-148 Renewal pre-Application Meeting

September 24, 2020, 5:30 pm – 7 pm at Holston Business Development Center

These individuals participated using the remote access option

	Name	Address
1	Mark Toohey	
2	Robert Nakamoto	
3	Laura Olah	
4		
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12		
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17		

Attachment 15-4: WRITTEN PUBLIC COMMENTS

Peters, Laura CIV USARMY JMC (USA)

From: Mark Toohey <markhtoohey@gmail.com>
Sent: Friday, September 18, 2020 11:28 AM
To: Barati, Justine A CIV USARMY JMC (USA)
Subject: [Non-DoD Source] Re: FW: Remote Access Instructions for Pre-Application Meeting.pdf (UNCLASSIFIED)

Thank you Justine. I completed the form and sent it to you via a separate email. It would be helpful if you could send the email with the posters a little sooner. I usually don't get out of court until 7 or 8 p.m. on Tuesdays and Thursdays.

Thanks,

Mark Toohey

On Fri, Sep 18, 2020 at 11:09 AM Barati, Justine A CIV USARMY JMC (USA) <justine.a.barati.civ@mail.mil < Caution-mailto:justine.a.barati.civ@mail.mil > > wrote:

> CLASSIFICATION: UNCLASSIFIED
>
> Resending.
>
> Justine Barati
>
> Director of Public and Congressional Affairs
>
> Joint Munitions Command
>
> Justine.A.Barati.civ@mail.mil < Caution-mailto:Justine.A.Barati.civ@mail.mil >
>
> Work: 309-782-7649
>
> Work Cell: 309-206-3461
>
> After Hours: 563-505-4359

From: Barati, Justine A CIV USARMY JMC (USA)
Sent: Monday, September 14, 2020 8:11 AM
To: 'marktoohey@gmail.com < Caution-mailto:marktoohey@gmail.com > ' <marktoohey@gmail.com < Caution-mailto:marktoohey@gmail.com > >
Subject: Remote Access Instructions for Pre-Application Meeting.pdf (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

Mark,

Please see the attached information about how to participate in the upcoming pubic meeting. Please let me know if you have any questions. I also need an email back to ensure you received this message.

Thanks.

Justine Barati

563-505-4359

Justine.A.Barati.civ@mail.com < Caution-mailto:Justine.A.Barati.civ@mail.com >

CLASSIFICATION: UNCLASSIFIED

CLASSIFICATION: UNCLASSIFIED

Peters, Laura CIV USARMY JMC (USA)

To: Barati, Justine A CIV USARMY JMC (USA)
Subject: RE: [Non-DoD Source] Army allowing only 6 HOURS for "public participation" re Holston AAP hazardous waste permit (UNCLASSIFIED)

From: Laura Olah <info@cswab.org>
Sent: Saturday, September 19, 2020 11:50 AM
To: Barati, Justine A CIV USARMY JMC (USA) <justine.a.barati.civ@mail.mil>
Cc: 'Ronnie Wilhoit' <Ronnie.Wilhoit@tn.gov>; 'Travis Blake' <travis.blake@tn.gov>; crosby-vega.terri@epa.gov; 'Kenneth Shuster' <shuster.kenneth@epa.gov>; 'Congressman Roe Phil' <rep.roe@mail.house.gov>; Lana_Moore@alexander.senate.gov; 'Walker, Mary' <walker.mary@epa.gov>; 'Monell, Carol' <Monell.Carol@epa.gov>; Mark & Connie Toohey/Volunteers EHJ <volunteersforenvironment@gmail.com>; rsorrell@bristolnews.com; jones-johnson.shea@epa.gov; Sasha Gerhard/EPA HQ OB_OD <Gerhard.Sasha@epa.gov>
Subject: [Non-DoD Source] Army allowing only 6 HOURS for "public participation" re Holston AAP hazardous waste permit

_____

ATTN: Justine Barati, Chief of Public and Congressional Affairs for the Joint Munitions Command (JMC)

Dear Ms. Barati,

We just received the attached instructions from the U.S. Army which stipulate a matter of HOURS for “public participation” regarding the pre-application to renew the RCRA hazardous waste permit for the Holston Army Ammunition Plant due to expire in 2021.

I’ve monitored Department of Defense cleanups for 30 years and have never heard of anything more dismissive, offensive and unjust to community members that are directly or indirectly affected by toxic military sites and activities. As the Army is keenly aware, the current RCRA permit at Holston allows the open burning and detonation of energetics and explosives-contaminated wastes which results in the uncontrolled dispersion of toxic and carcinogenic emissions including heavy metals, energetic compounds, perchlorate, nitrogen oxides and other munitions-related contaminants to the environment and the surrounding community.

We request that the Army, state and federal regulators immediately amend this proposal to allow for a minimum of 30 days for public comment. We encourage other recipients to request the same of the Army.

In the interim, please email us the documents described in Option A.

Laura Olah | Executive Director

Citizens for Safe Water Around Badger | Caution-www.CSWAB.org

National Coordinator | Cease Fire Campaign

E12629 Weigand's Bay South, Merrimac, WI 53561

P: 608 643 3124 | info@cswab.org <mailto:info@cswab.org> < Caution-mailto:info@cswab.org >

BCC: Tennessee media contacts

CLASSIFICATION: UNCLASSIFIED

Peters, Laura CIV USARMY JMC (USA)

To: Barati, Justine A CIV USARMY JMC (USA)
Subject: RE: [Non-DoD Source] Holston Army Ammunition Plant Permitting Public Meeting (UNCLASSIFIED)

From: Robert Nakamoto <Robert.Nakamoto@tn.gov>
Sent: Friday, September 18, 2020 2:10 PM
To: Barati, Justine A CIV USARMY JMC (USA) <justine.a.barati.civ@mail.mil>
Cc: Albert Frakes <Albert.Frakes@tn.gov>
Subject: [Non-DoD Source] Holston Army Ammunition Plant Permitting Public Meeting

---

Justine,

I will be assisting Al Frakes, the lead permit writer for this project, in reviewing the permit application.

Please put me on your public participation/contact list and I would like to receive a copy of the poster boards on September 24th for the public meeting.

Thank you! Robert

Robert S. Nakamoto, P.E., CHMM

TDEC-Environmental Consultant

DSWM, TDEC

Phone: (615) 532-0868

tn.gov/environment < Caution-http://www.tn.gov/environment >

Internal Customers: We value your feedback! Please complete ourcustomer satisfaction survey < Caution-https://stateoftennessee.formstack.com/forms/internal_cs > .

External Customers: We value your feedback! Please complete our customer satisfaction survey < Caution-https://stateoftennessee.formstack.com/forms/tdec_customer_svs > .

CLASSIFICATION: UNCLASSIFIED

Peters, Laura CIV USARMY JMC (USA)

From: Laura Olah <info@cswab.org>
Sent: Friday, September 25, 2020 12:40 PM
To: Barati, Justine A CIV USARMY JMC (USA)
Cc: Peters, Laura CIV USARMY JMC (USA); 'Ronnie Wilhoit'; 'Travis Blake'; crosby-vega.terri@epa.gov; 'Kenneth Shuster'; 'Congressman Roe Phil'; Lana_Moore@alexander.senate.gov; 'Walker, Mary'; 'Monell, Carol'; 'Robert Nakamoto'; Mark & Connie Toohey/Volunteers EHJ; rsorrell@bristolnews.com; jones-johnson.shea@epa.gov; Cole, Kathy O CIV USARMY JMC (USA); 'Mark Toohey'
Subject: [Non-DoD Source] Holston Army Ammunition Plant Resource Conservation and Recovery Act Subpart X Renewal Pre-Application Public Meeting (UNCLASSIFIED)

Ms Barati,

Due to the lack of information and the ridiculously short time that Army allowed to provide public comments, we -- like Holston and Tennessee residents – are simply speechless. We are unable to review, consider and discuss the proposal in the Army's required timeline. But Army already knows this.

Laura

--

Laura Olah | Executive Director

Citizens for Safe Water Around Badger | Caution-www.CSWAB.org

National Coordinator | Cease Fire Campaign

E12629 Weigand's Bay South, Merrimac, WI 53561

P: 608 643 3124 | info@cswab.org < Caution-mailto:info@cswab.org > | Caution-www.twitter.com/CSWAB < Caution-http://www.twitter.com/CSWAB >

Caution-www.facebook.com/cswab.org | Caution-www.facebook.com/ceasefirecampaign

From: Barati, Justine A CIV USARMY JMC (USA) [Caution-mailto:justine.a.barati.civ@mail.mil]
Sent: Thursday, September 24, 2020 4:31 PM
To: Robert Nakamoto; Mark Toohey; Laura Olah
Cc: Peters, Laura CIV USARMY JMC (USA); Barati, Justine A CIV USARMY JMC (USA); Cole, Kathy O CIV USARMY JMC (USA)
Subject: Holston Army Ammunition Plant Resource Conservation and Recovery Act Subpart X Renewal Pre-Application Public Meeting (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

The remote participation package for the Holston Army Ammunition Plant Resource Conservation and Recovery Act Subpart X Renewal Pre-Application Public Meeting is attached. One file is the cover letter and the other file contains the posters.

Justine Barati

Director of Public and Congressional Affairs

Joint Munitions Command

Justine.A.Barati.civ@mail.mil < Caution-mailto:Justine.A.Barati.civ@mail.mil >

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Work Cell: 309-206-3461

After Hours: 563-505-4359

CLASSIFICATION: UNCLASSIFIED

Peters, Laura CIV USARMY JMC (USA)

To: Barati, Justine A CIV USARMY JMC (USA)
Subject: RE: [Non-DoD Source] Questions re:HSAAP Subpart X Pre-Ap (UNCLASSIFIED)

From: Bobbi Smith <ardia1952@yahoo.com>
Sent: Friday, September 25, 2020 11:00 AM
To: Barati, Justine A CIV USARMY JMC (USA) <justine.a.barati.civ@mail.mil>
Cc: Nancy Bell <nancywithbell@gmail.com>; Eileen Queener <ehqueener@gmail.com>; Dan Firth <dwfirth@gmail.com>; Bill Kornrich <bkornrich@gmail.com>
Subject: [Non-DoD Source] Questions re:HSAAP Subpart X Pre-Ap

Hello Justine. Thanks for taking these questions. I did ask some questions at the public meeting last evening, but here are a couple more:

1) There was nothing in the materials displayed (repeated in the handout) about the Flash Furnace, which in previous meetings which, as explained to the public, will reportedly handle +/-65% of generated contaminated waste. Why no updated information in the handout or on the story boards? Can you update? I have read the update on HSAAP Facebook page. More info on this would make a big difference in how the public reacts to the permit to continue open burning of waste. Seems like a big omission.

2) With respect to the Static Detonation Chamber, seems as if the timeline will have to be moved significantly into the future, as all previous work was towards approval of the Moving Bed Reactor (chosen after significant time spent on research). Is there a current timeline? Has the funding changed?

3) I am confused about the 2018 memorandum from DOD Department of the Army, signed by John Tesner, Acting Deputy Ass't Sec. of Army for Environmental, Safety and Occupational Health (Nov. 2018), stating that (paragraph #3) "At the end of the 2020-2024 Program Objective Memorandum Cycle, the treatment of such material by Open Burning (OB) is prohibited. When was this changed to 2026? Is there an expectation that the Static Detonation Chamber will be completed by that date?

4) With respect to the "100 year flood" safety of the Open Burn Pan. Seems that designation should be updated since the Holston is affected as much by the opening and closing of upstream dams as it is by rainwater. Also the river level is affected by dams downstream, as the TVA attempts to mitigate flood waters from going downstream into the Tennessee and ultimately Mississippi Rivers. Waters have been held back more frequently as the climate has warmed leading to more significant rain events.

Thank you all for holding the public hearing last evening. Good wishes to LTC Carpenter. The efforts of the Army and BAE to end Open Burning at HSAAP and other munitions plants around the US are appreciated by all of us who desire to protect the environment of our beautiful country.

Respectfully, --Bobbi Smith, Care NET Community Conservation Committee of TN Sierra Club

CLASSIFICATION: UNCLASSIFIED

Peters, Laura CIV USARMY JMC (USA)

To: Barati, Justine A CIV USARMY JMC (USA)
Subject: RE: [Non-DoD Source] Holston Pre-Application Comments (UNCLASSIFIED)

From: Mark Toohey <markhtoohey@gmail.com>
Sent: Friday, September 25, 2020 10:13 AM
To: Barati, Justine A CIV USARMY JMC (USA) <justine.a.barati.civ@mail.mil>
Subject: [Non-DoD Source] Holston Pre-Application Comments

Ms Barati,

Due to the lack of information and the short time we were allowed to provide our comments, I am simply speechless. I will wait for further information and additional time to make comments during the permit application comment period.

Sincerely,

Mark Toohey

CLASSIFICATION: UNCLASSIFIED

Written Comments:

1. Request submitted in response to the remote participation opportunity:
   It would be helpful if you could send the email with the posters a little sooner.

   Response: The HSAAP discussed the request and determined that release of meeting information prior to the start of the meeting was not appropriate. Given the limited nature of the material presented to meet the requirements of the pre-application meeting, a significant extension was not considered to be necessary. The purpose of the pre-application meeting is to alert the general public that Holston plans to submit the application. Therefore, the comment period was extended from midnight on the 24th September until noon on the 25th.

2. Comment submitted in response to the remote participation opportunity:
   We just received the attached instructions from the U.S. Army which stipulate a matter of HOURS for "public participation" regarding the pre-application to renew the RCRA hazardous waste permit for the Holston Army Ammunition Plant due to expire in 2021.

   I've monitored Department of Defense cleanups for 30 years and have never heard of anything more dismissive, offensive and unjust to community members that are directly or indirectly affected by toxic military sites and activities. As the Army is keenly aware, the current RCRA permit at Holston allows the open burning and detonation of energetics and explosives-contaminated wastes which results in the uncontrolled dispersion of toxic and carcinogenic emissions including heavy metals, energetic compounds, perchlorate, nitrogen oxides and other munitions-related contaminants to the environment and the surrounding community.

   We request that the Army, state and federal regulators immediately amend this proposal to allow for a minimum of 30 days for public comment. We encourage other recipients to request the same of the Army.

   Response: The Army appreciates your concern over the public participation opportunities that are available during the Holston Army Ammunition Plant (HSAAP) renewal of permit TNHW-148. The renewal of this permit is not part of the Defense Cleanup Program, but rather a permit for an operating unit.

   The State of Tennessee requires all permit renewals to have a pre-application meeting under Tennessee Rule 0400-12-01.07(2)(e). This rule references paragraph 0400-12-01.07(1)(m) for meeting contents and instructions. The pre-application meeting hosted on September 24, 2020, is in accordance with these regulatory requirements. Due to the Coronavirus outbreak and the varied work schedules of the local populace, HSAAP has made additional efforts to provide a means for community members to participate remotely. These efforts include additional time for comment submission, which has been extended to noon on September 25, 2020.

   The pre-application meeting is only the beginning of the permit renewal process. The primary function of this meeting is to prepare the community for the renewal process. A public notice

will be issued to provide access to the application once it is submitted to the State of Tennessee. If tentatively approved by the State, a draft permit will be issued. There will be a 45-day comment period on the draft permit, which is the public's main participation opportunity in the renewal process.

In summary, HSAAP is seeking to renew operating permit TNHW-148 in accordance with the Tennessee Hazardous Waste Regulations. The pre-application meeting and remote access opportunity will occur on September 24, 2020, as originally scheduled. Please feel free to provide comments on the pre-application information or any other future public comment opportunities.

3. Comment on the Pre-application process:
   Due to the lack of information and the short time we were allowed to provide our comments, I am simply speechless. I will wait for further information and additional time to make comments during the permit application comment period.

   Response: Comment Noted. Please see the response to comment #2.

4. Written question from meeting participant:
   There was nothing in the materials displayed (repeated in the handout) about the Flash Furnace, which in previous meetings which, as explained to the public, will reportedly handle +/-65% of generated contaminated waste. Why no updated information in the handout or on the story boards? Can you update? I have read the update on HSAAP Facebook page. More info on this would make a big difference in how the public reacts to the permit to continue open burning of waste. Seems like a big omission.

   Response: The purpose of this meeting was to complete the regulatory requirements to submit the application for renewal of the existing hazardous waste treatment permit. This permit is only applicable to the burning pans that are used to treat waste explosives. The flashing furnace is a proposed, future unit being designed to address the explosives contaminated items that are placed on the piles and cages. The piles and cages are not part of permit TNHW-148. Therefore, the flashing furnace technology was not the subject of the meeting. The Army encourages the community to periodically review the Holston Army Ammunition Plant Facebook page for future community updates on planned general community meetings or press releases related to all open burning facilities.

5. Written question from meeting participant:
   With respect to the Static Detonation Chamber, seems as if the timeline will have to be moved significantly into the future, as all previous work was towards approval of the Moving Bed Reactor (chosen after significant time spent on research). Is there a current timeline? Has the funding changed?

   Response: As provided on the final poster that was sitting in the Question area, the design contract for the Static Detonation Chamber is planned for fiscal year 21. The funding received

for design has not changed. The funding requested for construction has not changed. The previous work on the Moving Bed Reactor was related to ensuring that a technology never built or operated in the United States could be accepted by all technical disciplines of the Army. The Static Detonation Chamber has previously been constructed and operated in the United States for alternate applications. Therefore, the pre-design work has not been as significant for the Static Detonation Chamber as it would have been for the Moving Bed Reactor.

6. Written question from meeting participant:
   I am confused about the 2018 memorandum from DOD Department of the Army, signed by John Tesner, Acting Deputy Ass't Sec. of Army for Environmental, Safety and Occupational Health (Nov. 2018), stating that (paragraph #3) "At the end of the 2020-2024 Program Objective Memorandum Cycle, the treatment of such material by Open Burning (OB) is prohibited. When was this changed to 2026? Is there an expectation that the Static Detonation Chamber will be completed by that date?

   Response: The November 2018 memorandum referenced was rescinded and replaced by a memorandum issued in November 2019. The Updated memorandum changed the Army's desired date for implementation of alternative technologies to open burning. In addition to the change in date, the updated memorandum only addresses explosive contaminated material. The waste explosives are not addressed by this memorandum. Therefore the Static Detonation Chamber is not subject to the 2019 memorandum. HSAAP's pursuit of alternative technologies was already in place prior to the issuance of either memorandum. As discussed during your questions at the meeting and at the last HSAAP community meeting, no change has occurred in the Holston timeline for alternative technologies as a result of the memorandum. The current projected completion date of the Static Detonation Chamber was provided on the final poster as fiscal year 2026. As always, all future funding is subject to annual Department of Defense appropriations.

7. Written question from meeting participant:
   With respect to the "100 year flood" safety of the Open Burn Pan. Seems that designation should be updated since the Holston is affected as much by the opening and closing of upstream dams as it is by rainwater. Also the river level is affected by dams downstream, as the TVA attempts to mitigate flood waters from going downstream into the Tennessee and ultimately Mississippi Rivers. Waters have been held back more frequently as the climate has warmed leading to more significant rain events.

   Response: Comment noted. During Holston's preparation of the application package, verification of the flood plain and associated berm calculations were completed. Therefore, Holston is reporting the most current 100 year floodplain level. The berm calculations are included in the application package. HSAAP does not have the authority to change the floodplain levels and designations.

8. Comment on the Pre-application process:

Due to the lack of information and the ridiculously short time that Army allowed to provide public comments, we -- like Holston and Tennessee residents – are simply speechless. We are unable to review, consider and discuss the proposal in the Army's required timeline.

Response: Comment Noted. Please see the response to comment #2.

Summary of Verbal Comments:

A few participants who have been regular attendees at the public meetings held for community outreach regarding Holston activities were the main participants at the pre-application meeting. Several asked questions. One applicant asked for clarification on whether or not this application was to continue the activities HSAAP is already permitted to do. This was confirmed in addition to mentioning no significant changes were being requested with this renewal and that the pans are operated within permit limits. There were several questions about the potentially contaminated explosives waste and the alternate technology selected to address those materials. Those questions were answered even though the purpose of this meeting was for the Subpart X permit renewal. There was a concern about perceived schedule slippage since the original Army memorandum listed 2024 while the Static Detonation Chamber (SDC) poster said the currently planned completion date was in 2026. The flashing furnace project is targeted for 2024 completion. HSAAP clarified the 2024 date was for the explosives contaminated waste only. The Army revised the memo with 2026 as the deadline, but Holston's goal is still 2024 for the flashing furnace. Holston had already completed a study of available technologies. The date was extended to accommodate other facilities in the Army who may be further behind in the process of identification of alternatives. The potential solution for the explosives waste has always been presented as occurring after the flashing furnace. The participants asked if the SDC would mean an end of open burning. Holston representatives told them that is the goal but could not be guaranteed at this time. Another participant asked if HSAAP could safely stockpile material until we have perfected new systems. Holston continues to make progress with the diversion program for potentially explosives contaminated waste that has helped to reduce material sent to the burning ground; however, production must continue which still results in material that must be destroyed. One participant did ask whether volatiles were present with the explosives. He was told it is minimal and that emissions are reported on the annual emissions inventory.

Section 14. HISTORY OF PERMIT MODIFICATIONS

The table below identifies permit modifications that happen over the term of this Permit. It is intended to serve as a guide for those modifications and to provide open and transparent record of all modifications made over the Permit term.

TABLE 14-1
HISTORY OF PERMIT MODIFICATIONS

MODIFICATION NO.	CLASS OF PERMIT MODIFICATION (1, 2, OR 3)	HSAAP SUBMITTAL DATE	TDEC APPROVAL DATE (IF REQUIRED)	DESCRIPTION OF PERMIT MODIFICATION

Section 16. DOCUMENT CROSS-REFERENCE TABLE

To aide in the review of this renewal application, HSAAP has prepared the cross-reference table presented below. This cross-reference table cites each applicable application requirement from 40 CFR Part 270 and TCRR 0400-12-01-.07 and specifies the location within this document where the requirement is satisfied. The regulatory citations provided therein are current through October 2020.

40 CFR CITATION	TCRR 0400-12-01-.07 CITATION	DESCRIPTION	SECTION(S) IN APPLICATION
270.14	**(5)**	**Contents of Part B: General Requirements**	**As per below**
270.14(a)	(5)	Provide general requirements specified in TCRR 0400-12-01-.07-(5)(a)1 (40 CFR Part 270.14(b)) as well as specific information for covered processes identified in TCRR 0400-12-01-.07-(5)(b)1 through 0400-12-01-.07(6) (40 CFR Part 270.15 through 270.29) as applicable.	3.4 and as per below
270.14(b)	(5)(a)1	Provide the following general information for the facility:	As per below
270.14(b)(1)	(5)(a)1(i)	A general description of the facility	2.1
270.14(b)(2)	(5)(a)1(ii)	Chemical and physical analyses of the hazardous waste and hazardous debris to be handled at the facility as required to treat, store, and/or dispose of the wastes under TCRR 0400-12-01-.06 (40 CFR Part 264).	3.1, 3.2
270.14(b)(3)	(5)(a)1(iii)	A waste analysis plan as described in TCRR 0400-12-01-.06(2)(d)2 and (2)(d)3 (40 CFR Part 264.13(b) and (c)), if applicable.	3.3
270.14(b)(4)	(5)(a)1(iv)	A description of the security procedures and equipment required by TCRR 0400-12-01-.06(2)(e) (40 CFR Part 264.14) or a justification as to why this information is not necessary.	6.1
270.14(b)(5)	(5)(a)1(v)	An inspection schedule meeting the requirements of TCRR 040-0-12-01-.06(2)(f)2 (40 CFR Part 264.15(b)), as well as any other specific requirements for regulated equipment as specified in individual subparts of TCRR 0400-12-01-.06 (40 CFR Part 264).	6.2, Attachment 6-1
270.14(b)(6)	(5)(a)1(vi)	A justification of any waiver requests for the preparedness and prevention requirements of TCRR 0400-12-01-.06(3) (40 CFR Part 264 Subpart C).	6.3
270.14(b)(7)	(5)(a)1(vii)	A contingency plan meeting the requirements of TCRR 0400-12-01-.06(4) (40 CFR Part 264, Subpart D), as well as any specific requirements from TCRR 0400-12-01-.06(11)(h) and TCRR 0400-12-01-.06(12)(f) (40 CFR Parts 264.227, 264.255 and 264.200), if applicable.	7, Attachment 7-1
270.14(b)(8)	(5)(a)1(viii)	Information on the procedures, structures, or equipment used to control releases, including those used to:	6.4
270.14(b)(8)(i)	(5)(a)1(viii)(I)	Prevent hazards in unloading operations	6.4.1

40 CFR Citation	TCRR 0400-12-01-.07 Citation	Description	Section(s) in Application
270.14(b)(8)(ii)	(5)(a)1(viii)(II)	Prevent runoff from waste handling areas and methods used to prevent flooding	2.3.3, 6.4.2
270.14(b)(8)(iii)	(5)(a)1(viii)(III)	Prevent contamination of water supplies	6.4.3
270.14(b)(8)(iv)	(5)(a)1(viii)(IV)	Mitigate the effects of equipment failure and power outages	6.4.4
270.14(b)(8)(v)	(5)(a)1(viii)(V)	Prevent undue exposure of personnel to hazardous wastes	6.4.5
270.14(b)(8)(vi)	(5)(a)1(viii)(VI)	Prevent releases to the atmosphere	6.4.6
270.14(b)(9)	(5)(a)1(ix)	Information on precautions taken to prevent accidental ignition or reaction of ignitable, reactive, or incompatible wastes as required by TCRR 0400-12-01-.06(2)(h) including 0400-12-01-.06(2)(h)(3) (40 CFR Part 264.17, including 264.17(c)).	6.5
270.14(b)(10)	(5)(a)1(x)	Details on traffic patterns, volumes, controls and roadway design.	2.4
270.14(b)(11)	(5)(a)1(xi)	The following information on the location of the facility:	2.3
270.14(b)(11)(i)	(5)(a)1(xi)(I)	The political jurisdiction, as required to demonstrate applicability of the seismic standard in TCRR 0400-12-01-.06(2)(i)1 (40 CFR Part 264.18(a))	2.3.2
270.14(b)(11)(ii)	(5)(a)1(xi)(II)	The information required to demonstrate compliance with the seismic standard of TCRR 0400-12-01-.06(2)(i)1 (40 CFR Part 264.18(a)), if determined to be applicable. This information shall provide details necessary to determine whether or not faults that have displacement in the Holocene time are present within 3,000 feet of the facility.	2.3.2
270.14(b)(11)(iii)	(5)(a)1(xi)(III)	Information and supporting data for determining whether the facility is located within a 100-year floodplain.	2.3.3, Attachment 2-1, and Attachment 2-2
270.14(b)(11)(iv)	(5)(a)1(xi)(IV)	If within the 100-year floodplain, engineering analyses and studies to demonstrate that the facility is designed to prevent washout from a 100-year flood, including, if appropriate, procedures for removing the wastes from the flood zone consistent with the requirements of TCRR 0400-12-01-.06(2)(i)2 (40 CFR Part 264.18(b)).	2.3.3, Attachment 2-3
270.14(b)(11)(v)	(5)(a)1(xi)(V)	A compliance plan for meeting the requirements of TCRR 0400-12-01-.06(2)(i)2 (40 CFR Part 264.18(b)) if the facility is within a 100-year floodplain and does not otherwise meet the applicable requirements.	Not applicable

40 CFR Citation	TCRR 0400-12-01-.07 Citation	Description	Section(s) in Application
270.14(b)(12)	(5)(a)1(xii)	An outline of the training programs required to demonstrate compliance with TCRR 0400-12-01-.06(2)(g) (40 CFR Part 264.16), including a description on how training will be designed to meet job tasks pursuant to TCRR 0400-12-01-.06(2)(g)1(iii) (40 CFR Part 264.16(a)(3)).	8
270.14(b)(13)	(5)(a)1(xiii)	The closure and, if applicable, post-closure plans required by TCRR 0400-12-01-.06(7)(c), -.06(7)(i), and -.06(10)(h) (40 CFR Part 264.112, 264.118, and 264.197), including, where applicable specific requirements for regulated equipment as specified in individual subparts of TCRR 0400-12-01-.06 (40 CFR Part 264).	9
270.14(b)(14)	(5)(a)1(xiv)	If the hazardous waste unit has been closed, documentation showing that the notices required by TCRR 0400-12-01-.06(7)(j) (40 CFR Part 264.119) have been filed.	Not applicable. No closed hazardous waste management units are included in the Permit.
270.14(b)(15)	(5)(a)1(xv)	A closure cost estimate for the facility in accordance with TCRR 0400-12-01-.06(8)(c) (40 CFR Part 264.142), and a copy of the documentation required to demonstrate financial assurance under TCRR 0400-12-01-.06(8)(d) (40 CFR Part 264.143).	9.6 (Not applicable)
270.14(b)(16)	(5)(a)1(xvi)	A post-closure cost estimate meeting the requirements of TCRR 0400-12-01-.06(8)(e) (40 CFR Part 264.144), and a copy of the documentation required to demonstrate financial assurance under TCRR 0400-12-01-.06(8)(f) (40 CFR Part 264.145). (Where applicable)	9.6 (Not applicable)
270.14(b)(17)	(5)(a)1(xvii)	A copy of the insurance policy or other documentation meeting the requirements of TCRR 0400-12-01-.06(8)(n) (40 CFR Part 264.147) including, if applicable, a request for a variance in the amount of required coverage pursuant to TCRR 0400-12-01-.06(8)(n)(3) (40 CFR Part 264.147(c)). (Where applicable)	9.6 (Not applicable)
270.14(b)(18)	(5)(a)1(xviii)	Proof of coverage by a State financial mechanism meeting 40 CFR Part 264.149 or Part 264.150, if appropriate.	9.6 (Not applicable)
270.14(b)(19)	(5)(a)1(xix)	A topographic map showing a distance of 1,000 feet around the facility at a scale of 2.5 centimeters (1 inch) equal to not more than 61.0 meters (200 feet) at a contour interval sufficient to clearly show the pattern of surface water flow in the vicinity of and from each operational unit of the facility. In addition, the topographic map shall show:	2.2, Attachment 2-1

40 CFR Citation	TCRR 0400-12-01-.07 Citation	Description	Section(s) in Application
270.14(b)(19)(i)	(5)(a)1(xix)(I)	The map scale and date	2.2, Attachment 2-1
270.14(b)(19)(ii)	(5)(a)1(xix)(II)	The 100-year floodplain area	2.2, Attachment 2-1
270.14(b)(19)(iii)	(5)(a)1(xix)(III)	Surface waters	2.2, Attachment 2-1
270.14(b)(19)(iv)	(5)(a)1(xix)(IV)	Surrounding land uses	2.2, Attachment 2-1
270.14(b)(19)(v)	(5)(a)1(xix)(V)	A wind rose	2.2, Attachment 2-1
270.14(b)(19)(vi)	(5)(a)1(xix)(VI)	Map orientation	2.2, Attachment 2-1
270.14(b)(19)(vii)	(5)(a)1(xix)(VII)	Legal boundaries of the hazardous waste facility	2.2, Attachment 2-1
270.14(b)(19)(viii)	(5)(a)1(xix)(VIII)	Access control	2.2, Attachment 2-1
270.14(b)(19)(ix)	(5)(a)1(xix)(IX)	On-site and off-site Injection and withdrawal wells	2.2, Attachment 2-1
270.14(b)(19)(x)	(5)(a)1(xix)(X)	Buildings, treatment, storage, or disposal operations, or other structures	2.2, Attachment 2-1
270.14(b)(19)(xi)	(5)(a)1(xix)(XI)	Barriers for drainage or flood control	2.2, Attachment 2-1
270.14(b)(19)(xii)	(5)(a)1(xix)(XII)	Location of operational units within the hazardous waste facility where waste is treated, stored, or disposed	2.2, Attachment 2-1
270.14(b)(20)	(5)(a)1(xx)	Other information as deemed necessary by the Regional Administrator to carry out his duties under other Federal laws as required in 40 CFR Part 270.3.	12
270.14(b)(21)	(5)(a)1(xxi)	For land disposal facilities, a copy of the notice of approval for the extension or petition is if approved under TCRR 0400-12-01-.10((1)(e) or (f) (40 CFR Part 268.5 or 268.6).	Not applicable.
270.14(b)(22)	(5)(a)1(xxii)	A summary of the pre-application meeting, including information on attendees and copies of any written comments or materials submitted at the meeting, as required under TCRR 0400-12-01-.07(1)(m)3 (40 CFR Part 124.31(c)).	Provided under separate cover.
270.14(c)	(5)(c)	Provide the following additional information necessary to protect groundwater, unless exempt per TCRR 0400-12-01-.06(6)(a) (40 CFR Part 264.90(b)).	5
270.14(d)	(5)(e)	Provide additional information for solid waste management units.	10

40 CFR Citation	TCRR 0400-12-01-.07 Citation	Description	Section(s) in Application
270.23	(5)(b)9	Owners and operators that threat, store, or dispose of hazardous waste in miscellaneous units, provide the following additional information:	11
270.23(a)	(5)(b)9(i)	Detailed description of the unit being used	4, Attachment 4-1
270.23(b)	(5)(b)9(ii)	Detailed hydrologic, geologic, and meteorologic assessments and land use maps for the region surrounding the site that address and ensure compliance of the unit with each factor in the environmental performance standards of TCRR 0400-12-01-.06(27)(b) (40 CFR Part 264.601).	2.3.1, Attachment 2-1
270.23(c)	(5)(b)9(iii)	Information on potential pathways of exposure of humans or environmental receptors to hazardous waste or hazardous constituents.	11.1, Attachment 11.1
270.23(d)	(5)(b)9(iv)	Report on a demonstration of effectiveness of the treatment based on laboratory or field data.	11.2
270.23(e)	(5)(b)9(v)	Additional information determined by the Director to be necessary for evaluation of compliance of the unit with the environmental performance standards of TCRR 0400-12-01-.06(27)(b) (40 CFR Part 264.601).	None requested