II.B WASTE CHARACTERISTICS

II.B1 PHYSICAL AND CHEMICAL CHARACTERISTICS OF WASTES AND RESIDUES [40 CFR 270.14(b)(2) and 40 CFR 264.13(a)]

Inventories of military ordnance items are maintained at various military installations, including EAFB. These items include unserviceable or serviceable excess munitions that are physically intact. If the unserviceable items cannot be reworked, they must be demilitarized or rendered harmless. Demilitarization of both unserviceable and serviceable excess munitions at EAFB is accomplished through treatment by OB/OD. Discussion of waste minimization techniques and alternatives is presented in Section III.A1.

Items from holding areas at EAFB are transported to the OB/OD units for scheduled OB/OD treatment. There is no storage of ordnance items on either of the two ranges, C-52N and C-62, prior to scheduled OB/OD treatment. Items scheduled for OB/OD treatment are processed without delay once they have reached the designated treatment unit.

The chemical and physical nature of typical ordnance items treated and the Waste Analysis Plan for sampling, testing, and evaluating these items is submitted in accordance with the requirements of 40 CFR 270.14(b)(2).

Regulatory requirements for wastes in containers (40 CFR 270.15), wastes in tanks (40 CFR 270.17), wastes in waste piles (40 CFR 270.18), wastes in incinerators (40 CFR 270.19), wastes in land treatment facilities (40 CFR 270.20), wastes in landfills (40 CFR 270.21), and wastes at facilities with process vents (40 CFR 270.24) are not applicable because none of these types of treatment units are present at the EAFB OB/OD designated areas.

II.B1.1 Volume and Composition of Wastes [40 CFR 270.14(b)(2) and 40 CFR 264.13(a)]

The volume and physical and chemical composition of typical wastes treated at the EAFB OB/OD units are addressed in Section II.B1.2, Wastes in Miscellaneous Units.

II.B1.2 Wastes in Miscellaneous Units [40 CFR 270.23]

Wastes that are to be treated at the EAFB OB/OD treatment units will generally be classified as hazardous by the reactivity characteristic of the explosive chemical constituents. Munitions

treated by OB/OD units include serviceable and unserviceable munitions. Serviceable munitions consist of munitions used in military training exercises and specialized weapons testing. These munitions include (but are not limited to) igniters, cartridges, rounds, flares, rockets, smoke canisters, bombs, propellants, and pyrotechnics. Wastes generated by the HERD facility consist of (but are not limited to) research and development (R & D) experimental explosives and traditional explosives ~~such as TNT, Comp B, Octol, and Tritonal~~. R & D explosives include AFX 1100, AFX 453, AFX 931, PBXN 109, AFX 931-M, and TNT/SNQ. Table II-1 presents a list of basic compositions for standard energetic materials in general use, as well as HERD-generated experimental explosives. Table II-1 represents the typical components that make up specific munitions items that may be treated at ~~Eglin~~ EAFB.

The munitions that are treated by OB/OD generally are composed of a variety of reactive chemical fill materials along with associated metal casings, projectiles, and primer components. The metal components account for a majority of the mass of the munitions. The reactive materials are usually less than 20 percent of the gross munitions weight. A number of energetic compounds are present in the munitions. These compounds fall into four general classes including pyrotechnic compositions, propellants, priming compositions, and high explosives. Propellants, pyrotechnic, and priming compositions are materials that react by deflagration. The high explosive reactions are manifested in the form of detonations. When the munitions are treated in the OB/OD units, various combustion and detonation products are formed.

The propellant mixtures are typically classified as single-base or double-base. Single-base propellants consist mainly of nitrocellulose. Double-base propellants are mixtures of nitrocellulose and nitroglycerin. A number of miscellaneous chemical compounds are added to the propellant charge to control the deflagration characteristics or to promote stability during storage. These additives incorporated into the propellant fuels generally account for 3 percent of the mixture and are oxidized during the deflagration reaction. The amounts of oxidized additive reaction products, including unreacted additives, is considered minimal as compared to the overall OB/OD reaction products generated. Therefore, the impacts of chemical additive oxidation were considered less significant than those from the reaction of primary constituents found in propellants. For this reason, they will not be considered as part of this permit application. All of the components of military propellants are in solid form and contain no free liquids. Confirmatory surface soil sampling in the area of ejected debris will be conducted as part of the detection monitoring program (Section II.G). This sampling will

TABLE II-1 WASTE ANALYSIS DATA: BASIC EXPLOSIVE COMPONENTS AND COMPOSITIONS

Reactive Material Name	Explosive Type	Constituents[a]	General/Typical Concentration (Percentage by Total Weight)	Comment
TNTO II, III, IV	High Explosive	TNT NTO Aluminum Polywax 500, 600, 650 D2 wax Petra wax Pax wax Indramic wax	30% 40% 20% (percentage of wax varies depending upon which type of TNTO)	Trinitrotoluene 3-Nitri-1,2,4-Triazol-5-One
Octol 75/25	High Explosive	HMX TNT	75% 25%	Octahydro-1,3,5,6-Tetranitro-1,3,5,7-tetrazocine
PBXN 109	High Explosive	RDX-I RDX-V MDX-81 Alum R45 HT DOA AO2246 FEAA IPDI	57.5% 6.5% 20% 7.26% 7.26% 0.26% 0.10% 0.0015% 1.12%	Hexahydro-1,3,5-trinitro-s-triazine Aluminum Powder Polybutadiene, Linear/Hydroxyl Terminated Dioctyl Adipate Di (2-Hydroxyethyl) Dimethyl Hydantoin Antioxidant (T-Butylphenol-type) Ferric Acetylacetonate Isophorone Diisocyanate
Composition B (Comp B)	High Explosive	TNT RDX Anti-crack wax	40% 60%	 Cyclonite O&P-Nitrotoluene
PETN	High Explosive	Pentaerythritol Tetranitrate		
Tritonal	High Explosive	TNT Aluminum	80% 20%	
AFX 453	High Explosive	HBNQ MENQ 1401 Aluminum Aluminum Nitrate TDO	60% 13% 15% 11.5% 0.5%	High Bulk Nitroguanidine Methyl Nitroguanidine N-Tallow-1,3-Diaminopropane
TNT/SNQ	High Explosive	TNT SNQ	50% 50%	 Spherical Nitroguanidine

(a) Includes stabilizer and additives.

Table II-1 (Cont.)

Reactive Material Name	Explosive Type	Constituents[a]	General/Typical Concentration (Percentage by Total Weight)	Comment
Pentolite	High Explosive	PETN TNT	50% 50%	
PBX(AF)-108M	High Explosive	RDX-I RDX-V R45 HT DOA DHE AO2246 FEAA IPDI	62% 20% 8.168% 8.168% 0.293% 0.113% 0.0017% 1.26%	
Comp A-5	High Explosive	RDX Stearic Acid	98.5% 1.5%	
AFX 1100	High Explosive	TNT Polywax 655 Tritonal Aluminum	66% 16% 18%	
Comp Polywax 655	Propellant	Polywax 655 NC Lecithin	84% 14% 2%	
Comp Polywax 600	Propellant	Polywax 600 NC Lecithin	96% 2% 2%	
PBXN 110	High Explosive	R45 HT IDP Ethyl 702 Lecithin FEAA HMX-II HMX-III IPDI	5.365% 5.365% 0.05% 0.75% 0.002% 22% 66% 0.51%	Ethyl Antioxidant 702
Fine Grain Comp B-3	High Explosive	TNT RDX-V RDX-I	40% 15% 45%	

(a) Includes stabilizer and additives.

Table II-1 (Cont.)

Reactive Material Name	Explosive Type	Constituents[a]	General/Typical Concentration (Percentage by Total Weight)	Comment
AFX 931-M	High Explosive	R45HT DOA DHE FEAA AO2246 H-5 Aluminum RDX-I RDX-V Ammonium Perchlorate IPDI	7.26% 7.26% 0.26% 0.0015% 0.10% 15% 16% 16% 37% 1.12%	
TNAZ				1,3,3-Trinitro Azetidine
Propellant (exact composition varies by use and types)	Propellant	Nitrocellulose Nitroglycerin	52-98% 2-43% Traces of other chemicals to retard burn	
Propellant (20 mm, 30 mm, 40 mm target practice)	Propellant	Nitrocellulose/nitroglycerin Charcoal Sulfur Graphite	75% 12.5% 12.5% Trace	
Black Powder	Igniter/Propellant	Potassium (or sodium) nitrate Charcoal Sulfur	75% 15% 10%	
Illumination mixture	Pyrotechnic	Sodium nitrate Magnesium Polymeric binder	36-40% 53-56% 4-8%	
Tetryl	High Explosive			
C-4	High Explosive	RDX Polyisobutylene Binder	91% 2% 7%	

(a) Includes stabilizer and additives.

Table II-1 (Cont.)

Reactive Material Name	Explosive Type	Constituents[a]	General/Typical Concentration (Percentage by Total Weight)	Comment
Incendiary mix	Pyrotechnic	Ammonium perchlorate Aluminum Calcium stearate Other	35% 52% 1.9% 9.7%	
PBX	High Explosive	RDX Polymer	91-94% 6-9%	
M1 Propellant	Propellant	Nitrocellulose Dinitrotoluene Dibutylphthalate Diphenylamine	84% 10% 5% 1%	
M2 Propellant	Propellant	Nitrocellulose Nitroglycerin Ethyl Centralite Barium Nitrate Potassium Nitrate Graphite	77.45% 19.50% .60% 1.40% .75% .30%	
M5 Propellant	Propellant	Nitrocellulose Nitroglycerin Ethyl Centralite Barium Nitrate Potassium Nitrate Graphite	81.95% 15.00% .60% 1.40% .75% .30%	
M6 Propellant	Propellant	Nitrocellulose Dinitrotoluene Dibutylphthalate	87% 10% 3%	
M10 Propellant	Propellant	Nitrocellulose Dinitrotoluene Potassium Sulfate	98% 1% 1%	
M12 Propellant	Propellant	Nitrocellulose Diphenylamine Potassium Sulfate Tin	97.7% .8% .75% .75%	

(a) Includes stabilizer and additives.

Table II-1 (Cont.)

Reactive Material Name	Explosive Type	Constituents[a]	General/Typical Concentration (Percentage by Total Weight)	Comment
M15 Propellant	Propellant	Nitrocellulose Nitroglycerin Nitroguanidine Ethyl Centralite Cryolite	20% 19% 54.7% 6% .3%	
M17 Propellant	Propellant	Nitrocellulose Nitroglycerin Nitroguanidine Barium Nitrate Cryolite	22% 21.5% 54.7% .1% .3%	
T23 Propellant	Propellant	Nitrocellulose Nitroglycerin Ethyl Centralite Barium Nitrate Potassium Nitrate Graphite	67.25% .25% 6% .75% .7% .3%	
M8 Propellant	Propellant	Nitrocellulose Nitroglycerin Diethylphthalate Ethyl Centralite Potassium Nitrate	52.15% 43% 3% .6% 1.25%	
M9 Propellant	Propellant	Nitrocellulose Nitroglycerin Diethylphthalate Ethyl Centralite Cryolite Potassium Nitrate	54.85% 40% 3% .6% .3% 1.25%	
M7 Propellant	Propellant	Nitrocellulose Nitroglycerin Ethyl Centralite Potassium Perchlorate Carbon Black	54.6% 35.5% .9% .3% 1.2%	

(a) Includes stabilizer and additives.

Table II-1 (Cont.)

Reactive Material Name	Explosive Type	Constituents[a]	General/Typical Concentration (Percentage by Total Weight)	Comment
M13 Propellant	Propellant	Nitrocellulose Nitroglycerin Diphenylamine Ethyl Centralite Potassium Sulfate	57.3% 40% .2% 1% 1.5%	
M16 Propellant	Propellant	Nitrocellulose Nitroglycerin Dinitrotoluene Ethyl Centralite Potassium Sulfate Carbon Black	55.5% 27.5% 10.5% 4% 1.5% .5%	
T2 Propellant	Propellant	Nitrocellulose Nitroglycerin Dinitrotoluene Ethyl Centralite Lead Stearate	57.5% 30% 2.5% 8% .5%	
T8 Propellant	Propellant	Nitrocellulose Nitroglycerin Dinitrotoluene Ethyl Centralite Lead Stearate Triacetin	58% 22.5% 2.5% 8% .5% 8.5%	
Photoflash	Incendiary	Laminac Lupersol, DDM Iron Oxide	96.8% 3% .2%	
TPA Incendiary	Incendiary	Triethylaluminum		
Lead Azide	Primer/Detonator	Nitrogen Lead	28.8% 71.2%	
Lead Styphnate	Primer	Carbon Hydrogen Nitrogen Oxygen Lead	15.4% .65% 9% 30.8% 44.2%	

(a) Includes stabilizer and additives.

Table II-1 (Cont.)

Reactive Material Name	Explosive Type	Constituents[a]	General/Typical Concentration (Percentage by Total Weight)	Comment
Amatol	High Explosive	Ammonium Nitrate TNT	80% 20%	
Ammonium Nitrate	Incendiary	Nitrogen Hydrogen Oxygen	35% 5% 60%	
Composition A3	High Explosive	RDX Wax	91% 9%	
Explosive A4	High Explosive	RDX Wax	97% 3%	
Explosive D	High Explosive	Carbon Hydrogen Nitrogen Oxygen	29.3% 2.4% 22.7% 45.6%	Ammonium Picrate
Haleite	Explosive	Carbon Hydrogen Nitrogen Oxygen	16% 4% 37.3% 42.7%	EDNA Ethylene-Dinitramine
HBX-1.3 & 6	High Explosive	RDX TNT Aluminum Densitizer Comp D2 CACL	39.6% 37.8% 17.1% 5% .5%	
Pentolite 10/90	High Explosive	PETN TNT	10% 90%	
Picratol	High Explosive	Explosive D TNT	52% 48%	
Tetrytol	High Explosive	Tetryl TNT		
Torpex	High Explosive	RDX TNT Aluminum	42% 40% 18%	

(a) Includes stabilizer and additives.

Table II-1 (Cont.)

Reactive Material Name	Explosive Type	Constituents[a]	General/Typical Concentration (Percentage by Total Weight)	Comment
Nitroglycerin	High Explosive/ Propellant	Carbon Hydrogen Nitrogen Oxygen	15.9% 2.2% 18.5% 63.4%	
Nitroguanidine (Picrate)	High Explosive/ Propellant	Carbon Hydrogen Nitrogen Oxygen	11.5% 3.9% 53.8% 30.8%	Picrate
Military Dynamite - Medium Velocity	High Explosive	RDX TNT Starch SAE No. 10 Oil Polysobutylene	75% 15% 5% 4% 1%	
Military/Dynamite - Low Velocity	High Explosive	RDX/DYE TNT Tripentaery-Thritol Binder* Cellulose Acetate	17.5% 67.8% 8.6% 4.1% 2%	* The binder is vistac No. 1 consisting of polybutene and diioctyl sebacate.

(a) Includes stabilizer and additives.

show if miscellaneous chemical additives from past disposal actions have survived and accumulated in the vicinity of the units.

The pyrotechnic compositions are mixtures of compounds which are designed to emit smoke or light. These munitions primarily consist of a mixture of fuel and oxidizer compounds. The fuels are one of a variety of metal powders including magnesium, aluminum, titanium, or zirconium. Typical oxidizers consist of metal nitrates, ammonium or metal perchlorates, and chlorates, or metal peroxides. Secondary constituents which are also present in pyrotechnic mixtures are binders, ignition agents, retardants, and colorants. A variety of chemical compounds are present in these additives. Typical minor components include black powder, chlorinated organics, waxes, sugar, asphalt, polyvinyl chloride, and vegetable oils. Pyrotechnic compositions contain no free liquids. The thermal treatment of pyrotechnics results in gaseous combustion products and solid particulates.

Priming compositions are mixtures that are very sensitive to shock or friction and are used to provide a source of ignition for pyrotechnics, propellants, or explosives. Primers are a mixture of fuel, oxidizer, and explosive compounds. Typical fuels are antimony sulfide and lead thiocyanate; oxidizers include barium nitrate and potassium chlorate. The primary explosives are lead azide and lead styphanate.

High explosives are typically nitrated organic materials which generate large quantities of gaseous reaction products as a result of detonation. The most common high explosives are trinitrotoluene (TNT), cyclotrimethylenetrinitramine (RDX), trinitrophenylmethylnitramine (tetryl), cyclotretramethylenetetranitramine (HMX), and various mixtures thereof. Minor additives to high explosive ordnance include waxes and aluminum powder. All constituents are in the solid form.

While a general description of the types of munitions to be treated at the OB/OD units has been described above, the variety and variability of the energetic materials contained in military ordnance is extensive. Similarly, it is not likely that exact quantities of various compounds can be predicted for those ordnance items that may require treatment in the future. For these reasons, this application presents a representative list of ordnance items which may be burned or detonated at the OB/OD units at EAFB and their chemical composition. Although the list of potentially treated ordnance items is not exhaustive, the list of compounds contained in these ordnance items as shown in Table II-1 is meant to encompass compounds that would potentially be encountered in the waste munitions.

Table II-1 presents a list of reactive materials potentially subject to RCRA designation as hazardous waste by the reactive characteristic that are typically treated by OB/OD at EAFB. This list includes the types of waste energetic materials generated by the HERD facility that would be treated by the EOD personnel at the OB/OD units. A representative list of types of ordnance items that could be treated and the reactive contents of the ordnance is presented in Table II-2. Table II-2 is provided for illustration purposes only and is not to be construed as a comprehensive inventory of ordnance items that could be treated at Eglin AFB. Table II-2 represents a single OB/OD event that occurred in 1993. The intent of Table II-2 is to show how the explosive components identified in Table II-1 may be combined to make ordnance items.

Obsolete and off-specification items are assumed to have the same characteristics as currently acceptable items. Explosive content by weight and type may vary by model. All items contained in these tables are reactive (D003) hazardous wastes and/or toxic due to barium (D005), 2,4-dinitrotoluene (D030), or lead (D008).

Although Tables II-1 and II-2 present various types of ordnance items, these lists do not reflect all items that may potentially be burned or detonated at EAFB during the period that this RCRA permit applies. However, the compounds and elements presented in the ordnance compositions (Table II-1) are intended to be the complete list of waste munitions treated at the EAFB OB/OD areas. Ordnance and explosives degradation products primarily consist of metals, metal oxides, sulfur and nitrogen compounds, and particulates. The Department of Defense has conducted ordnance destruction testing at Dugway Proving Ground, Utah, using the "Bangbox." Bangbox data were used in developing the POLU13G air emissions model, which predicts the degradation products of OB/OD activities. (POLU13G is an EPA-accepted model that is used in Section III.C of this application to establish air emissions for purposes of performing exposure risk assessments.) Tables summarizing POLU13G model output of probable degradation products for OB/OD activities at Eglin AFB are provided in Section III.C6a.3. Section III.B1 presents the Environmental Performance Standards that are adhered to at EAFB.

A document related to explosives chemistry [an EPA Office of Research and Development document entitled, *State-of-the-Art Military Explosives and Propellant Production Industry* (Volume III) discussing the chemistry of military explosives, dated October 1976] is provided as Appendix F-2 for additional background informational purposes.

TABLE II-2 REPRESENTATIVE ORDNANCE BURNED/DETONATED AT EAFB

Ordnance Name	No.[a] Treated per mo.	NEW (lbs.) per Round	No. of Rounds	OB	OD	Basic Energetic Composition	Casing Composition	Composition Reference
Cartridge, Impulse, BBU-35/B	11	0.0008	240	✓		Nitrocellulose Propellant - EBW	Aluminum	T.O. 11A-1-46
Cartridge, Impulse, BBU-36/B	20	0.0002	2160	✓		Nitrocellulose Propellant - EBW	Aluminum	T.O. 11A-1-46
Initiator	2	0.0008	N/A	✓		Propellant - Percussion Primer	Aluminum	T.O. 11A-1-46
Cartridge, Impulse	1	0.0529	1	✓		Nitrocellulose Propellant - EBW	Aluminum	T.O. 11A-1-46
Cartridge, Impulse, ARD446-1	94	0.0276	4	✓		Nitrocellulose Propellant - EBW	Aluminum	T.O. 11A-1-46
Cartridge, Canopy Remover (Cartridge, Impulse)	1	0.0529	1	✓		Propellant - EBW	Aluminum	T.O. 11A-1-46
MT86 Canopy Remover (Cartridge Remover)	1	0.0302	N/A	✓		Propellant - Percussion Primer	Aluminum - Steel	T.O. 11A-1-46
M187 ARD 446-7 (Cartridge,Impulse,ARD 446-1)	8	0.0276	4	✓		Nitrocellulose Propellant	Aluminum	T.O. 11A-1-46
Catapult Rocket	1				✓	Propellant/Cartridge Percussion (Propellant) Primer	Aluminum - Steel	T.O. 11A-1-46
Flare, MJU-7 A/B	2	0.6278	15	✓	✓	Magnesium/Teflon	Aluminum	T.O. 11A-1-46
Squib, BBU-35 (Cartridge, Impulse, BBU-35/B)	697	0.0008	240	✓		Nitrocellulose Propellant	Aluminum	T.O. 11A-1-46
Squib, BBU-36 (Cartridge, Impulse, BBU-36/B)	22	0.0022	2160	✓		Nitrocellulose Propellant	Aluminum	T.O. 11A-1-46
Cartridge, 0.50-cal.	400	0.0336	200	✓		SB-Nitrocellulose	Brass/Aluminum/Tin	T.O. 11A-1-46
Flare IR, MJU-10/B	20	2.0	24	✓	✓	Magnesium/Teflon	Aluminum	T.O. 11A-1-46
Cartridge, 20mm, TP-T	3	0.0861	250	✓		Nitrocellulose - Nitroglycerin Double-Base	Steel - Aluminum Brass	T.O. 11A-1-46 and Ellsworth AFB

(a) Based on Inventory List ADR Support Request dated 14 July 1993 for the month of August 1993.

TABLE II-2 (Cont.)

Ordnance Name	No.[a] Treated per mo.	NEW (lbs.) per Round	No. of Rounds	OB	OD	Basic Energetic Composition	Casing Composition	Composition Reference
Cartridge, 20mm, TP	460	0.0861	250	✓		Nitrocellulose - Nitroglycerin Double-Base	Steel - Aluminum Brass	T.O. 11A-1-46 and Ellsworth AFB
BBU-35 (Cartridge, Impulse, BBU-35/B)	534	0.0008	240	✓		Nitrocellulose Propellant	Aluminum	T.O. 11A-1-46 and Ellsworth AFB
Simulator, Flare, MJU-7(T-1)/B	846	0.0783	60	✓	✓	Diethylaminoazobenzene/Potassium - Chlorate	Aluminum or Plastic	T.O. 11A-1-46
Cartridge, Impulse, MK23 MOD0	125	0.0002	4	✓		Nitrocellulose Propellant	Aluminum	T.O. 11A-1-46
Cartridge, Drogue Gun (Cartridge Assembly)	11P7-21-7 2	0.0019	1	✓		Propellant	Aluminum	T.O. 11A-1-46
Cartridge, Actuated (Cartridge Assembly Item)	11P3 Series 1	0.0004	1	✓		Propellant	Steel	T.O. 11A-1-46
Canopy Remover	1			✓		Propellant - EBW	Aluminum	T.O. 11A-1-46
Cartridge, Mortar	11P3 Series 1	0.0140	1	✓		Propellant	Steel - Aluminum	T.O. 11A-1-46
Cartridge, 0.38-cal.	7200	0.0006	2400	✓		SB - Nitrocellulose	Brass/Aluminum	T.O. 11A-1-46
Drogue (FLSC Holder Assembly)	11P21-1-7 4	0.0011	N/A	✓		Flexible Linear Shaped Charge	Steel	T.O. 11A-1-46
Cartridge, Fire Extinguisher	11P-18-147 7	0.0008	1	✓		Propellant Zea EBWs	Brass	T.O. 11A-1-46
Initiator (various)	11P3 Series 38	0.0069	1	✓		Propellant - Percussion Primer	Aluminum	T.O. 11A-1-46