2 FACILITY CHARACTERIZATION

2.1 SUMMARY OF OPERATIONS

Detailed information on the processes to be employed at PCAPP and EDS and wastes to be treated is available in the PCAPP and EDS RCRA hazardous waste permits. PCAPP will safely disassemble munitions, treat the mustard agent by low-temperature, low-pressure neutralization, biologically treat the resulting neutralent, and recover water. The EDS units will use a sealed, stainless steel vessel to contain an explosive charge that will breach the chemical munitions/items, eliminating their explosive capacity (if present), and allowing the chemical agent to be neutralized within the vessel. In general, treatment of mustard agent and wastes contaminated with mustard agent are conducted on site, whereas wastes that are not contaminated with mustard agent (e.g., the majority of the energetics, secondary waste, and recyclables) are treated, disposed, and/or recycled off site. Treatment processes will generate sludges and salts, which will be dewatered prior to off-site treatment and/or disposal. Secondary waste streams, such as boxes and pallets, demilitarization protective ensemble (DPE) suits, personal protective equipment (PPE), and decontamination supplies contaminated with mustard agent will be decontaminated by low temperature thermal treatment processes or will be shipped off site to an appropriate treatment, storage, or disposal facility. The decontaminated items will then be packaged for off-site treatment and/or disposal.

2.2 PROCESS OVERVIEW

Figure 2-1 presents a simplified block flow diagram for PCAPP and EDS treatment operations. In general, chemical munitions/items will be managed through the following seven processes discussed further in the paragraphs that follow:

1. **Baseline and enhanced reconfiguration (energetics removal).** Munitions are delivered to PCAPP in over-pack pallets from the PCD igloos and either temporarily stored in one of three munitions service magazines (MSM) or taken to, unpacked, and disassembled in the Enhanced Reconfiguration Building (ERB) to remove the wood and metal dunnage, propellant, bursters, fuzes, and other parts from the munitions (i.e., baseline and enhanced reconfiguration).
2. **Agent processing.** The reconfigured munitions are sent to the Agent Processing Building (APB) where the agent is washed out from the munitions bodies and hydrolyzed in the Agent Neutralization Reactors.
3. **Munitions bodies treatment.** The munitions bodies undergo thermal treatment for final disposition off site.
4. **Biotreatment.** The agent hydrolysate is transferred to the Biotreatment System (BTS) where aerobic biological treatment of the agent hydrolysate occurs in Immobilized Cell Bioreactors (ICB™).
5. **Water recovery and brine reduction.** The resulting bio-effluent is processed through the Water Recovery System (WRS) and the Brine Reduction System (BRS) to recover water for reuse as process water. Filter cake collected from the BRS is dispositioned as hazardous waste.
6. **Agent-contaminated secondary waste processing.** Agent-contaminated secondary waste is thermally treated in the Supplemental Decontamination Unit (SDU) or autoclave located in the APB or is shipped to an off-site treatment and/or disposal facility.
7. **EDS operations.** Munitions or other items in a condition that may not be safely processed through the above PCAPP process (e.g., leakers and rejects) are treated in the EDS where the chemical fill and/or energetic/propellant material are destroyed.

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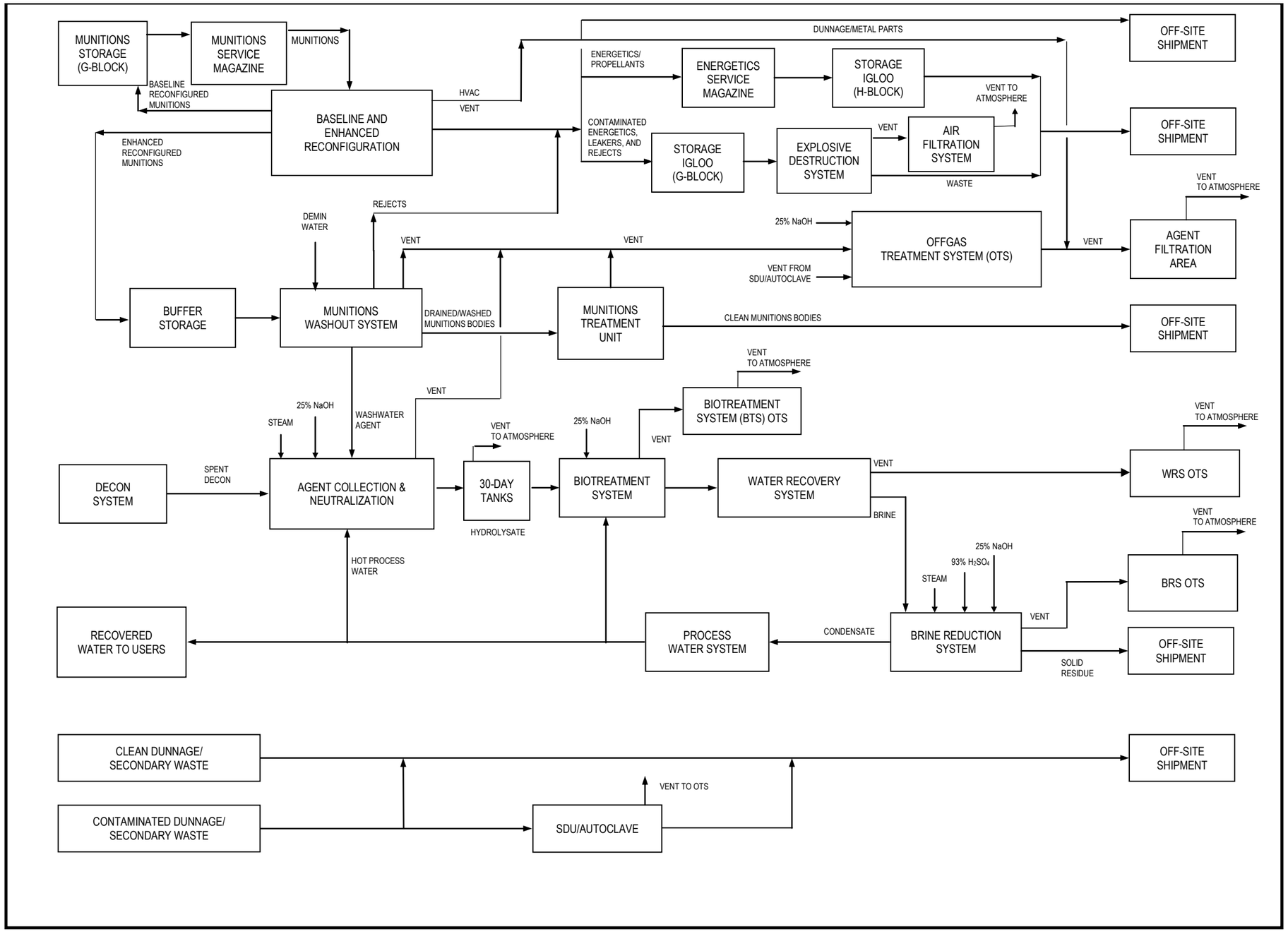

Figure 2-1. Simplified block flow diagram for PCAPP/EDS treatment operations.

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2.2.1 Munitions Reconfiguration

At PCAPP, munitions reconfiguration is conducted within the ERB. Boxed munitions undergo baseline reconfiguration in the Vapor Containment Room and Reconfiguration Rooms where the propellants, cartridge cases, and ignition cartridges are removed from the projectiles or mortars. Palletized and baseline reconfigured munitions undergo enhanced reconfiguration in the Explosion Containment Rooms where removal of nose closures, bursters, and other parts occurs. The munitions bodies and removed energetics and miscellaneous parts are transferred to a monitoring and packaging area where the energetics and miscellaneous parts are confirmed to satisfy army requirements for release and packaged for off-site treatment and disposal. The munitions bodies are transferred to the APB for treatment. Rejected munitions and/or munitions bodies or energetics identified as potentially contaminated will be returned to PCD for temporary storage pending treatment in the EDS.

2.2.2 Agent Processing

The agent-containing munitions bodies are transferred to the MWS in the APB where they are robotically accessed, drained, and washed out using a high-pressure water spray. The agent and washwater are sent to the Agent/Water Separator (AWS) which gravitationally separates the denser agent concentrate from the lighter washwater. The washwater is transferred to a temporary holding tank prior to being transferred to the Agent Neutralization System (ANS) with Agent concentrate from the AWS and spent decontamination solution (SDS), per the reactor recipe for neutralization of the agent. The resulting agent hydrolysate is transferred to an Agent Hydrolysate Holding Tank where the hydrolysate is recirculated, sampled, and analyzed for chemical agent to confirm destruction criteria are met, prior to being transferred to 30-day Storage Tanks located outside of the APB.

2.2.3 Munitions Bodies Treatment

The washed munition bodies are transferred to the Munitions Treatment Unit (MTU) where they are thermally decontaminated to satisfy Army requirements of clean for unrestricted release. After passing through the muffle-type furnace and cooling zones, the decontaminated munition bodies are transferred to the Paint Residue Removal System (PRRS), built into the rotary valve at the MTU discharge end where compressed air jets and a vacuum remove loose paint debris from the munitions bodies and baseplates. The paint flakes captured by the PRRS vacuum system are collected in a free-standing Torit filter unit. The munitions are then deposited onto a discharge conveyor that transports the munitions bodies through a second rotary valve to a bin located in an enclosure outside the APB. When filled, the bins are moved to the Clean Munitions Body Staging area to complete cooling prior to final off-site disposition. The discharge rotary valve forms a physical interface between the MTU room and the bin enclosure, and serves to control airflow into the APB.

2.2.4 Biotreatment

The BTS processes agent hydrolysate via aerobic microbiological treatment to degrade organic constituent products of agent hydrolysis to principally carbon dioxide, water, sulfate, and other oxidized mineral salts. Dissolved oxygen is required and supplied by air blowers. Chemical additives are introduced to the bioreactors as required to maintain the appropriate pH and growth conditions for the microbes. The treated water from the ICB™ is discharged to an Effluent Tank prior to release to the WRS.

2.2.5 Water Recovery and Brine Reduction

The WRS brine concentrator (BC) feed tanks blend BTS effluent with reverse osmosis reject, and boiler and cooling tower blowdown, for feed to the BRS. In addition to equalizing flow to the BRS, the WRS, which consists of three mixed and aerated tanks, provides 7 days of buffer storage. The WRS transfers the blended liquid (brine) to the BRS where suspended solids, dissolved salts, and organic compounds are separated from the liquid to produce recovered reusable water and a solids cake suitable for off-site disposition. After the feed is conditioned, it is de-aerated and transferred to the BC Evaporator where the brine is concentrated into a slurry which passes to the Crystallizer. In the Crystallizer, a recirculation pump circulates the slurry through the heater, producing water vapor and supersaturated crystal slurry. The supersaturated crystal slurry passes to the BRS Belt Filter, an automatic pressure filter, which produces a wet cake. The evaporated water vapor from the Brine Concentrator and Crystallizer is condensed and transferred to the Distillate Carbon Filter Feed Tank where it is pH adjusted and passed through carbon filters before being returned as recovered water to the Process Water Tank.

2.2.6 Agent-Contaminated Secondary Waste Processing

Agent-contaminated secondary waste streams resulting from general maintenance activities, equipment cleaning and repair, measures to ensure worker safety, and sampling will be decontaminated for off-site treatment and/or disposal. Decontamination of agent-contaminated secondary waste will occur in the APB using the SDU and Autoclave. The SDU is a thermal treatment system with a low operational temperature (less than 500°F) that uses electric convection heating. The Autoclave is a thermal treatment system that uses thermal energy from direct contact with steam at low operational temperatures (less than 275°F). Once decontamination to the desired level has been confirmed, the decontaminated secondary wastes are managed for off-site disposition.

2.2.7 Explosive Destruction System (EDS)

Leakers, rejects, and contaminated energetics determined to be unsuitable for processing through PCAPP will be processed through one of two EDS units. The EDS units are transportable systems designed to safely treat/destroy munitions and other items that contain chemical agent with or without energetic components. The main component of an EDS unit is a sealed, stainless steel vessel that contains all the blast, vapor, and fragments from the process. The EDS units use explosive charges to detonate the munition burster, if present, and breach the munition or item wall to expose the chemical agent fill. Chemical reagents are added to the exposed chemical agent, and the containment vessel is rotated and heated. Agent treatment is confirmed by sampling residual liquid and air from the vessel prior to reopening the EDS. When treatment of the chemical agent fill is complete, waste materials are removed from the containment vessel, placed in waste containers, and temporarily stored pending transport off site for treatment and/or disposal.

2.3 FACILITIES

The following provides a summary of the PCAPP and EDS facilities with a detailed description of emission points and air pollutant control systems employed at each. The relative location of the two facilities is provided in Figure 2-2.

2.3.1 PCAPP

PCAPP consists of two primary process buildings, outdoor equipment and utilities, and various support buildings. Figure 2-3 provides an illustration of the area. The ERB and APB house the equipment that will be used to reconfigure the munitions and process the mustard agents, respectively. These buildings were designed with engineered control features, such as explosion containment rooms and cascade ventilation systems, to protect workers and ensure that chemicals are not released into the environment.

Support facilities include electrical equipment, boilers for steam and hot water supply, air compressors, and other utility supplies; buildings that will be used for storage and maintenance; buildings for access control; tanks for storage of fuel or intermediate processed wastes; and buildings for other support functions (locker room, break areas, control room, medical, and laboratory). Except for the laboratory and control room, the support buildings are designed as general industrial facilities for worker comfort.

2.3.1.1 PCAPP Emission Units

Emissions from hazardous waste operations at the PCAPP are included in the MPHRA. These processes will operate continuously and release emissions from the following eight points:

- One stack dedicated to the Agent Filtration Area (AFA) emissions consisting of the treated ERB/APB cascade ventilation system effluent and the OTS effluent as described below (AFA stack)
- 30-day Hydrolysate Storage Tanks vent
- Four BTS OTS stacks, i.e., one for each of the four BTS module OTS
- WRS (BC feed tank) OTS stack
- BRS OTS stack

Potential emissions from other operations were assessed and eliminated from further consideration. For example, the three MSMs, which provide temporary buffer storage of overpacked munitions to ensure adequate feed for the ERB processes, are not sources that are expected to result in potential emissions given the short period for storage and minimal handling. Additionally, the munitions bodies and baseplates treated in the MTU are processed through the PRRS to remove dust and debris prior to transfer through the rotary valve and discharge to the cooling bins within an enclosure. Emissions of particulate matter (i.e., dust) will be minimal from munitions entering the enclosure and from subsequent handling. Because the potential for dust emissions from the enclosure is minimal, these potential emission points have also been eliminated from further consideration.

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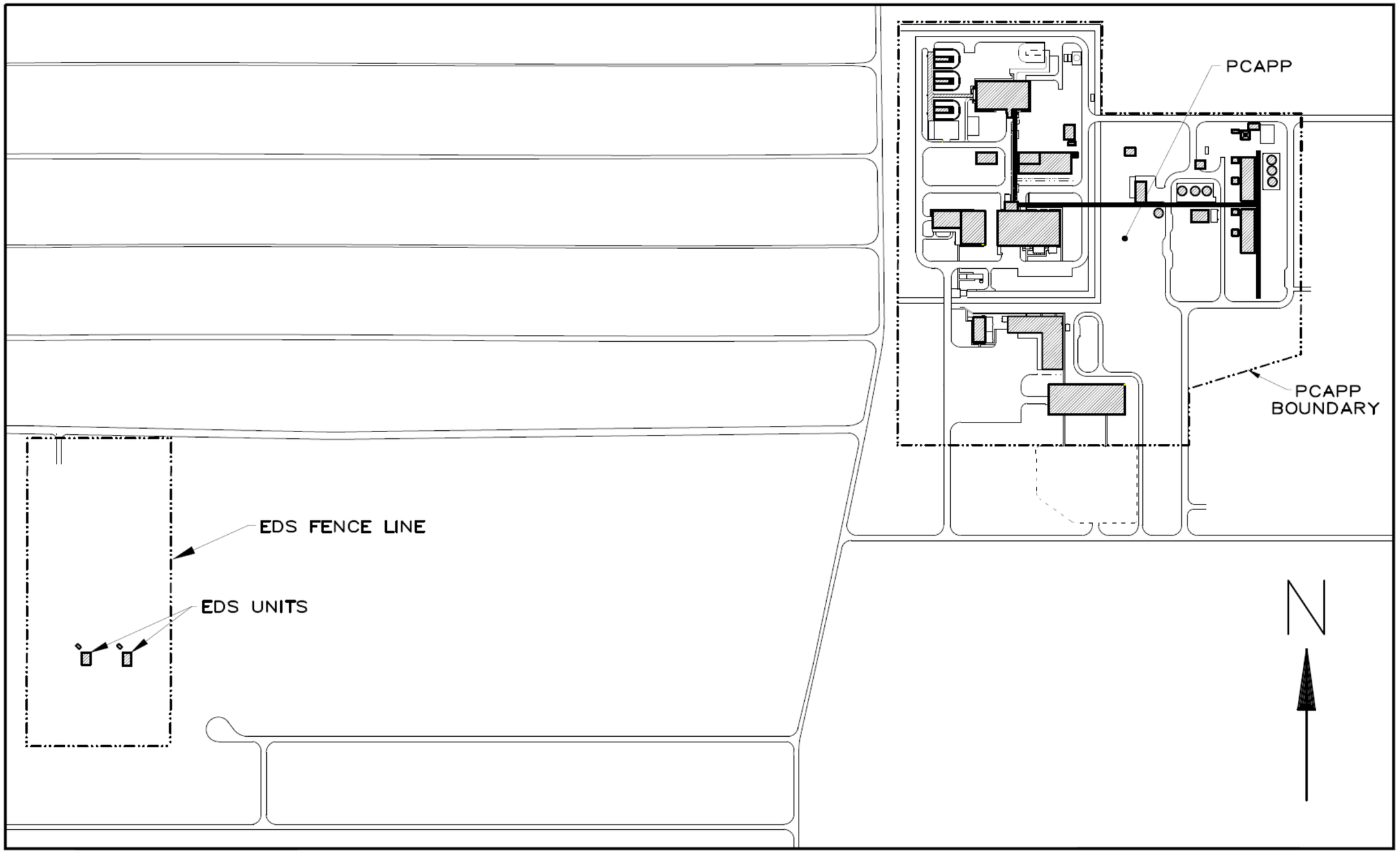

Figure 2-2. PCAPP and EDS locations.

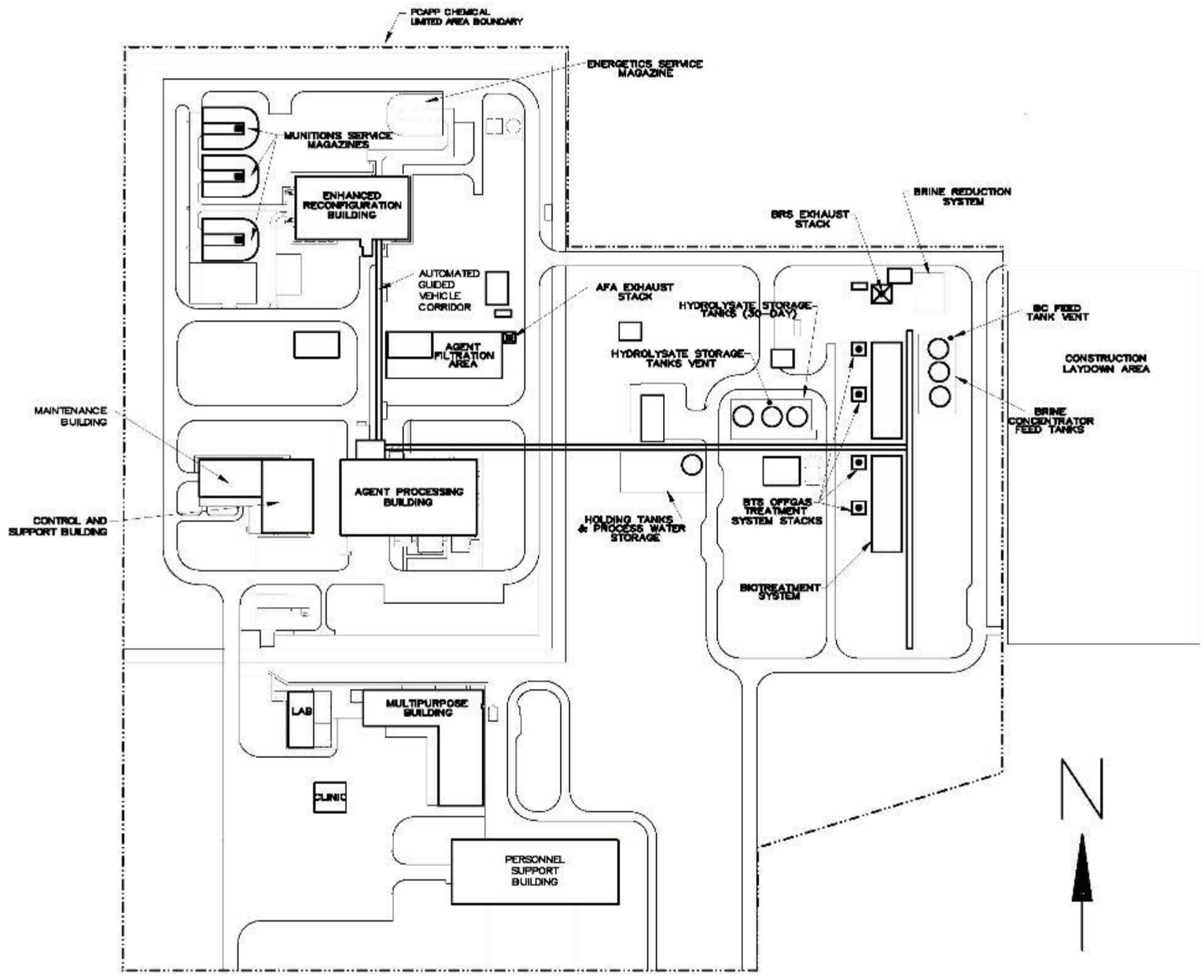

Figure 2-3. PCAPP site layout.

2.3.1.2 PCAPP Process Offgas Treatment Systems (OTS)

Each emission point identified in Section 2.3.3.1 is located downstream of an OTS. A description of the OTS for each emission type is provided below.

The AFA stack is the final release point for emissions from the ERB and APB cascade ventilation system exhaust and process offgas from the OTS. The OTS treats process offgas from the MTUs, ANS, MWS, SDS tanks, SDU, and Autoclave prior to release to the AFA. The OTS consists of a bulk oxidizer preheater, bulk oxidizer, venturi/scrubber tower, offgas reheater, and offgas blowers. The preheater heats the process offgas from the MTU, ANS, MWS, SDS, and autoclave to a maximum temperature of 1,150°F. The bulk oxidizer maintains gases at temperature for a minimum residence time of 1.5 seconds for the destruction of agent HD vapor. The offgas from the bulk oxidizer is rapidly quenched to approximately 120°F in the venturi, which removes the majority of particulates and acid gases. The cooled gas and scrubber liquid exit the bottom of the venturi and, with the SDU vent stream, enter the scrubber tower below the packed bed section. The scrubber tower continues the removal of acid gases and other soluble species from the OTS offgas. The OTS offgas reheater raises the gas temperature after it exits the scrubber tower, thereby lowering the relative humidity of the offgas to prevent condensation from occurring in the offgas blower and AFA filters. The offgas blower discharges the treated offgas to the AFA and provides the necessary gas flow for the OTS, while maintaining the MTUs, SDU, MWS-washed agent and water surge drums, and autoclave condensate drum under a slight vacuum.

The AFA serves as a pollution control device for filtering any agent, and particulate matter that may be present in ERB and APB cascade ventilation system exhaust or that may remain in the OTS offgas after treatment. The AFA consists of 10 filter housings, each containing nine filters. The first filter is a pre-filter for removal of large particulates. The second filter is a high-efficiency particulate air (HEPA) filter for removal of fine particles for protection of the activated carbon filters that follow. The next five filters are activated carbon filters for the removal of agent vapor, followed by a sulfur impregnated activated carbon filter for removal of residual mercury. The final filter is another HEPA filter for the purpose of collecting any fine particles that may erode from the carbon filters.

The three 30-day Storage Tanks vent to a dedicated passive activated carbon filter system, consisting of three carbon filters, prior to release to the atmosphere. The combined vent streams from the three 30-day Storage Tanks are routed through two carbon filters in series, prior to release to the atmosphere. The third carbon filter is maintained in stand-by to support carbon-changeout, as required.

Each of the four BTS process stacks has an individual OTS to mitigate nuisance odors and control organic emissions. The major components of each train include an ICB™ Offgas heater; an activated carbon filter system consisting of two carbon filters in series; and an ICB™ Offgas fan and stack. The ICB™ Offgas heater lowers the relative humidity of the combined exhaust stream from the ICB™ reactors to protect the carbon filters from excessive moisture and maintain the adsorption capacity of the carbon. The activated carbon filter system removes potentially odorous gases and other volatile organic compounds (VOC). The carbon filters are arranged in a lead-lag arrangement to maximize use of the carbon adsorption capacity as breakthrough is approached. The offgas fan provides the motive force for the gases throughout the OTS.

The BC feed tank OTS consists of one offgas heater, two 100% capacity offgas activated carbon filters in lead-lag configuration, and two 50% capacity centrifugal-type offgas blowers.

The heater increases the offgas temperature to maintain the relative humidity below 50%. The carbon removes potentially odorous gases and other VOCs. The blowers provide the motive force to transfer the offgas to the stack.

The BRS OTS is used to treat the BRS vent gases and consists of an entrainment separator, heater, carbon filters, fan, and stack. The combined vapors from the evaporator/crystallizer process pass through the Entrainment Separator to remove residual water, are then heated in the heater to reduce the relative humidity to 50% or less, and then pass to the carbon filters for removal of odorous compounds or other VOCs. The OTS fan pulls the offgas through this treatment process and delivers it to the OTS stack from which it is vented to the atmosphere. Three OTS carbon filters are provided with two filters in service and the third filter in standby. The filters are operated in a lead-lag service to optimize carbon adsorption capabilities.

2.3.2 EDS

The EDS incorporates two primary process facilities, outdoor equipment and utilities, and support buildings. Figure 2-4 provides an illustration of the area. The two environmental enclosures used to house the EDS units incorporate engineered control features, such as a cascade ventilation system, to protect workers and ensure that chemicals are not released into the environment.

Support facilities include electrical equipment and other utility supplies; facilities that will be used for storage and maintenance; facilities for access control; and facilities for other support functions (e.g., change house and mobile analytical platform).

While two EDS units will be constructed at PCD, only one unit will operate at a time. The other unit will be used as a backup if the primary unit is not operational. In addition, the EDS will only operate during daylight hours (i.e., based on 12 hours per day and not 24 hours per day).

2.3.2.1 EDS Emission Units

EDS emissions will be released from two stacks associated with each of the two EDS units. Potential emissions from other operations were assessed and eliminated from further consideration within the MPHRA. For example, the Container Storage Unit, which provides temporary buffer storage of overpacked munitions, DOT containers, or other miscellaneous items to be treated in the EDS, is not a source that is expected to result in potential emissions given the period for storage and minimal handling.

2.3.2.2 Process Offgas Treatment Systems

Each EDS unit is enclosed in an environmental enclosure. Each EDS has a Waste Transfer Sub-system (WTS) that receives liquid and gaseous wastes from the containment vessel. Emissions from the WTS are combined with enclosure air prior to passing through the air filtration system (AFS), which is equipped with a mid-bed chemical agent monitor, and exiting the stack. Each enclosure is equipped with two AFSs that operate in parallel during operations. Each AFS includes a prefilter, HEPA filter, two banks of sulfur-impregnated carbon filters, another HEPA filter, and an induced draft fan to maintain a negative pressure with the structure.

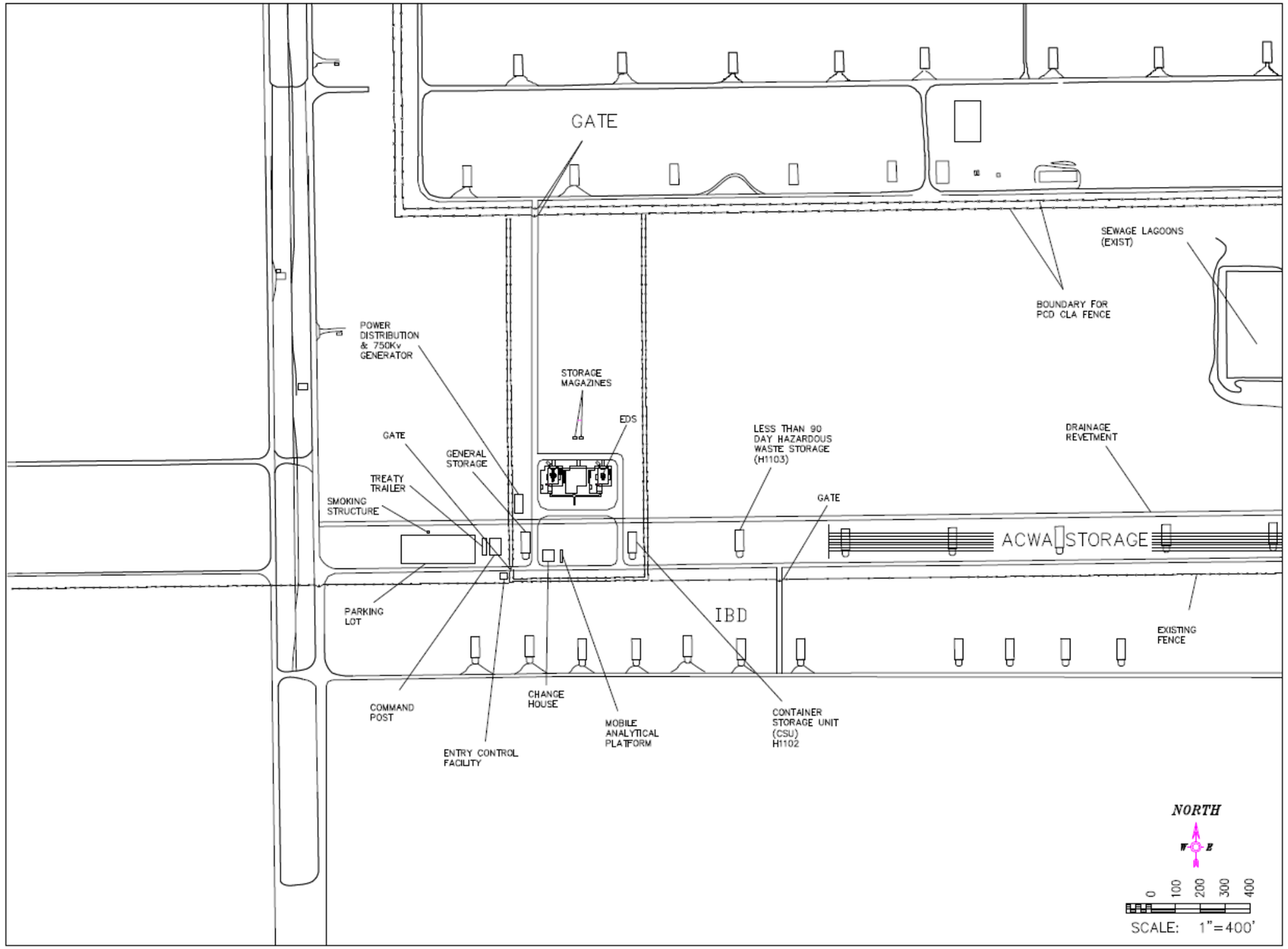

Figure 2-4. PCD EDS site layout.

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2.4 PCAPP AND EDS WASTE DESCRIPTION

The PCAPP and EDS RCRA permits each include a Waste Analysis Plan that provide a description of the wastes to be received, stored, and treated at each facility.

PCAPP will treat non-leaking munitions from the PCD stockpile that contain mustard agent. EDS will treat mustard agent-filled leaking munitions, PCAPP-rejected munitions, DOT containers, and potentially contaminated bursters. Remaining energetics removed from configured munitions, such as TNT, tetryl, and M1/M6 components, will be treated off site.

During operation of the PCAPP and EDS, secondary waste streams contaminated with mustard agent may be generated by the processes used to treat munitions and destroy mustard agent. These wastes may result from general maintenance activities, equipment cleaning and repair, measures to ensure worker safety, and sampling activities. Examples of these potential secondary waste streams include:

- Sampling equipment and other instruments
- DPE suits and other PPE
- DPE hoses
- Utility hoses
- Equipment, parts, valves
- Tools
- Seals, gaskets, and diaphragms
- Drums, drum liners, and other containers
- Decontamination supplies
- Strainer cleanout solids
- Paint chips
- Insulation

A complete listing of anticipated secondary waste streams from each facility is included in the corresponding Waste Analysis Plan.

2.5 COPC SELECTION

COPCs are those chemicals that 1) have been identified as potentially being present in the agent-containing wastes that will be treated at the PCAPP or in the EDS, 2) have been observed in other facilities treating mustard agent using a similar process, or 3) may be generated during the treatment processes at the PCAPP or EDS and may become airborne as a result of volatilization or other processes and emitted in a process gas stream. In general, the approach for selecting COPCs is as follows:

1. Identify possible COPCs from literature that discusses HD components, impurities, and degradation products or other chemicals present in HD munitions.
2. Identify possible COPCs from available data for sources similar to the PCAPP and EDS and from bench-scale evaluations of the processes expected to be located at the PCAPP.
3. Review each potential COPC identified in steps 1 and 2 to determine whether it is expected to be found in a process gas stream.
4. If the chemical could be found in a process gas stream, evaluate the air pollution controls associated with that emission point to determine the likelihood of release of that chemical to the air.

Appendix A describes this selection process in detail. This selection process resulted in a list of 104 COPCs (listed in Table 2-1). PCAPP has 67 COPCs and EDS has 69 COPCs, with 32 COPCs being common to both PCAPP and EDS. Several sources of verifiable toxicity values (described in detail in Section 6) were searched to identify available toxicity data for the chemicals in Table 2-1. Of the 104 COPCs, 31 have carcinogenic toxicity factors, 75 have chronic noncarcinogenic toxicity factors, and 89 have acute toxicity factors. If no toxicity factor or no emission rate is available for a COPC, then no quantitative risk assessment can be performed for that COPC, and the risk from that COPC is addressed qualitatively in Section 8, Uncertainty Analysis.

2.6 EMISSION RATE DETERMINATIONS

An estimated emission rate was determined for each COPC for which data were available to base the estimate. These emission rates are a function of the agent-containing waste composition and treatment by-products that ultimately become entrained in the process vent streams. These rates were derived by using existing process and bench-scale data applied to the units in question. If no existing process or bench-scale data were available with which to estimate an emission rate for a particular COPC, the risk and hazard associated with that COPC were qualitatively analyzed in Section 8, Evaluation of Assumptions, Uncertainties, and Confidence in MPHRA Results.

Emissions as a result of startups and shutdowns are not anticipated to be any greater than stack emissions estimated for normal operations in this MPHRA. In addition, the pollution control systems incorporated into the PCAPP and EDS designs will capture any potential fugitive emission from RCRA-regulated sources. Therefore, emissions related to startups, shutdowns, and fugitive sources are not evaluated as separate scenarios in this MPHRA.

As discussed in Section 2.5 and Appendix A, a number of COPCs have been identified based on preliminary mass balances and chemicals found in processes similar to the PCAPP and EDS. Chemical-specific emission rates were derived for each stack based on the COPCs expected to be released from associated operating units. For PCAPP, chemical-specific long-term (chronic) emission rates were calculated by combining the maximum design emission rates for continuously-operating emission sources (AFA stack, BTS stacks, BRS stack, and BC Feed Tanks vent) with the annual average emission rates for intermittent emission units (30-day Hydrolysate Storage Tanks vent). As discussed in Appendix B-1, the maximum design emission rates are based on processing 18,000 pounds of agent per day. Based on continuous operation at this processing rate, the 2,600 tons of chemical agent in the PCD stockpile would be completely processed in only 289 days. For conservatism in the MPHRA, however, the maximum design emission rates were assumed to occur over the entire 5 year operating period. For EDS, the chemical-specific long-term emission rates were calculated by dividing total campaign COPC emissions by the EDS operating schedule of 12 hours per day.

Chemical-specific short-term (acute) emission rates were calculated by combining the maximum design emission rates for continuously-operating emission sources with the maximum hourly emission rates for intermittent emission units. All emission rates used in this MPHRA were estimated based on the maximum design emission rate for each PCAPP and EDS unit operation. Table 2-2 summarizes the long-term emission rates used in the MPHRA (presented in terms of pounds per hour [lb/hr]). Table 2-3 summarizes the short-term emission rates used in the MPHRA (presented in terms of lb/hr). Emission calculations for some COPCs incorporated an activated carbon control factor that was established based on vendor-supplied

activated carbon performance information. Table 2-2 and Table 2-3 provide the COPC-specific activated carbon control factor. Appendix B presents detailed emission calculations for each emission point.

Table 2-1. Chemicals of Potential Concern and Data Availability

CAS No.	Compound Name	COPCs	PCAPP COPC	PCAPP Emission Rate Available?	EDS COPC	EDS Emission Rate Available?	Toxicity Data		
							Chronic		Acute
							Cancer	Noncancer	Inhalation
630-20-6	1,1,1,2-tetrachloroethane	1	1		1		√	√	√
71-55-6	1,1,1-trichloroethane	2	2		2			√	√
79-34-5	1,1,2,2-tetrachloroethane	3	3	√	3		√	√	√
75-34-3	1,1-dichloroethane	4	4	√			√	√	√
75-35-4	1,1-dichloroethene	5	5		4	√		√	√
87-61-6	1,2,3-trichlorobenzene	6	6	√				√	√
120-82-1	1,2,4-trichlorobenzene	7	7		5	√	√	√	√
95-63-6	1,2,4-trimethyl benzene	8	8	√				√	√
13105-10-7	1,2-bis(ethylthio)-ethene	9	9						
63938-34-1	1,2-bis(vinylthio)-ethane	10	10						
95-50-1	1,2-dichlorobenzene	11			6	√		√	√
616-21-7	1,2-dichlorobutane	12	11	√					
107-06-2	1,2-dichloroethane	13	12	√	7	√	√	√	√
78-87-5	1,2-dichloropropane	14	13	√			√	√	√
541-73-1	1,3-dichlorobenzene	15			8	√			√
106-46-7	1,4-dichlorobenzene	16			9	√	√	√	√
123-91-1	1,4-dioxane	17	14				√	√	√
505-29-3	1,4-dithiane	18	15	√	10	√		√	
15980-15-1	1,4-oxathiane	19	16	√	11	√			√
109-69-3	1-chlorobutane	20	17	√				√	√
592-41-6	1-hexene	21	18	√					√
3772-13-2	2,2-dimethyl-trans-thiirane	22	19						
632-16-6	2,3-dimethyl-thiophene	23	20						
118-96-7	2,4,6-trinitrotoluene	24			12		√	√	√
120-83-2	2,4-dichlorophenol	25			13	√		√	√
121-14-2	2,4-dinitrotoluene	26			14		√	√	√
606-20-2	2,6-dinitrotoluene	27			15		√	√	√
78-93-3	2-butanone	28	21	√	16	√		√	√
78-86-4	2-chlorobutane	29	22	√	17				√
112-26-5	2-chloroethoxyethane	30	23	√					√
3404-63-5	2-ethyl 1,3-butadiene	31	24	√					
591-78-6	2-hexanone	32	25	√				√	√
95-48-7	2-methyl phenol	33			18	√		√	√
5616-51-3	2-methyl-1,3-dithiacyclopentane	34	26						
6007-26-7	2-methyl-1,3-dithiane	35	27						
17642-74-9	2-methyl-1,3-oxathiolane	36	28						
91-57-6	2-methylnaphthalene	37			19	√		√	√
108-39-4	3-methyl phenol	38	29	√	20	√		√	√
106-44-5	4-methyl phenol	39	30	√	21	√		√	√
108-10-1	4-methyl-2-pentanone	40	31	√				√	√
208-96-8	acenaphthylene	41			22	√			√
75-07-0	acetaldehyde	42	32				√	√	√
67-64-1	acetone	43	33	√	23	√		√	√
74-86-2	acetylene	44			24	√			√

Table 2-1. Chemicals of Potential Concern and Data Availability (continued)

CAS No.	Compound Name	COPCs	PCAPP COPC	PCAPP Emission Rate Available?	EDS COPC	EDS Emission Rate Available?	Toxicity Data		
							Chronic		Acute
							Cancer	Noncancer	Inhalation
107-02-8	acrolein	45	34	√				√	√
98-83-9	alpha-methylstyrene	46	35	√				√	√
71-43-2	benzene	47	36	√	25	√	√	√	√
108-60-1	bis(2-chloroisopropyl) ether	48			26	√	√	√	
75-15-0	carbon disulfide	49	37	√	27	√		√	√
108-90-7	chlorobenzene	50			28	√		√	√
75-00-3	chloroethane	51	38	√				√	√
67-66-3	chloroform	52	39	√	29	√	√	√	√
74-87-3	chloromethane	53	40	√				√	√
3188-13-4	chloromethoxyethane	54	41	√					
156-59-2	cis-1,2-dichloroethene	55			30	√		√	√
75-71-8	dichlorodifluoromethane	56			31	√		√	√
60-29-7	diethyl ether	57	42	√				√	√
84-66-2	diethyl phthalate	58			32			√	√
84-74-2	di-n-butyl phthalate	59			33			√	√
122-39-4	diphenylamine	60			34			√	√
74-84-0	ethane	61	43	√	35	√			√
64-17-5	ethanol	62			36	√			√
74-85-1	ethene	63	44		37				√
85-98-3	ethyl centralite	64			38				
100-41-4	ethylbenzene	65	45	√	39	√	√	√	√
505-60-2	HD	66	46	√	40	√	√	√	√
87-68-3	hexachlorobutadiene	67	47				√	√	√
67-72-1	hexachloroethane	68	48		41		√	√	√
110-54-3	hexane	69	49	√				√	√
74-82-8	methane	70	50		42	√			√
1634-04-4	methyl tert-butyl ether	71	51	√			√	√	√
75-09-2	methylene chloride	72	52	√	43	√	√	√	√
141-43-5	monoethanolamine	73			44	√			√
91-20-3	naphthalene	74	53	√	45	√	√	√	√
98-95-3	nitrobenzene	75			46	√	√	√	√
55-63-0	nitroglycerin	76			47		√	√	√
111-65-9	octane	77	54	√					√
109-66-0	pentane	78	55	√				√	√
85-01-8	phenanthrene	79			48	√			√
108-95-2	phenol	80			49	√		√	√
115-07-1	propene	81	56	√				√	√
100-42-5	styrene	82			50	√		√	√
75-65-0	tert-butyl alcohol	83	57	√					√
92-24-0	tetracene	84			51				
127-18-4	tetrachloroethene	85	58	√	52	√	√	√	√
479-45-8	tetryl	86			53			√	√
420-12-2	thiirane	87	59	√					
111-48-8	thiodiglycol	88	60	√	54			√	√
108-88-3	toluene	89	61	√	55	√		√	√
156-60-5	trans-1,2-dichloroethene	90			56	√		√	√
79-01-6	trichloroethene	91	62	√	57	√	√	√	√
75-01-4	vinyl chloride	92	63	√	58	√	√	√	√

Table 2-1. Chemicals of Potential Concern and Data Availability (continued)

CAS No.	Compound Name	COPCs	PCAPP COPC	PCAPP Emission Rate Available?	EDS COPC	EDS Emission Rate Available?	Toxicity Data		
							Chronic		Acute
							Cancer	Noncancer	Inhalation
1330-20-7	xylenes	93	64	√	59	√		√	√
7429-90-5	aluminum	94			60	√		√	√
7664-41-7	ammonia	95	65	√	61	√		√	√
7440-38-2	arsenic, inorganic	96			62	√	√	√	√
7440-43-9	cadmium	97			63	√	√	√	√
7782-50-5	chlorine	98	66	√				√	√
7440-50-8	copper	99			64	√		√	√
7647-01-0	hydrogen chloride	100	67	√	65			√	√
74-90-8	hydrogen cyanide	101			66	√		√	√
7439-92-1	lead	102			67	√	√		√
7440-02-0	nickel	103			68		√	√	√
7440-22-4	silver	104			69	√		√	√

√ = Indicates emission data/toxicity data are available for this COPC.

Table 2-2. PCAPP and EDS Long-term Emission Rates[a]

COPC	Activated Carbon Control Efficiency (%)	Long-term Emission Rates After Controls[b] (lb/hr)					
		AFA Stack	30-day Hydrolysate Storage Tanks Vent	BTS Stacks[c]	BRS Stack	BC Feed Tanks Vent	EDS Stacks[d]
1,1,1,2-tetrachloroethane	0	0	0	0	0	0	0
1,1,1-trichloroethane	0	0	0	0	0	0	0
1,1,2,2-tetrachloroethane	66	2.57E-06	5.07E-07	2.08E-03	1.31E-07	5.33E-11	0
1,1-dichloroethane	0	5.44E-05	1.61E-06	2.76E-04	4.98E-07	2.67E-09	0
1,1-dichloroethene	0	0	0	0	0	0	1.61E-09
1,2,3-trichlorobenzene	0	5.63E-11	2.13E-11	1.95E-06	4.71E-12	1.62E-16	0
1,2,4-trichlorobenzene	0	0	0	0	0	0	2.79E-12
1,2,4-trimethyl benzene	0	1.04E-04	0	0	0	0	0
1,2-bis(ethylthio)-ethene	0	0	0	0	0	0	0
1,2-bis(vinylthio)-ethane	0	0	0	0	0	0	0
1,2-dichlorobenzene	66	0	0	0	0	0	5.37E-12
1,2-dichlorobutane	33	7.40E-06	5.31E-06	8.38E-03	1.51E-06	1.20E-09	0
1,2-dichloroethane	0	2.00E-01	4.77E-04	2.06E-01	1.40E-04	3.37E-07	2.38E-09
1,2-dichloropropane	33	9.89E-09	8.10E-09	5.17E-06	2.38E-09	4.10E-12	0
1,3-dichlorobenzene	66	0	0	0	0	0	4.79E-12
1,4-dichlorobenzene	66	0	0	0	0	0	5.35E-12
1,4-dioxane	33	0	0	0	0	0	0
1,4-dithiane	0	9.67E-05	4.56E-05	1.00E-01	1.07E-05	9.39E-10	2.53E-08
1,4-oxathiane	0	1.69E-04	8.57E-05	1.08E-01	2.08E-04	7.58E-08	2.62E-07
1-chlorobutane	66	7.46E-09	9.34E-10	3.32E-07	2.83E-10	7.89E-13	0
1-hexene	33	5.73E-07	5.55E-07	1.15E-04	1.74E-07	6.91E-10	0
2,2-dimethyl-trans-thiirane	0	0	0	0	0	0	0
2,3-dimethyl-thiophene	0	0	0	0	0	0	0
2,4,6-trinitrotoluene	0	0	0	0	0	0	0
2,4-dichlorophenol	0	0	0	0	0	0	9.93E-13
2,4-dinitrotoluene	0	0	0	0	0	0	0
2,6-dinitrotoluene	0	0	0	0	0	0	0
2-butanone	33	1.71E-04	2.94E-06	1.07E-03	8.92E-07	2.39E-09	1.05E-08
2-chlorobutane	33	8.07E-06	5.60E-06	1.39E-03	1.74E-06	7.02E-09	0
2-chloroethoxyethane	66	2.03E-07	5.83E-08	1.56E-02	1.18E-08	1.95E-13	0
2-ethyl 1,3-butadiene	0	3.85E-06	7.63E-08	2.36E-05	2.32E-08	6.85E-11	0
2-hexanone	33	5.00E-04	6.04E-08	1.47E-04	1.56E-08	1.08E-11	0
2-methyl phenol	66	0	0	0	0	0	2.54E-11
2-methyl-1,3-dithiacyclopentane	0	0	0	0	0	0	0
2-methyl-1,3-dithiane	0	0	0	0	0	0	0
2-methyl-1,3-oxathiolane	0	0	0	0	0	0	0
2-methylnaphthalene	0	0	0	0	0	0	1.67E-11
3-methyl phenol	66	1.38E-10	2.14E-11	2.87E-06	3.41E-12	2.69E-16	3.88E-12
4-methyl phenol	66	1.38E-10	2.14E-11	2.87E-06	3.41E-12	2.69E-16	3.88E-12
4-methyl-2-pentanone	33	1.69E-07	1.15E-07	1.73E-04	3.17E-08	2.98E-11	0
acenaphthylene	0	0	0	0	0	0	4.40E-12
acetaldehyde	0	0	0	0	0	0	0
acetone	0	3.25E-03	2.76E-05	4.51E-03	8.58E-06	4.50E-08	3.71E-06
acetylene	0	0	0	0	0	0	1.13E-04
acrolein	0	3.25E-04	0	0	0	0	0
alpha-methylstyrene	0	1.25E-04	0	0	0	0	0
benzene	66	1.66E-07	1.50E-07	5.54E-05	4.51E-08	1.18E-10	6.97E-08
bis(2-chloroisopropyl) ether	0	0	0	0	0	0	5.73E-12
carbon disulfide	0	1.21E-03	0	0	0	0	1.79E-06
chlorobenzene	66	0	0	0	0	0	8.86E-11
chloroethane	0	3.58E-03	0	0	0	0	0
chloroform	33	1.42E-04	6.38E-07	1.23E-04	1.99E-07	8.67E-10	1.22E-08
chloromethane	0	2.67E-04	1.37E-05	1.61E-04	4.97E-06	1.92E-07	0
chloromethoxyethane	66	2.52E-08	0	8.87E-02	0	0	0
cis-1,2-dichloroethene	0	0	0	0	0	0	5.20E-09
dichlorodifluoromethane	0	0	0	0	0	0	3.03E-08
diethyl ether	0	1.80E-06	2.08E-06	1.66E-04	6.87E-07	5.90E-09	0
diethyl phthalate	0	0	0	0	0	0	0

Table 2-2. PCAPP and EDS Long-term Emission Rates[a] (continued)

COPC	Activated Carbon Control Efficiency (%)	Long-term Emission Rates After Controls[b] (lb/hr)					
		AFA Stack	30-day Hydrolysate Storage Tanks Vent	BTS Stacks[c]	BRS Stack	BC Feed Tanks Vent	EDS Stacks[d]
di-n-butyl phthalate	0	0	0	0	0	0	0
diphenylamine	0	0	0	0	0	0	0
ethane	0	3.70E-03	5.42E-04	1.09E-03	2.16E-04	2.53E-05	1.25E-06
ethanol	0	0	0	0	0	0	5.81E-06
ethene	0	0	0	0	0	0	0
ethyl centralite	0	0	0	0	0	0	0
ethylbenzene	66	1.50E-03	0	0	0	0	1.14E-10
HD	NA[b]	9.75E-04	0	0	0	0	1.20E-05
hexachlorobutadiene	0	0	0	0	0	0	0
hexachloroethane	0	0	0	0	0	0	0
hexane	0	2.25E-04	0	0	0	0	0
methane	0	0	0	0	0	0	2.81E-03
methyl tert-butyl ether	0	8.33E-04	0	0	0	0	0
methylene chloride	0	2.33E-04	9.44E-06	8.93E-04	3.04E-06	2.46E-08	2.59E-11
monoethanolamine	0	0	0	0	0	0	3.85E-04
naphthalene	66	1.02E-10	3.87E-11	2.62E-06	8.41E-12	3.95E-16	1.85E-10
nitrobenzene	66	0	0	0	0	0	1.05E-12
nitroglycerin	0	0	0	0	0	0	0
octane	0	5.00E-04	0	0	0	0	0
pentane	0	5.42E-04	0	0	0	0	0
phenanthrene	0	0	0	0	0	0	1.55E-12
phenol	66	0	0	0	0	0	5.27E-11
propene	0	6.67E-04	0	0	0	0	0
styrene	66	0	0	0	0	0	8.35E-10
tert-butyl alcohol	0	4.13E-04	0	0	0	0	0
tetracene	0	0	0	0	0	0	0
tetrachloroethene	66	5.88E-04	1.26E-06	1.99E-03	3.43E-07	2.96E-10	2.27E-08
tetryl	0	0	0	0	0	0	0
thiirane	0	5.41E-06	1.39E-06	2.16E-04	4.47E-07	2.22E-09	0
thiodiglycol	66	1.61E-04	1.80E-04	9.93E-05	2.94E-04	2.97E-09	0
toluene	66	1.96E-03	4.68E-09	5.05E-06	1.31E-09	1.50E-12	1.47E-06
trans-1,2-dichloroethene	0	0	0	0	0	0	2.22E-09
trichloroethene	33	5.09E-04	1.51E-06	7.16E-04	4.39E-07	9.54E-10	5.49E-09
vinyl chloride	0	2.08E-01	4.57E-04	8.11E-03	1.66E-04	4.26E-06	2.92E-07
xylenes	66	4.42E-03	5.98E-10	1.88E-06	1.57E-10	7.97E-14	2.64E-10
aluminum	0	0	0	0	0	0	1.60E-05
ammonia	0	0	0	4.44E-02	9.35E-01	7.62E-02	1.63E-04
arsenic	0	0	0	0	0	0	3.67E-07
cadmium	0	0	0	0	0	0	1.84E-07
chlorine	0	1.25E-01	0	0	0	0	0
copper	0	0	0	0	0	0	3.88E-06
hydrogen chloride	0	1.46E-01	0	0	0	0	0
hydrogen cyanide	0	0	0	0	0	0	2.69E-05
lead	0	0	0	0	0	0	1.41E-06
nickel	0	0	0	0	0	0	0
silver	0	0	0	0	0	0	8.34E-09

a. Chemical-specific long-term (chronic) emission rates were calculated by dividing the daily emission rates presented in Appendix B by 24 hours per day for PCAPP sources and 12 hours per day for EDS sources. See Appendix B for details on estimating long-term emission rates.
b. Emissions after activated carbon control were calculated using either 66%, 33%, or 0% control for all organic compounds except HD; HD emissions were calculated based on 0.7 times the vapor screening level (VSL). See Appendix B for details and for a discussion of HD and metal emission controls.
c. These are total emissions from the four BTS stacks.
d. These are total emissions from one EDS unit; only one EDS unit will operate at a time.

Table 2-3. PCAPP and EDS Short-term Emission Rates[a]

COPC	Activated Carbon Control Efficiency (%)	Short-term Emission Rates After Controls[b] (lb/hr)					
		AFA Stack	30-day Hydrolysate Storage Tanks Vent	BTS Stacks[c]	BRS Stack	BC Feed Tanks Vent	EDS Stacks[d]
1,1,1,2-tetrachloroethane	0	0	0	0	0	0	0
1,1,1-trichloroethane	0	0	0	0	0	0	0
1,1,2,2-tetrachloroethane	66	2.57E-06	6.09E-06	2.08E-03	1.31E-07	5.33E-11	0
1,1-dichloroethane	0	5.44E-05	1.94E-05	2.76E-04	4.98E-07	2.67E-09	0
1,1-dichloroethene	0	0	0	0	0	0	1.74E-07
1,2,3-trichlorobenzene	0	5.63E-11	2.55E-10	1.95E-06	4.71E-12	1.62E-16	0
1,2,4-trichlorobenzene	0	0	0	0	0	0	3.02E-10
1,2,4-trimethyl benzene	0	1.04E-04	0	0	0	0	0
1,2-bis(ethylthio)-ethene	0	0	0	0	0	0	0
1,2-bis(vinylthio)-ethane	0	0	0	0	0	0	0
1,2-dichlorobenzene	66	0	0	0	0	0	5.82E-10
1,2-dichlorobutane	33	7.40E-06	6.38E-05	8.38E-03	1.51E-06	1.20E-09	0
1,2-dichloroethane	0	2.00E-01	5.72E-03	2.06E-01	1.40E-04	3.37E-07	2.58E-07
1,2-dichloropropane	33	9.89E-09	9.72E-08	5.17E-06	2.38E-09	4.10E-12	0
1,3-dichlorobenzene	66	0	0	0	0	0	5.19E-10
1,4-dichlorobenzene	66	0	0	0	0	0	5.79E-10
1,4-dioxane	33	0	0	0	0	0	0
1,4-dithiane	0	9.67E-05	5.47E-04	1.00E-01	1.07E-05	9.39E-10	2.75E-06
1,4-oxathiane	0	1.69E-04	1.03E-03	1.08E-01	2.08E-04	7.58E-08	2.84E-05
1-chlorobutane	66	7.46E-09	1.12E-08	3.32E-07	2.83E-10	7.89E-13	0
1-hexene	33	5.73E-07	6.66E-06	1.15E-04	1.74E-07	6.91E-10	0
2,2-dimethyl-trans-thiirane	0	0	0	0	0	0	0
2,3-dimethyl-thiophene	0	0	0	0	0	0	0
2,4,6-trinitrotoluene	0	0	0	0	0	0	0
2,4-dichlorophenol	0	0	0	0	0	0	1.07E-10
2,4-dinitrotoluene	0	0	0	0	0	0	0
2,6-dinitrotoluene	0	0	0	0	0	0	0
2-butanone	33	1.71E-04	3.52E-05	1.07E-03	8.92E-07	2.39E-09	1.12E-06
2-chlorobutane	33	8.07E-06	6.72E-05	1.39E-03	1.74E-06	7.02E-09	0
2-chloroethoxyethane	66	2.03E-07	7.00E-07	1.56E-02	1.18E-08	1.95E-13	0
2-ethyl 1,3-butadiene	0	3.85E-06	9.15E-07	2.36E-05	2.32E-08	6.85E-11	0
2-hexanone	33	5.00E-04	7.25E-07	1.47E-04	1.56E-08	1.08E-11	0
2-methyl phenol	66	0	0	0	0	0	2.31E-09
2-methyl-1,3-dithiacyclopentane	0	0	0	0	0	0	0
2-methyl-1,3-dithiane	0	0	0	0	0	0	0
2-methyl-1,3-oxathiolane	0	0	0	0	0	0	0
2-methylnaphthalene	0	0	0	0	0	0	1.54E-09
3-methyl phenol	66	1.38E-10	2.57E-10	2.87E-06	3.41E-12	2.69E-16	3.54E-10
4-methyl phenol	66	1.38E-10	2.57E-10	2.87E-06	3.41E-12	2.69E-16	3.54E-10
4-methyl-2-pentanone	33	1.69E-07	1.38E-06	1.73E-04	3.17E-08	2.98E-11	0
acenaphthylene	0	0	0	0	0	0	4.69E-10
acetaldehyde	0	0	0	0	0	0	0
acetone	0	3.25E-03	3.31E-04	4.51E-03	8.58E-06	4.50E-08	6.41E-04
acetylene	0	0	0	0	0	0	2.08E-02
acrolein	0	3.25E-04	0	0	0	0	0
alpha-methylstyrene	0	1.25E-04	0	0	0	0	0
benzene	66	1.66E-07	1.81E-06	5.54E-05	4.51E-08	1.18E-10	7.41E-06
bis(2-chloroisopropyl) ether	0	0	0	0	0	0	6.21E-10
carbon disulfide	0	1.21E-03	0	0	0	0	3.08E-04
chlorobenzene	66	0	0	0	0	0	9.59E-09
chloroethane	0	3.58E-03	0	0	0	0	0
chloroform	33	1.42E-04	7.65E-06	1.23E-04	1.99E-07	8.67E-10	1.32E-06
chloromethane	0	2.67E-04	1.64E-04	1.61E-04	4.97E-06	1.92E-07	0
chloromethoxyethane	66	2.52E-08	0	8.87E-02	0	0	0
cis-1,2-dichloroethene	0	0	0	0	0	0	5.62E-07
dichlorodifluoromethane	0	0	0	0	0	0	3.28E-06
diethyl ether	0	1.80E-06	2.50E-05	1.66E-04	6.87E-07	5.90E-09	0
diethyl phthalate	0	0	0	0	0	0	0

Table 2-3. PCAPP and EDS Short-term Emission Rates[a] (continued)

COPC	Activated Carbon Control Efficiency (%)	Short-term Emission Rates After Controls[b] (lb/hr)					
		AFA Stack	30-day Hydrolysate Storage Tanks Vent	BTS Stacks[c]	BRS Stack	BC Feed Tanks Vent	EDS Stacks[d]
di-n-butyl phthalate	0	0	0	0	0	0	0
diphenylamine	0	0	0	0	0	0	0
ethane	0	3.70E-03	6.50E-03	1.09E-03	2.16E-04	2.53E-05	2.31E-04
ethanol	0	0	0	0	0	0	1.00E-03
ethene	0	0	0	0	0	0	0
ethyl centralite	0	0	0	0	0	0	0
ethylbenzene	66	1.50E-03	0	0	0	0	1.19E-08
HD	NA[b]	9.75E-04	0	0	0	0	4.43E-05
hexachlorobutadiene	0	0	0	0	0	0	0
hexachloroethane	0	0	0	0	0	0	0
hexane	0	2.25E-04	0	0	0	0	0
methane	0	0	0	0	0	0	4.16E-01
methyl tert-butyl ether	0	8.33E-04	0	0	0	0	0
methylene chloride	0	2.33E-04	1.13E-04	8.93E-04	3.04E-06	2.46E-08	2.33E-09
monoethanolamine	0	0	0	0	0	0	4.10E-02
naphthalene	66	1.02E-10	4.65E-10	2.62E-06	8.41E-12	3.95E-16	1.72E-08
nitrobenzene	66	0	0	0	0	0	1.13E-10
nitroglycerin	0	0	0	0	0	0	0
octane	0	5.00E-04	0	0	0	0	0
pentane	0	5.42E-04	0	0	0	0	0
phenanthrene	0	0	0	0	0	0	1.42E-10
phenol	66	0	0	0	0	0	4.82E-09
propene	0	6.67E-04	0	0	0	0	0
styrene	66	0	0	0	0	0	8.99E-08
tert-butyl alcohol	0	4.13E-04	0	0	0	0	0
tetracene	0	0	0	0	0	0	0
tetrachloroethene	66	5.88E-04	1.51E-05	1.99E-03	3.43E-07	2.96E-10	2.46E-06
tetryl	0	0	0	0	0	0	0
thiirane	0	5.41E-06	1.66E-05	2.16E-04	4.47E-07	2.22E-09	0
thiodiglycol	66	1.61E-04	2.16E-03	9.93E-05	2.94E-04	2.97E-09	0
toluene	66	1.96E-03	5.61E-08	5.05E-06	1.31E-09	1.50E-12	2.53E-04
trans-1,2-dichloroethene	0	0	0	0	0	0	2.40E-07
trichloroethene	33	5.09E-04	1.81E-05	7.16E-04	4.39E-07	9.54E-10	5.93E-07
vinyl chloride	0	2.08E-01	5.48E-03	8.11E-03	1.66E-04	4.26E-06	5.04E-05
xylenes	66	4.42E-03	7.18E-09	1.88E-06	1.57E-10	7.97E-14	2.77E-08
aluminum	0	0	0	0	0	0	2.73E-03
ammonia	0	0	0	4.44E-02	9.35E-01	7.62E-02	1.67E-02
arsenic	0	0	0	0	0	0	5.53E-05
cadmium	0	0	0	0	0	0	3.17E-05
chlorine	0	1.25E-01	0	0	0	0	0
copper	0	0	0	0	0	0	7.00E-04
hydrogen chloride	0	1.46E-01	0	0	0	0	0
hydrogen cyanide	0	0	0	0	0	0	4.98E-03
lead	0	0	0	0	0	0	2.38E-04
nickel	0	0	0	0	0	0	0
silver	0	0	0	0	0	0	1.43E-06

a. Chemical-specific short-term (acute) emission rates for intermittent emission units were obtained from the hourly emission rates presented in Appendix B; emission rates for continuously-operating emission sources were calculated by dividing the daily emission rates presented in Appendix B by 24 hours per day for PCAPP sources and 12 hours per day for EDS sources. See Appendix B for details on estimating short-term emission rates.
b. Emissions after activated carbon control were calculated using either 66%, 33%, or 0% for all organic compounds except HD; HD emissions were calculated based on 0.7 times the VSL. See Appendix B for details and for a discussion of HD and metal emission controls.
c. These are total emissions from the four BTS stacks.
d. These are total emissions from one EDS unit; only one EDS unit will operate at a time.

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