1   **ATTACHMENT D-4**

2   **EDS AIR FILTRATION SYSTEM CARBON FILTER PERFORMANCE**

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1 **ATTACHMENT D-4**

2 **EDS AIR FILTRATION SYSTEM CARBON FILTER PERFORMANCE**

3

4 **1.   INTRODUCTION**

5

6 **1.1   Purpose**

7

8 Two Explosive Destruction System (EDS) units will be located at the Pueblo Chemical Agent-Disposal

9 Pilot Plant (PCAPP) Explosive Destruction System (EDS) site, Pueblo Chemical Depot, Colorado. Each

10 EDS unit will be located inside an Environmental Enclosure that provides weather protection and interior

11 environmental control for worker comfort and safety. Each enclosure will have two Air Filtration

12 Systems (AFSs). Each AFS includes prefilter, high efficiency particulate air (HEPA) filters (2),

13 sulfur-impregnated carbon (SIC) high efficiency gas adsorber (HEGA) filters (2), and an induced draft

14 fan to maintain a negative pressure within the structure relative to the outside air and to capture vapors

15 that may result from handling and treatment operations.

16

17 This attachment contains a description of an enclosure AFS and carbon filter unit components plus

18 calculations on carbon filter performance. The purpose of the calculations is to predict how the carbon

19 filter will perform during a catastrophic event.

20

21   •   **Appendix Attachment D-4-1** contains a list of acronyms and abbreviations.

22

23   •   **Appendix Attachment D-4-2** details the calculations for the catastrophic release

24   scenario.

25

26   •   **Appendix Attachment D-4-3** is a list of references.

27

28 A description of the EDS and treatment operation is provided in Section D of the permit modification.

29 Mustard chemical agents distilled sulfur mustard (HD)/mustard-T mixture (HT) will be treated at the

30 PCAPP EDS site.

1   **1.2   Background**

2

3   An Environmental Enclosure surrounds the EDS. The AFS provides negative pressure ventilation for the

4   enclosure and filters air from the enclosure before it is released to the environment. Gases from the EDS

5   treatment process are vented via a duct to the AFS. The release of gases from the EDS to the AFS is a

6   controlled process and is not performed until the treatment level has been reached. Therefore, the amount

7   of chemical agent released from the EDS to the AFS is negligible. The greatest potential for agent

8   challenge to the AFS would be if a munition were to leak while inside the Environmental Enclosure, but

9   before it has been sealed inside the EDS Containment Vessel.

10

11   The AFS consists of a prefilter, a HEPA filter, two HEGA filter banks in series, another HEPA filter, and

12   a motor-powered exhaust fan. The filter unit fan draws air from the Environmental Enclosure through the

13   carbon filter unit components and subsequently discharges to the atmosphere.

14

15   The two HEGA filter banks in the enclosure AFS are composed of SIC beds.

16

17   **1.3   Methodology for Evaluating Calculation Results**

18

19   The evaluated scenario has been developed using an indoor spill scenario developed for the Federal

20   Emergency Management Agency and U.S. Army Chemical Stockpile Emergency Preparedness Program

21   (CSEPP) and presents conservative operating conditions and maximum anticipated operating parameters.

22

23   **1.4   EDS Safeguards**

24

25   Safeguards and procedures have been established to ensure that: (1) filter units are operating properly

26   before treatment operations begin and (2) if breakthrough occurs, necessary actions are taken to restore

27   filter performance. Additionally, all of the munitions to be treated will arrive at an EDS unit in either a

28   universal munition storage container or other containers approved for use at PCD, and will be placed in its

29   entirety into an EDS for treatment. The container will not be opened.

30

31   EDS safeguards include:

32

33   •   Leak-testing of AFS carbon filter banks

34   •   Midbed agent monitoring

35   •   Carbon changeout.

1   **Leak-Testing Carbon Banks**

2

3   EDS carbon filters are tested before first use, after each changeout of carbon filters, and before restarting

4   operations after a temporary closeout. Testing is in accordance with the American National Standards

5   Institute/American Society of Mechanical Engineers (ANSI/ASME) standard N511-2007, "Testing of

6   Nuclear Air Cleaning System."

7

8   **Midbed Agent Monitoring**

9

10   Operational safeguards present at the EDS provide for system reliability. As described in

11   **Attachment F-2** of this permit modification, MINICAMS® and Depot Area Air Monitoring System

12   (DAAMS) confirmation monitoring will be used to monitor the enclosure AFS. The presence of

13   chemical agent mustard at the midbed is monitored continuously; the filters are replaced should

14   breakthrough be confirmed. Monitoring will be performed to provide sufficient warning so that

15   corrective action can be taken before a release of chemical agent occurs.

16

17   **Carbon Changeout Strategy**

18

19   Mandatory criteria have been established for changing out banks of activated carbon in the enclosure AFS

20   when chemical agent is positively detected in the midbed or exhaust monitoring locations. Carbon filters

21   will be changed out when (1) midbed monitoring confirms breakthrough of chemical agent at a

22   concentration at or above the vapor screening level (VSL) alarm level and (2) after completing EDS

23   treatment operations (Resource Conservation and Recovery Act [RCRA] closure). If a carbon midbed

24   monitoring detection is confirmed, the operation will be brought to a safe shutdown state. The first

25   carbon filter will be removed and disposed of, the second carbon filter will be moved to the first, and a

26   new carbon filter will be added as the second filter. All filters will be leak checked in accordance with

27   the ANSI N511-2007 standard before processing may resume. The in-place leak tests ensure mechanical

28   integrity of the filter units before bringing them back into service after the carbon changeout.

29

30   **2.   CALCULATION METHOD**

31

32   Vapor emission rates are calculated based on physical properties and process parameters. The emission

33   period for vapors will be scenario-specific, but a time sequence for operation, monitoring, and

34   performance of corrective actions will be postulated. Termination of the emission event will be

35   recognized when engineering containment of the release is re-established.

1 **3.   CALCULATION SCENARIO**

2

3   The following scenario was considered:

4

5   •   Catastrophic release of mustard agent (H)[1] within the EDS enclosure from the rupture of

6   a munition outside the EDS Containment Vessel.

7

8   Calculations for this scenario are presented in **Appendix Attachment D-4-2** of this attachment.

9

10   **3.1   Catastrophic Scenario**

11

12   The catastrophic scenario evaluated is the accidental release of H, the fill material present in all of the

13   items to be treated in the EDS. The spill size was assumed to be the entire contents of the largest item

14   expected to contain that fill and be brought into the EDS enclosure. It was assumed that the spilled liquid

15   formed a pool 0.1 centimeter deep that was open to the room (as opposed to being contained in a sump).

16

17   The largest H-filled item is a 155mm projectile, which could contain up to 11.7 pounds (lbs) (0.148 cubic

18   feet) of H (SciTech, 1998). This amount of H fill (11.7 lbs) equates to approximately 7.6 lbs (0.096 cubic

19   feet) of liquid mustard agent, as the rest is solid heel. After being placed into a munition, H forms a heel

20   of solid material, which no longer being liquid would not flow from the munitions. A study of 155mm

21   H-filled munitions revealed that the average munition contained 39 percent heel while the median value

22   was 32 percent. Therefore, a heel value of 35 percent was used for these calculations (PMCD, 2011). It

23   is assumed that 1 hour is needed for the spilled material to be contained and that the temperature of the

24   spilled material is 21.1°C (70°F). Based on these assumptions, the filter challenge is calculated to be the

25   amount of agent that would be adsorbed by the carbon filter in 60 minutes at 21.1°C (70°F). The minute

26   by minute iterative calculations showed that only 0.02273 lb of H was transferred to the carbon filter in

27   60 minutes and 0.02271 lb was adsorbed by the carbon filter with 99.9 percent mechanical efficiency.

28

29   **3.2   Calculations**

30

31   **Catastrophic Scenario.** The catastrophic emission scenario calculations are presented in

32   **Appendix Attachment D-4-2**.

---

[1]   HD/HT are measured as H.

1 **4.   RESULTS**

2

3 **4.1   Catastrophic Emission**

4

5 **4.1.1   H Scenario.** The evaporation for H was calculated to be 68.6 milligrams per minute (mg/min)

6 per square meter (m^2) (or 185 mg/min based on 2.699 m^2 pool area). A mass of 0.02273 lb of H was

7 transferred to the carbon filter during the 60 minutes after the spill. The amount adsorbed by the carbon

8 filter was 0.02271 lb during these 60 minutes. Thus, the emissions from the carbon filter would be

9 0.000023 lb in the first 60 minutes after the spill. The maximum concentration in the exhaust air was

10 estimated to be 0.000982 milligram per cubic meter (mg/m^3) during this 60-minute period. Based on a

11 carbon filter capacity for H of 0.2 gram (g) of H per g of carbon, the total filter capacity (assuming

12 4,000 pounds of carbon) is approximately 800 lbs of H. The filter is capable of handling more than

13 35,195 H maximum credible events (MCEs) without breakthrough. Therefore, the catastrophic event

14 would not result in breakthrough of the carbon filter.

15

16 **5.   CONCLUSIONS**

17

18 The carbon filter unit used in the enclosure AFS was specifically designed for chemical agent processing

19 operations and is more than adequate to handle normal as well as catastrophic releases as shown by

20 calculations. The use of this filtration system, in addition to EDS Standing Operating Procedures, will

21 ensure that normal EDS operations with accidental spills pose little threat to human health and the

22 environment.

23

24 The calculations for an unlikely catastrophic release of H within the EDS enclosure indicate that the

25 enclosure AFS has sufficient capacity to contain H vapors without breakthrough of the AFS. The filter

26 challenge from the H catastrophic scenario was determined to be 0.02273 lb of H and the filter capacity

27 for H was calculated to be 800 lbs of H.

28

29 The maximum 1-minute emission rate for H leaving the AFS is 0.000982 mg/m^3, which is less than the

30 source emission limit (SEL) of 0.03 mg/m^3 and below the VSL of 0.003 mg/m^3.

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1   **APPENDIX ATTACHMENT D-4-1**

2   **ACRONYMS AND ABBREVIATIONS**

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1   **APPENDIX ATTACHMENT D-4-1**

2   **ACRONYMS AND ABBREVIATIONS**

3

4

5	AFS	Air Filtration System
6	ANSI	American National Standards Institute
7	ASME	American Society of Mechanical Engineers
8		
9	cfm	cubic feet per minute
10	cm	centimeter
11	CSEPP	Chemical Stockpile Emergency Preparedness Program
12		
13	DAAMS	Depot Area Air Monitoring System
14		
15	EDS	Explosive Destruction System
16		
17	ft^3	cubic feet
18		
19	g	gram
20	g/g	gram per gram
21		
22	H	sulfur mustard (bis(2-chloroethyl) sulfide)
23	HD	distilled sulfur mustard
24	HEGA	high efficiency gas adsorber
25	HEPA	high efficiency particulate air
26	HT	mustard-T mixture
27		
28	kg	kilogram
29		
30	lbs	pounds
31		
32	m^2	square meter
33	m/min	meter per minute
34	MCE	maximum credible event
35	mg	milligram

1	mg/min	milligram per minute
2	mg/m^3	milligram per cubic meter
3	mg/min/m^2	milligram per minute per square meter
4	mm	millimeter
5		
6	PCAPP	Pueblo Chemical Agent-Destruction Pilot Plant
7	psia	pounds per square inch absolute
8		
9	RCRA	Resource Conservation and Recovery Act
10		
11	SEL	source emission limit
12	SIC	sulfur-impregnated carbon
13		
14	VSL	vapor screening level

1   **APPENDIX ATTACHMENT D-4-2**

2   **CATASTROPHIC RELEASE**

3   **MUSTARD AGENT (H)**

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1 **APPENDIX ATTACHMENT D-4-2**

2 **CATASTROPHIC RELEASE**

3 **MUSTARD AGENT (H)**

4

5

6 **1.   PURPOSE**

7

8 Determine the capacity of the enclosure Air Filtration System (AFS) to contain chemical agent during a
9 catastrophic release within the Explosive Destruction System (EDS) enclosure.

10

11 Calculations were performed for the following catastrophic release scenario: a spill of sulfur mustard (H).
12 H was selected because the items with the largest catastrophic potential to be brought into the EDS
13 enclosure are mustard-filled munitions. Therefore, assuming all the munitions are equally corroded, it is
14 most likely that if there is a leak, it will be from an H-filled munition.

15

16 The catastrophic release scenario for H assumes spillage of the liquid portion of a 155mm projectile (the
17 largest recovered munition likely to contain H) contents inside the EDS enclosure.

18

19 **2.   ANALYTICAL METHOD**

20

21 • Calculate H challenge to the AFS.
22 • Calculate H evaporation rate.
23 • Calculate mass of H evaporated.
24 • Calculate enclosure AFS capacity for H.
25 • Calculate AFS carbon capacity safety factor and H emission rate.

26

27 **3.   H SCENARIO INPUTS**

28

29 EDS Enclosure Volume (assumes Sprung Structure with 60' L x 40' W x 25' H)

30

31 35,100 cubic feet (ft^3)

32

33 **Munitions (SciTech, 1998)**
34 Type   155mm projectile, M110
35 Fill   11.7 pounds (lbs) H
36 Heel   35%
37 Liquid H   7.6 lbs
38 Density of H   79.28 lbs/cubic foot
39 Volume of Liquid H   0.096 ft^3

1	**AFS Specifications**	
2	Flow rate	3,325 ft^3 per minute (cfm per AFS; two AFS units operate in
3		parallel during operations)
4	Mass of carbon	4,000 lbs (2,000 lbs per AFS)
5	Filter mech. efficiency (H)	99.9%
6	(per ASME N-510-1)	
7	Carbon capacity H	0.2 gram of H per gram (g/g) of carbon (based on Mahle, 2008)
8		

9 **4. ASSUMPTIONS**

10

11 1. The EDS enclosure has no interior rooms or false ceilings.
12 2. Airflow through the room is constant and uniform.
13 3. The spilled material forms a pool 0.1 centimeter (cm) deep.
14 4. Evaporation rate is constant over the duration of the calculation.
15 5. The spilled liquid is at the same temperature as the enclosure air (21.1°C [70°F] is
16 assumed).
17 6. Ambient pressure is 14.7 pounds per square inch absolute (psia).
18 7. The entire mass of evaporated chemical enters the AFS; none is lost due to condensation
19 on equipment or structural surfaces.
20 8. It is further assumed that 1 hour elapses before spill response actions are able to contain
21 the spilled chemical agent.

22

23 **5. H CALCULATIONS**

24

25 **5.1 Calculate H Challenge to Enclosure AFS**

26

27 **5.1.1 Calculate Evaporation Rate of H.** This calculation used the evaporation model for indoor spill
28 scenarios developed for the Chemical Stockpile Emergency Preparedness Program (CSEPP) (Fedele,
29 2003). This model is considered conservative, as it provides the highest value for evaporation flux.

$$E = C_{vol} \text{ x } V_{evap}$$

30 Where:
31 E = evaporation flux in milligrams per minute per square meter (mg/min/m^2)
32 C_{vol} = volatility of the liquid in milligrams per cubic meter (mg/m^3) = 686 mg/m^3 at
33 21.1°C (70°F) for H
34 V_{evap} = evaporation transfer rate in meters per minute (m/min) = 0.1 m/min
35 (Fedele, 2003)
36 E = 686 mg/m^3 × 0.1 m/min = 68.6 mg/min per m^2

1   Because mustard agent has about 35% heel, the liquid portion is calculated to be:

3   Liquid Portion   =   Total Content (1 - % Heel/100)
4   = $11.7 \times (1 - 35/100)$
5   =   7.6 lbs

7   Because the spill amount is 7.6 lbs (3.45 kilograms [kg]), the pool area (A) is evaluated to be 29.04 sq. ft.
8   (2.699 m^2) for H agent with density of 79.28 lbs/cubic foot and 0.039 inch (0.1 cm) pool thickness. The
9   evaporation rate (R) for the entire spill is calculated as follows:

11   ER   = $E \times A$
12   = 68.6×2.699
13   =   185 mg/min

15   **5.1.2   Calculate Mass of H Evaporated in 60 Minutes.**

17   Mass of H evaporated in 60 minutes = 60 min × (Evaporation Rate)
18   Mass   =   60 min × 185 mg/min = 11,100 mg (or 0.0111 kg)
19   =   11,100 mg × 0.001 g/mg / 454 g/lb
20   =   0.02445 lbs

22   **5.1.3   Calculate Filter Capacity for H.**

24   Filter Capacity   =   (Carbon Capacity) × (Mass of Carbon)
25   Capacity   =   0.2 lb/lb × 4,000 lb = 800 lbs

27   **5.1.4   Calculate AFS Carbon Capacity Safety Factor and Emission Rate.**

29   Amount transferred to filter in one hour = 0.02273 lbs
30   (By iterative calculations)

32   Amount adsorbed in AFS carbon filters   =   (Mass Rate of H Entering Filter in 1 hour) × (% Filter
33   Efficiency/100)
34   =   0.02273 lbs/hr × 0.999
35   =   0.02271 lbs/hr

37   Emission Rate   =   (Mass Rate of H Entering Filter in 1 hour) × (1 - % Filter Efficiency/100)
38   Emission Rate   =   0.02273 lbs/hr × (1-0.999)
39   =   0.000023 lbs/hr

41   Note: Mass rate entering the filter is calculated by evaluating the gas concentration in the room as a
42   function of time. This concentration changes as long as there is a difference between the amount
43   evaporated in a minute and the amount transferred to the carbon filter.

45   The filter capacity (800 lbs) is greater (by a factor of about 35,195) than the size of the H challenge
46   (0.02273 lb/hr). Therefore, the filter is able to contain the challenge without reaching breakthrough for H.

48   **6.   CONCLUSION**

50   As shown by calculation, the enclosure AFS has sufficient capacity that the H released from the
51   catastrophic spill scenarios will not exceed the capacity of the AFS.

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1 **APPENDIX ATTACHMENT D-4-3**

2 **REFERENCES**

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1 **APPENDIX ATTACHMENT D-4-3**

2 **REFERENCES**

3

4

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6 1989.

7

8 Fedele, P., P. Georgopoulos, P. Shade, P. Lioy, M. Hodgson, and M. Brown, *In-hospital Response to*

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10 *and Medical Programs*, para. 3.5, pg. 11, 15 April 2003.

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12 Mahle, J., L. Buettner, and T. Sewell, Edgewood Chemical Biological Center, Draft, *Umatilla*

13 *Post-Treatment Filter Simulant Performance for Candidate Mercury Capture Absorbents*, 2008.

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1 **SECTION D**

2 **PROCESS DESCRIPTION**

3 [6 CCR 1007-3 § 100.41(a)(8)]

4

5 **D.1   Overview**

6

7 The Pueblo Chemical Agent-Destruction Pilot Plant (PCAPP) Explosive Destruction System (EDS)

8 operations will contain two EDS units and a Container Storage Unit (CSU).

9

10 An EDS is a transportable system designed to safely treat/destroy munitions and other items that contain

11 chemical agent fills with or without energetic components. The system uses explosive shaped charges to

12 detonate a munition burster, if present, and breach the munition/item wall, exposing the chemical fill.

13 Once the chemical fill is exposed, an appropriate treatment reagent is added to treat the chemical fill and

14 explosive residues. Mixing with heating follows, if required. After the chemical fill is treated, and the

15 treatment level confirmed, the resulting neutralent is drained into a liquid waste container, and the

16 Containment Vessel is rinsed. After the rinsate is drained into a waste container, the vessel is purged with

17 an inert gas and a headspace vapor sample is collected; once the vapor concentration is less than 1 vapor

18 screening level (VSL) or an acceptable value, the Containment Vessel door is opened. Solid waste

19 materials are then removed from the Containment Vessel and placed in appropriate solid waste

20 containers. All wastes are then stored pending shipment to a permitted treatment, storage, and disposal

21 facility (TSDF) for further treatment or ultimate disposal.

22

23 The EDS units will be deployed to treat/destroy overpacked munitions, Department of Transportation

24 (DOT) cylinders,[1] and other miscellaneous items (ignition cartridges, propellant) currently stored at

25 Pueblo Chemical Depot (PCD) that contain mustard agents (distilled sulfur mustard [HD]/mustard-T

26 mixture [HT]), as well as to treat/destroy any reject chemical agent munitions or contaminated bursters

27 generated from PCAPP operations.

28

29 The CSU is an existing earth-covered concrete storage igloo that will be used to store items pending

30 treatment in an EDS. The overpacked munitions and miscellaneous items may or may not contain

31 energetics.

---

[1]   DOT cylinders may or may not be in overpacks.

1   This section presents a general overview of the EDS treatment process. Physical descriptions and other

2   information on the CSU and EDS units are provided in Sections D-1 and D-11 of this permit

3   modification, respectively.

4

5   **D.2   EDS Flow Process**

6

7   A simplified block flow diagram of the EDS operation is presented in **Figure D-1**.[2]

8

9   **D.2a   PCAPP EDS Site Operations**

10

11   Overpacked munitions, DOT cylinders, and other miscellaneous items that contain or are contaminated

12   with mustard agent (HD/HT) will be transferred from the PCD storage area to the CSU at the PCAPP

13   EDS site for storage pending treatment. The CSU will hold up to a maximum of 300 munitions and DOT

14   cylinders.

15

16   Each EDS unit can be operated to treat one or more munitions or items simultaneously. Treatment

17   configurations may include one to six or more munitions or other chemical-agent items in each EDS unit

18   per process cycle, provided the net explosive weight (NEW) does not exceed the value established for the

19   particular EDS unit.

20

21   **Table D-1**[3] identifies the chemical fill, associated treatment reagent, and treatment level for EDS

22   operations at the PCAPP EDS site.

23

24   A brief discussion of the EDS operational steps follows.

25

26   **D.2a(1)   Staging Munitions and Other Items**

27

28   Items to be treated will be brought from the CSU and staged in the unpack area of an Environmental

29   Enclosure. Items contained in a universal munition storage container (UMSC) will be treated in an EDS

30   in their entirety. The items (munitions and/or DOT cylinders) will not be removed from the overpack.

31   The munitions and miscellaneous items in other overpacks and containers, respectively, will be unpacked

32   and placed into special holders before they are placed into an EDS. Dunnage will be containerized,

33   headspace monitored for agent, and shipped offsite for treatment and/or disposal.

---

[2]   All figures are located at the end of this section.
[3]   All tables are located at the end of this section.

1 **D.2a(2)   Place Item(s) in Advanced Fragment Suppression System (AFSS) and Attach Explosive**

2 **Shaped Charges**

3

4 Depending on the types and numbers of items being treated, the items to be processed will be put into an

5 expendable metal holder then placed inside the reusable AFSS with expendable steel rods.

6

7 The framework serves to connect, hold, and align explosive charges that open the main body of items

8 being treated to expose chemical fill and to protect the Containment Vessel interior from the high velocity

9 fragments resulting during detonation of shaped charges, burster casing, and munitions (or other items).

10

11 Once shaped charges are attached, a final detonator connection is made; then the Containment Vessel

12 door will be closed and sealed.

13

14 **D.2a(3)   Periodic Helium Leak Test**

15

16 A helium leak test is periodically conducted to confirm the integrity of the vessel seal. The helium leak

17 detector is used at that time to test the adequacy of the Containment Vessel door seals.

18

19 **D.2a(4)   Access Item and Destroy Burster (If Present)**

20

21 Once the seal is confirmed, the firing system is used to remotely and simultaneously initiate the shaped

22 charges, causing the burster, if present, to detonate.

23

24 **D.2a(5)   Treat Chemical Fill and Un-reacted Explosive Residues**

25

26 Following detonation, a treatment reagent will be pumped/sprayed into the Containment Vessel. The

27 Containment Vessel will be heated by injecting steam, if necessary, to a specified temperature of up to

28 60°C ±10°C [140°F ±18°F]. The Containment Vessel will be rotated to agitate the contents of the vessel,

29 promoting mixing between chemical fill and reagent for a complete reaction. Containment Vessel

30 temperature and pressure will be monitored during the treatment process.

31

32 **D.2a(6)   Sample Liquid Wastes (Neutralent)**

33

34 A liquid sample will be collected from the Containment Vessel to monitor the progress of the reaction or

35 confirm treatment is complete. Once the treatment level (**Table D-1**) is achieved, liquid wastes

1   (neutralent) will be drained from the Containment Vessel into a waste container, then transferred to a less

2   than 90-day hazardous waste storage area.

3

4   **D.2a(7)   Rinse with Water and Steam**

5

6   Following reagent drain, a water rinse is pumped/sprayed into the Containment Vessel. The Containment

7   Vessel is heated by injecting steam to a specified temperature of up to 100°C ±10°C [212°F ±18°F]. The

8   Containment Vessel will be rotated to agitate the contents of the vessel and maintained at a temperature of

9   up to 100°C ±10°C for a required time to ensure clearing of the vessel interior. After rotation for the

10 required time, the Containment Vessel rinsewaters will be drained into an interim holding tank (a less

11 than 90-day hazardous waste storage tank), cooled, then transferred to a waste container.

12

13 Following the first rinsewater drain, a chilled water rinse is pumped/sprayed into the Containment Vessel.

14 The Containment Vessel is cooled to temperatures around 60°C ±10°C [140°F ±18°F]. After rotation for

15 cooling, the rinsewater is drained directly into a waste container.

16

17 **D.2a(8)   Flush Vapors and Sample Headspace**

18

19 The Containment Vessel headspace will be flushed with an inert gas (e.g., helium or nitrogen) to the

20 carbon filter and then a headspace vapor sample will be collected from the vessel.

21

22 **D.2a(9)   Remove Solid Wastes**

23

24 Once the vapor concentration is less than 1 VSL or an acceptable value, the Containment Vessel door will

25 be opened. The solid wastes will be visually inspected for any unexploded energetic material, and then

26 manually removed from the vessel and placed into waste containers for solid waste.

27

28 **D.2a(10)   Rinse Containment Vessel with Water**

29

30 Once the solid wastes are removed, the Containment Vessel will then be manually rinsed with water to

31 remove any remaining debris. This rinsewater will be collected from the vessel into a debris pan placed

32 underneath the Containment Vessel. The rinsewater will then be transferred from the debris pan into a

33 waste container. Any remaining solid materials will be placed into a solid waste drum. Both liquid and

34 solid wastes will be transferred to a less than 90-day hazardous waste storage area pending shipment

35 offsite to a permitted TSDF for further treatment or ultimate disposal.

D.2a(11)   Prepare for Next Item(s)

Prior to treating subsequent chemical-filled items, the Containment Vessel interior and door will be cleaned using household bleach, general-purpose detergent, or other designated cleaning fluid, and the interior wall of the vessel, its sealing surface, and its door will be visually inspected. The Containment Vessel door metal seal and O-ring will be replaced after each operation. The electrical connection feedthroughs will be replaced as necessary. Both liquid and solid wastes will be transferred to a less than 90-day hazardous waste storage area pending shipment offsite to a permitted TSDF for further treatment or ultimate disposal.

D.3   Waste Management

Wastes generated from the EDS treatment operation will be managed at the PCAPP EDS site less than 90-day hazardous waste storage area (H1103) pending shipment to a permitted TSDF.

A detailed description of the waste streams, including applicable waste codes, is presented in Section C, Waste Characteristics.

D.4   Utilities and Site Support Equipment at PCAPP EDS Site

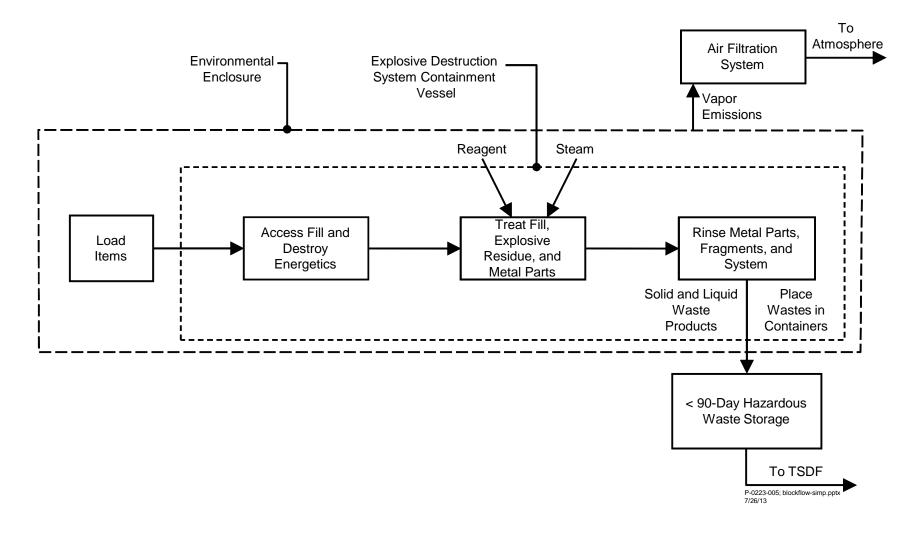A description of utilities and site support equipment is provided in **Attachment D-1**.

Figure D-1. Simplified Block Flow Diagram for the EDS

1   Table D-1. Chemical Fills, Treatment Reagents, and Treatment Levels

2

Chemical Fill	Treatment Reagent	Treatment Level[a]
Sulfur Mustards (HD/HT)[b]	90 vol.% MEA	$\leq$ 50 mg/L mustard agent

3
4 Notes:
5
6   [a]   When treating chemical agent fills, the neutralent and rinsewaters must meet the treatment level shown.
7   [b]   HD/HT will be measured as H.
8
9   MEA   =   monoethanolamine
10   mg/L   =   milligram per liter
11   vol.%   =   volume percent

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