APPENDIX 2-5

SITE-SPECIFIC MONITORING STRATEGY FOR PUEBLO CHEMICAL DEPOT (PCD) RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) PERMITTED HAZARDOUS WASTE MANAGEMENT UNITS G203, G1009, G1107, G1109, AND G1110

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1.0 MONITORING OPERATIONS

The PCD Monitoring/Laboratory Branch provides air monitoring support to the storage, surveillance, and maintenance operations for the chemical munitions. The overriding requirement in the design of the Laboratory and Monitoring Systems is reliable day-to-day performance. Reliability relates to the ability of the instrument and method to perform its intended function.

1.1 Methodology Certification and Validation

PCD complies with the *Site Specific Laboratory Quality Control Plan* (Site Specific LQCP), April 2013, of this Permit when performing air monitoring in the igloos. Analyst and operator certifications are covered by the implementation of the PCD Site Specific LQCP Section 11; the Analyst Certification Plan is described in Appendix C of the PCD Site Specific LQCP; the Operator Certification Plan is outlined in Appendix D of the PCD Site Specific LQCP. The first phase of certification involves the instruction of analysts, covering both theoretical concepts and practical considerations. Instruction and certification are documented for all laboratory/monitoring personnel. The second phase involves a practical exercise to determine the proficiency of the analyst/operator with the method and instrumentation.

1.2 Agent Air Monitoring Capability and Processes

The near real-time (NRT) monitoring of the igloos is performed in accordance with Standard Operating Procedure (SOP) **PU-0000-R-491**, Revision 16, December 1, 2014 (**Attachment 3** of this Permit) for NRT monitoring systems. MINICAMS® is the NRT monitoring instrumentation used at PCD.

NRT samples requiring confirmation are analyzed using procedures defined in PCD SOP 491 when a second NRT monitor with a dissimilar analytical column is employed for confirmation or **SOP PU-0000-465**, Revision 13, Change 1, March 3, 2014 (**Attachment 9** of this Permit), for laboratory analytical operating procedures confirmation by a gas chromatograph/Depot Area Air Monitoring System (DAAMS).

The air in storage igloos is monitored weekly for the presence of mustard vapor using the dedicated sampling ports in each storage structure headwall in accordance with the PCD Site Specific Monitoring Plan (SSMP), February 2013, to detect releases and any time workers are deployed into the storage units for mission operations.

1.3 Confirmation Monitoring Cessation

Confirmation monitoring may be suspended once agent has been confirmed to be present (NRT-only monitoring is required to verify effectiveness of corrective actions). Once corrective actions have been resolved, confirmation monitoring shall be reinstituted. Any MINICAMS alarm, without co-located DAAMS or without a dissimilar column MINICAMS, is assumed to be agent. Any agent detection, confirmed with dissimilar column MINICAMS, or DAAMS (with a single column or dual column laboratory gas chromatography) is assumed to be agent.

The MINICAMS serves as the primary NRT agent detection instrument. In conjunction with the MINICAMS, PCD also utilizes the Real-Time Analytical Platform (RTAP), which provides mobility and environmental protection to the MINICAMS monitoring system. A mobile laboratory is equipped with two MINICAMS to provide direct, onsite NRT air monitoring within the chemical munitions storage area. The DAAMS may be used to provide secondary confirmation of any agent detected inside the storage structures. The DAAMS has a preconfigured sorbent collection tube (DAAMS tube) and a sampling pump. This equipment is operated and maintained in accordance with the procedures in the PCD Site Specific LQCP. Method certification and validation are outlined in the PCD Site Specific LQCP, which covers methodology certification procedures for the equipment. Section 12 of the PCD Site Specific LQCP covers the calibration of monitoring and laboratory methods. Acceptance testing of other analytical equipment (e.g., DAAMS) methodology and certification can also be found in the PCD Site Specific LQCP.

1.4 Monitoring Strategy

1.4.1 MINICAMS

The MINICAMS is an NRT monitor system with the ability to detect and report the concentration of chemical agent in the air at either low levels or high levels, dependent upon on its monitoring configuration. The MINICAMS is configured for the appropriate detection level. Employment of the MINICAMS is described in detail in the PCD Site Specific LQCP. An agent detection at or above this action level compels the workers in the immediate vicinity to mask with an M40A1 Air Purifying Respirator. The Monitoring Systems Operator records the alarm time and agent concentration, and detections at or above the action level are communicated to the PCD Operations Center (OC). Positive MINICAMS readings for all monitoring levels outside of the Worker Population Limit (WPL) are confirmed or refuted utilizing a second MINICAMS equipped with a different analytical column.

The MINICAMS certification process evaluates the system in a range of agent air concentrations ranging from 0 vapor screening level (VSL) to 2.0 VSL, and the continuing calibration and challenge elements of instrument operation validate this as an operational range. Encountering concentrations in excess of this valid range requires a different sampling technology with certification, calibration, and challenge. In areas when mustard agent is present at high concentrations, either a low volume sampler (LVS) may be utilized, or alternatively, PCD has and may employ decreased sampling volume by variation of the MINICAMS sampling time to ascertain concentrations outside of the MINICAMS certification range. PCD prefers the decreased sampling protocol because the existing certification, calibration, and challenge are applicable. The decreased sampling protocol is conducted in accordance with **PCD SOP 491**. These approaches are necessary to prevent saturation of the MINICAMS detector while providing valid data.

1.4.2 DAAMS

DAAMS is an additional monitoring system used by PCD for historical monitoring and confirmation of positive MINICAMS readings at the WPL. The DAAMS is described in detail in the PCD Site Specific LQCP. If a MINICAMS is not monitoring correctly, the DAAMS tubes may become the primary monitor and must be collected and analyzed. DAAMS samples provide independent confirmation of positive MINICAMS readings and a historical record of monitoring, in areas not monitored by MINICAMS, at the WPL.

1.4.3 Nitrogen Oxide (NO_x) Filters

In order to retain chemical agent mustard on the DAAMS tube, NO_x prefilters may be necessary for mustard sample collection. If the NO_x prefilters are used on the inlet to the DAAMS tube, the prefilters shall be used during the entire time of aspiration of the DAAMS sample. NO_x prefilters are tested by visually inspecting the prefilter for cracks, packing separation, and other physical defects.

1.4.4 Distal Challenges of Sample Lines

The method and timing of distal challenges of sample lines shall be in accordance with PCD Site Specific LQCP, paragraph 13.2.3.

1.4.5 Passive Filter for Agent Igloos

Rear vent and front passive filter units are monitored using the provided filtering ports with an NRT monitor in accordance with **PCD SOP 491**.

1.5 Monitoring Levels

PCD conducts monitoring at the levels specified in **Table Appendix 2-5-1** and as described in sections 1.5.1 and 1.5.2 to detect leaking munitions and to minimize the possibility of unplanned sudden or non-sudden releases of mustard agent to the air that could threaten human health in accordance with 6 CCR 1007-3 §265.31 and 265.51.

1.5.1 WPL Monitoring

WPL monitoring is performed in accordance with the PCD SSMP using either an 8-hour or 4-hour MINICAMS and/or DAAMS WPL method. WPL monitoring shall be conducted each operational day for all work areas where chemical agent may be present and where workers do not wear respirator protection, including areas at, near, or surrounding the storage units that house the waste munitions. WPL

Table Appendix 2-5-1. Monitoring Levels

Airborne Exposure Limits	Mustard Agent (mg/m^3)	Mustard Agent STEL Equivalent
IDLH (30 minute limit)	0.7	233
STEL (15 minute limit/day)	0.003	1.0
WPL (4 hour limit/day)[a]	0.0008	0.27
WPL (8 hour limit/day)[a]	0.0004	0.13
GPL (12 hour limit/day)[b]	0.00002	0.007
M40 Action Level (masking point)[a]	0.00075	0.25
SCBA Action Level (masking point)[c]	>0.006	>2.0
VSL[d]	0.003	1.0

Notes:

[a] Powered filtration is utilized, in accordance with SOP PU-0000-M-486, on storage structures with agent concentrations > 0.25 STEL; personnel are masked when working in storage structures with agent concentrations > 0.25 STEL.

[b] Historical monitoring typically is used for time-weighted average (TWA) monitoring where the sample analyzed represents an extended time period, for example, 8 or 12 hours. Results are not known until laboratory analysis is completed after the sampling event. Airborne exposure limits (AELs), using historical monitoring, are set at levels at which health effects are not expected to occur for most workers. Exposures above WPL-8, but below the STEL, likewise are not expected to result in significant health effects since the WPL is a chronic exposure limit. PCD tracks the historical frequency of all confirmed detections above the WPL to ensure the workers involved in agent operations are not routinely exposed to mustard above the WPL. Any exceedance of mustard agent above the WPL is managed in accordance with the PCD WPL Exceedance Plan listed in Section 8 of the PCD Site-Specific Monitoring Plan.

[c] M40 respirator use is authorized in environments ≤ 2.0 STEL as based on hazards associated with the use scenario, airborne concentration, and the task duration. Daily maximum use limits for the M40 mask in environments above the WPL are in accordance with DA Pam 385-61, Table 4-2.

[d] Vapor Screening Limit equals one cycle, or a single MINICAMS® result used to monitor encapsulated materials for determination of residual agent contamination levels.

GPL = general population limit
IDLH = immediately dangerous to life and health
mg/m^3 = milligram per cubic meter
SCBA = self-contained breathing apparatus
STEL = short-term exposure limit
VSL = vapor screening level
WPL = worker population limit

samples are analyzed and reported as described in the PCD SSMP. The results of this analysis shall be validated, and if any exceedances of the WPL are determined, a report of the exceedance shall be reported in writing to the Hazardous Materials and Waste Management Division within 14 days in accordance with the *WPL Excursion Response Plan*, approved by Colorado Department of Public Health and Environment (CDPHE) on July 20, 2010.

PCD commissioned a third party, U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM), to conduct an industrial hygiene (IH) assessment to validate current practices. When data were obtained from the Department of Transportation (DOT) container analysis, the data were used to determine whether current IH practices were adequate, i.e. whether or not mustard agent only monitoring was sufficient to protect workers against other hazardous waste constituents in the agent when releases occur. Studies provided to CDPHE on February 27, 2010, concluded current IH practices are adequate.

1.5.2 Short-Term Exposure Limit (STEL), Action Level, and Vapor Screening Level (VSL) Monitoring

VSL monitoring is performed in accordance with the Site-Specific Monitoring Plan. DAAMS, or a MINICAMS equipped with a dissimilar column, is used to confirm a VSL exceedance. When clearing items for reuse or waste determination, except for bagged items, incoming air is minimized to prevent dilution of sample when monitoring.

STEL and VSL are equivalent in terms of concentration values, but are different in that STEL is based on a 15-minute time-weighted average and VSL is independent of time. Theoretically, exceedances of the STEL for personnel are not possible because workers at PCD are trained to don the M40A1 mask when detections of agent are equal to or greater than the action level concentration (0.25 VSL). However, if exposures to workers occur that exceed the 15-minute STEL, a report of the instance, along with corrective actions, shall be provided to the Hazardous Materials and Waste Management Division within 14 days.

1.6 Equipment Operation, Maintenance, and Repair

The PCD Monitoring/Laboratory Branch is a component of PCD's Chemical Operations Directorate and is responsible for all air monitoring operations, including routine open-door or closed-door operations, and training and certification of the assigned monitoring systems operators. The Monitoring/Laboratory

Branch also maintains, services, and repairs PCD's air monitoring equipment to a designated level of precision and accuracy in accordance with the PCD Site Specific LQCP.

In accordance with the limiting conditions of operation (LCOs) in the PCD SSMP, a minimum number of RTAPs equipped with fully functional MINICAMS are required to be maintained by the Monitoring/Laboratory Branch at all times.

The laboratory ventilation system is tested semi-annually in accordance with procedures detailed in Department of the Army Pamphlet 385-61, Section 8.

PCD implements corrective actions for all monitoring equipment and filters in accordance with the procedures in the PCD Site Specific LQCP.

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