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Blue Grass Chemical Agent-Destruction Pilot Plant (BGCAPP)

Laboratory Document

Laboratory Analysis and Monitoring Plan

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(CDRL D007)

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prepared by
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prepared for
Program Executive Office –
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This document has been reviewed for ITAR/EAR and ITAR/EAR sensitive information has been removed.

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Change No.	Effective Date of Change	Brief Change Description
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1.0 EXECUTIVE SUMMARY

The Bechtel Parsons Blue Grass (BPBG) Laboratory analysis and monitoring system is used to verify the Blue Grass Chemical Agent-Destruction Pilot Plant (BGCAPP) operations are conducted in a manner that destroys the chemical agent by neutralization and explosive destruction technology (EDT); that can detect a release of chemical agent; and that characterizes and clears various waste streams for storage, treatment, or disposal.

The data obtained from the analysis and monitoring system accomplishes the following:

- Alerts the plant operators to take corrective actions
- Properly characterizes waste for storage, treatment, or disposal
- Provides historical monitoring (HISM) records
- Provides monitoring records for off-normal conditions
- Provides quantitative data to decision-makers
- Provides regulatory clearance for hydrolysate treatment

To ensure the monitoring and analysis data support the above objectives, instrumentation was selected to measure at appropriate monitoring levels and/or for specific compounds. Neutralization process samples, air samples, and waste samples are taken to provide timely information to protect workers and the general public. Reliability and redundancy is built into all monitoring, sampling, and analysis systems.

2.0 PURPOSE

This Laboratory Analysis and Monitoring Plan (LAMP) provides the technical and administrative requirements for sampling and analysis of agent hydrolysate, air monitoring samples, and various liquid and solid process/waste samples. This document provides the necessary requirements for BPBG Laboratory to perform these various processes. Specific Laboratory procedures and methods detail how the hydrolysate sampling/analysis and the monitoring operations will be conducted.

3.0 SCOPE

The scope of this LAMP is to identify processes, procedures, and requirements for the following:

- Data collecting, processing, reporting
- Data management and security
- Document and record storage
- Laboratory operations supporting the Chemical Weapons Convention (CWC) Compliance Office (Treaty)
- Laboratory organization, training, and qualification program
- Non-standard test protocol (NSTP) process
- Quality assurance/quality control (QA/QC)

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- Sampling and analytical air monitoring processes to identify agent vapor concentrations in air
- Sampling and analytical processes for agent and non-agent material for process controls
- Sampling and analytical processes for agent- and non-agent-related waste streams
- Sampling and analytical processes for the detection of chemical agent in hydrolysates
- Sampling and analytical processes for the United States Environmental Protection Agency (USEPA) Region IV and the Kentucky Department for Environmental Protection (KDEP) permit compliance
- Special monitoring requirements

4.0 DEFINITIONS

Accuracy	The closeness of agreement between an observed value and an accepted reference value
Action Level	The minimum and maximum values of a quality assurance measurement that can be interpreted as representing acceptable performance with respect to the parameter being tested. Values less than the minimum or greater than the maximum action level indicate that corrective action must be taken. Action levels are also sometimes called control levels.
Administrative Control	Policies and procedures used to limit access and/or to reduce potential chemical exposures
Airborne Exposure Limits (AELs)	Allowable concentrations in the air for occupational and general population exposures to chemical warfare agents (CWAs)
Alarm Level	A predetermined concentration setpoint for a near real-time (NRT) instrument that, when equaled or exceeded, generates an audible alarm to indicate the monitoring level may have been exceeded
Category A Area	The toxic processing area supported by the cascade ventilation system designated for probable liquid and/or vapor agent contamination (e.g., munitions processing bay, toxic cubicle)
Category B Area	The toxic processing area supported by the cascade ventilation system designated for possible vapor agent contamination only
Category C Area	The nontoxic work area adjacent to Category A or B areas, that is supported by the cascade ventilation system designated for possible low-level vapor agent contamination under off-normal situations (e.g., observation corridors)
Category D Area	An area where chemical agent liquid and vapor are not expected under normal situations or off-normal situations
Challenge	An introduction of a known standard at a known concentration to validate the instrument/method calibration

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Chemical Warfare Agent (CWA)	Chemical agents contained in or associated with CWM
Chemical Warfare Materiel (CWM)	Equipment, munitions, devices, and containers designed for use directly in connection with the employment of chemical weapons or containerization of chemical agents. This term includes the chemical weapons stockpile; chemical weapons production facilities; binary weapons and components; buried, range recovered, or found chemical munitions, or containers.
Closeout	Completion of all related site operations
Closure	The phase of an Assembled Chemical Weapons Alternatives (ACWA) project that encompasses activities associated with dismantling the facility or removal of the mobile system, the disposal or decontamination of the components, and the restoration of the site
Confirmation	The process of validating or invalidating a positive response
Corrective Action	Any action taken to rectify monitoring/laboratory method nonconformance, and where possible, to preclude recurrence
Decontamination	The process of decreasing the amount of chemical agent or industrial chemical on any person, object, or area by adsorbing, neutralizing, destroying, ventilating, or removing chemical agent
Demilitarization	The mutilation, destruction, or neutralization of chemical materiel, rendering it harmless and ineffectual for military purposes
Duplicate Samples	Also known as replicate samples, two aliquots taken from the same sample container and analyzed separately to test repeatability of an analysis. For air matrices, duplicate samples are two distinct samples from separate sampling devices collected from the same location simultaneously.
Engineering Control	Physical controls, such as cascade ventilation system, to contain agent in specified areas and to control/limit contamination levels
Found Concentration (FC)	Concentration of a standard analyte solution measured by a sampling and analysis method after a challenge with a known standard concentration (i.e., target concentration [TC])
GB (Sarin)	A lethal anticholinesterase (nerve) agent. Its toxic hazard is high for inhalation, ingestion, and eye and skin exposure. Due to its high volatility, GB is mainly an inhalation threat
General Population Limit (GPL)	A criterion that is set to protect the general public, including all ages and medical conditions. GPL is the maximum concentration to which members of the general population may be continually exposed to for the following duration and agent: • 3 continuous years for H • 24 hours per day for 7 days a week for GB • 24 hours per day for 3 days a week for VX

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Generator Knowledge	A process used to ascertain potential agent contamination based on area air monitoring readings, operational history, instrumentation data, or other process information
H (Mustard)	Levinstein mustard, or bis(2-chloroethyl) sulfide. Mustard produced by the Levinstein process contains about 30 percent sulfur impurities. H is monitored as HD (see HD for additional hazard information).
Hazardous Waste	A solid waste that, as defined in 40 Code of Federal Regulations (CFR) 261.2 and 401 Kentucky Administrative Regulation (KAR) Chapter 31, is a hazardous waste if it is not excluded from regulation as a hazardous waste under 40 CFR 261.4(b) and the applicable KARs, and it meets any of the criteria listed in 40 CFR 261.3(a)(2)i through v.
HD (Distilled Mustard)	Distilled mustard, or HD, is H that has been purified by washing and vacuum distillation to reduce sulfur impurities. HD is a vesicant (blister agent) and alkylating agent, producing cytotoxic action on the hematopoietic (blood-forming) tissues. The rate of detoxification of HD in the body is very slow, and repeated exposures produce a cumulative effect. Its toxic hazard is high for inhalation, ingestion, and skin and eye absorption, but the most common acute hazard is from liquid contact with eyes or skin.
Headspace Monitoring	The process of monitoring off-gassing vapors from a substance in an enclosed, unventilated space
Hydrolysate	A product resulting from the reaction of chemical agent with water and/or sodium hydroxide
Hydrolysis	A chemical process in which a molecule is cleaved into two parts by the addition of a molecule of water. One fragment of the parent molecule gains a hydrogen ion (H+) from the additional water molecule. The other group collects the remaining hydroxyl group (OH−).
Immediately Dangerous to Life and Health (IDLH)	An atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere For planning purposes, the respirator wearer will be unaffected by the environment for up to 30 minutes without any respirator being worn. IDLH also includes atmospheres where oxygen content by volume is less than 19.5 percent. IDLH is a 30–minute time-weighted average (TWA). The 30–minute period is not meant to imply that anyone should stay in the environment any longer than necessary; in fact, every effort should be made to exit immediately. IDLH values are used solely for the purpose of establishing the concentrations at which a self-contained breathing apparatus (SCBA) or a supplied-air respirator (SAR) is required.
Laboratory Operating Procedure (LOP)	A written document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps and is officially approved as the method for performing certain routine or repetitive tasks

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Limiting Conditions of Operations (LCO)	The minimum functional capability or performance level of equipment required for safe operation of the facility each day
Lower Limit of Quantitation (LLOQ)	Is the lowest concentration at which the laboratory has demonstrated target analytes can be readily measured and reported with a certain degree of confidence, which must be greater than or equal to the lowest point in the calibration curve
Matrix	The component or substrate that contains the analyte of interest
Method	A set of procedures and techniques for systematically performing an activity (for example, sampling, chemical analysis, quantification). Critical method parameters with tolerance limits are identified and the method is placed under configuration control. If the limits on the parameters are exceeded, a new method may result.
Method Detection Limit (MDL)	The minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyzed concentrations is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. The MDL is the lowest level at which an analyte may be reported using that method (source is Appendix B of 40 CFR 136).
MINICAMS®	An automatic, near real-time (NRT), continuous air monitoring system using gas chromatography and sample collection with a solid adsorbent pre-concentrator or fixed-volume sample loop
Monitoring	The continued or periodic act of seeking to determine whether a chemical agent is present (Department of the Army Pamphlet [DA PAM] 385-61). Monitoring in the context of the LAMP refers to the collection and chemical agent analysis of samples of any matrix type
Monitoring Level (Z)	The concentration of chemical warfare agent at which monitoring is performed for the specific application and matrix. For air monitoring methods, the AEL is the monitoring level. For waste screening purposes, the monitoring level is the negotiated treatment level or estimated quantification limit (EQL) for a specific analyte within a specific matrix.
Monitoring Plan	A detailed, site-specific plan that covers all laboratory and monitoring objectives and strategies for a given site. The plan describes methods and equipment used, locations, number and type of samples, safety requirements, transportation and shipping instructions, scheduling, and any other site-related monitoring requirements.
Near Real-Time (NRT) Confirmation	Confirmation monitoring (CONM) to validate/invalidate (prove/disprove) agent detection at the required monitoring level by an NRTM alarm
Near Real-Time Monitor (NRTM)	An instrument that has the capability to monitor for chemical agent automatically. An NRTM collects a sample, analyzes the sample, and reports/displays the sample analysis results within 15 minutes.
Non-Standard Test Protocol (NSTP)	A process used at BGCAPP to complete special studies or projects that may fall outside of an established Laboratory operating procedure (LOP)

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Neat Chemical Agent	An undiluted, full-strength (as manufactured) chemical agent. Chemical agent manufactured by the binary synthesis route is also considered a neat agent, regardless of purity.
Nerve Agent	A lethal agent that causes casualties by interfering with the ability of muscles to relax after stimulation by associated nerves
Neutralization	The act of altering chemical, physical, and toxicological properties to render the chemical agent or industrial chemical ineffective for use as intended
Practical Quantitation Limit (PQL)	The lowest concentration that can reliably be determined within specified limits of precision and accuracy (P&A) for a given analytical method. The PQL is generally 5–10 times the MDL, as defined by USEPA SW-846.
Precision	An agreement among a set of replicate measurements without assumption of knowledge of the true value. Precision is estimated by means of duplicate/replicate analyses of aliquots of the same sample.
Quality	The totality of features and characteristics of a product or service that bear on its ability to meet the stated or implied needs and expectations of the user
Quality Assurance (QA)	An integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the customer.
Quality Control (QC)	The overall system of technical activities that measure the attributes and performance of a process, item, or service against defined standards to verify it meets the stated requirements established by the customer
QC Sample	A separate aliquot of a sample that is spiked with a known and documented amount of reference material to check for matrix or sampling effects on percent recovery. The sample is introduced into a process to monitor the performance of the analytical system.
Quality Laboratory (QL) Sample	Sampling media that has been spiked with a solution of dilute chemical agent, and then analyzed after exposure to laboratory air. The purpose of the sample is to verify the in-control status of the laboratory instrument.
Quality Plant (QP) Sample	An air sample or air-sampling medium that has been spiked with dilute chemical agent or other analyte reference material, and then analyzed after exposure to plant air. Aspiration is for the specific monitoring level cycle. The purpose of the QP is to identify sources of sample contamination or sample degradation in the field at the sampling collection location by determining the percent recovery of the spiked analyte and comparing it to acceptance criteria.
Recovery	The amount or concentration of recovered analyte as compared to the amount or concentration of spiked analyte

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Reportable Limit (RL)	A predetermined value for historical and confirmation methods that when met or exceeded will be reported as chemical material that may have exceeded the monitoring level
Research Development, Test, and Evaluation (RDT&E) Standards	Chemical material defined by Army Regulation (AR) 50-6, Chapter 6, *Classification of Chemical Surety Material*, or DA PAM 385-61, Glossary, Section II RDT&E dilute solutions are those that do not exceed the following quantities or concentrations: • GB – maximum total quantity of 20 milligrams (mg) or a maximum concentration of 2.0 milligrams per milliliter (mg/mL) • VX and EA2192 solutions combined – maximum total quantity of 10 mg or a maximum concentration of 1.0 mg/mL • H, HD, HT, and T – maximum quantity of 100 mg or a maximum concentration of 10.0 mg/mL
Sample	Physical evidence collected for environment measuring and monitoring
Sampling	The physical collection of a representative portion of the population universe, or environment
Sampling Plan	A detailed, site-specific plan that covers all sampling objectives and strategies for a given site. The plan describes methods and equipment used, locations, number and type of samples, safety requirements, transportation and shipping instructions, scheduling, and any other site-related sampling requirements.
Short-Term Exposure Limit (STEL)	A 15-minute TWA exposure that should not be exceeded during the workday, even if the 8-hour WPL is not exceeded. NRT monitoring should use the shortest, practicable instrument cycle time. Exposures up to STEL should not be longer than 15 minutes and should not occur more than as follows: • Once per day for H and VX • Four times per day for GB and at least 60 minutes should elapse between successive exposures in this range
Solid Waste	Discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but does not include solid or dissolved materials in irrigation return flows or industrial discharges.
Source Emission Limit (SEL)	A non-regulatory ceiling value that limits allowable emissions from the stack and does not serve as a health standard. SEL may be used for monitoring ductwork and stacks that vent to the atmosphere.
Standard	A known concentration of a known chemical that is used to perform quantitative, semi-quantitative, or qualitative analysis

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Stock A Standard	A concentrated or dilute solution containing one or more analytes that is used to prepare reference solutions. The stock standard may be chemical agent standard analytical reference material (CASARM) or an assayed material obtained from a reputable commercial source (e.g., U.S. Army Combat Capabilities Development Command [CCDC] Chemical Biological Center [CBC]).
Target Concentration (TC)	The amount or concentration of analyte spiked with a QC sample and is the expected concentration after analysis, based on 100 percent recovery
Time-Weighted Average (TWA)	Refers to a concentration of airborne toxic material weighted for a certain time duration, usually 8 hours. These concentrations are typically expressed as parts per million (ppm) or milligrams of contaminant per cubic meter of air (mg/m^3).
Treatment Level	A negotiated concentration for a specified contaminant in a specified extract or total waste that must be met by any method designed to physically or chemically change the nature of a hazardous waste.
Two Vial Concept	Two vials (e.g., calibration and QC) are prepared from the same standard. The "two vial" concept aids in identifying standards that may become contaminated during use or may degrade because of solvent evaporation.
Vapor Screening Level (VSL)	Equivalent to the absolute STEL concentration, but it is independent of a designated sampling time (e.g., TWA) and may be used to define the level of item cleanliness, or alternately the readout of an NRTM.
VX	A lethal anticholinesterase chemical materiel. Its toxic hazard is high for inhalation, ingestion, and eye and skin exposure, but due to its low volatility, the primary route of exposures is through ingestion or skin contact.
Worker Population Limit (WPL)	A TWA for a conventional 8-hour workday and a 40-hour work week
Working Standard	A standard solution derived from a stock solution (either concentrated or dilute) that is used to directly calibrate or challenge laboratory or monitoring equipment
Z	Generic designation for the applicable monitoring level

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5.0 INTRODUCTION

5.1 Program Updates

At least annually, this LAMP will be reviewed and, when required, updated to ensure compliance with new regulations, new programmatic guidance, permit modifications, or project safety and monitoring requirement implementation or change. Should a change be required, it will be done IAW 24915-00-2KP-A03-50000, *Development, Review, and Control of Documents*.

5.2 Waivers and Deviations

This LAMP may require revision based on regulation changes and operational experience during the course of Laboratory operations (e.g., monitoring and analysis activities). Waivers and deviations required to meet regulation changes and correct issues developed during operational experience that conflict with this LAMP will be submitted by Laboratory Management and approved by PEO ACWA. Approved waivers and deviations will supersede this document until this document is properly revised. Deviations and waivers are processed in accordance with guidance in the LMQAP. BPBG management and personnel reserve the right to cease any operation that endangers the health or safety of the workers, the public, and the environment.

5.3 Neutralization System

The BGCAPP project utilizes a neutralization process for the destruction of the chemical nerve agents GB and VX, which are contained in various munitions including 155-millimeter (mm) projectiles, 8-inch projectiles, and 115-mm rockets. This process will consist of mixing sodium hydroxide (caustic), water, and nerve agent together in a heated reactor. Processing times, temperatures, and mixing ratios may vary to optimize destruction and removal efficiency (DRE).

The product of this process is called "agent hydrolysate". The BPBG Laboratory will perform analyses on representative samples of the hydrolysates to verify destruction requirements for chemical warfare agent (CWA) compounds are achieved. [redacted]

Laboratory personnel will use sampling ports within the BGCAPP facility to collect agent hydrolysate samples. [redacted]

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5.3.1 Supercritical Water Oxidation

A representative sample of blended hydrolysate will be taken and analyzed for select ions (e.g., aluminum [Al], sodium [Na], sulfur [S], phosphorus [P], chlorine [Cl], and fluorine [F]). These analyses will provide the necessary information for plant operators to add additional compounds to the hydrolysate blend for salt balancing in preparation for Supercritical Water Oxidation (SCWO) treatment. After the additional compounds have been added, a second blended hydrolysate sample may be taken and analyzed for the same selected ions to verify adequate compound composition of the blended hydrolysate. After the blended hydrolysate reaches an acceptable compound composition, it will then be introduced into the SCWO for treatment. The SCWO uses temperature and pressure to change the state of water to a supercritical state, which gives it characteristics of both a liquid and a gas. In this state, water will convert hydrolysate into carbon dioxide, brine, and water.

The SCWO effluent is then sent to a water recovery system where reverse osmosis (RO) is performed. The water recovery system produces two components: (1) RO permeate that can be reused in the SCWO process and RO reject, a brine solution. The water recovery system then directs RO permeate back into the process for reuse so any type of analytical analysis for this process stream is not anticipated. The brine solution or RO reject material is containerized and shipped to an off-site disposal facility. Sampling frequency, analyses, and analytes will be determined by the receiving TSDF or in accordance with the Hazardous Waste Research, Development, and Demonstration (RD&D) permit requirements.

5.4 Explosive Destruction Technology

Based upon the amount of heel observed in the mustard (H) agent munitions at Blue Grass Army Depot (BGAD), the BGCAPP project has elected to use EDT for the demilitarization process of the mustard agent munitions. The EDT facility air will be monitored for chemical agent vapor as well as oxygen and carbon monoxide for process knowledge. This EDT process may produce solid and liquid waste streams that will require various analyses by Laboratory personnel. All air monitoring and liquid/solid waste samples will be implemented and analyzed IAW all associated Program Executive Office – Assembled Chemical Weapons Alternatives (PEO ACWA) and KDEP requirements as described in the waste and monitoring sections of this plan as well as 24915-70-GPE-GGPT-00001, *Class 3 Hazardous Waste Storage & Treatment Permit Modification Request, Addition of Explosive Destruction Technology (EDT),* (CDRL A010) Part C – Waste Analysis Plan.

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5.5 Monitoring System Requirements

The BPBG Laboratory analyzes process hydrolysate and fluid, air, liquid, and solid waste samples for chemical agents GB, H, and VX. Air monitoring locations for chemical agents include near-real-time monitor (NRTM) air monitoring stations and sorbent tubes (also known as, depot area air monitoring system [DAAMS]) located throughout the Main Plant and EDT. Combinations of these systems monitor the Category A, B, and C areas, as defined in the PEO ACWA Monitoring Concept Plan (MCP), within the Munitions Demilitarization Building (MDB), EDT, the Medical Facility vestibule and decon room, the carbon filtration systems, and a variety of process waste streams. DAAMS may serve as an HISM system, which is used to capture historical data for specific monitoring locations, or as a Confirmation Monitoring, (CONM) system, which confirms or refutes the initial reading of a primary agent monitor (e.g., an NRTM). These monitoring systems will provide a means of early detection and warning to the BGCAPP operating facility if chemical agent concentrations exceed acceptable thresholds within air and process samples.

Instruments and methods have been selected to measure for chemical agents GB, H, and VX that have sufficient sensitivity to reliably measure threshold quantities at the required monitoring level. The air monitoring system has been designed to provide reliable coverage and performance for the site. This may include 24/7, daily, weekly, monthly, or annual sampling events. Air monitors have been placed throughout the site for either point-source monitoring or area monitoring. Category A and B areas are typically monitored by NRTM only, while Category C areas are typically monitored by both NRTM and DAAMS.

Process streams and waste sampling is conducted to provide information on chemical agent concentrations for process control and waste release requirements as well as other waste profiling analyses.

5.5.1 Types of Air Monitoring Employed at BGCAPP

The following types of air monitoring are employed at BGCAPP and are discussed in the following sections:

- Confirmation Monitoring (CONM)
- Emissions Monitoring for EDT – for process efficiency
- Historical Monitoring (HISM)
- Life Support System
- Near-Real-Time (NRT) Monitoring
- Non-baseline Monitoring
- Sub-alarm Data Tracking

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5.5.2 Confirmation Monitoring

CONM is performed to confirm or refute a response at or above the alarm set point or reportable limit from a primary monitoring system (i.e., NRTM or historical method). The CONM method will be able to qualitatively or quantitatively detect the same relative amounts of chemical agent as the primary method and will collect the sample from the same sampling location. CONM samples have the highest priority for analysis. Analysis of a confirmation sample will be initiated when a NRTM reports a result above the alarm setpoint or an historical method responds at or above the reportable limit. These analyses will be performed via a method different from that used by the primary instrument, (e.g., different column or detector, or other differentiating factor), to potentially resolve positive interferences. DAAMS tubes will be analyzed in the laboratory. Laboratory data from DAAMS tubes analyzed past their holding times, as defined in the applicable Laboratory procedure, will be qualified or only used for informational purposes. CONM samples are not expected to exceed their hold times as defined by applicable BPBG Laboratory procedures.

5.5.3 Emissions Monitoring

Continuous Emissions Monitoring System (CEMS) is performed on the EDT effluent exhaust gas stream. The system is designed to provide continuous, real-time analyses from the primary EDT exhaust stack. This monitoring system is used maintain and assess EDT process efficiency. The CEMS system analyzes concentrations of Carbon Monoxide (CO) and Oxygen (O_2) in the effluent gas stream as a performance indicator of combustion efficiency.

5.5.4 Historical Monitoring

HISM is performed to measure low concentrations of airborne chemical agent in areas where contamination is unlikely or where personnel are working without personal protective equipment (PPE). HISM is conducted at the Worker Population Limit (WPL) for worker protection and at the General Population Limit (GPL) for protection of the public and the environment. WPL monitoring may be performed by NRTMs or DAAMS, while GPL monitoring is performed by DAAMS. DAAMS tubes will be analyzed in the laboratory. HISM samples are not expected to exceed their hold times as defined by applicable BPBG Laboratory procedures.

5.5.5 Life Support System

The Life Support System undergoes routine DAAMS analysis. In addition to this analysis, breathing air in the LSS system is monitored for the following parameters at the life support compressors and air stations: oxygen (O_2), hydrocarbon (oil and particulate), carbon monoxide (CO), odor, carbon dioxide (CO_2), water, and dew point.

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5.5.6 Near-Real-Time Monitoring

Near Real Time Monitoring is an active sampling and analysis process conducted in areas where contamination is likely or possible to determine airborne chemical agent concentration in the shortest amount of time at the monitoring level commensurate with engineering controls and worker protection. The NRT monitoring system has by MINICAMS the capability to automatically collect the sample, analyze the sample, and report/display the results in 15 minutes or less. The NRTMs at BGCAPP will display results of chemical agent concentration in terms of the Vapor Screening Level (VSL) when monitoring at the short-term exposure limit (STEL), monitoring levels, Source Emission Limit (SEL) and Immediately Dangerous to Life and Health (IDLH), where applicable." Area monitoring NRTMs, except those in hazard Category A and Category B, may be backed up with either a delayed confirming NRT or DAAMS for Confirmation Monitoring.

5.5.7 Non-Baseline Monitoring

An additional type of air monitoring method used at BGCAPP is "non-baseline DAAMS" air monitoring. Non-Baseline DAAMS methods are defined and used when no specific historical period is associated with the samples, monitoring is performed intermittently, or the matrix is expected to be too variable to maintain a meaningful baseline. At each station, a DAAMS QP tube is sampled and analyzed with each set of DAAMS tubes. Non-baseline DAAMS air monitoring methods require the completion of a successful P&A study before the methods can be used to support operations, but no initial or continuing baselines are performed. Method validation is demonstrated by simultaneous collection and analysis of QP samples with each field DAAMS sample collected and analyzed. Control limits for the quality samples are defined in 24915-00-9PL-00-00002, *Laboratory Quality Control Plan* (CDRL D006).

5.5.8 Sub-Alarm Data Tracking

Sub-alarm data tracking and trending will be used at BGCAPP for early detection of sub-alarm chemical agent readings. Data collected from the other monitoring types, including NRT, confirmation, historical, and/or non-baseline, will be used to provide an early detection of low levels of agent migration. Evaluation of monitoring data will be performed by the Monitoring Trend Evaluation Group (MTEG) in accordance with 24915-00-9PR-00-00015, *Evaluation of Data in the Monitoring Trend Evaluation Group (MTEG)*. The BPBG Laboratory may also elect to increase sampling and/or sample analysis frequency to gather additional data for purposes of sub-alarm data tracking.

5.6 Process Sample Analysis

To verify process efficiency (e.g., meet agent compliance limits in hydrolysate), agent hydrolysate samples will be collected and analyzed for specific analytes prior to further processing of chemical agent and hazardous wastes.

5.7 Waste Analysis

Waste streams will be sampled by BGCAPP Operations or Waste Management department (excluding laboratory waste) and analyzed by the BGCAPP laboratory for waste disposal purposes. Vapor screening or liquid extraction techniques are used, depending on the waste stream and the waste-release criteria requirements. Laboratory waste may be monitored or processed for disposal based on processes defined in:

- 24915-00-9SO-00-00007, *Laboratory Waste Management* (CDRL D012)

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- 24915-00-G01-GGPT-00006, *Attachment C – Waste Analysis Plan*
- 24915-70-GPE-GGPT-00001, *Class 3 Hazardous Waste Storage & Treatment Permit Modification Request, Addition of Explosive Destruction Technology (EDT)* (CDRL A010), Part C – Waste Analysis Plan

5.8 Treaty Verification Samples

Treaty agent verification samples are collected by the BGCAPP Operations department and processed/analyzed by the BGCAPP laboratory in support of the CWC. The frequency of these samples is IAW the Treaty compliance support agreements. Analyses will consist of chemical agent verification as well as the sampling and analysis of agent neutralization system hydrolysate on a GC/MSD or similar type instrument. BGCAPP Laboratory will not perform treaty analysis for EDT munitions.

5.9 The Laboratory

5.9.1 General

The laboratory is a 10,920-square-foot modular facility. It contains space for the following functions:

- An agent standards room, which is dedicated to the receipt, storage, preparation, and decontamination of chemical agent challenge, calibration, and verification standards
- A sample receipt room for sample receipt, storage, and preparation
- Analytical chemistry rooms for analysis of hydrolysate samples, air monitoring samples, waste samples, and environmental samples.
- Administrative and logistical support areas

5.9.2 Laboratory Responsibilities

Laboratory personnel are responsible for the following:

- Analyzing CWC treaty samples for the Main Plant
- Analyzing samples to support plant operations
- Collecting hydrolysate, blended hydrolysate, Spent Decontamination Solution, Grade D air, DAAMS samples, laboratory waste samples
- Conducting Near Real Time Monitoring (NRTM)
- Documenting that laboratory analytical and monitoring equipment is properly labeled, installed, maintained, calibrated, and operated
- Ensuring and documenting process and data QC
- Ensuring proper handling, labeling, and storage of laboratory waste
- Ensuring subcontract laboratory processes and procedures meet quality standards according to the project's quality assurance requirements
- Generating and reporting data
- Maintaining all agent and non-agent standards
- Publishing Laboratory operating procedures (LOPs) and methods
- Qualifying all operators, instruments, and laboratory methods

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- Reporting final processed data accurately
- Storing applicable data of record IAW 24915-000-2KP-A03-00001, *Records Management and Document Control* and 24915-000-2KP-A03-00012, *Records Retention and Turnover*
- Testing samples for interference investigation

5.9.3 Laboratory Personnel Qualification

The Laboratory's organization and personnel responsibilities are described in the Laboratory Quality Control Plan (LQCP). A qualified employee is one who possesses the training, demonstrated knowledge, skills, and experience to independently operate or maintain laboratory equipment and/or perform laboratory procedures and analytical methods. Employees are tested to verify they are fully capable of safely and effectively completing their jobs without supervision. Personnel qualifications will be managed IAW 24915-00-9PL-00-00003, *Laboratory Training Plan*.

6.0 HYDROLYSATE ANALYSIS STANDARDS AND REQUIREMENTS

The statutory requirement of KRS 224.50-130 (3) (a) has established that the process for chemical agent destruction must have a destruction and removal efficiency (DRE) of 99.9999 percent or greater. Therefore, the BPBG Laboratory will conduct chemical agent analyses before Operations releases agent hydrolysate from engineering controls. Concentrations for the CWAs must be at or below compliance concentration limits that meet the equivalent of 99.9999 percent DRE, in accordance with *RD&D Permit* (24915-00-GPE-GGPT-00359).

Laboratory extraction methods and instrument configurations will be established and implemented based upon site specific LOPs. Method detection limits (MDLs), Lower Limit of Quantification (LLOQ), and/or P&A studies will be performed IAW the BPBG LQCP to develop methods with acceptable performance to accurately qualitate and quantitate to compliance concentration limits equivalent to the required 99.9999 percent DRE. All QC samples and limits will be documented and implemented IAW the BPBG LQCP.

7.0 MONITORING STANDARDS AND REQUIREMENTS

BGCAPP will adhere to the monitoring requirements set forth in this plan. Laboratory safety will be IAW AR 385-10, *The Army Safety Program*; DA PAM 385-61, *Toxic Chemical Agent Safety Standards*, and programmatic guidance from PEO ACWA.

P&A studies will be performed IAW the LQCP to develop and certify methods with acceptable performance to accurately qualitate and/or quantitate chemical agent at the monitoring level.

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7.1 Airborne Exposure Limits for Chemical Agents

To provide a safe working environment, the BGCAPP project has adopted the Airborne Exposure Limits (AEL) criteria for the general population and chemical workers. AELs for GB, H, and VX (the latter of which is also monitored for as G-analog of VX) chemical agents are specified in PEO ACWA, Monitoring Concept Plan. Concentration limit values for airborne vapors for GB, H, and VX chemical agents are identified in the LQCP. These criteria provide the maximum concentration values that are not to be exceeded for a given period of time based on the level of protection for personnel.

Due to the low volatility of VX and its tendency to irreversibly absorb, VX is converted to its G-analog using a polyester-felt pad impregnated with silver fluoride. After conversion, the G-analog can be sampled through the probe or line with adequate transmission for detection with an NRTM or collection onto a DAAMS tube for laboratory analysis.

VX may also be sampled and analyzed for by using a direct VX method. Depending upon the monitoring needs of the BGCAPP, Laboratory personnel may develop and implement a direct VX method.

7.1.1 Short-Term-Exposure Limit and Vapor Screening Level

The STEL values are short-term exposure limits. Occurrences above these short-term concentrations require immediate egress. NRTM systems are used for VSLs at the STEL concentration. The STEL is based on a 15-minute TWA and the NRTM reports agent-vapor concentrations in units of VSL. The concentration term VSL is independent of time and is therefore not a TWA exposure level. BGCAPP has adopted the use of VSL terminology in this document and equates the concentration of a STEL equivalent to the concentration of a VSL.

VSL, which is a vapor concentration term, is independent of sampling time and is used to report chemical agent vapor concentrations as well as define the level of cleanliness of an item. The NRTM will display the reading in terms of VSL in order to prevent misinterpretation of a single-cycle NRTM reading as a STEL exposure. Monitoring/Industrial Hygiene/Safety personnel will calculate the STEL based on multiple measurements from the NRTM in order to determine whether a STEL exceedance has occurred.

7.1.2 Worker Protection Limit and General Population Limit

The WPL and GPL values are TWA exposure limits designed to warn of low-level, long-term chemical agent concentrations to protect workers and the general population, respectively. If average concentrations in an area for extended periods of time (e.g., 8, 12, or 24 hours) exceed these values, then corrective actions and notification procedures are required. Administrative controls or increased levels of PPE can be used to limit potential exposure to workers to exceedances above the prescribed monitoring levels.

7.1.3 Source Emission Limit

The Source Emission Limit, also known as the allowable stack concentration (ASC), is a non-regulatory value that limits allowable emissions from the stack and does not serve as a health standard. Monitoring at these levels, is used at the off gas treatment system exhaust at the EDT facility.

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7.1.4 Immediately Dangerous to Life or Health

Immediately Dangerous to Life or Health (IDLH) Monitoring with NRTM will be performed as required to support Level A entries in agent process areas. The NRTM will report results in units of IDLH. There will be no co-located DAAMS associated with these NRTMs since they will be monitoring Category A and B areas, where vapor or liquid chemical agent contamination is expected to be present. The alarm levels for these NRTMs will be established by the S&H department. A low volume sampler (LVS) will be used in conjunction with the NRTM to enable high concentration measurements.

7.1.5 Waste Screening Limit – Main Plant

Waste Monitoring with NRTM at the Waste Screening Limit (WSL) is utilized in the toxic maintenance area (TMA) for screening of secondary waste that may be further decontaminated, treated in the MPT, or containerized and sent offsite for disposal. The WSL is equivalent 0.5 IDLH for GB and VX.

7.1.6 Waste Screening Limit – EDT

Waste monitoring with NRTM at the VSL is utilized in the 90 Day area of the EEB for screening of low-level waste that needs to be containerized and sent offsite for disposal. In the event of higher-level agent contamination, the IDLH method is utilized.

7.2 Maximum Use Concentrations

[redacted]

7.3 Exposure Limit Implementation Concept

The monitoring levels at a specific location will be based on potential time of exposure considering the MUC for a given respirator protection factor. Different monitoring levels are used depending on the level of PPE and administrative controls required within an operational area. If a NRTM indicates a concentration at or above the monitoring level, immediate corrective actions will be implemented.

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7.4 Waste Control Limit

For BGCAPP purposes, waste control limit (WCL) is defined as the chemical agent concentration limit below which waste can be released from the process for disposal. Concentration limits for constituents were developed based on the United States Army Public Health Command (USAPHC) Chemical Agent Health-Based Standards and Guidelines Summary. Clearance criteria for wastes are based on the applicable clearance criteria in the BGCAPP Waste Analysis Plan (WAP) Summary.

8.0 MONITORING CONCEPTS

8.1 Introduction

This section describes the agent process analysis and air monitoring system concept for systemization and operation phases of the BGCAPP project. Different requirements may be instituted during the closure phase. The laboratory is designed with the required equipment and a monitoring and analysis strategy to protect workers, the public, and the environment.

The air monitoring equipment was selected and is located throughout the facility to facilitate the detection of chemical agent vapor in air within the plant. The air monitoring system will allow the BPBG team to take immediate action in the event of a chemical agent release. The monitoring systems will be installed and undergo thorough testing prior to plant operations. The goal of the air monitoring system is, but not limited, to providing the following:

- Breathing air records for the presence or absence of chemical agent vapor
- Certification of decontamination effectiveness
- Chemical agent confirmation monitoring at the site perimeter
- Continuous 24-hour-per-day, 7-day-per-week, 365-days-per-year notification and data output for potential detection of chemical agents
- Detector sensitivities capable of measuring GB, H, and VX chemical agents in air at the VSL concentrations
- Historical record of monitoring workspace chemical agent vapor concentration
- NRT agent alarm confirmation by DAAMS analysis or a different configuration (e.g., column type) of an NRT
- Stack emission records for chemical agent vapor
- The earliest possible warning of potential chemical agent vapor to protect workers
- The earliest possible warning of process upset conditions

The process analytical equipment and apparatuses were selected for Laboratory personnel to safely collect, transport, and analyze air, liquid, or solid samples from process streams.

The goal of the process analysis system is to provide:

- Analysis of process streams for process control or worker protection
- Analytical data to support safety-based health risk assessment
- Characterization of process streams for regulatory compliance

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- Clearance of agent hydrolysate greater than or equal to KDEP's DRE requirement of 99.9999 percent
- Clearance of waste pollutants below the WCL

8.1.1 Process Support Areas

Process support areas are the Category C areas (i.e., airlocks, observation corridors, and equipment rooms adjacent to the process areas) where chemical agent contamination is not expected unless there are failures in engineering and administrative controls. [redacted] Process support areas that have confirmed exceedances above the WPL will require initiation of the 24915-00-GPP-GHX-00411, *Worker Population Limit (WPL) Exceedance Response*.

8.1.2 Workspace Process Areas

Workspace process areas include any area where work will be performed on single-contained Chemical Warfare Materiel outside of a fume hood or glovebox. Chemical agent is not expected, but because of the type of operations being performed, there is a potential for contamination. Workspace process areas are monitored at the VSL using NRTMs with CONM, and at the WPL with HISM and CONM.

8.1.3 Chemical Warfare Materiel Enhanced Onsite Container

NRTM and/or DAAMS will be used to monitor the headspace of enhanced onsite containers at the VSL prior to Enhanced Onsite Container (EONCs) being opened and every 7 days in which they remain in the unpack area/container handling building loaded with their munitions. DAAMS non-baseline monitoring may be requested if/when an EONC cannot be cleared using NRTM.

8.1.4 Facility Support Areas

Facility support areas are considered Category D areas, except for the Treaty Compliance office and Medical Facility, and are outside the agent operating area but within the chemical limited area. These areas, typically lunch/break room and administrative areas, will not be monitored. The Treaty Compliance office and Medical Facility will be monitored by HISM at the WPL. The Medical processing of a casualty through the Medical Decon facility is addressed in 24915-00-9SO-AMS-00012, *Medical Contingency Monitoring*.

8.1.5 Positive Pressure Support Areas

Positive-pressure support areas include the Control Room and the administrative area of Medical. These areas may be monitored with NRTM at the VSL and/or CONM at the WPL or VSL.

8.1.6 External Support Areas

External support areas, such as work and break areas outside the chemical limited area, do not require monitoring.

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8.2 Monitoring Strategy

8.2.1 Process Areas

The process areas include Category A and B areas. These represent the areas where chemical agent contamination in the form of vapor or liquid is expected to be present. These areas have monitoring and alarm levels established by the S&H Department in accordance with environmental permits and are monitored with NRTMs. Some Category B areas may be monitored with DAAMS at the request of S&H / Plant Management to permit less than Level C entries into those areas, as warranted, based on the hazard.

8.2.2 Process Effluent

Process effluent includes vapor and liquid streams resulting from the demilitarization process. When hazardous waste is being processed at the EDT facility, no more than one OTS stack NRT instrument shall be offline at any given time and for no greater than 3 hours. Additionally, when hazardous waste is being processed at MDB, no more than one HVAC stack NRT instrument shall be offline at any given time and for no greater than 3 hours.

8.2.3 Neutralization Process Liquid Effluent

The liquid effluents from chemical neutralization of agent will be sampled by laboratory personnel and analyzed according to approved laboratory procedures and analytical methods. Agent hydrolysates will be analyzed for residual chemical agent concentration at or below the compliance limits before being released from the MDB. Other liquid effluents from the plant processes will be analyzed IAW requirements defined in 24915-00-G01-GGPT-00006, *Attachment C – Waste Analysis Plan*.

8.2.4 Ventilation Exhaust Filter System

The ventilation exhaust filter systems for the MDB will be continuously monitored by NRTM and CONM at the VSL and/or WPL with redundant monitoring systems. The main plant configuration is such that all of the air in the MDB, to include the exhaust from the off-gas treatment units, is routed through the HVAC ducts to two main stacks, each with a series of seven IONEX carbon filter units. Both stacks and all fourteen filter units are continuously monitored as described in Sections 8.2.4.1 – 8.2.4.4.

8.2.4.1 Filter Mid-beds

The filter mid-beds will be monitored for the campaign agent with NRTM/CONM between filter beds one and two, and two and tree, sequentially, for agent breakthrough. Once agent breakthrough is detected between beds one and two, the monitoring will be moved downstream (between filter beds four and five) to monitor for any further potential breakthrough until contaminated filters have been replaced. The past agent will be monitored at WPL between Mid-beds 4-5.

Facility filter mid-beds will be monitored for all agents that have been processed or are being processed while the filters were/are online. If/when filters are replaced and a particular agent will no longer be processed, monitoring for that agent will no longer be required in the mid-beds.

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8.2.4.2 Filter Vestibule/Enclosure

The filter vestibule or enclosures are monitored at the VSL for the current and past campaign agent using NRTM with CONM. When occupied by unprotected workers, vestibules/enclosures will be continuously monitored at the VSL level and HISM at the WPL for current and past campaign agent. CONM is required for both the NRTM and the HISM.

8.2.4.3 Filter Operations

The area where personnel enter into the filter mid-beds, perform filter change out operations, or perform other maintenance operations inside the filter enclosures will be considered as workspace process areas and monitored accordingly.

8.2.4.4 Filter Stacks/Exhaust – Main Plant

The MDB HVAC filter stacks/exhaust ducts are monitored with redundant NRTM/CONM at the VSL for the current campaign agent. The filter stacks are monitored for previous campaign agent(s) until all potentially contaminated mid-bed carbon filters have been replaced. If needed, the filter stacks/exhaust ducts may also be monitored with HISM/CONM at the WPL to demonstrate DRE.

8.2.4.5 Filter Stack/Exhaust – EDT

The EDT stack configuration differs from the Main Plant in that there are three separate stacks, each with a single IONEX carbon filter unit; one for the air in the EDT munitions service magazine (ESM), one for the air in the EDT Enclosure Building (EEB) and one for the exhaust from the thermal oxidizer off-gas treatment system (OTS). The monitoring configuration for each is described below:

- EEB (IONEX 16000) – monitor mid-bed and outlet with NRTM and CONM at the VSL
- ESM (IONEX 1000) – monitor mid bed and outlet with NRTM and CONM at the VSL
- OTS Filter System (IONEX 4000) – mid-bed with NRT only and exhaust stack with redundant NRTM and CONM at the SEL

8.2.5 Life Support System Air Connects

The Life Support System (LSS) air stations and the connected air hoses will be monitored daily with HISM/CONM at the 2 hour WPL. Sampling will be completed no more than 36 hours before stations and hoses will be used, assuming the last sample analyses had no confirmation of chemical agent. The analysis for all LSS stations will be completed each calendar day and reported to the CON, regardless of reading. Agent monitoring for LSS will be suspended during agent changeover and therefore no report will be generated. The routine monitoring frequency should be every 24 hours but not exceed 36 hours if the previous monitoring result indicated no measurable level of agent. If agent contamination is confirmed above the WPL, the CON will initiate the proper corrective actions. Positive results below the WPL will be tracked and trended as part of the sub-alarm tracking and reviewed by the MTEG.

8.2.6 Grade D Air

Analytical analysis is performed on the breathing air system to certify the system to the Compressed Gas Association/American National Standards Institute standards for Grade D breathing air IAW 24915-00-9SO-00-00010, *Life Support Air System*. Both life support compressors and the bottle filling station are monitored for the following parameters:

- Carbon dioxide

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- Carbon monoxide
- Dew point
- Hydrocarbons (oil and particulates)
- Odor
- Oxygen
- Water

8.2.7 Laboratory Work Areas

Laboratory work areas are not required to be monitored where chemical agent standards at or below the Research Development, Test, and Evaluation (RDT&E) dilute levels are used, nor where agent hydrolysate samples and diluted Treaty-verification samples are received and processed, and where Stock A standard solutions are used. No unknown/unscheduled samples or "found-on-site" questionable liquids with the potential for unknown concentration of chemical agent will be allowed into the laboratory IAW 24915-00-9SO-00-00005, *Sample Management* or an approved NSTP for handling, preparing, analyzing, reporting, and disposing of the sample.

A safety-based health risk assessment will be completed for these samples prior to receipt in the laboratory and to develop the NSTP. NSTPs will be required to receive and process such samples within the BPBG Laboratory. Acceptable processes for such samples may include but are not limited to sample field dilution prior to Laboratory receipt or temporary agent monitoring in the laboratory until samples have either been destroyed or diluted to a concentration below the dilute thresholds.

The BPBG Laboratory uses an electronic request for sample analysis (eRFSA) form that uses established profiles for the various samples to be requested at the BGCAPP facility. These profiles include potential hazards, handling precautions, applicable PPE, and type of analyses requested. Only samples with a completed RFSA will be received by the BGCAPP Laboratory. Laboratory procedures prohibit the receipt of samples that are not accompanied with an associated RFSA.

8.2.8 Laboratory Ventilation Exhaust Filter System

The BPBG Laboratory has an in-line activated charcoal filter on every exhaust system. The filters have been installed prior to the exhaust fan. These filters are not monitored.

8.2.9 Facility Perimeter

The BGCAPP facility's perimeter requires routine monitoring. Permanent monitoring stations are used to monitor the BGCAPP perimeter. Document 24915-00-9PL-00-00009, *Perimeter Monitoring Plan*, provides guidance for the perimeter monitoring at the BGCAPP facility.

8.2.10 First-Entry Monitoring

Prior to entry of personnel, first-entry monitoring will be conducted in any area that was previously contaminated and has not been under continuous monitoring after loss of ventilation for more than 24 hours, or for entry into any unmonitored plenum, if agent contamination is suspected. [redacted].

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8.2.11 Headspace Monitoring

Headspace monitoring is used at the VSL, WPL, WSL, IDLH or GPL to determine operational constraints, PPE requirements, and handling precautions for waste clearance. It will also be used to investigate upset conditions to obtain information for corrective actions and mitigation procedures. Either NRTM or DAAMS methods may be used for headspace monitoring based on approved methods.

8.2.12 Interferent testing

Interferent testing has been implemented to minimize number of false positive/negative responses from known or suspected interferences. The interferent process is described in 24915-00-9PR-00-00016, *Interferent Control*. The BPBG laboratory will evaluate chemical materials brought on site and prior to use on the BGCAPP footprint. Materials that are known interferents must be submitted to the Interferent Use Committee for consideration for use. If the material is approved for use, control measures will be documented in the BPBG SDS/Interferent Database to ensure protection of the air monitoring system.

8.3 Monitoring Cessation

Monitoring activities may be suspended or terminated based on Project needs, campaign changes, and/or closure. These activities will be conducted IAW the applicable BPBG plans and procedures and the ACWA MCP.

8.3.1 Carbon Filters Mid Beds

Cessation of monitoring of carbon filter mid-beds for previously processed agents will not occur until the potentially contaminated carbon mid-beds have been replaced in the applicable filter bank.

8.3.2 Category A and B Areas

Monitoring for previously processed agents may be discontinued for Category A and B areas when 24 hours of monitoring within the areas [redacted] shows that the contamination concentration is less than one VSL. If contamination above the acceptable detection limit in the applicable area is detected during this 24-hour monitoring period, additional decontamination and resumption of monitoring is required until acceptable agent levels are achieved.

8.3.3 Category C Areas

The site may discontinue air monitoring in Category C areas for previously processed agents after 24 hours of continuous monitoring with no contamination found above a concentration equivalent to the numerical value of the WPL for the specific chemical agent. During the 24-hour monitoring period the area shall be maintained [redacted] If these conditions are not met, monitoring shall not be suspended.

8.3.4 Filter Stack/Exhaust

Cessation of NRTM/CONM (and HISM/CONM, if applicable) monitoring of the filter stacks/exhaust ducts for previously processed agents will not occur until all potentially contaminated carbon filter mid-beds from previous agent campaigns have been replaced in all filter banks for each filter stack/exhaust duct.

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8.4 Process Analysis and Air Monitoring Concept

The agent air monitoring and process analysis systems are designed to use monitoring and analysis equipment with a monitoring strategy to protect workers, the public, and the environment. The major types of air monitoring and process analytical equipment are provided in Table 1.

8.4.1 Analytical Methods

Analytical methods, to include methods based on USEPA wastewater sampling and analysis methods as modified for BGCAPP matrices, will be published and approved by Lab Management, Lab Quality, and the Chief Scientist. Those methods supporting chemical agent measurement will require CD Compliance Directorate review and concurrence before the method supporting chemical agent operations.

These methods will be used during systemization, operations, and closure phases of the project. They may be modified and optimized as required by mission requirements. As plant conditions and monitoring requirements change, additional procedures and methods may also be developed. New or modified procedures and methods will be in compliance with the LQCP.

Laboratory procedures and analytical methods will be maintained under configuration control IAW 24915-00-9PL-00-00014, *Configuration Management Plan*.

8.4.2 Equipment

8.4.2.1 Air Monitoring

The air monitoring equipment was selected and located throughout the facility to facilitate the detection of chemical agent vapor in the air. Air monitoring locations for BGCAPP are given in engineering drawings 24915-00-JA-AMS-00002, *Near Real Time and History Monitors Components Table Instrument Diagram* through 24915-00-JA-AMS-00004, *Near Real Time and History Monitors Components Table Instrument Diagram* for the Main Plant, and 24915-00-9MP-AMS-00001 for EDT and Main Plant which lists locations in table format. In addition, air monitoring capabilities within each room are illustrated in engineering drawings for EDT and Main Plant. The air monitoring system will allow BPBG CON operations to take immediate action in the event of an agent release. Placement of the distal end of sample lines was determined by a certified Industrial Hygienist. The air monitoring systems have undergonethorough testing prior to beginning plant agent operations.

The air monitoring system consists of the following key elements:

- Automated audible and/or visual alarm systems for early warning
- HISM network for worker protection and treaty workplace monitoring
- Immediate alarm enunciation and equipment operational status to the facility control system
- LSS air monitoring to monitor breathing air for chemical agent contamination
- NRTMs with associated DAAMS systems for early agent alarm detection and confirmation
- Standalone NRTMs for process information and for defining PPE requirements

8.4.2.2 Process Analysis

The process analysis equipment includes sampling devices to obtain agent, hydrolysate, liquid, and solid samples from process streams; chromatographic -analytical instruments; and specialized apparatuses for sample analysis. Table 1 provides some details about major air monitoring and process analysis equipment.

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Table 1 – Major Air Monitoring and Process Analysis Equipment

Equipment	Purpose	General Description
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

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Equipment	Purpose	General Description
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
TOC	To determine organic carbon concentrations in aqueous samples	The total organic carbon (TOC) is used to characterize samples for disposal purposes. TOC analyzers are designed for natural and wastewater samples. An aspirated sample is injected into a high-temperature reaction chamber through which flows a nitrogen carrier gas with a constant level of oxygen. All oxidizable components are combusted to their stable oxides, and all inorganic and organic carbon in the aqueous sample is converted to carbon dioxide. The carrier gas flows through a non-dispersive infrared analyzer. Total Inorganic Carbon is subtracted from Total Carbon to determine Total Organic Carbon.
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

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Equipment	Purpose	General Description
pH meters	To measure pH in aqueous solutions	pH meters are simply voltmeters and consist of a pH-responsive electrode, a reference electrode, and a potential-measuring device.
[redacted]	[redacted]	[redacted]

9.0 WASTE STREAMS

9.1 Introduction

Operational and laboratory wastes are sampled and analyzed to characterize the waste streams prior to reuse, off-site shipment, or disposal. Waste is screened to the appropriate WCL by headspace monitoring, liquid/liquid extraction techniques, solid/liquid extraction techniques, or by process/generator knowledge. Waste analysis will be conducted using IAW published procedures and approved methods.

The specific waste clearance standards will be specified by the United States Army Public Health Command (USAPHC) Chemical Agent Health-Based Standards and Guidelines Summary.

Requirements for off-site shipment to a TSDF for evaluating hazardous waste under the Resource Conservation and Recovery Act (RCRA), 40 CFR, Part 261, will be accomplished by the BPBG Laboratory or by an approved subcontract laboratory and documented in the BPBG Waste Analysis Plans (WAPs) (24915-00-G01-GGPT-00006, Attachment C – *Waste Analysis Plan for Main Plant* and 24915-70-GPE-GGPT-00001, Part C – *Waste Analysis Plan for EDT*).

9.2 Sources of Waste Streams

Waste from BGCAPP includes both solid and liquid waste streams. These wastes may include but are not limited to matrices as defined in the WAPs for EDT and Main Plant.

9.3 General Requirements for Monitoring Waste Materials

Table 2 provides the general requirements for monitoring waste material. Specific Laboratory procedures and methods have been developed and approved for monitoring waste produced by BGCAPP.

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Table 2 – General Requirements for Monitoring Waste Materials

Type of Waste	Required Monitoring	Sample Collection
Liquid Waste	Laboratory personnel will verify chemical materiel concentrations are below the WCL based on the federal, KDEP, TSDF, and local requirements by laboratory analysis or generator knowledge.	Sample collection will be according to LOP 24915-00-9SO-00-00004, *Laboratory Sample Collection*, for hydrolysate, blended hydrolysate, and laboratory wastes. All other liquid waste samples will be collected IAW applicable BGCAPP Operations and/or Waste Management departmental procedures. Analysis procedures will be based on USEPA SW-846, USEPA 40 CFR Part 136, Appendix B or U.S. Army approved/concurred methods.
Solid Waste	Laboratory or Operations personnel will verify chemical materiel concentrations are below the WCL or VSL based on the federal, KDEP, TSDF, and local requirements by laboratory analysis or generator knowledge.	Sample collection will be IAW with applicable BGCAPP Operations and/or Waste Management departmental procedures. Waste will be contained, allowed to off gas (at a specified time and temperature), and monitored by NRT or DAAMS techniques, or by waste screen analytical procedures based upon the USEPA SW-846, USEPA 40 CFR Part 136, Appendix B. or U.S. Army approved methods. Documented Generator Knowledge may also be used.
Complex Matrices (multiphase, non-soluble, reactive, etc.)	NSTPs will be developed to monitor complex matrices, as required.	Sample collection will be specified with applicable BGCAPP Operations and/or Waste Management SOPs, LOPs, method, or other BGCAPP approved forms of work control documents.

9.4 Decontamination Verification Monitoring

Decontamination verification monitoring includes the following:

- Liquids, which is accomplished via:
  - Decontaminating by approved procedures and either:
    - Analyzing by liquid/liquid extraction or
    - Characterizing by process knowledge
- Solids, which is accomplished via:
  - Decontaminating by approved procedures, or
  - Bagging or containing in a vapor barrier of sufficient volume; headspace vapor equilibration at specified time and temperature, and monitoring and analyzing by NRT or DAAMS methods IAW LMQAP/MCP requirements, or
  - Analyzing by solid/liquid extraction, or
  - Characterizing by process/generator knowledge

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9.5 Sample Containers

Sample containers must be:

- Chosen according to containment required
- Compatible with USEPA requirements
- Labeled according to applicable procedures

9.6 Item Reutilization and Disposal

Laboratory personnel have developed and approved waste clearing and screening procedures and methods for the specific waste streams prior to reuse, off-site shipment, or disposal. These procedures and methods are based on health-based risk assessments or approved decontamination procedures and analytical clearance methods.

9.6.1 Decontamination Classification

Items will be classified as contaminated if they are contacted by liquid agent, were exposed to an environment above IDLH, were in an uncontrolled environment that was monitored above the VSL, or were in an unmonitored area and show potential signs of being contaminated with liquid agent. 24915-SAF-5PR-00-00023, *Toxic Chemical Agent Safety* for decontamination classification and descriptions; 24915-GEN-5PL-00-00006, *Equipment Decontamination Plan,* provides direction for proper disposition of contaminated items. Items, excluding carbon, that have been in a continuously-controlled environment where the environment is documented to never have exceeded the VSL when the item was present, are considered uncontaminated.

If an item was in a continuously-controlled environment that is documented to never have exceeded the VSL when the item was present, the item may be regarded as uncontaminated based on an acceptable risk assessment that takes into consideration the following factors:

- Agent concentration and duration of exposure
- Historical documentation for similar operations and items
- Location of object considering source of vapor and airflow direction
- Material composition (e.g., porosity, density, organic, inorganic, metallic crystalline)
- Temperature of the environment
- Type of equipment (e.g., wrench, rubber mat, process equipment, auxiliary equipment)
- Type of process, operation, or task

When a contaminated item needs to be moved to an area without engineering controls, the item will be cleaned according to currently accepted industrial hygiene practices or placed in double vapor containment for movement to another area with engineering controls. The type of release and the level of monitoring will depend on the planned end state of the item as shown in Table 3.

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Table 3 – Classification Levels for Decontamination and Release

Classification Level	Screening Criteria (concentration value – mg/m^3)	Health Based/Risk Assessment
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

Contaminated items that have been cleaned may be released unconditionally to the public IAW applicable federal, state, and local regulations if one of the following conditions is met (and further disassembly could not release any residual agent):

- DAAMS monitoring is to be less than the GPL concentration.
- The item is cleaned according to the approved Equipment Decontamination Plan
- The item is heated to a surface temperature of 538 degrees Celsius (°C) (1,000°F) for at least 15 minutes.

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9.6.2 Secondary Wastes

BGCAPP secondary waste that does not meet the definition of clean will be shipped IAW established applicable bounding transportation risk assessment (BTRA), and in accordance with guidance in applicable WAPs. BGCAPP will assess its hazardous waste and implement objective and consistent methods to characterize the secondary waste. The BPBG Laboratory will comply and support these processes.

10.0 DESCRIPTIONS AND REQUIREMENTS FOR MONITORING AND SAMPLING EQUIPMENT

The minimal specifications for the sampling and analytical equipment for verifying control of agent migration in air and in process effluents for BGCAPP are provided in Table 4. The minimal specifications for the analytical gas and support equipment are provided in Table 5.

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Table 4 – Descriptions and Requirements for Monitoring and Sampling Equipment

Monitoring Equipment	Operational Components	Manufacturer Specification	Minimum Operational Requirements	Preventive Maintenance
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

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Monitoring Equipment	Operational Components	Manufacturer Specification	Minimum Operational Requirements	Preventive Maintenance
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

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Monitoring Equipment	Operational Components	Manufacturer Specification	Minimum Operational Requirements	Preventive Maintenance
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

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Table 5 – Analytical Gas Equipment Requirements

Support Gases	Leak Detectors	Compressed Gas Regulators	Compress Gas Lines
[redacted]	[redacted]	[redacted]	[redacted]

11.0 LABORATORY DOCUMENTATION REQUIREMENTS

The BGCAPP contract data requirements list (CDRL) items include the following documentation requirements:

- 24915-00-9PL-00-00001, *Laboratory Analysis and Monitoring Plan (LAMP)* D007
- 24915-00-9PL-00-00002, *Laboratory Quality Control Plan (LQCP)* (D006)
- 24915-00-9PL-00-00008, *Laboratory Chemical Hygiene Plan (LCHP)* (D010)
- 24915-00-9SO-00-00007, *Laboratory Waste Management Procedure* (D012)
- 24915-OPS-5PR-00-00023, *Hazardous Waste Management and Hazardous Material Reporting Procedure* D012

Other document requirements include:

- 24915-00-3YD-00-00007, *System Design Description for Agent Monitoring*
- 24915-00-9PL-00-00009, *Perimeter Monitoring Plan*
- 24915-00-GPP-GHX-00411, *Worker Population Limit (WPL) Exceedance Response*
- 24915-GEN-5PL-00-00006, *Equipment Decontamination Plan*
- 24915-SAF-5PR-00-00023, *Toxic Chemical Agent Safety*
- Analytical methods (as required)
- Monitoring and Analytical Reports, as required

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12.0 DATA REPORTING AND DELIVERY

Results for laboratory sample analysis are reported accurately, clearly, and objectively. Each report is provided to the applicable requestor, as appropriate. Any data reported by the BPBG Laboratory shall be provided to ACWA CD upon request. Report contents will vary depending upon the data of interest and the requestor. Significant figures will be used for reporting IAW 24915-00-9PR-00-00005, *Mathematical Procedures for Standardizing Laboratory Calculations*. Specific content for Laboratory reports are provided in the 24915-00-9PL-00-00010, *Laboratory Data Management Plan* and other Laboratory plans/procedures.

13.0 PROCEDURES FOR REPORTING POSITIVE CHEMICAL AGENT AIR RESPONSES

13.1 Introduction

Because of the low monitoring levels required during BGCAPP operations and the potential for false positive or negative readings, Laboratory personnel must follow a strict protocol for reporting any chemical agent responses at or above alarm setpoints.

13.2 Chemical Agent Detected in Air Samples

Responses greater than the monitoring levels will be reported as a fraction of Z (where Z is the monitoring level expressed as WPL, VSL, SEL, or GPL). This value is read from the NRT display or from the analytical instrument's recorded value. For instrumentation or monitors that report the response as concentrations (e.g., ppm or mg/m^3) the observed values will be converted to monitoring level units prior to reporting. Response to air monitoring system alarms and malfunctions is described in 24915-00-9SO-AMS-00003, *Air Monitoring System (AMS) Malfunction and Alarm Response*.

Confirmed chemical agent readings require notification to the Shift Plant Manager (SPM) as described in 24915-00-9SO-00-00006, *DAAMS Spiking and Analysis*. The SPM will take action IAW project procedures.

13.3 Alarm Response

Table 6 provides a summary of the actions required on exceedance of alarm setpoints for NRT only monitors and Figure 1 gives the response concept for NRT-only monitoring stations.

13.3.1 NRT Monitoring Stations Paired with DAAMS Confirmation Stations

Table 6 provides actions to take based upon equipment readings and Figure 1 also provides the response concept for NRT monitoring stations paired with DAAMS CONM stations.

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Table 6 – Alarm Response

Type of Station and Station Location	Action Taken If Response Is at or Above Action Level	Action Taken If Response Is Below Action Level	Confirmation Monitoring for GC Methods and Detection Level Requirements
NRT monitoring stations in toxic areas Located where DAAMS CONM is not required	No action taken	No action taken	Not applicable
NRT monitoring stations Located where DAAMS CONM is required (i.e., workspace areas)	Actions taken IAW LOP 24915-00-9SO-AMS-00003, *Air Monitoring System (AMS) Malfunction and Alarm Response*	Investigate and conduct sub alarm tracking. Corrective actions will be implemented.	GC Methods: • The CONM method will use a different analytical technique than those used by primary instrument. Detection Levels: • The CONM method must aspirate the entire aspiration period of the NRT and have sufficient sensitivity to detect agent over the range of the NRT.

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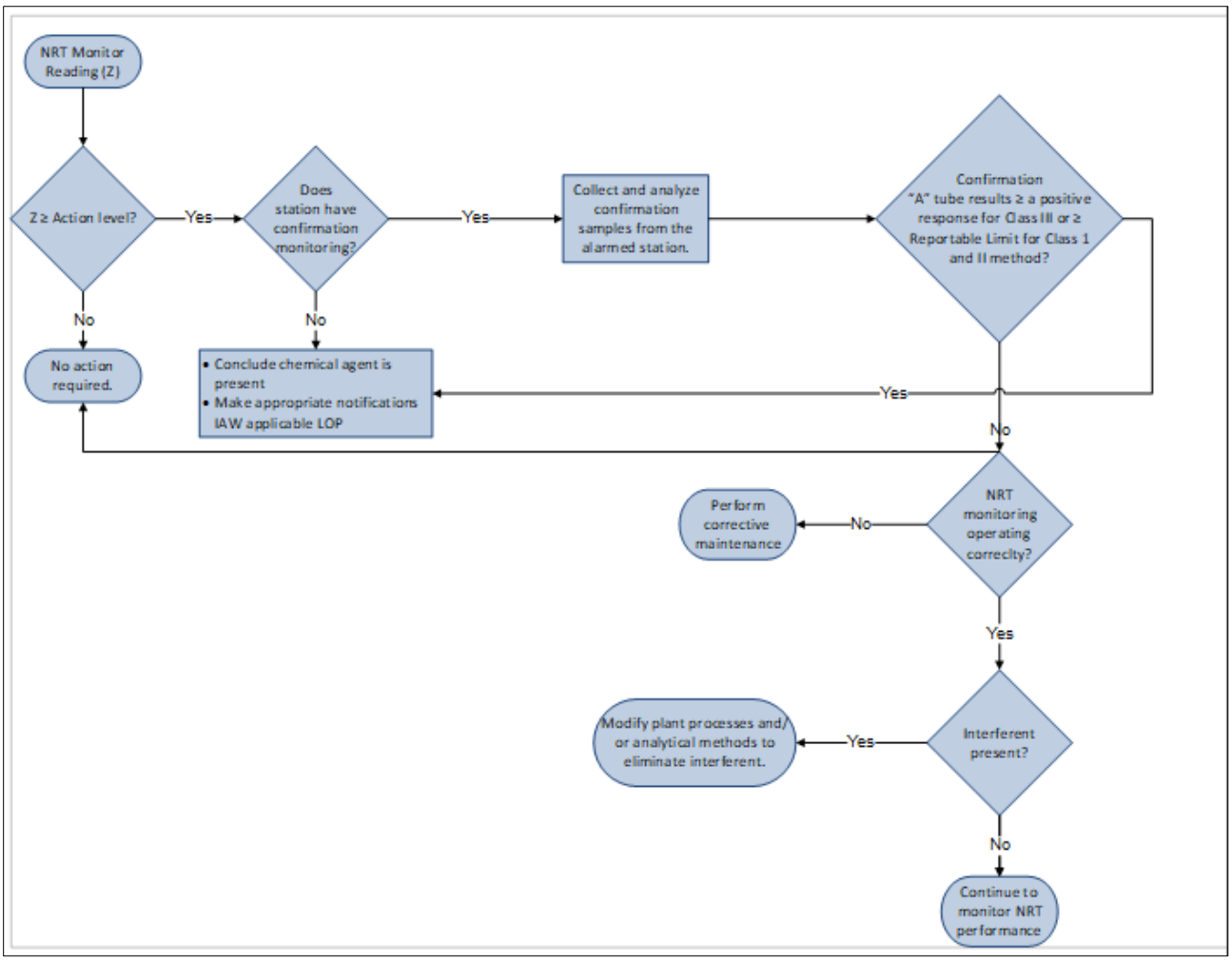
Figure 1 – Response Concept for Near Real-Time Monitor Alarm



1) If no source of chemical material is present at the time of a confirmed alarm, the investigating team will determine the agent results may be inconclusive.
2) "B" tubes are analyzed if "A" tube results are suspect or at management direction.
3) A positive response for Class III methods is defined during method development and is at or below the lower 95 percent confidence bound for the 1Z readings obtained during a P&A study such that the project can be sure the monitoring method will indicate agent alarm 97.5 percent of the time when agent is present at 1Z.

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14.0 LIMITING CONDITIONS OF OPERATION

14.1 Requirements

Limiting conditions of operation (LCOs) are specific monitoring and laboratory conditions that must be in place before site operations are permitted to proceed. LCOs identify the minimum functional capability or performance level of personnel and equipment required for safe operation of the facility. If established LCOs cannot be maintained, the CON must be notified that Laboratory LCOs are not being met and direction to operate outside of these conditions must be formally approved IAW 24915-GEN-5PR-00-00020, *Limiting Conditions of Operation* (Main Plant), and 24915-70-G01-GGOP-00001, *Explosive Destruction Technology (EDT) Limiting Conditions of Operation.* Any operation outside the LCOs will be documented and provided to the CON. Laboratory LCOs are reported to both the Main Plant Control Room and the EDT Control Room at the beginning of each shift. The LCOs for analytical and monitoring systems are given in Table 7 and Table 8, respectively.

Table 7 – Analytical LCOs

Personnel	Calibration and QA/QC	BPBG Laboratory Facility	Instrumentation
[redacted]	[redacted]	[redacted]	[redacted]

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Table 8 – Monitoring LCOs

Personnel	Calibration and QA/QC	Instrumentation
[redacted]	[redacted]	[redacted] [redacted]n required) is operational and online.

15.0 OPERATIONAL CONFIGURATION CONTROL

15.1 Introduction

Laboratory personnel have identified potential parameters that may be under operational configuration control for monitoring and laboratory equipment to ensure equipment hardware and software is safeguarded against adjustments that would invalidate results, to maintain proper functioning, and to prevent deterioration of the equipment. Specific Laboratory methods will specify parameters and allowable variance that are under configuration control. See 24915-00-9PL-00-00002, *Laboratory Quality Control Plan* (CDRL D006) for parameters for selected equipment that should be considered during method development.

Certified methods will have the configuration control flexibility as specified in the method or as defined in USEPA SW-846.

Operational configuration control parameters are documented in the method certification records (i.e., approved P&As, approved MDL, and LLOQ studies).

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15.2 Near Real-Time Monitors

NRTMs will have multiple configurations that will include, but are not limited to, FPD, XSD, low-volume samplers, and stream selectors. Upon completion of a successful method validation, the NRT method will come under configuration control. Changing a monitoring level of a method will require the method be validated for that level.

15.3 Depot Area Air Monitoring System Stations

Configuration control of sorbent type, mesh size, and sorbent bed dimensions are maintained and documented. Changes to items under configuration control will be evaluated and a new validation study may be performed. Changes in configuration will be reviewed by Laboratory Management.

15.4 Gas and Liquid Chromatographs

[redacted]

Once the specific method(s) for any of the systems above has successfully completed its validation, the instrument and method(s) will come under configuration control. Method parameter adjustment ranges will be specified IAW the method certification records (i.e., Approved P&As, approved MDL, and LLOQ studies).

15.5 Inductively Coupled Plasma Mass Spectrometry

[redacted]

Once the specific method(s) for the ICP-MS has successfully completed its validation, the instrument and method will come under configuration control IAW method certification records (i.e., approved P&As, approved MDL, and LLOQ studies).

15.6 Laboratory Information Management System

The Laboratory Information Management System (LIMS) manages Laboratory information and data and is under configuration control. Changes to software, code, monitoring levels, campaign changeovers, and action levels will require a system validation as directed in 24915-00-9PR-LIMS-00001, *Laboratory Software Engineering and Configuration Control*. This document will also direct processes for periodic system validation.

15.7 Certification and Documentation of Controlled Parameters

Once the specific method(s) for any of the Laboratory systems has successfully completed its validation, the instrument (or equipment) will come under configuration control and configuration control parameters will be documented. Configuration control parameters may be documented in standalone documents/procedures or may be documented within the certification data packet for the particular method.

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15.7.1 Changes to Controlled Parameters

Permanent changes to items under configuration control are allowed within tolerances stated with the method certification records (i.e., Approved P&As, approved MDL, and LLOQ studies). Changes outside of these tolerances will require a new method certification, including approval, IAW the LQCP.

15.7.2 Hardware Components

Replacement components will meet the specifications of those components used during the method validation. These specifications will be documented in the associated logbook, method(s), LIMS, or LOP(s). Replacement components that do not meet the specifications of those components used during the method validation will require revalidation or a waiver to operate using the new components without revalidation. Laboratory Management will submit a waiver request IAW the LMQAP requirements. PEO ACWA approval is required on all waivers prior to implementation.

15.7.3 Setpoints

Parameters will contain some flexibility for adjustment as defined in the associated method(s) or LOP(s). Changes outside the adjustment ranges specified in the method or LOP will require revalidation or a waiver to operate outside the ranges. Laboratory Management will submit a waiver request IAW the LMQAP requirements. PEO ACWA approval is required on all waivers prior to implementation.

15.7.4 Software

Software upgrades and code changes will be properly documented, tested, and approved. The Laboratory Manager or Chief Scientist will review software upgrades, identify acceptance-testing procedures, and will be the final approval authority for the upgrade. Software upgrades may be implemented without formal acceptance testing if the vendor has performed such testing. However, if backward compatibility does not exist, the previous version of the software will be maintained for data reprocessing and review.

16.0 ACCEPTANCE AND PERFORMANCE OF EQUIPMENT AND REFERENCE MATERIALS

Refer to the LQCP for the minimum requirements for acceptance and performance of equipment and reference materials.

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16.1 Equipment

Laboratory personnel will maintain equipment required for the performance and operation of agent monitors and analytical instruments. Maintenance activities will be documented in a laboratory instrument logbook, which may be electronic. Each item of equipment in use for acquiring a critical measurement will be labeled, marked, or otherwise documented with its current calibration status. All other equipment and calibrations will be managed IAW 24915-00-9PL-00-00011, *Laboratory Calibration Plan*. Records and documentation will be maintained on equipment and reference standards that have a significant impact on the calibration, operation, or performance of the agent monitoring/analysis systems. Records will be maintained on laboratory equipment including as a minimum:

- Condition when received (e.g., new, used, reconditioned)
- Copy of owner and maintenance manuals
- Current location, if appropriate
- Date placed into service
- Date received
- Dates and results of calibrations
- Dates of next scheduled calibration, if applicable
- Details of maintenance performed, and maintenance activities scheduled for the future
- History of damage, malfunctions, modification, or repair
- Manufacturer
- Nomenclature
- Serial number or other unique identification number

16.2 Measurement Equipment Traceability and Calibration

16.2.1 Requirements

The Laboratory will maintain equipment for measurement, traceability, and calibration IAW 24915-00-9PL-00-00011, *Laboratory Calibration Plan*.

Where reference materials require calibration/recalibration by external organizations, sufficient lead-time will be incorporated into the calibration/recalibration schedule to ensure availability.

16.2.2 Lab-Specific Equipment

16.2.2.1 NRTM Field Acceptance Testing

NRTM field acceptance tests will be performed by laboratory personnel Each instrument system will be challenged using the chemicals and instrument parameters at which the system will routinely be operated.

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16.2.2.2 Gas and Liquid Chromatograph Performance Testing

Laboratory GC and LC systems with their respective detectors will be performance tested by injecting a performance check standard that is specifically for the detector. The performance check standard will, as a minimum, verify column performance and detector response. Direct injection of performance check standards may be used on instruments that use DAAMS. Under the laboratory quality system, each instrument-detector system will successfully pass its performance test criteria.

16.2.2.3 Nitrogen Oxide (NOx) Filter Acceptance Testing Requirements

NOx filters will be visually inspected for cracks, packing separation, and other physical defects. NOx filters will be glass or fluoropolymer tubing packed with treated Chromosorb® P or equivalent material. They may also contain diphenylcarbazide-treated cotton for a moisture indicator.

16.2.2.4 Sorbent (DAAMS) and Pre-Concentrator Tube (PCT) Acceptance Testing Requirements

A. Visual inspection includes verification of the number and type of tubes received matches the shipping manifest, verification the vendor specifications are met, and verification of the absence of obvious defects in tube construction. Any questionable tube will be rejected, and the Laboratory Operations Shift Manager notified.
B. Chemical agent testing for DAAMS tubes will consist of spiking the tube at the 1.0 Z WPL then aspirating for 12-hours. Acceptance of the tube lot requires a passing test by a required percentage of the tubes IAW American National Standards Institute/American Society for Quality (ANSI/ASQ) Z1.4-2008.
C. Every lot of DAAMS tubes used for chemical agent monitoring will be tested. Tube lots that do not meet the above acceptance criteria will be discarded. Tubes that do not satisfy DAAMS tube GC agent performance specifications will also be discarded.
D. DAAMS tubes will be conditioned prior to use and reconditioned prior to additional use IAW LOP 24915-00-9SO-00-00012, *Acceptance Testing and Reconditioning for DAAMS Tubes*. The agent window from sample analyses will be shown to be chromatographically blank or will be discarded. Tubes will not be reused until a baseline is observed containing no peaks greater than half the lowest calibration point in the retention time window for the chemical agents of interest.
E. PCT acceptance testing only requires that the tube be visually inspected to verify there is no gapping greater than one millimeter in the sorbent material and the glass tubing is not fractured.

16.3 Acceptance Testing

Equipment acceptance testing will be accomplished prior to operations of the equipment to produce compliance data. Instruments will be challenged directly. Acceptance testing requirements for selected laboratory and monitoring equipment is provided in the BPBG LQCP. For other equipment, an acceptance test plan specifying the testing requirements and acceptance criteria will be published and approved, as required.

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16.4 Total Organic Carbon Analyzers

Total Organic Carbon (TOC) analyzers will be operated and maintained IAW manufacturer's operations and maintenance (O&M) manual. All calibration gases used for TOC analyzers will be traceable to National Institute of Standards and Technology (NIST) standard reference material, where practical, and satisfy USEPA protocols.

16.5 Hoods

Fume hoods will be tested and recertified at least every 12 months or when the system has undergone major repairs. Hood face velocity will be maintained at [redacted]

16.6 Systemization of NRTMs and the Data Acquisition System Interface

NRTM systemization will include challenges at the 1.0Z, verification of the data acquisition system, carryover clearance criteria, and sufficient power supply sources. Acceptable systemization performance will be IAW the BPBG LQCP and outlined in the applicable monitoring documents, plans, AMS Systemization Demonstration Plan and non-standard test protocol.

16.7 Use of Chemical Agent as a Reference Material

The laboratory will obtain only RDT&E levels of chemical agent standards (Stock A) from the Chemical Transfer Facility (CTF), U.S. Army Combat Capabilities Development Command (CCDC) Chemical Biological Center (CBC), as required and IAW laboratory procedures. This agent will be used for the preparation of RDT&E dilute solution standards for calibration, challenge, and verification purposes. The analytical standards to be prepared are defined in Table 9. Figure 2 illustrates the preparation sequence of chemical agent standards.

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Table 9 – RDT&E Standards

Analytical Standard	Description
Stock A Standard	A solution with a known high-level concentration of chemical agent; prepared gravimetrically by CTF, U.S. Army Combat Capabilities Development Command (CCDC) Chemical Biological Center (CBC) from neat agent of known purity. Stock A standards will be received from CCDC CBC on a periodic basis, typically annually, and will be at concentrations below the dilute agent thresholds defined in AR 50-6.
Intermediate Standard	A solution with a known mid-level concentration of chemical agent; prepared gravimetrically or volumetrically from a Stock A standard.
Working Standard	A solution with a known low-level concentration of chemical; typically prepared gravimetrically or volumetrically from an intermediate standard.
Calibration Standard	A solution with a known concentration of chemical agent; typically prepared gravimetrically or volumetrically from a working standard. It is used to calibrate the analytical and monitoring instruments that support agent monitoring and environmental analysis.
Challenge Standard	A solution with a known concentration of chemical agent; typically prepared gravimetrically or volumetrically from a working standard. These standards may be prepared from the same working standard as the calibration standards because they are independently prepared from and verified with the verification solutions. It is used to determine the in-control status of the analytical instruments and method performance.
Verification Standard	A solution with a known concentration of chemical agent typically prepared gravimetrically or volumetrically from a working standard. It is used to verify P&A of the calibration standards and challenge standards. Verification standards must be prepared from a different stock solution than was used to prepare the challenge and calibration standard or if only one stock solution is available, then verification standards must be prepared by different operators than those preparing the challenge and calibration standards.

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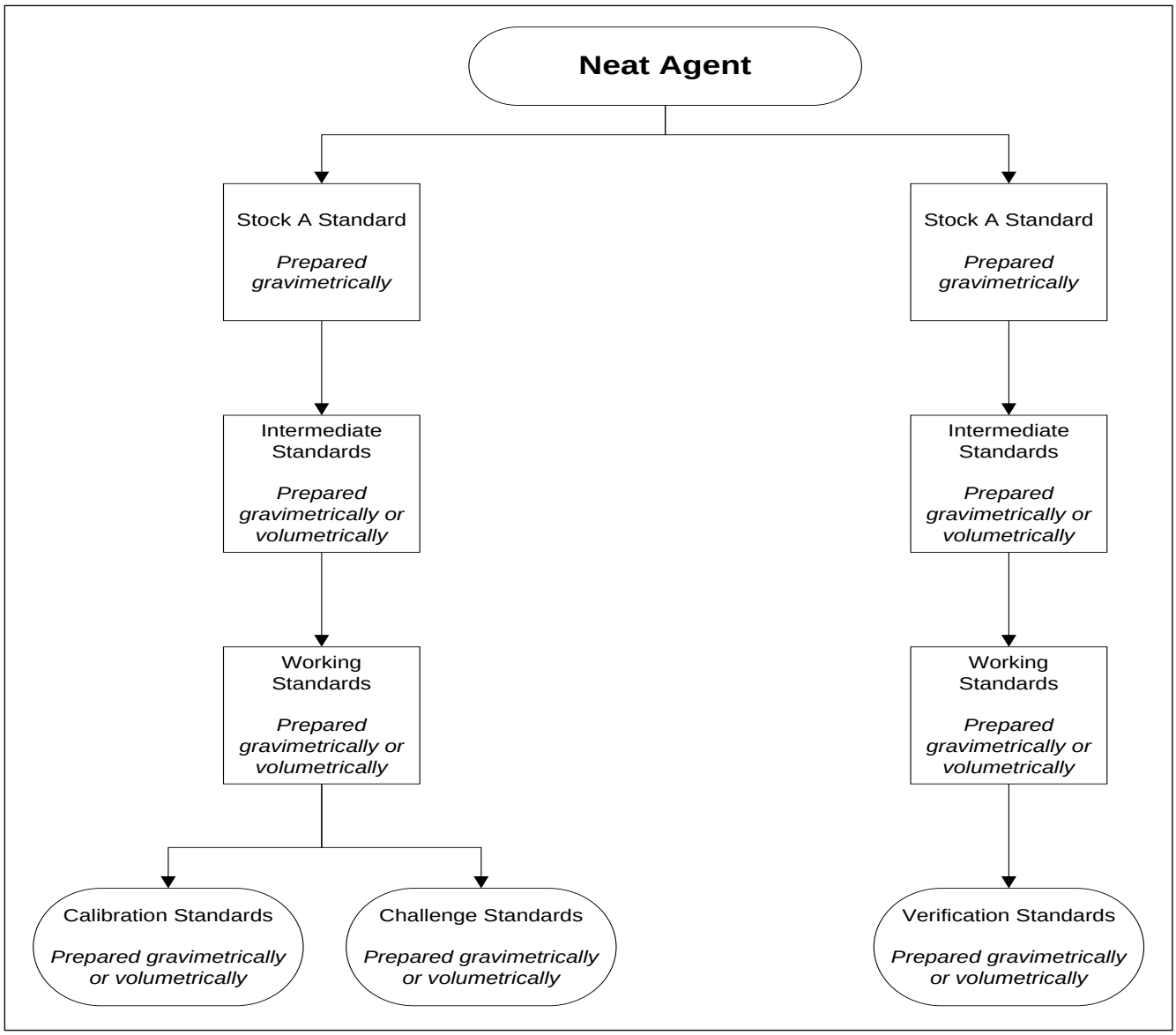
Figure 2 – Preparation Sequence for Chemical Agent Standards



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16.8 Research, Development, Test, and Evaluation Dilute Solution Standards

A. The maximum quantities and concentrations for standards to be considered RDT&E dilute solutions are defined in AR 50-6 and provided in Table 10. The BPBG Laboratory will also track total volume of RDT&E dilute solutions through the LIMS.

Table 10 – RDT&E Dilute Solutions

Agent	Maximum Total Quantity	Maximum Concentration
HD	100 mg	10.0 mg/mL
GB	20 mg	2.0 mg/mL
VX	10 mg	1.0 mg/mL
EA2192	10 mg	1.0 mg/mL

B. Dilute agent intermediate and working standards will be prepared gravimetrically or volumetrically with an accuracy of significant figures equal to that of the Stock A chemical agent standards. Subsequent dilutions will be prepared gravimetrically or volumetrically and verified IAW the frequencies and concentrations listed in Table 11. Intermediate standards may be required to accurately prepare working standards at low concentration levels.

C. Standards that are prepared volumetrically will be diluted from the appropriate stock standard using calibrated pipettes or chromatographic grade syringes.

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Table 11 – RDT&E Dilute Solution Preparation and/or Verification

Agent	Nominal Concentration (mg/mL)	Solvent	Shelf Life[a,c]	Verification Frequency[b]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

NOTE: mg/mL = milligrams per milliliter

[a] Shelf life reflects storage at or below 4°C and indicates duration of the concentration certificate.
[b] Verification Frequency does not apply to certified sealed ampules.
[c] Actual solution shelf life will be specified on the solution's Certificate of Analysis (COA). ACWA approval may be obtained to use a COA shelf life rather than the stated month limit.

D. Working standards will be prepared within 5 percent of the required TC.
E. Calibration and challenge standards may be aliquoted from the same working standard but will be placed in separate vials (two-vial concept). Verification standards will be a controlled set of standards, prepared independently from a separate Stock A standard as previously illustrated (Figure 2, or if only one Stock A solution is available, verification standards may be prepared by a different analyst and from the same Stock A by which the challenge and calibration standards were prepared.)
F. The laboratory will maintain traceability of standards including concentration, solvent name and lot number, date prepared, expiration date, preparer's name, and analysis/verification data.

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16.9 Quality Evaluation of Internal Standards

Internal standards to be used for each chemical agent are specified in LOP 24915-00-9SO-00-00003, *Research, Development, Test, and Evaluation Dilute Agent Operations*. Internal standards will be verified at least once every six months when in use as specified in LOP 24915-00-9SO-00-00003, *Research, Development, Test, and Evaluation Dilute Agent Operations*. If the assays fail to confirm the purity within 5 percent of the manufacturer's listed purity, the standard will be destroyed and a new standard will be used. No internal standard with a purity of less than 85 percent will be used.

16.10 Verification of Working Standards

Working standards (i.e., calibration and/or challenge standards) will be prepared and/or verified monthly. Results are acceptable if the RRF of the solution is 1.0 ±0.1. The RRF will be determined by comparing a working standard against the verification standard. When comparing two standards, the concentrations of the standards must be within the same order of magnitude. The RRF will be calculated using the following equation:

$$RRF = \frac{(AREA_{Working})(CONC_{Verification})}{(AREA_{Verification})(CONC_{Working})}$$

If more than one injection is used for standard verification, the same number of injections will be used for all standards against that verification standard. The AREA then becomes the average area of the injections. Results of standard verification are reviewed and approved by a QC specialist prior to standards being issued.

16.11 Use of Commercially Available Chemical Standards

Where possible, the Laboratory will purchase certified commercial chemical standards and calibration gases. All commercial standards should be traceable to NIST standard reference material. The manufacturer's stated purity will be accepted, unless contamination or interference problems are indicated. Once opened, the container will be labeled with the date opened. Commercial standards will be stored IAW the vendor recommendations. A Certificate of Analysis will be obtained, if available from the vendor. If a certificate of analysis is not available, Laboratory personnel will determine relative purity by appropriate analysis.

16.12 Standards Handling Requirements

When single-contained agent is removed from engineering controls (e.g., spiking DAAMS tubes using a working standard in a GC vial), Laboratory personnel involved with the agent operation will wear PPE as required by the applicable procedure. The *General Laboratory Safety Requirements Plan*, 24915-SAF-9PL-00-00001 addresses the minimum PPE requirements. The handling requirements in Table 12 apply to standards of all concentration levels.

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Table 12 – Standards Handling Requirements

Personnel Criteria	Requirements
Refrigeration	• All standards shall be stored at or below 4°C. • All refrigerators will have temperature monitoring and may have temperature alarms to record when temperature requirements are exceeded. If a temperature alarm is not present, the Laboratory must implement other measures to ensure Stock A standards are not above 4°C for more than 96 hours (e.g., physical routine temperature verification and recording).
Standard Preparation	• All agent solutions diluted from Stock A standards shall be prepared in a suitable grade of organic solvent shown to be of sufficient quality and shall be documented. • Prior to use, all stock standards will be allowed to warm to room temperature. • Immediately following use, all stock standards will be returned to cold storage. • All standards will be traceable to concentration, solvent name and lot number, date prepared, expiration date, identification number for each serial dilution, preparer's name, and analytical date.
Security	• All standards will be secured/controlled.
Containers	• Standards will be stored in suitable containers and working standard vials shall be maintained to minimize evaporation of solvent.

16.13 Storage of Agent Standards

Agent standards will be controlled and stored IAW the requirements of 24915-00-9PR-00-00006, *Laboratory Dilute Chemical Agent Material Handling*.

The Laboratory will store Stock A standards at 4°C or less as measured with a temperature device with an accuracy of ±1°C. Working standards are stored under refrigeration not to exceed 4°C. To maintain agent integrity during storage, all storage freezers and refrigerators will be equipped with a 24-hour temperature monitor and may be equipped with an alarm.

16.14 Disposal of Standard Solutions

Agent standards will be disposed of IAW 24915-00-9SO-00-00003, LOP for *Research, Development, Test and Evaluation (RDT&E) Dilute Agent Operations*.

The Laboratory will maintain accountability of agent standards solutions IAW 24915-00-9PR-00-00006, which will be in compliance with 24915-00-G01-GAZ-00003, *Chemical Surety Management Plan* (CDRL D022).

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17.0 QUALIFICATION, VALIDATION, AND CERTIFICATION REQUIREMENTS

17.1 Introduction

During operations, qualification, validation, and certification requirements will be enforced for operators, methods, monitors, and instruments.

Qualification is achieved by an operator when he/she has sufficiently demonstrated the ability to perform certain tasks, jobs, or assignments and includes successful completion of required training classes. Performance in completing these tasks will be evaluated based upon the quality of data produced when performing the task IAW 24915-00-9PL-00-00003, *Laboratory Training Plan*.

Method validation is achieved when a method and/or process has successfully met all required data quality objectives (DQOs) for that particular type of method. DQO criteria for each method type can be referenced in the LQCP.

Method certification is achieved after administrative tasks for the applicable operator/method are complete.

17.2 Operator Qualification

Operator qualification will be granted based on successfully completing all training requirements including qualification checklists as defined in 24915-00-9PL-00-00003, *Laboratory Training Plan*. The Shift Manager and Department Manager will review and document qualification of operators and conduct requalification when appropriate.

17.3 Method Certification

Analytical methods will be certified prior to generating data to support agent operations. Method certification requirements will be based on the items listed below. Once a method passes certification criteria, it will come under configuration control.

- **Agent Air Monitoring** will complete and be maintained, if required, with one of the following techniques
  - Chemical agent qualitative CONM air methods will complete a Class III certification (refer to section 17.6) and may be used as a gross screening method for Class I methods.
  - DAAMS HISM and quantitative CONM air methods will complete a Class I certification.
  - NRTMs will be required to complete a Class I P&A study as defined in this document (refer to section 17.5).
  - Semi-quantitative analytical and chemical agent process air methods will complete a Class II certification (refer to section 17.6).

- **Waste and process screening methods** will complete and be maintained, if required, with one of the following
  - Method Detection Limit Study as defined in 24915-00-9PL-00-00002, *Laboratory Quality Control Plan.*

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- Lower Limit of Quantification (LLOQ) Study as defined in 24915-00-9PL-00-00002, *Laboratory Quality Control Plan.*
- Class II certification may be used for Agent related methods only. Class II Agent methods for solid and liquid wastes are not required to follow section 17.6. Rather the QC data (e.g., MS/MSD) will be trended to observe if method is still appropriate for each matrix used.
- For some plant process information samples, some of the listed method certifications may not be required to support client needs. In these cases, Laboratory Management may work with the client IAW 24915-00-9PL-00-00002, *Laboratory Quality Control Plan* to design a method certification processes to meet the documented data quality objectives. Sample results acquired with these relaxed criteria may not be used to document compliance with federal, state, or local regulations and/or permits.

- **Other**
  - USEPA SW-846 equivalent certifications when applicable, and/or satisfy all DQOs
  - Unless required by state, federal or other regulation methods used to determine a sample's certain innate physical or chemical properties do not require a certification, if certified/calibrated equipment and or standards are used, so long as the required data quality objectives are demonstrated with each sample batch. A list of methods which do not require certification will be approved by Laboratory and Quality Management.

17.4 Qualification and Re-Qualification Requirements

Laboratory personnel who meet the education, experience, training, and any special requirements necessary to perform assigned responsibilities for a position will become qualified and/or requalified. Personnel become qualified to perform Laboratory duties by completing requirements designated in a Qualification Check List. Specific checklists and qualification requirements for laboratory personnel and the processes for obtaining qualification are defined in 24915-00-9PL-00-00003, *Laboratory Training Plan*.

Qualification requirements are identified by responsible managers who consider education and experience required by the job description, and safety and regulatory requirements.

17.5 Class I Certification and Recertification

A. A Class I P&A study will only be conducted as required by the analytical method. A Class I P&A study is a fully quantitative method that identifies the presence or absence of a chemical agent as well as the concentration of the chemical agent.

B. A Class I P&A study consists of the analysis of 12 chemical agent challenges on 4 days (preferably consecutive) by two or more analysts operating two or more calibrated monitoring instruments. The 12 daily challenges will be duplicated at 0.0, 0.5, 0.75, 1.0, 1.5, and 2.0 times the monitoring levels for a total requirement of 48 challenges. The challenges will be blind QC samples for the analysts. The data generated during the 4-day Class I P&A study will be entered into the Government-supplied and the approved statistical program Certify, or equivalent. This statistical program performs a weighted linear regression analysis on the data to construct the 95 percent confidence bounds of the true concentration. The analytical method will satisfy the following criteria to be validated:

   - Target action level (TAL) is greater than the limit of quantification (LOQ).

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- The uncertainty in found mass (UIFM) is less than or equal to ±25 percent except for instruments with MSD where the UIFM is less than or equal to ±40 percent
- Overall percent recovery at the monitoring level is within 75 to 125 percent for all monitoring levels

C. One analyst and one instrument can perform a Modified Class I certification. It will consist of 12 daily challenges (e.g., duplicating challenges at 0.0, 0.5, 0.75, 1.0, 1.5, and 2.0 times the monitoring level for four days for a total requirement of 48 challenges).

D. Class I or Modified Class I recertification will be required if the instrument configuration is changed, instrument configuration and operating parameters are not within acceptance tolerances established during the P&A study, the continuing baseline requirements cannot be met after all corrective actions have been exhausted, or if a continuing baseline is discontinued.

E. Requirements for recertification of a baseline due to cessation vary depending upon the amount of time the baseline has been discontinued. Refer to the PEO ACWA *Chemical Agent Laboratory and Monitoring Quality Assurance Plan* (LMQAP) for recertification requirements.

17.6 Class II and III Certification and Recertification

A. The Class II P&A study is a semi-quantitative method that can determine whether an analyte is present at or above a defined monitoring level. The study consists of analyzing 10 chemical agent challenges on two days (preferably consecutively) for a total of 20 challenges. Each set of challenge samples will consist of two samples at 1.25 Z, four at 1.0 Z, and four at 0.5 Z, where Z represents the monitoring level. The operator will be given blind QP samples and will not know the TCs until after the FCs are determined. The Class II P&A study acceptance criteria are as follows:

- All samples at the 1.25-Z and 1.0-Z level yield positive response as defined during method development
- No more than 25 percent of the samples at the 0.5-Z level yield a positive response

B. A Class III P&A study may be performed for CONM methods and is a qualitative method only that identifies a positive response of a chemical agent, as defined by the method. The Class III P&A study will consist of analyzing a minimum of 8 QC challenges at the monitoring level and two blank samples for two days (preferably consecutive) for a total of 20 challenges. The operator will not be given the TCs of the sample until the results have been reported. The validation acceptance criteria will be as follows:

- All (100 percent) of the monitoring level QC challenges yield a positive response
- None of the blank samples yield a positive response

C. During method certification, the QL will satisfy the analytical methods' definition for a positive response and will establish the retention time window for the analyte. The QP will yield a positive response and be within the retention time window established by the analysis of the QL.

D. Recertification of a Class II or Class III method will be performed for the same reasons as those for Class I P&A Recertification. Additionally, if the definition of a positive response is changed, the method will be recertified on all instruments using the method.

E. Requirements for recertification of a baseline due to cessation vary depending upon the amount of time the baseline has been discontinued. Refer to the PEO ACWA LMQAP for recertification requirements.

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17.7 United States Environmental Protection Agency SW-846 Equivalent Validation

USEPA SW-846 Equivalent Validation will be used as indicated by the analytical method.

Laboratory waste analytical methods require quantitative reporting that satisfies USEPA guidance, when applicable. As a minimum, the laboratory will complete an MDL, and LLOQ study IAW USEPA 40 CFR 136, Appendix B, or other certification processes as deemed acceptable by Laboratory Management.

17.8 Short-Term Method Validation

USEPA 40 CFR 136, Appendix B, provides guidance for the quantitative and qualitative laboratory analytical methods that may be subject to short-term method validation. This validation will include the determination of the MDL, percent recovery, method bias, and method P&A.

Other analytical methods may require an USEPA SW-846 Equivalent Validation which consists of the analysis of seven replicate samples at the regulatory action level for which the standard deviation will be calculated. This validation will include the determination of percent recovery, method bias, and method P&A.

17.9 USEPA SW-846 Equivalent Validation for Quantitative Reporting

Laboratory waste analytical methods that require quantitative reporting will be developed based on USEPA guidance. The BPBG LQCP summarizes waste screening validation requirements. As a minimum, the Laboratory will determine the MDL, recovery, and precision.

17.10 MDL Qualitative Validation

MDL method validation will be accomplished by calculating the MDL IAW 40 CFR 136 Appendix B. No bias or precision determinations are required for methods with qualitative validation. However, sufficient data will be generated to provide an estimate of P&A. The following items are significant changes in the method and require the performance of a new MDL:

- A change in the type of media used to collect the sample
- Changes in any parameter under configuration control

17.11 Long-Term Method Validation

Validation will be accomplished through the initial and continuing baseline studies or through acceptable performance of continued QC verification samples, depending upon the method type.

17.12 Instrument Certification

Analytical instruments used in BPBG laboratories will be certified prior to participating in an initial baseline study. Instrument certification requirements are defined in the PEO ACWA LMQAP as well as the BPBG LQCP.

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Instruments that have undergone extensive repair, as determined by Laboratory Management, or have not been used for longer than six months require recertification. Such instruments will be recertified by the generation of an acceptable calibration curve and QL (i.e., continuing calibration verification [CCV]) sample for instruments. Instruments that fail to meet these requirements shall be tagged for repair or replacement.

18.0 CALIBRATION AND CHALLENGE REQUIREMENTS

Calibration and challenge requirements will be specific to the method and instrumentation used for each laboratory operation. All calibrations and challenges will be performed at levels necessary to detect chemical agent and other chemicals at the required monitoring levels.

18.1 Method Selection Requirements

If outside laboratories are used for non-agent analyses, Battelle will be responsible for ensuring certified methods and procedures are used and that all data quality objectives are met and/or appropriately qualified.

Where calibration and test methods are not specified, Laboratory management will, whenever possible, select methods that are certified and published as international or national standards, published in peer-reviewed scientific texts or journals, or certified under local testing.

Any method selected will meet environmental regulatory requirements and be legally and technically defensible.

18.2 Recordkeeping Requirements

Laboratory personnel will develop and document the performance tests, preventive maintenance, and acceptance criteria for using and operating all relevant equipment, calibration items, and calibrating equipment. Maintenance and calibration checks will be captured in the LIMS or logbooks, which may be electronic. If information is logged electronically, it will be protected as to prevent inadvertent changes of the original records.

Instructions, standards, manuals, procedures, and reference data will be maintained in the laboratory. These will be readily available to staff and auditors. Records for specific applications will be kept at that application's work location.

Records generated by the Laboratory from analyses for the purposes of waste characterization or permit compliance will be recorded in the LIMS or manually until the LIMS is fully functional.

Laboratory notebooks and/or forms will document manual calculations and handwritten data supporting laboratory operations (e.g., solution preparation, calibration, sample analysis).

18.3 Automated Recordkeeping Requirements

The LIMS will be used to capture, process, manipulate, and report data when fully functional. This may be accomplished manually when the LIMS is offline, but will be converted into the LIMS as LIMS processes are operational.

Computer and automated equipment will be maintained in a controlled environment to ensure proper functioning.

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Software and operating systems will be under configuration control and properly maintained and secured.

LIMS data backups will be performed IAW Bechtel operating procedures and performance will be verified IAW LOPs.

18.4 Other Requirements

The purchase, receipt, and storage of consumable material used for technical operations will meet the requirements of the Laboratory quality system and the Battelle procurement procedures.

18.5 Chemical Agent Calibration Requirements

All calibrations will be performed at levels necessary to detect the chemical agent and industrial chemical at the required monitoring levels. Specific laboratory equipment calibration requirements are defined in the BPBG LQCP.

If an analytical detector system cannot satisfy the acceptance criteria, it will be re-calibrated and corrective actions will be taken until the acceptance criteria are met. Calibrations may be performed after corrective actions, especially if parts are replaced, or when any condition under configuration control is corrected.

18.6 Chemical Agent Challenge Requirements

Calibrated instruments used to quantify the amount of an analyte in a sample will be subject to periodic challenges to check the measurement process from sample collection through analysis. QC criteria and frequency of these periodic challenge requirements are provided in the BPBG LQCP and are to be used to:

- Determine the effectiveness of the implemented corrective actions
- Evaluate the P&A of the analytical data to establish the quality of the data
- Provide an indication when corrective actions are needed

18.7 Physical Measurement Equipment

The calibration requirements for physical measurement by laboratory equipment are defined in 24915-00-9PL-00011, *Laboratory Calibration Plan*. All equipment calibration documentation will be maintained within the LIMS.

18.8 Transfer Lines

18.8.1 Sample Transfer Lines

Sample transfer lines will be heat-traced and their length minimized to maximize transmission efficiency.

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All sample transfer lines will be challenged IAW 24915-00-9SO-AMS-00004, Sample Line Testing at the applicable monitoring level prior to the start of agent operations. During operations, all NRTM sample lines monitoring non-toxic areas will be challenged within a 2-month period or as specified in the LQCP. When a sample line is replaced, the new line will be challenged. Sample lines for NRTMs monitoring toxic areas will be challenged prior to toxic operations for transmission efficiency and between the GB and VX campaigns.

Each sample transfer line will be uniquely identified and labeled at both ends.

18.8.2 Exhaust Lines

Exhaust return lines are required on all NRT and DAAMS stations monitoring potentially toxic areas. Exhaust lines will be uniquely labeled at both ends. Exhaust lines will be filtered, returned straight to the sampling point (no tee connections), or vented to engineering controls that prevent release to the workplace/environment.

18.8.3 LSS Air Line Manifolds

The LSS station sample lines will be challenged with the chemical agent of interest prior to first use and at campaign changeover. This challenge will be at the distal end of the sample line.

19.0 QUALITY CONTROL SAMPLE REQUIREMENTS

19.1 Air Method QC Samples

[redacted]

[redacted]

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[redacted]

19.2 Calibration Verification Samples

[redacted]

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[redacted]

19.3 Data Quality Objectives

A. The BPBG LQCP provides the minimum DQOs for solid/liquid waste analysis methods. DQOs should be specified for each analytical method and technique. They will address the following data characteristics:
   - Precision
   - Accuracy
   - Representativeness
   - Completeness
   - Comparability

B. Surveillances will be conducted by the Quality Branch and reported to the Laboratory oversight representative for the Government Field Office, as requested.

19.4 Non-Standard Test Protocol

NSTP is a process used at BGCAPP to complete special studies or projects that may fall outside of an established LOP. NSTPs may have different calibration, challenge, or DQO requirements than what has been set forth in this document. All NSTPs will be established IAW BGCAPP site procedures and will include management and Laboratory Safety review prior to execution.

20.0 PREVENTIVE MAINTENANCE

20.1 Introduction

The term "preventive maintenance" refers to scheduled procedures that are intended to maintain a product or system at a specified level of performance. Systematic inspection, detection, servicing, calibration, and/or replacement of critical parts will enable operators to prevent any malfunction in the equipment that might result in inaccurate analyses. Hardware associated with air monitoring equipment and laboratory equipment will be maintained IAW the manufacturer's O&M manual recommendations. All preventive maintenance performed on the equipment will be scheduled and documented. Laboratory personnel will maintain maintenance logs, which may be electronic, on each analytical instrument and monitor for recording and tracking preventive maintenance. Tracking preventive maintenance ensures proficiency in implementation of corrective actions.

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20.2 Near Real-Time Monitors

NRTM preventive maintenance will be performed IAW the O&M manual recommendations and will be documented in the instrument logbook.

20.3 DAAMS Sample Stations

DAAMS sample station preventive maintenance will be performed IAW manufacturer's specifications and will be documented in the equipment logbook.

20.4 Gas Chromatographs, High-Performance Liquid Chromatograph, and Inductively Coupled Plasma Mass Spectrometer (LC-QQQ)

Preventive maintenance will be performed IAW O&M manuals and will be documented in the instrument logbook. Operator maintenance will focus on maintaining injectors, detectors, columns, reagents, and performing diagnostic tests.

20.5 Physical Measurement Equipment

Physical measurement equipment (e.g., flowmeters, balances) checks and calibrations, and their preventive maintenance requirements are documented in the associated methods, logbooks, and/or LOPs.

20.6 Preventive Maintenance Personnel

The personnel responsible for operating the equipment will also perform preventive maintenance on the equipment. If an outside vendor is contracted for maintenance activities, the equipment operator will be responsible for ensuring all maintenance is scheduled and performed IAW the manufacturer's recommendations and documented in the instrument logbook.

21.0 CORRECTIVE ACTIONS

21.1 Immediate Corrective Actions

Immediate corrective action by an operator will be required when response to a given QC sample is unacceptable. Corrective actions will be recorded in the applicable instrumentation logbook which may be electronic or hardcopy. The effectiveness of the corrective action will be verified by challenging the instrument with a monitoring level challenge that produces an acceptable response. An operator unable to solve the problem will inform Laboratory management who may initiate long-term corrective action.

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21.2 Long-Term Corrective Actions

Long-term corrective actions will be designed to define and resolve systematic problems, if they exist. The basic steps include the following:

- Assign a responsible person(s) to define the problem, determine root cause(s), and implement corrective action
- Conduct surveillance or trend analysis on performance of operators, instruments, or station location, as appropriate
- Define the problem
- Document the corrective action in the applicable instrument logbook
- Verify effectiveness of the corrective action

21.3 Preventive Actions: Trends, Bias, and Accuracy

Analyst errors, instrument instability, contamination of the samples, interferences or analytes in the method blanks, poor reagent quality, or fluctuations of the laboratory environment may cause bias. Inaccuracy can be caused by incorrect calibrations, losses of analyte during sample preparation or analysis, bias, errors by the analyst, matrix effects, instrument drift, and contamination of the sample or standards. The Laboratory may track, trend, and measure potential bias. Areas identified for further investigation, and any subsequent corrective actions, will be tracked as appropriate.

22.0 REFERENCES

- 24915-00-2KP-A03-50000, *Development and Management of Documents*
- 24915-00-3YD-00-00007, *System Design Description for Agent Monitoring*
- 24915-00-9MP-AMS-00001, *MINICAMS/DAAMS Monitoring Table*
- 24915-00-9PL-00-00002, *Laboratory Quality Control Plan* (CDRL D006)
- 24915-00-9PL-00-00003, *Laboratory Training Plan*
- 24915-00-9PL-00-00009, *Perimeter Monitoring Plan*
- 24915-00-9PL-00-00010, *Laboratory Data Management Plan*
- 24915-00-9PL-00-00011, *Laboratory Calibration Plan*
- 24915-00-9PR-00-00006, *Laboratory Dilute Chemical Agent Material Handling*
- 24915-00-9PR-00-00016, *Interferent Control*
- 24915-00-9PR-00011, *Monitoring Configuration Control Procedure*
- 24915-00-9PR-LIMS-00001, *Laboratory Software Engineering and Configuration Control*
- 24915-00-9SO-00-00003, *Research, Development, Test, and Evaluation (RDT&E) Dilute Agent Operations*
- 24915-00-9SO-00-00004, *Laboratory Sample Collection*
- 24915-00-9SO-00-00006, *DAAMS Spiking and Analysis*
- 24915-00-9SO-00-00007, *Laboratory Waste Management* (CDRL D012)
- 24915-00-9SO-00-00010, *Life Support Air System*

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- 24915-00-9SO-00-00012, *Acceptance Testing and Reconditioning for DAAMS Tubes*
- 24915-00-9SO-AMS-00003, *Air Monitoring System (AMS) Malfunction and Alarm Response*
- 24915-00-9SO-AMS-00004, *Sample Line Testing*
- 24915-00-G01-GAZ-00003, *Chemical Surety Management Plan* (CDRL D022)
- 24915-00-GPP-GHX-00411, *Worker Population Limit (WPL) Exceedance Response*
- 24915-00-JA-AMS-00002, *Near Real Time and History Monitors Components Table Instrument Diagram*
- 24915-00-JA-AMS-00003, *Near Real Time and History Monitors Components Table Instrument Diagram*
- 24915-00-JA-AMS-00004, *Near Real Time and History Monitors Components Table Instrument Diagram*
- 24915-00-LAC-GAM-02560a02, *PEO ACWA, Chemical Agent Monitoring Concept Plan (MCP)*, November 2012
- 24915-00-LAC-GAM-04952a02, PEO ACWA, *Chemical Agent Laboratory and Monitoring Quality Assurance Plan* (LMQAP), October 14, 2015
- 24915-70-G01-GGOP-00001, *Explosive Destruction Technology (EDT) Limiting Conditions of Operation*
- 24915-70-J2-AMS-00101, *EDT Facility – EDT Enclosure Building/IONEX 16000 Air Monitoring System Location Plan*
- 24915-70-J2-AMS-00102, *EDT Facility – Monitor House/IONEX 4000 Air Monitoring System Location Plan*
- 24915-70-J2-AMS-00103, *EDT Facility – EDT Enclosure Building/IONEX 16000 Analytical Gases/Vac./Sample Return*
- 24915-70-J2-AMS-00104, *EDT Facility – Monitor House/IONEX 4000 Analytical Gases/Vac./Sample Return*
- 24915-70-J2-AMS-00105, *EDT Facility – EDT Service Magazine Air Monitoring System Location Plan*
- 24915-70-J2-AMS-00106, *EDT Facility – EDT Service Magazine Analytical Gases/Vac./Sample Return*
- 24915-GEN-5PL-00-00006, *Equipment Decontamination Plan*
- 24915-GEN-5PR-00-00020, *Limiting Conditions of Operation*
- 24915-SAF-5PR-00-00023, *Toxic Chemical Agent Safety*
- 29 CFR 1910, *Occupational Safety and Health Standards*
- 29 CFR 1910.101, *Compressed Gasses (general requirements)*
- 40 CFR 136, Appendix B, *Definition and Procedure for the Determination of the Method Detection Limit*
- 40 CFR 261, *Identification and Listing of Hazardous Waste*
- American National Standards Institute/American Society for Quality (ANSI/ASQ) Z1.4-2008
- AR 385-10, *The Army Safety Program*
- AR 50-6, *Chemical Surety*
- AR 700-68, *Storage and Handling of Liquefied and Gaseous Compressed Gasses and Their Full and Empty Cylinders*

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- Compressed Gas Association Pamphlet P-1, *Safe Handling of Compressed Gasses in Containers*
- DA PAM 385-61, *Toxic Chemical Agent Safety Standards*
- U.S. Army Chemical Materials Agency, *Guidelines for RDT&E Dilute Solution Laboratory Operations*, February 2008
- USEPA, *Method Detection Limit*
- USEPA, SW-846, *Test Methods*

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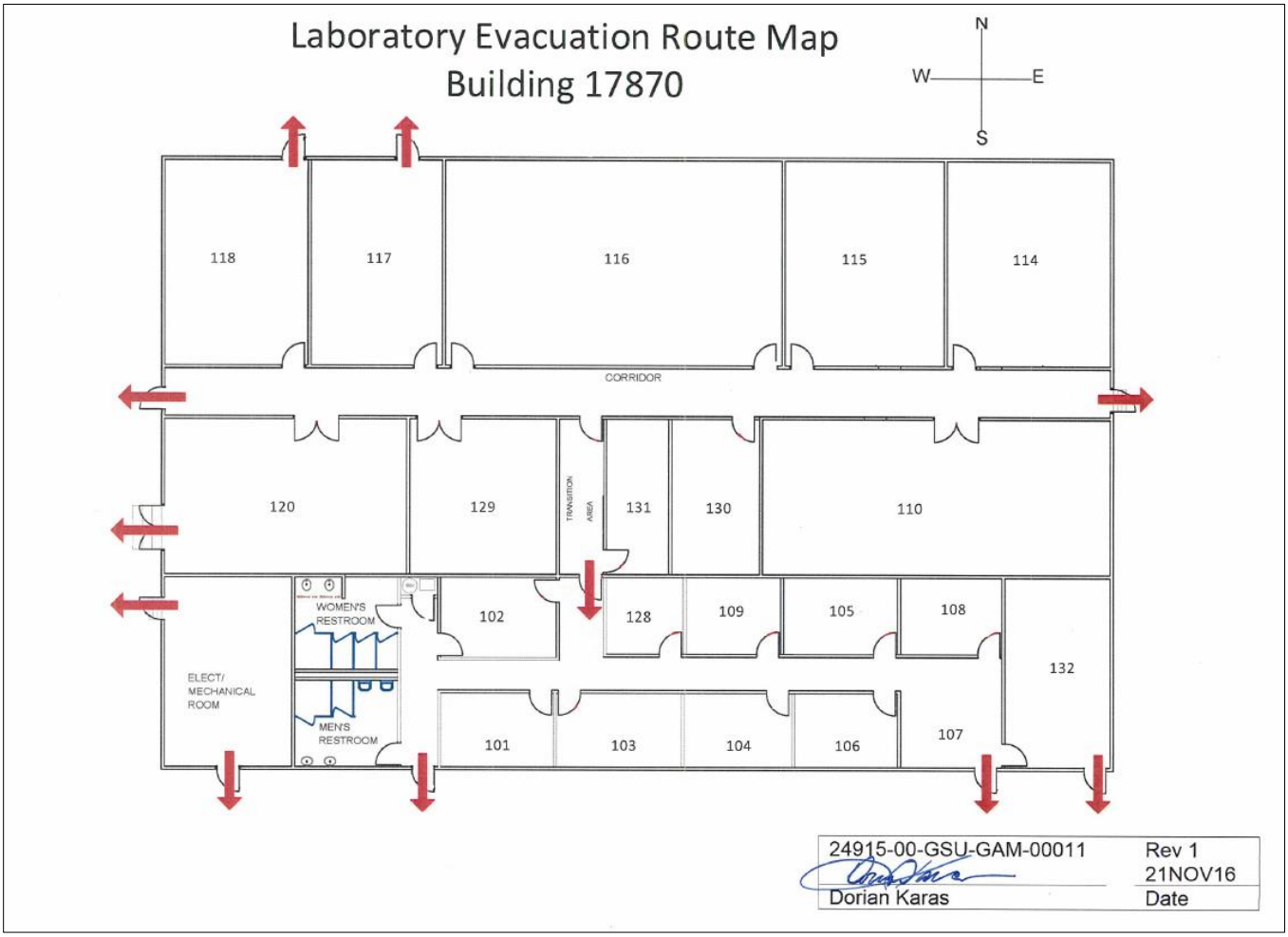
Attachment 1 – Layout of Laboratory



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