Department of the Army

Program Manager for

Chemical Demilitarization

Aberdeen Proving Ground, Maryland

Chemical Stockpile Disposal Program

Programmatic Process
Functional Analysis Workbook (FAWB)

Book 31 - Automatic Continuous Air Monitoring System

ACAMS

Revision 0

April 10, 2003

NOTE: The ACAMS programmatic process FAWB applies to ANCDF, PBCDF, TOCDF and UMCDF.

ALL FAWB SYSTEMS

Book (Chapter[1])	System Identifier	FAWB Title
UTILITY SYSTEMS (Site-specific)		
1 (5.15)	NGLPG	Fuel Gas System (Natural Gas and Liquefied Petroleum Gas)
2 (5.14)	HYPU	Hydraulic Power Unit and Distribution System
3 (5.19)	BCS	Bulk Chemical Storage System
4 (5.16)	CAS	Compressed Air Systems (Plant, Instrument, and Life Support)
5 (5.22)	SGS	Steam Generation System
6 (5.26)	DMS	Door Monitoring System
7 (5.28)	PCS	Primary Cooling Systems
8 (5.12)	EPS	Electrical Distribution and Emergency Power System
9 (5.13)	—	(HVAC FAWB moved to Book 20 (Process Systems))
10 (5.17)	WATER	Water Systems (Process Water, Potable Water, and Water Treatment Systems)
11 (5.21)	CDSS	Central Decon Supply System
12 (5.18)	TSHS	Toxic Storage and Handling Systems (Agent Collection, Spent Decon, and Sumps)
13 (5.20)	ACSWS	Acid and Caustic Storage and Wash System (DELETED[2])
14 (5.27)	FDSS	Fire Detection and Suppression System
15 -19	—	(not assigned; reserved for future use)
PROCESS SYSTEMS (Programmatic)		
20	HVAC	Heating, Ventilation, and Air Conditioning System
21	RHS	Rocket Handling System
22	PHS	Projectile Handling System
23	MHS	Mine Handling System
24	BCHS	Bulk Container Handling System
25	DFS	Deactivation Furnace System
26	LIC	Liquid Incineration System
27	MPF	Metal Parts Furnace System
28[3]	PAS/PFS	DFS, LIC, and MPF Pollution Abatement System and PAS Filter System
29	BRA	Brine Reduction Area and BRA PAS
30	CHB	Container Handling Building
31	ACAMS	Automatic Continuous Air Monitoring System
32	TCE	Treaty Compliance Equipment
33[4]	DUN	Dunnage Incineration System and DUN PAS

[1] TOCDF has original “chapter” numbers for utility system FAWBs.

[2] The ACSWS FAWB was deleted.

[3] The PAS and PFS draft FAWBs were combined into a single PAS/PFS FAWB (Book 28).

[4] A DUN FAWB is not being developed per direction of PMCSD on 9-10-98.

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REVISION LOG

REV.#	PAGE(S)	REFERENCE AND DESCRIPTION OF CHANGE
0	NA	Initial Issue

SECTION 1
INTRODUCTION

1.1 CSD PROJECT BASELINE TECHNOLOGY OVERVIEW

The Office of the Project Manager for Chemical Stockpile Disposal (PMCSD) is responsible for the disposal of the United States' existing unitary chemical weapon stockpile. PMCSD manages execution of the design, construction, equipment acquisition/installation, systemization, plant operations, and closure of all CSD project sites.

The CSD project baseline technology consists of the following:

- mechanical disassembly or puncturing the munitions to remove chemical agent and any explosives or propellant,
- incineration of the chemical agent and any explosives and propellant, and
- thermal detoxification of metal parts and any contaminated dunnage.

This technology was demonstrated during a series of operational verification testing (OVT) campaigns at the Johnston Atoll Chemical Agent Disposal System (JACADS). JACADS represented the first generation of a full-scale facility implementation of the project baseline technology. JACADS completed disposal of the chemical agent and munitions stockpiled at Johnston Atoll in November, 2000.

The second generation plants implementing the baseline technology include the following:

- Anniston Chemical Agent Disposal Facility (ANCDF), located at the Anniston Army Depot near Anniston, Alabama;
- Pine Bluff Chemical Agent Disposal Facility (PBCDF), located at the Pine Bluff Arsenal near Pine Bluff, Arkansas;
- Tooele Chemical Agent Disposal Facility (TOCDF), located at the Deseret Chemical Depot in Tooele, Utah; and,
- Umatilla Chemical Agent Disposal Facility (UMCDF), located at the Umatilla Chemical Depot near Hermiston, Oregon.

Unless otherwise noted, the programmatic functional analysis workbooks (FAWBs) for process systems apply to each of these CSD sites.

1.2 BACKGROUND

FAWBs for 25 plant systems were issued for JACADS in January 1985 by The Ralph M. Parsons Company (now the Parsons Infrastructure & Technology Group, Inc.). Parsons is the Design and Systems Integration Contractor (DSIC) for the CSD project. The FAWBs provided the basis for the facility control system's programmable logic controller (PLC) and computer systems programming. The JACADS FAWBs were later revised by United Engineers & Constructors and, by the July 1989 issue, two additional systems had been added.

FAWBs for TOCDF were issued in April 1993 by Parsons. There were 28 plant systems defined for TOCDF; however, only 27 FAWBs were issued (The Residue Handling Area FAWB was not issued). Most of the TOCDF plant systems were the same as those for JACADS; however, there were some differences due to different plant configurations, system consolidations, and the inclusion of additional systems. The TOCDF systems contractor (SC) received the FAWBs and assumed responsibility for maintaining the set current with the TOCDF plant configuration and the evolution of its operational strategy. Utility system FAWBs also were developed for ANCDF, PBCDF and UMCDF. Their purpose is to assist the sites during utility systems equipment procurement, and to describe their use in facility operation. Utility system FAWBs are more site-specific, consist primarily of SC-procured equipment, and will be maintained by the individual demilitarization sites.

In September 1997, PMCSD began the development of programmatic process FAWBs for process systems common to all sites, eliminating the need to maintain separate process FAWBs at each site. Having a single set of process FAWBs provides a means to ensure operational consistency between the sites and to accurately record differences between the demil facilities. The programmatic process FAWBs serve as an invaluable training tool for the Systems Contractor for Training (SCT) to ensure consistent training on process systems for all sites, and to quickly identify site-specific training requirements.

1.3 PROGRAMMATIC PROCESS FAWB SYSTEMS

Sixteen process systems having minimal differences between sites were designated as programmatic systems. These programmatic process FAWBs are maintained as a single reference rather than at each site. Minor site configuration differences between the sites are highlighted in the FAWB discussions and tables. Fourteen of these 16 systems were included in the 28 original plant system FAWBs developed by the DSIC. For conciseness, the dunnage incinerator (DUN) and DUN pollution abatement system (PAS) FAWBs were to be combined into a single FAWB, for a total of 15 programmatic process FAWBs. However, development of a programmatic FAWB for the DUN and DUN PAS was suspended indefinitely at the direction of the PMCSD Operations Team (see FAWB Note B-1). In addition, FAWBs for the wet PAS and the PAS filter system (PFS) were combined into a single FAWB (see FAWB Note B-2). Therefore, a total of 13 programmatic FAWBs were developed for the process systems. The heating, ventilating, and air-conditioning (HVAC) FAWB originally was included as one of the utility system FAWBs produced for ANCDF in 1996 (HVAC FAWB was Book 9 for ANCDF Utility FAWBs). It has been recategorized as a process system and is included in the set of programmatic process FAWBs.

The programmatic process FAWBs are numbered in accordance with the convention established during production of the ANCDF and UMCDF utility system FAWBs. This convention reserves book numbers 1 through 19 for utility systems, and book numbers 20 through 34 for the process FAWBs. Programmatic process FAWB book numbers and titles are listed in Table 1.1. The original TOCDF FAWB chapter numbers are shown for reference.

Twelve of the 28 original plant system FAWBs are designated as site-specific utility systems. For these systems, the SC is delivered an initial utility FAWB indicating the system design configuration and operational strategy. The SC maintains the utility FAWBs to reflect the site-specific configuration. The utility FAWBs are listed in Table 1.2; original TOCDF FAWB chapter numbers are shown for reference.

The two remaining systems of the 28 originally planned plant system FAWBs are the acid and caustic storage and wash system (ACSWS) (5.20) and the residue handling area (5.24). The ACSWS FAWB at TOCDF no longer is maintained and has not been developed for follow-on sites (see FAWB Note B-3). A FAWB for the residue handling area was not produced due to its lack of automatic control features.

Table 1.1 Programmatic Process FAWBs

FAWB Book #	FAWB Title (TOCDF FAWB Chapter #)
20	Munitions Demilitarization Building HVAC (5.13)
21	Rocket Handling System (5.1)
22	Projectile Handling System (5.2)
23	Mine Handling System (5.3)
24	Bulk Container Handling System (5.4)
25	Deactivation Furnace System (DFS) (5.5)
26	Liquid Incinerator (LIC) System (5.6)
27	Metal Parts Furnace (MPF) System (5.7)
28[1]	DFS, LIC, and MPF Pollution Abatement System and PAS Filter System (5.9)
29	Brine Reduction Area (BRA) and BRA PAS (5.23)
30	Container Handling Building (5.11)
31	Automatic Continuous Air Monitoring System (5.25)
32	Treaty Compliance Equipment (Not included in original FAWB)
33[2]	DUN System and DUN PAS (5.8 & 5.10)

[1] Per discussions held during the comment resolution matrix meeting for the PAS FAWB on 11-10-98, the draft programmatic process FAWBs for the PAS and PFS were combined into a single PAS/PFS FAWB, Book 28 (See FAWB Note B-2).

[2] As directed at the FAWB teleconference on 9-10-98, a programmatic process FAWB for the DUN/DUN PAS is not being developed (See FAWB Note B-1).

Table 1.2 Site-Specific Utility FAWBs

FAWB Book #	FAWB Title (TOCDF FAWB Chapter #)
1	Fuel Gas System (5.15)
2	Hydraulic Power Unit and Distribution System (5.14)
3	Bulk Chemical Storage System (5.19)
4	Compressed Air Systems (5.16)
5	Steam Generation System (5.22)
6	Door Monitoring System (5.26)
7	Primary Cooling System (5.28)
8	Electrical Distribution & Emergency Power System (5.12)
9	Not used; formerly HVAC
10	Water Systems (5.17)
11	Central Decon Supply System (5.21)
12	Toxic Storage and Handling Systems (5.18)
13	Not used; formerly acid and caustic storage and wash system
14	Fire Detection and Protection System (5.27)
15 - 19	Not assigned; reserved for future use

1.4 PROGRAMMATIC PROCESS FAWB PURPOSE

The programmatic process FAWBs serve as a repository for all control information for the automated aspects of the baseline technology demilitarization process systems. They serve as one of the source documents for PLC control system and computer system programming, operator training, and facility operation. These FAWBs also serve as programmatic reference documents that define how the process systems operate and capture the differences between facility operational configurations. Each programmatic process FAWB contains a subsection that defines the system boundaries and identifies the interfaces with other plant process and utility systems.

Programmatic process FAWBs are living documents, subject to configuration control under the CSD project Participant Quality Assurance Plan. They are meant to be continuously updated with user input whenever system modifications are made, or as needed to enhance the information presented. Programmatic process FAWB revisions are implemented as outlined in Section 1.6. The process by which the SCT maintains the programmatic process FAWBs and the roles and responsibilities of each organization affiliated with the CSD project are described in detail in the Programmatic Process FAWB Maintenance Plan.

Programmatic Process FAWB Limitations

Even though the FAWBs contain detailed descriptions of the configuration and control for each process system, they are not all-inclusive. Every effort is made to include the level of detail necessary to fully describe the specific operating configuration for each process system. Each process FAWB includes supporting references to direct the user to relevant programmatic and site-specific documentation (e.g., standing operating procedures, drawings).

Because of the revision cycle time, there will be a slight lag time between recent changes and their reflection in the FAWB. Maintenance of the FAWBs will be done semiannually, or more frequently if needed, to reflect significant modifications.

The FAWB maintenance program relies heavily on input from each baseline technology demilitarization site. Timely and accurate input ensures that the FAWBs reflect the current configuration at each of the sites. All information received will be thoroughly reviewed to ensure consistent and accurate documentation.

As a programmatic document, the FAWBs describe the configuration and operation of four separate facilities. Care must be taken by the user to ensure that the information extracted from this document reflects the configuration for the facility of interest. Site-specific differences are highlighted in both the text and the appendices to avoid confusion.

1.5 PROGRAMMATIC PROCESS FAWB ORGANIZATION

The process FAWBs document the chemical demilitarization facility operations at ANCDF, PBCDF, TOCDF, and UMCDF. The format and structure of the programmatic process FAWBs differ from the original format prepared by the DSIC, and from the format previously maintained at TOCDF. The information from earlier versions has been retained and updated to reflect lessons learned from the design, construction, systemization, and operation of the demilitarization facilities, including JACADS and the Chemical Agent Munition Disposal System (CAMDS). The overall layout of the programmatic process FAWBs is shown in Table 1-3.

1.6 PROGRAMMATIC PROCESS FAWB REVISIONS

The programmatic process FAWBs are maintained by the SCT to reflect the operational and control system configuration at each CSD site that implements the baseline destruction technology. Each programmatic process FAWB will be reviewed and revised, as required, on a semiannual basis. Individual process FAWBs can be revised more frequently, if needed, to reflect significant configuration changes. Programmatic process FAWB modifications can be generated by the following:

- Engineering change proposals at any of the CSD sites
- CSD project programmatic lessons learned
- Operational modifications that do not involve configuration changes
- Programmatic changes
- Need for greater detail or clarification

The programmatic process FAWB maintenance plan identifies the organizations that participate in the FAWB maintenance program and the responsibilities of each to supply information that could result in revisions to the FAWB. All organizations are represented on the FAWB Evolvement/Evaluation Team (FEET), and are involved with review of each FAWB revision to ensure that the site configuration and operating strategy is current.

Table 1.3 Organization of the Programmatic Process FAWBs

Section	Title	Contents
1	Introduction	General FAWB background, organization, and revision method
2	System Overview	Purpose of the system; operational and process design basis summary; system boundaries and interfaces
3	Process Description	Description of subsystems; control sequences
4	Component Summary	Tables listing parameters for primary components; power source listings
App. A	Acronyms and Abbreviations	
App. B	FAWB Notes	Notes that provide additional detail or background information
App. C	Alarm and Interlock Matrices	Programmatic matrices or matrices for each site
App. D	PLC Automatic Control Sequences	Automatic logic contained in the PLC code; burner management system automatic controls; sequencer logic for demil systems
App. E	Operator Screens	Advisor PC screens for each site
App. F	Instrument Ranges	Tables showing instrument ranges and setpoints
App. G	Intercontroller Communications	Tables listing the digital intercontroller inputs/outputs (DICIs/DICOs)
App. H	References	Listing of reference documents, including drawings, used to prepare and maintain the FAWB

SECTION 2
SYSTEM OVERVIEW

2.1 PURPOSE AND FUNCTION

The automatic continuous air monitoring system (ACAMS) is an automatic near real-time[1] (NRT) air monitoring system that collects compounds present in the air on a solid, sorbent trap, thermally desorbs them into a capillary column for separation, and then detects the agent with a flame photometric detector (FPD). ACAMS monitors are used at CSD project sites to detect and report airborne concentration levels of the nonpersistent nerve agent GB, the persistent nerve agent VX, and the blister agents H, HD, and HT. The ACAMS can detect agent present in ambient air, furnace exhaust, filter units, and highly contaminated areas. The primary purpose of the ACAMS is to protect personnel by sounding an alarm when detected agent levels exceed a preset limit.

2.2 OPERATIONAL SUMMARY

The ACAMS provides continuous NRT air monitoring for areas where agent could be present. The ACAMS presents a direct readout of agent concentration in monitoring level units on a gas plasma display (GPD) at the end of each sampling and analysis period. Agent quantity associated with the detected monitoring levels can be calculated based on the ACAMS's daily calibration of instrument response, sample collection time and flow rate through the preconcentrator tube (PCT). A local strip chart recorder provides real-time, local hardcopy display of the ACAMS chromatogram and the hazard level. Audible and visual alarms are generated in the control room (CON) for ACAMS units that monitor category A, B, C, and D areas. Local audible and visual alarms are also generated directly at the ACAMS stations for category C and D areas to allow unprotected workers to don protective clothing in the event of a potential agent release/exposure. The signal output and status of all ACAMS stations, with a few exceptions, are sent to the CON.

The ACAMS samples air for a specified sampling period, depending on monitoring hazard level. Agent present in the sampling stream is collected on the solid, sorbent bed of the PCT for the specified sample period and thermally desorbed off the PCT during the ACAMS purge period. The desorbed sample passes into a gas chromatograph module where the individual components are separated in the analytical column and then into a flame photometric detector (FPD) for detection and quantification. The results are displayed on the front panel of the ACAMS. The chromatogram and agent concentration are permanently recorded on the strip-chart recorder. An analog output signal giving the agent concentration is transmitted via programmable logic controller (PLC) to the CON and recorded by the process data acquisition and recording system (PDARS). An audible

[1] NRT monitors are capable of providing detection of chemical warfare materiel in less than 15 minutes (Ref: Department of the Army Pamphlet 385-61).

and visible alarm signal is generated locally when the agent hazard level equals or exceeds a preset alarm level. An ACAMS signal indicating this alarm condition is sent to the CON for annunciation. Additional alarms are programmed in the PLC to alert operators at different agent concentration values, depending on the monitoring level.

ACAMS units can be operated at six different monitoring levels[2]. Two of the levels, time-weighted average (TWA) and immediately dangerous to life and health (IDLH), are considered hazard levels because they were established based on specific health-based criteria. The other four monitoring levels are considered engineering control levels, which are used to evaluate a process for abnormal agent levels and to govern control of protected personnel in, or egressing from, toxic areas.

ACAMS units can be used to monitor the agents and levels specified in Table 2.1 as fourteen different modes of operation. The ACAMS can operate in only one mode of operation at a time.

Table 2.1. CSD Project ACAMS Monitoring Levels

Monitoring Level	GB	VX	HD[3]
Time-Weighted Average (TWA)	X	X	X
Immediately Dangerous to Life and Health (IDLH)	X	X	
Gross Detection Level (GDL)			X
Maximum Permissible Limit (MPL)	X		X
Allowable Stack Concentration (ASC)	X	X	X
Engineering Control Level (ECL)	X	X	X

The three ASC modes of operation are used to monitor furnace and incinerator stack gases and require the use of a stack sampling probe assembly, and a dilution airflow controller (DAFC). In the MPL mode, a low-volume sampler (LVS) is required. An LVS can also be used to support operation in the IDLH mode.

ACAMS monitors support both single point and multipoint sampling systems. Single-point sampling ACAMS monitors are connected via a heat-traced sample transfer line to the sample point or sample probe. They continuously monitor a single sampling point unless the normal sampling line is disconnected and a sampling line for a different sampling point is attached.

Multipoint sampling ACAMS monitors automatically sample multiple sampling points using solenoid valves that cycle on and off in a specified sequence to allow sampling via individual, heat-traced sample lines. The solenoid valves and sampling sequence are

[2] The ACAMS software does not display all six monitoring levels as identified by the names used in the text (see FAWB Note B-4).

[3] The ACAMS has only a single blister agent configuration, the HD configuration, which is used to monitor for any of the blister agents H, HD or HT (see FAWB Note B-5).

controlled by the PLC. Multipoint sampling ACAMS monitors are used to monitor multiple points in each of the MDB heating, ventilating, and air-conditioning exhaust air filtration units.

Some plant locations only require intermittent monitoring and have no regularly assigned ACAMS monitor. The ACAMS station equipment consists of a sample line only. When monitoring is needed, an adjacent ACAMS is connected to the sample line. In some cases, the line is arranged on spool that allows it to be reeled out and moved to the sampling point.

Select ACAMS data are acquired by the PDARS and permanently archived. The ACAMS monitor status (e.g., power on, alarm, malfunction), the agent and concentration/level being monitored, and the operational mode (e.g., operate, service, calibrate) are sent to the PDARS by the PLC. Whenever the detected concentration value is updated, or if the operational mode changes or the ACAMS goes into one of the alarm conditions, the ACAMS data is captured by PDARS and archived; otherwise it is not recorded.

2.3 PROCESS DESIGN BASIS SUMMARY

The ACAMS, with the various accessories, subsystem components and hazard monitoring operational modes, is designed to conduct NRT chemical-agent air monitoring for worker safety and process control. The general ACAMS monitoring requirements are presented in the Project Manager for Chemical Stockpile Disposal (PMCSD) Specific Monitoring Concept Plan (MCP), which is an attachment to the Program Manager for Chemical Demilitarization (PMCD) Programmatic MCP. At TOCDF, specific sampling locations and quantity of ACAMS monitoring stations are specified in the TOCDF Agent Monitoring Plan. ANCDF, PBCDF, and UMCDF designs include ACAMS monitors at specific locations in the plant. In addition, these sites have, or are developing, Laboratory Analysis and Monitoring Plans that identify all monitoring stations used during process operations.

The ACAMS interface with the plant control system is required to be tested and systemized prior to operations. Successful systemization ensures that the PLC software and ACAMS software are working properly and are integrated so that relaying signals, commands, and data are communicated properly. Electronic archiving of required data must be demonstrated. PDARS systemization is required by the PMCSD Specific Laboratory Quality Assurance Plan (LQAP) Appendix A, which is an attachment to the PMCD Programmatic LQAP.

All ACAMS monitors, with the exception of a very few mobile, locally alarming ACAMS units, are required to have their data recorded by PDARS. The locally alarming ACAMS units that are not connected to the plant control system are used for process monitoring to provide contamination information for local activities, such as assessing the state of contamination of equipment or waste in toxic maintenance activities.

2.4 SYSTEM BOUNDARIES AND INTERFACES

The ACAMS system consists of the instrumentation and components associated with individual ACAMS units. Some ACAMS monitors interface directly with furnace systems[4]. Major system interfaces include the following:

(1) HVAC: ACAMS units are used to monitor for agent in the filter banks of the MDB exhaust filtration units. In addition, rooms in the MDB that have ACAMS monitoring are serviced by the MDB HVAC system.

(2) Deactivation Furnace System (DFS): ACAMS units continuously monitor for the presence of agent in the DFS exhaust duct, at the common stack, and, at sites with a PFS, in the exhaust duct before the PFS filter units[5]. The DFS cyclone enclosure is also continuously monitored by an ACAMS unit. At TOCDF, the HDC bin is monitored by an ACAMS, DAAMS, or a real-time analytical platform system (RTAPS) monitor (see FAWB Note B-6) prior to changeout.

(3) Liquid Incinerator System (LIC): ACAMS units continuously monitor for the presence of agent in the LIC exhaust duct, at the common stack, and, at sites with a PFS, in the exhaust duct before the PFS filter units[5].

(4) Metal Parts Furnace (MPF): ACAMS units continuously monitor for the presence of agent in the MPF exhaust duct, at the common stack, and, at sites with a PFS, in the exhaust duct before the PFS filter units[5]. An ACAMS unit is also used to monitor for the presence of agent in the MPF discharge airlock whenever a load exits the MPF.

(5) Brine Reduction Area (BRA): The PMCSD Specific MCP requires the BRA stack to be monitored at the ASC level with an ACAMS station unless BRA agent feed concentrations are below the waste control limit (see FAWB Note B-7).

(6) Door Monitoring: At all sites except PBCDF, an ACAMS unit that monitors the decon hood in MDB decon vestibule 12-177 prevents the door to the vestibule from being opened when the unit is in alarm.

(7) Utilities: ACAMS units require electric power from the uninterruptible power supply (UPS) system. Instrument air is supplied as the combustion air source for the FPD, and for dilution air for the DAFC and stack sample probe assembly. ACAMS monitors also rely on high purity nitrogen and hydrogen, which are supplied from dedicated compressed gas cylinders.

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[4] There is no interface listed for the dunnage incinerator since it not planned to be operated at any of the sites (see FAWB Note B-1).

[5] PFS duct monitors were added by ECPs ANAP533PAS, PBAP406PAS, and UMAP384PAS. At ANCDF, the ACAMS monitors are not yet shown on the design drawings; the ECP is currently being implemented. PBCDF also has PFS filter units mid-bed ACAMS monitors.

SECTION 3
PROCESS DESCRIPTION

3.1 INTRODUCTION

ACAMS monitors provide near real-time (NRT), chemical-agent detection, monitoring, and alarms for worker safety and plant process control. An ACAMS monitor can detect and quantify the stockpile chemical agents GB, VX, H, HD, and HT.

The majority of the plant ACAMS monitors are linked to the control room (CON) via a computer interface module connection to a plant control system PLC. ACAMS data is sent to the process data acquisition and recording system (PDARS) for permanent electronic storage. A very small number of mobile, stand-alone, locally alarming ACAMS can be used in certain areas and under specified conditions. These ACAMS are not linked to the plant control system. Generally, regardless of the configuration, the monitored area, and the mode of operation, the ACAMS units linked to the CON and PDARS indicate operational status, alarms, and malfunctions on the screen in the CON. The majority of these instruments, however, are read-only capable in that the PLC acquires ACAMS inputs, but does not use the ACAMS inputs to automatically control a process.

The majority of alarms require manual response and intervention to interpret, correct, and verify proper ACAMS operation. The control room operator (CRO) can use ACAMS output to manually take actions to shut down or modify plant processes. There are a few ACAMS units that generate signals used by the PLCs to initiate action (see Appendix C, Alarm and Interlock Matrices).

3.2 ACAMS MONITORS

The ACAMS is used by the demilitarization sites as an audio-visual alarm, NRT, chemical-agent monitor to detect GB, VX, H, HD, and HT at all levels, except the general population limit (GPL). GPL monitoring requires the use of the depot area air monitoring system (DAAMS). The ACAMS is an automatic gas chromatograph (GC) that collects agent from a sampling point through a sample inlet and/or transfer line onto a solid sorbent bed within a preconcentrator tube (PCT). Agent collected and concentrated on the PCT is thermally desorbed into an analytical column for separation into individual sample components and detected with a flame photometric detector (FPD). The FPD responds to compounds containing either phosphorus (GB and VX) or sulfur (H, HD, and HT).

ACAMS monitors configured to monitor for VX require the use of polyester felt pads impregnated with silver fluoride (AgF) attached to the distal end of the sample inlet or heat-traced sample lines. These pads, known as V-to-G conversion pads, react with VX as the sample is pulled into the sample line and contacts the AgF. The heavy, nonvolatile VX molecule is converted to a smaller, lighter molecule with a much higher volatility and lower boiling point, known as the "G-analog of VX."

The ACAMS can operate at six different monitoring levels[1] for three different agent configurations, a total of 18 possible operating configurations. Only 14 different modes of operation are used since not all agents are monitored at each of the monitoring levels. The three agent configurations are GB, VX, and HD. The HD configuration is used to monitor for any of the blister agents H, HD, or HT (see FAWB Note B-5). The following paragraphs describe the ACAMS configurations for each of the six monitoring levels.

3.2.1 Time-Weighted Average ACAMS

TWA ACAMS units are configured for worker safety air monitoring at low levels for GB, VX, H, HD, and HT. Plant areas that require TWA-level monitoring are listed in Section 3.2.7 and are defined in the PMCSD Specific MCP. Each site's agent monitoring plan lists, or will list, the exact location and number of TWA ACAMS monitors required to support plant operations. During the life of the plant, specific TWA monitoring requirements may be modified to support different agent and munition campaigns.

The PMCD MCP defines the TWA hazard level concentration as the airborne concentration of a chemical agent to which unprotected workers can be repeatedly exposed for 8-hours-per-day, 5-days-per-week, for a working lifetime without adverse health effects. The TWA values are 0.0001 mg/m^3 for GB, 0.00001 mg/m^3 for VX, and 0.003 mg/m^3 for H/HD/HT. The TWA monitoring level is operationally treated as a ceiling value for the purpose of masking workers at a site.

TWA ACAMS monitors in the unpack area (UPA) can be accompanied by gross-level detectors with faster response times to provide more rapid response to a high-level agent release. JACADS used, and TOCDF uses the M8A1 detector as a gross-level detector in the UPA for this purpose. ANCDF, PBCDF, and UMCDF do not plan to use gross-level detectors in the UPA (see FAWB Note B-8).

Most TWA ACAMS units monitor individual point sources inside a building, container, or room using a heat-traced sample line. TWA ACAMS units also are used for multipoint-source monitoring for the MDB HVAC exhaust air filtration units and vestibules. These ACAMS units use sample probes, heat-traced sample lines, and a stream selection/sequential sampler system.

A typical TWA ACAMS station configuration includes a heat-traced sample line running from the sampled area to the ACAMS monitor inlet, an ACAMS monitor, a sample pump, a strip-chart recorder, a computer-interface module, support gasses, electrical power, and environmental protection/controls.

TWA ACAMS monitors have local audio-visual alarms as well as alarms and signals to the CON. Error/malfunction signals, attaining or exceeding the agent alarm setpoints, and changes in operational status signals for the agent method are relayed to the CON and displayed on the operator screen. At TOCDF, TWA ACAMS monitors alarm in one of two agent alarm configurations, depending on their purpose. The majority of TWA ACAMS units monitor for the presence of agent in normally uncontaminated areas and alarm at values below 1.0 TWA so that workers can mask if agent is detected. Other TWA ACAMS

[1] Monitoring levels refer to different agent concentration levels. The ACAMS software does not display all six monitoring levels as identified by the names used in the text (see FAWB Note B-4).

units are used to support entries into toxic areas in which workers are dressed in Army level B protective clothing. These TWA ACAMS monitors alarm at 40 TWA, referred to as the OSHA C ABORT alarm because it is set just below the threshold level of 50 TWA for OSHA level C protective gear. These alarms were recently modified to support implementation of redefined PPE levels in a revision to Department of the Army Pamphlet (DA-PAM) 385-61, Toxic Chemical Agent Safety Standards (see FAWB Note B-9). TWA ACAMS alarms are discussed in detail in Section 3.4.5.

In the multisample point, TWA, ACAMS configuration, sample points located between the filter banks in each filter unit are sampled by one TWA ACAMS monitor and a stream selection/sequential sampling system that is controlled by PLC output signals. The PLC outputs switch Teflon solenoid valves on/off in a specified sequence to allow the single TWA ACAMS monitor to analyze samples from the filter bank sample points on a specified timing cycle. The status of the PLC output is used by the PLC to determine the sampling location. Each individual, heat-traced sample line and the associated solenoid valve are displayed on the CON screen as an individual ACAMS unit with a unique ACAMS identification number, even though only one ACAMS monitor is used.

The PLC switches between sample points during the ACAMS purge period. With each sampled point treated as an individual ACAMS unit, the analog value and any associated alarms are retained until the cycling sequence returns to that sample point for the next reading.

Two primary ACAMS sampling configurations are used for HVAC filter unit and filter unit vestibule monitoring. One configuration is used at ANCDF and PBCDF; the other is used at TOCDF and UMCDF. At all sites, the MDB HVAC filter units are similar. Each contains, in sequence, a prefilter, a HEPA filter, six carbon filter banks, and another HEPA filter prior to the exhaust stack. See Programmatic Process FAWB Book 20, HVAC, for a more detailed description of the HVAC exhaust filtration units.

3.2.1.1 ANCDF and PBCDF HVAC Exhaust Filtration Unit Monitoring

At ANCDF and PBCDF, each exhaust air filter unit has a multisample-point ACAMS unit for monitoring. A separate, single-point ACAMS unit is used to monitor each of the filter unit vestibules[2,3] (see FAWB Note B-10). The filter units have a total of four sample points, one between each filter bank: between filter banks 1 and 2, between filter banks 2 and 3, between filter banks 3 and 4, and between filter banks 4 and 5. The ACAMS alternates monitoring at each one of the sample points. ANCDF recently modified the sampling sequence to sample two consecutive ACAMS cycles for the sample point between filter banks 2 and 3. The first reading is discarded to prevent a false reading due to the potential for carryover if agent was detected at the previous sample location, between filter banks 1 and 2. The second sample taken between filter banks 2 and 3 is considered an accurate reading for the sampling point.

[2] In conversations with ANCDF, they have stated that they will not install permanent ACAMS units for vestibule monitoring. Instead, they will use portable ACAMS, as needed.

[3] The PBCDF configuration described reflects the current design. ECP PBSP1598MDB is being prepared to delete the vestibule-dedicated ACAMS and configure PBCDF similar to UMCDF.

3.2.1.2 TOCDF and UMCDF HVAC Exhaust Filtration Unit Monitoring

At TOCDF and UMCDF, one multisample-point, TWA ACAMS unit is used for monitoring each of the nine MDB HVAC exhaust air filtration units and the filter vestibules (see FAWB Note B-10). Each ACAMS unit automatically cycles between sampling locations as follows:

1. Sample space between filter banks 1 and 2. Record reading.
2. Sample space between filter banks 2 and 3. Discard reading to prevent a false reading due to carryover from the previous sample.
3. Sample space between filter banks 2 and 3. Record reading.
4. Sample space between filter banks 3 and 4. Record reading.
5. (UMCDF only[4]) Sample filter unit vestibule. Record reading.

Sampling of the first midbed is stopped if agent is confirmed above 4 TWA at that location. TOCDF recently modified the PLC code to allow the CON operator to not only bypass the first midbed after agent is detected, but also to bypass the first sampling sequence between filter banks 2 and 3. The change was made so that the sampling sequence does not include the discarded sample cycle when the first midbed is not being sampled. Thus, the ACAMS unit will simply alternate between Steps 3 and 4 above. UMCDF is currently evaluating this revision for potential incorporation.

At TOCDF, ACAMS monitoring of HVAC filter unit vestibules is performed only when the filter unit is offline. When the filter unit is taken offline, the PLC automatically switches from cycling through each of the midbed positions to monitoring the vestibule. To avoid reporting inaccurate results, the PLC delays for one ACAMS cycle before spooling to, or from, the vestibule.

3.2.2 Immediately Dangerous to Life and Health ACAMS

IDLH ACAMS units are configured for worker safety air monitoring for GB and VX. There is no regulatory IDLH value for HD because of its carcinogenic properties. See Section 3.2.3 for an HD-related engineering control level.

The IDLH[5] hazard level concentration is defined in the PMCD MCP as the maximum concentration of GB or VX from which, in the event of respirator failure, an individual

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[4] TOCDF previously included filter unit vestibule monitoring in the sequence once every eight hours. Under TEMP-2045-HVC R2, TOCDF removed vestibule monitoring from the sequence and now performs DAAMS sampling of the vestibules every eight hours while the filter unit is online.

[5] The IDLH definition given above refers to the process control level for CSD project site monitoring, as specified in the PMCD MCP. This is different than the IDLH level defined by the National Institute for Occupational Safety and Health (NIOSH), which defines IDLH as a situation that poses a threat of exposure to airborne contaminants when that exposure is likely to cause death or immediate or delayed permanent adverse health effects, or prevent escape from such an environment.

could escape within 30 minutes without a respirator and without experiencing appropriate escape-impairing or irreversible health effects. IDLH levels are 0.2 mg/m^3 for GB and 0.02 mg/m^3 for VX.

Plant areas that require IDLH-level monitoring are listed in Section 3.2.7.2 and are defined in the PMCSD Specific MCP. Each site's agent monitoring plan lists, or will list, the exact location and number of IDLH ACAMS monitors required to support plant operations. During the life of the plant, specific IDLH monitoring requirements may be modified to support different agent and munition campaigns.

The operation, configuration, and signal outputs for IDLH ACAMS units are similar to those for TWA ACAMS units. Because of the high concentrations of agent that are expected to be present, IDLH ACAMS units can be configured with a low-volume sampler (LVS), similar to an MPL ACAMS unit. The LVS allows sampling and analysis of high concentrations without having these high agent concentrations actually pass through the ACAMS, and without saturating the detector response beyond the range of the meter. The LVS is described in detail in section 3.2.4.

IDLH ACAMS stations require electrical power; environmental controls for dust, temperature, and humidity; support gases; a strip-chart recorder; and a computer interface module. IDLH ACAMS output signals are acquired by the plant control system, displayed in the CON, and recorded by PDARS.

3.2.3 Gross Detection Level ACAMS

GDL ACAMS units are configured for monitoring H/HD/HT at an engineering control level established for exiting airlocks and specified locations within agent-contaminated areas. The H/HD/HT GDL is 0.2 mg/m^3.

Plant areas that require GDL-level monitoring are listed in Section 3.2.7.2 and are defined in the PMCSD Specific MCP. GDL ACAMS units sample and monitor for H, HD, and HT only. Each site's agent monitoring plan lists, or will list, the exact location and number of GDL ACAMS monitors required to support the specific plant during mustard agent campaigns. Specific GDL monitoring requirements may be modified to support different munition campaigns.

GDL ACAMS stations require electrical power; environmental controls for dust, temperature, and humidity; support gases; a strip-chart recorder; and a computer interface module. GDL ACAMS output signals are acquired by the plant control system, displayed in the CON, and recorded by PDARS.

3.2.4 Maximum Permissible Limit ACAMS

MPL ACAMS units are configured for monitoring GB or H/HD/HT at an engineering control level based on the maximum concentration in which personnel in DPE may work for two hours or less, per entry, in agent-contaminated areas. The MPL value for GB and HD is 100 mg/m^3. For GB, the MPL level is equivalent to 500 IDLH. VX does not have an applicable MPL monitoring value due to its low vapor pressure. For H/HD/HT, the MPL level is equivalent to 500 GDL because there is no IDLH for H/HD/HT.

Plant areas that require MPL-level monitoring are listed in Section 3.2.7.2 and are defined in the PMCSD Specific MCP. Areas that require MPL-level monitoring for GB and HD are monitored at the IDLH level for VX since there is no MPL value for VX. During the life of the plant, specific MPL monitoring requirements may be modified to support different agent and munition campaigns.

The operation, configuration, and signal outputs for MPL ACAMS units are similar to those for TWA, IDLH, and GDL ACAMS. Because of the known or expected high concentrations of agent that are expected to be present, MPL ACAMS units are normally configured with a low-volume sampler (LVS) with a one milliliter (1-mL) sample loop integrated into the sampling system. The LVS is a microprocessor-controlled sample device used to limit the size of the sample collected from an area of known or expected high levels of contamination to a very small known volume, 1-mL. The MPL ACAMS with LVS allows sampling and analysis of GB, H, HD, and HT at high concentrations without having these high agent concentrations actually pass through the ACAMS, and without saturating the detector response beyond the range of the meter.

The LVS consists of four components:

1. 1-mL Sample Loop
2. LVS Six-Port Valve
3. LVS Controller
4. LVS Sample Pump(s)[6]

The 1-mL sample loop is used to collect a known volume of sample prior to being analyzed by the MPL ACAMS. The sampled air is circulated through the sample loop and returned to the sample area until the MPL ACAMS is ready to receive a sample during the MPL ACAMS sample period.

The LVS six-port valve, which is similar to the ACAMS six-port valve, directs the sample flow from either the sampled area to the sample loop (LVS sample mode) or from the sample loop to the ACAMS sample inlet (LVS purge mode).

Operation of the LVS six-port valve and the ACAMS six-port valve must be synchronized, normally in 180° opposing operational cycles. The LVS controller synchronizes and controls the operation of the LVS six-port valve in relation to the ACAMS six-port valve.

The LVS sample pump[6] provides a vacuum source for sample transport and collection within the LVS. This is separate and in addition to the ACAMS sample pump that is used to transport the sample from the LVS 1-mL sample loop to the inlet of the ACAMS monitor.

The MPL ACAMS units work slightly differently from the TWA, IDLH, and GDL ACAMS units previously discussed. The sample is continuously pulled through the heat-traced sample line, the 1-mL sample loop of the LVS six-port valve, the LVS sample pump[6], and then returned to process when the ACAMS monitor is in the purge period. When the ACAMS six-port valve is in the purge position, the LVS six-port valve is in the

[6] The LVS can be equipped with either one or two pumps. The second pump, the auxiliary pump, works in conjuction with the LVS pump to ensure sufficient vacuum is developed when long sample lines are used.

sample position and air from the sampled area is pulled through the 1-mL sample loop inside the LVS.

At the end of the ACAMS purge period, the ACAMS six-port valve switches to the sample position. The LVS solenoid valve in the LVS sample pump line deenergizes causing the solenoid valve to shut. This allows the pressure within the 1-mL sample loop to reach equilibrium with the pressure of the area being sampled. After a five-second delay, the LVS six-port valve activates and rotates to the purge position and the agent sample trapped in the sample loop is pulled into the ACAMS inlet and onto the solid sorbent bed of the PCT for collection and concentration. At the completion of the ACAMS sample period, the ACAMS six-port valve returns to the purge position, the PCT heater heats to a high ramp temperature (approximately 220°C), and the carrier gas flow pushes the desorbed agent sample off the PCT and into the gas chromatograph module. At the same time, the LVS six-port valve returns to the sample position to begin collecting the sample for the next sample period.

The signals and communications for the operation of the LVS and synchronization of the LVS and ACAMS sample and purge periods are between the ACAMS and LVS. These signals are not sent to the plant control system and, therefore, are not displayed in the CON or acquired by PDARS. However, MPL ACAMS station output signals are acquired by the plant control system, displayed in the CON, and recorded by PDARS, similar to ACAMS units at other monitoring levels.

MPL ACAMS stations require electrical power; environmental controls for dust, temperature, and humidity; support gases; a strip-chart recorder; and a computer interface module.

3.2.5 Allowable Stack Concentration ACAMS

ASC ACAMS sample and monitor for the presence of GB, VX, H, HD, and HT in stack emissions. Monitoring is performed in the furnace ducts and exhaust stacks. Plant areas that require ASC-level monitoring are listed in Section 3.2.7.1 and are defined in the PMCSD Specific MCP.

ASC ACAMS stations are configured for monitoring GB, VX or H/HD/HT at an engineering control level established as a source emission limit for monitoring furnace ducts and common stack. The ASC values are 0.0003 mg/m^3 for GB, 0.0003 mg/m^3 for VX, and 0.03 mg/m^3 for H/HD/HT.

The operation, configuration, and plant control system signal outputs for the ASC ACAMS monitors are similar to those for the TWA, IDLH, and GDL ACAMS monitors. The sampling system, however, is unique. ASC ACAMS monitors require a stack sample probe assembly and a dilution airflow controller (DAFC). The stack-sampling probe ensures that a representative sample is collected from the hot stack gases for analysis. Hot stack gases are continuously collected, passed through the sample probe, and exhausted downstream of the sample probe inlet.

The DAFC injects clean, dry dilution air at a known volume ratio into the stack-sampling probe to reduce the sample temperature and dew point to a level such that moisture will not condense in the sample line and be drawn into the ACAMS. A slug of water passing into the PCT and/or analytical column would render the ACAMS inoperable. The mixing/dilution of the original sample at a known ratio also reduces the agent concentration in the sample by the same ratio.

Common stack monitoring procedures have been modified for staggered, ASC ACAMS operation to artificially reduce cycle times, to minimize missed sample periods when the ASC ACAMS are in the purge period, and to reduce false alarms. The staggered ASC ACAMS only monitor for the campaign agent[7]. A minimum of three ASC ACAMS units is required to support the staggered stack monitoring cycle. Two ASC ACAMS monitors are online continuously operating in opposed staggered cycles so that while one unit is in the purge period, the other is sampling. Each of these two ACAMS monitors has a different type of GC column. The different column types separate the constituents of an air sample differently, which helps to differentiate actual alarms from false alarms. The third ACAMS monitor serves as a backup unit when one of the other units is offline for challenging or corrective action. If the backup ASC ACAMS is brought online and it has the same type column phase as the opposing cycle ACAMS, then the column in one of the ASC ACAMS must be replaced with a different column type. The staggered ACAMS protocol defined in Appendix A of the PMCSD MCP allows for four to six hours to replace one of the columns and return the system to the dissimilar column configuration.

If one staggered ACAMS monitor is in alarm, DAAMS tubes are collected for alarm confirmation analysis. Verification challenges of the common stack monitoring stations are performed to verify that both staggered ASC ACAMS are functional (challenge = 1.0 ASC +/- 0.25 ASC). If one or both staggered ASC ACAMS is not functional, then the backup ASC ACAMS is immediately brought online.

The plant control system automatically generates furnace STOP FEED signals based on digital and analog signals from furnace duct and common stack ACAMS monitors. Site-specific alarms and setpoints are listed in the alarm and interlock matrices in Appendix C.

The PMCSD Specific LQAP requires that online common stack staggered ASC ACAMS units be challenged six times a day at 1.0 ASC and once per day at 0.2 ASC. Furnace duct and the backup ASC ACAMS units are required to be challenged once per day at 0.2 and 1.0 ASC.

ASC ACAMS monitors require electrical power; environmental controls for dust, temperature, and humidity; support gases, a strip-chart recorder; and the computer interface module.

3.2.6 Engineering Control Level ACAMS

The ECL designation is applied to ACAMS units that monitor at a nonregulatory monitoring level. An ECL could be based on an extrapolation of health-based standards, such as the TWA, or be an established monitoring level for which data or procedures already exist, such as the ASC. An ECL can be established for GB, VX, or HD. The ECL must be lower than the monitoring level required by the PMCD MCP. ECL

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[7] TOCDF currently has two sets of staggered ACAMS on the common stack; one for VX monitoring and the other for GB. Monitoring for GB during VX munition campaigns is performed because waste from earlier GB campaigns is being processed concurrently.

ACAMS are used to evaluate a process for abnormal agent levels and to govern control of protected personnel in, or egressing from, toxic areas.

Alarm levels for ECL ACAMS monitors depend on the type of toxic area entry the ACAMS monitor is used to support. For example, at TOCDF, an ECL ACAMS that monitors at the IDLH level is used to support toxic area entries in which the entrants wear DPE suits. The threshold value for DPE suits is 1 MPL, or 500 IDLH. A DPE ABORT alarm is generated if the ACAMS monitor detects an agent concentration greater than 400 IDLH to notify workers monitoring the entrants that the agent concentration is approaching the threshold value for DPE.

ECL ACAMS stations require electrical power; environmental controls for dust, temperature, and humidity; support gases, a strip-chart recorder; and a computer interface module. ECL ACAMS output signals are acquired by the plant control system, displayed in the CON, and recorded by PDARS.

3.2.7 ACAMS Locations

General agent monitoring requirements are specified in the PMCSD Specific MCP. There are five area categories identified in the PMCSD Specific MCP that are monitored for chemical agent at the CSD project sites: 1) Stack monitoring, 2) Plant area monitoring, 3) Laboratory area monitoring, 4) Support area monitoring, and 5) Installation perimeter monitoring. The following sections summarize the monitoring requirements in each area. A table showing stack monitoring locations is included to highlight similarities and differences between the sites. For other plant areas, complete listings of ACAMS unit locations can be found in the site-specific agent monitoring plans.

All sites will use monitoring station numbers to identify all facility monitoring locations. Station numbers identify the area being monitored and can correspond to a variety of monitoring configurations, including: 1) ACAMS only; 2) DAAMS only; 3) ACAMS and DAAMS; 4) Portable units only - station is serviced by portable ACAMS and or DAAMS; and 5) Spooled – station consists of a sample line that can be temporarily connected to a nearby ACAMS to monitor any location in the range of the spool.

Monitoring stations that use ACAMS monitors are identified on the Advisor PC screens by the station number and not the ACAMS number. Advisor PC screens are shown in Appendix E.

3.2.7.1 Stack Monitoring

The PMCSD Specific MCP requires that stacks be monitored at the ASC level with NRT monitors and DAAMS stations. ACAMS monitors are used at all four incineration sites for NRT monitoring. The specific stack monitoring locations listed in the MCP are as follows:

1. Furnace ducts,
2. Common stack,
3. DUN stack emergency vent,
4. BRA stack, and
5. MDB ventilation filter system stacks and filter midbanks (monitored at TWA rather than ASC).

Monitoring is also required for the LAB ventilation filter system stack and filter midbanks (see Section 3.2.7.3). Table 3.1 lists the ACAMS units used for stack monitoring at all four sites. TOCDF station numbers are listed. ANCDF, PBCDF, and UMCDF station numbers are expected to be similar, but may differ due to site-specific modifications.

Table 3.1 Stack Monitoring Locations

Location	ACAMS Tag #(s)	Site(s)	Monitoring Level	TOCDF Station #(s)	Notes
DFS Furnace Duct	MON-ACAM-183	AN/PB/TE/UM	ASC	PAS 702	Note 4
DFS Cyclone Encl. Exhaust Duct	MON-ACAM-297	AN/PB/UM	TWA	CYC 260	
	MON-ACAM-330	TE			
DFS PFS Duct	MON-ACAM-353	AN/PB/UM	ASC	NA	Note 3
DFS PFS Filters	MON-ACAM-348 MON-ACAM-349	PB	ASC	NA	
LIC (No.1 at TE & UM) Furnace Duct	MON-ACAM-163	PB/TE/UM	ASC	PAS 704	
LIC (No.2 at TE & UM) Furnace Duct	MON-ACAM-134	AN/TE/UM	ASC	PAS 705	
LIC (No.1 at UM) PFS Duct	MON-ACAM-357	PB/UM	ASC	NA	Note 3
LIC (No.2 at UM) PFS Duct	MON-ACAM-354	AN/UM	ASC	NA	Note 3
LIC PFS Filter	MON-ACAM-356	PB	ASC	NA	
MPF Furnace Duct	MON-ACAM-167	AN/PB/TE/UM	ASC	PAS 703	Note 4
MPF PFS Duct	MON-ACAM-355	AN/PB/UM	ASC	NA	Note 3
MPF PFS Filter	MON-ACAM-347	PB	ASC	NA	
Common Stack	MON-ACAM-129 MON-ACAM-223 MON-ACAM-225	AN/PB/TE/UM	ASC	PAS701/706A PAS701/706B PAS701/706C	Note 4
DUN Stack	MON-ACAM-130 MON-ACAM-286	AN/UM	ASC	NA	Note 1
DUN furnace duct	MON-ACAM-289	AN/UM	ASC	NA	Note 1
BRA Stack	MON-ACAM-152	AN/PB/TE/UM	ASC	BRA 801	Note 2
HVC-FILT-101	MON-ACAM-109	AN/PB/TE/UM	TWA	FIL 692/693/ 694/699	
HVC-FILT-102	MON-ACAM-132	AN/PB/TE/UM	TWA	FIL 682/683/ 684/689	
HVC-FILT-103	MON-ACAM-142	AN/PB/TE/UM	TWA	FIL 672/673/ 674/679	
HVC-FILT-104	MON-ACAM-187	AN/PB/TE/UM	TWA	FIL 662/663/ 664/669	
HVC-FILT-105	MON-ACAM-186	AN/PB/TE/UM	TWA	FIL 652/653/ 654/659	
HVC-FILT-106	MON-ACAM-161	AN/PB/TE/UM	TWA	FIL 642/643/ 644/649	
HVC-FILT-107	MON-ACAM-188	AN/PB/TE/UM	TWA	FIL 632/633/ 634/639	

Table 3.1 (Cont'd)

Location	ACAMS Tag #(s)	Site(s)	Monitoring Level	TOCDF Station #(s)	Notes
HVC-FILT-108	MON-ACAM-189	AN/PB/TE/UM	TWA	FIL 622/623/ 624/629	
HVC-FILT-109	MON-ACAM-190	AN/TE/UM	TWA	FIL 612/613/ 614/619	
MDB HVAC Filter Stack	MON-ACAM-135	AN/PB/TE/UM	TWA	FIL 601	
LAB-FILT-301	MON-ACAM-256	AN/PB	TWA	NA	
	MON-ACAM-369	UM			
LAB-FILT-302	MON-ACAM-256	AN/PB	TWA	NA	
	MON-ACAM-370	UM			
LAB Filter Stack	MON-ACAM-258	AN/PB/UM	TWA	NA	

Note 1: DUN exhaust monitoring has been deleted at PB and TE, but is still shown in the AN and UM designs. None of the sites plan to operate the DUN (see FAWB Note B-1).

Note 2: The PMCSD Specific MCP allows BRA stack monitoring to be omitted if brine feed is sampled and analyzed to be below treatment limits. TE does not operate the BRA and does not use BRA 801 (See FAWB Note B-7).

Note 3: PFS duct monitors were added at AN, PB, and UM by ECPs ANAP533PAS, PBAP406PAS, and UMAP384PAS. At AN, the ACAMS are not yet shown on the design drawings; the ECP is currently being implemented.

Note 4: TOCDF's current configuration includes additional ACAMS monitors on the MPF and DFS furnace ducts and on the common stack. Additional monitors are required for dual-agent monitoring while processing VX munitions and miscellaneous waste from earlier GB campaigns.

3.2.7.2 Plant Area Monitoring

The PMCSD Specific MCP requires that plant areas be monitored with NRT monitors at the MPL, IDLH, GDL, and TWA monitoring levels, depending on the level of contamination to be monitored. There are two categories of plant area monitoring: 1) Safety monitoring, and 2) Process monitoring. Safety monitoring refers to monitoring conducted at the TWA level to protect unmasked workers in HVAC category C and D areas, or to filter or common stack monitoring at the ASC level. Process monitoring is conducted in HVAC category A and B areas for the following: 1) to provide contamination information for operations and maintenance tasks, 2) to assess the state of contamination of equipment or waste in toxic maintenance processing, 3) to ensure the cleanliness of a DPE at Level B egress. Although the ECL level is not listed as a required level, it is used at the sites as an alternate monitoring level (see Section 3.2.6). ACAMS monitors are used at all four incineration sites for NRT monitoring. The specific plant area monitoring locations and the area monitoring requirements are as follows:

1. HVAC Category A Ducts Evacuating the Area – monitored with NRT monitors at the MPL level for GB and HD, and the IDLH level for VX.
2. First Airlock from HVAC Category A – monitored with a NRT monitor, via a sample wand, at the IDLH level for VX and GB, and at the GDL level for HD.

3. HVAC Category B – monitored with a NRT monitor at the IDLH level for VX and GB, and at the GDL level for HD.
4. Airlocks from HVAC Category B – monitored with a NRT monitor, via a sample wand, at the TWA level for all agents.
5. HVAC Category C and Final Airlock from HVAC Category A and B Areas - monitored with a NRT monitor at the TWA level for all agents.
6. HVAC Category D – No monitoring requirement, but may be monitored with a NRT monitor at the TWA level for all agents.
7. Furnace Rooms – monitored with a NRT monitor at the IDLH level for VX and GB, and at the TWA level for HD.
8. Transport Containers - monitored with an NRT monitor at the TWA level for all agents before being opened.
9. Mine Glovebox Airlock[8] – monitor inside the mine glovebox with an NRT monitor at the TWA level.

Specific ACAMS monitoring locations are, or will be, specified in each site's agent monitoring plan. Some monitoring locations and levels could change with different munition campaigns.

3.2.7.3 Laboratory Area Monitoring

The PMCSD Specific MCP requires NRT monitoring at the TWA level for the agent standards room, laboratory carbon filter system, and other laboratory rooms where samples above research development, test, and evaluation agent concentrations may be present or analyzed. Laboratory carbon filter system monitors are listed in Table 3.1; all other laboratory monitors are, or will be, listed in each site's agent monitoring plan.

3.2.7.4 Support Area Monitoring

The PMCSD Specific MCP requires plant support areas that house personnel to be monitored with an NRT and/or DAAMS at the TWA level. ACAMS monitors are used at TOCDF, and are specified in the designs at the other sites to monitor medical areas in the personnel and maintenance building. Specific ACAMS monitoring locations are, or will be, specified in each site's agent monitoring plan.

3.2.7.5 Installation Perimeter Monitoring

The PMCSD Specific MCP requires that the installation perimeter be monitored with DAAMS at the GPL level. NRT monitors are not required for perimeter monitoring. The GPL is the allowable 72-hour TWA concentration for indefinite, unprotected exposure of the general public without adverse health effects. GPL levels are 0.0001 mg/m^3 for HD, and

[8] Because the mine glovebox will not be used to unpack mine drums (see Programmatic Process FAWB Book 23, Mine Handling System), this requirement is no longer relevant. The mine unpacking process has not been determined at each of the sites. Monitoring requirements to replace mine glovebox airlock monitoring will be specified after the mine unpacking process has been finalized.

0.000003 mg/m^3 for GB and VX. Perimeter monitoring stations are used to record whether agent is released outside of installation boundaries; they are not used to control disposal activities or to provide early warning of an accidental release.

3.3 ACAMS OPERATION

General operational procedures for the ACAMS are discussed below. ACAMS being used in specific areas or in specific applications using additional support equipment such as the LVS, DAFC, stream selection system/sequential sampler, and stack sampling probe assembly were discussed previously.

Operation of the ACAMS monitors will be identical at all four sites. However, specific application of the monitors will vary based on each site's agent monitoring plan.

3.3.1 Initial Setup, Calibration, Challenging, and Operation of the ACAMS

ACAMS monitors are fully installed, serviced, and equipped at the monitoring location. An ACAMS technician turns on the carrier and flame support gases, sample pump, and electrical power and allows the heat-traced sample line (if used), and any auxiliary components, to equilibrate to normal operating parameters and temperatures. ACAMS operational parameters for each of the agents and specified hazard levels can be adjusted to optimize the operation of the individual ACAMS monitoring unit. Initial setup activities are performed with the computer interface module in the SERVICE position. The computer interface module is switched to CALIBRATE to notify the CON that the specified ACAMS is being calibrated.

The ACAMS technician selects and programs the desired agent and hazard level from the ACAMS menu and allows the heated zones to heat and equilibrate. If the agent retention time for the specified agent isn't known, the 1.0 Z[9] agent standard is injected when the INJECT notification is displayed to determine the retention time. The agent gate is adjusted, if necessary, to bracket the agent peak on both sides. Upon successfully determining the agent gate, the ACAMS monitor is ready to calibrate.

The ACAMS technician places the ACAMS monitor in the CALIBRATE mode and injects a 1.0Z standard when INJECT is displayed during the sample period. After the sample period ends, the normal purge period begins, as described in Section 3.3.3.2. The ACAMS monitor generates an electronic signal proportional to the detected agent level. The ACAMS software processes this signal and sends a hazard level signal and instrument/alarm status to the GPD and through the computer interface module to the CON. The ACAMS data is recorded by PDARS.

If the calibration value is acceptable, then the ACAMS technician enters the value into the calibration register and continues with the next calibration injection. After the prescribed number of hazard-level calibration injections are made, accepted, and entered into the ACAMS, the ACAMS computer interface module is switched to a position to allow a daily challenge to be conducted.

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[9] Z is used as a general designation of the monitoring hazard level. For example, an alarm at 0.2Z for a TWA ACAMS is 0.2 TWA; for an IDLH ACAMS, a 0.2Z alarm is 0.2 IDLH.

3.3.2 Periodic and Daily Challenges

Once operational and online, the programmatic LQAP, MCP, and local, site-specific LQCP, and agent monitoring plan require that each ACAMS be challenged daily (once per 24-hour period) to verify accurate detection by the ACAMS monitors. Some ACAMS, such as the common stack ASC ACAMS, require more frequent challenging, as specified in previously referenced documents and plans.

Site-specific agent monitoring plans may require that the ACAMS be challenged at one or more levels, usually a low-level to ensure that the instrument is capable of detecting agent at/near the limit of quantification (LOQ) and at a higher level to verify the linearity of the detector response.

At TOCDF, ACAMS units that monitor at the MPL, IDLH, GDL, and ECL levels are challenged daily using a 1.0 Z agent standard. ASC and TWA ACAMS monitors are challenged daily using 0.2 Z and 1.0 Z agent standards, and also are challenged monthly using a 10.0 Z agent standard.

Site-specific challenging procedures are given in the sites' standard operating procedures for ACAMS operations (e.g., TE-LOP-524 at TOCDF). For ACAMS challenging, the computer interface module is switched to the appropriate challenge position[10], and the proper hazard-level challenge solution is injected when the INJECT notification is displayed on the GPD. At the end of the analysis period, the GPD displays the hazard-level value and the signal is sent to the CON. Upon successful completion of the challenge, the ACAMS technician switches the computer interface module back to OPERATE to place the ACAMS back online.

Failure to complete a successful challenge requires corrective action in accordance with the LQCP, MCP, and local, site-specific agent monitoring plan.

In the event that routine maintenance or repair is required, the ACAMS operator switches the computer interface module to the SERVICE position. If calibration, challenging, or repair of the ACAMS exceeds one hour, a NOT ONLINE TIMEOUT alarm is generated in the CON. If the ACAMS is expected to be offline for more than two hours, the CON is notified and the ACAMS unit can be replaced rather than serviced in place.

3.3.3 ACAMS Operational Mode

After initial setup, calibration, and challenging, an ACAMS unit is ready to operate online. The computer interface module is switched to the OPERATE mode and the ACAMS begins normal monitoring operations. ACAMS monitors operate in cycles, with each cycle consisting of a sample period and a purge period.

3.3.3.1 Sample Period

During the sample period, the ACAMS sample pump pulls the sample stream from the source area, through a sample line (usually heat-traced), six-port valve, PCT, and the sample

[10] At TOCDF all challenges are performed with the computer interface module in the MON CHALLENGE position. At follow-on sites, the CHALLENGE position will be used for all challenges (see section 3.4.1).

pump. The sample is collected on the PCT for a specified time and flow rate. At the end of the sample period, the microprocessor signals the six-port valve to switch to its purge-period position. The sample stream exhausts from the sample pump discharge back into the sampled process area, or is routed to the facility HVAC system.

3.3.3.2 Purge Period

The purge period is the time during which the collected sample is desorbed from the PCT. When the six-port valve switches to the purge position, the sample stream continues to flow through the sample line, a different set of ports in the six-port valve, and the sample pump before being exhausted.

In the purge position, the six-port valve aligns the carrier gas ports to supply a reverse flow of nitrogen to purge the sample off the PCT. The PCT heater rapidly heats to approximately 220°C and the agent sample desorbs and is flushed off the sorbent bed of the PCT. The combination of the reversed flow of carrier gas and high temperature heating of the PCT strips the agent sample from the sorbent bed as a slug and pushes it through the six-port valve and into the analytical column.

At the same time, the microprocessor signals the PCT heater to heat up, and the column heater begins a two-stage, high-temperature ramp program. As the sample is pushed through the column, the sample components are selectively retained or not retained by the column's applied-phase material based on volatility, molecular weight, boiling point, and affinity for the column's active phase. Then, the components are separated into individual slugs as a function of time that pass into the FPD and are burned in a hydrogen-rich flame. The analytes of interest give off specific wavelengths of light that are characteristic of either phosphorus [green/yellow light at 525 nanometer (nm)] or sulfur (purple light at 394 nm). Light given off when the samples are burned in the hydrogen rich flame passes through an interference filter of one of the specified wavelengths and strikes the photomultiplier tube. The photomultiplier tube generates a current signal that is proportional to the magnitude of light produced by the sample. This signal is processed by an electrometer board to produce an equivalent voltage that is proportional to the agent concentration. This agent concentration data along with ACAMS system/setpoint status are presented on the GPD and sent via the computer interface module to the CON.

3.3.4 Service Mode

In the event of a failure/malfunction during normal operations or during one of the other modes of operation, an ACAMS or instrument technician has to service the ACAMS monitor and/or support systems onsite. After contacting the CON to request permission to take the ACAMS unit offline, the technician switches the computer interface module to the SERVICE mode. A signal is sent to the CON indicating that the instrument is temporarily offline for service. Troubleshooting/service are made and completed, if possible, within an hour to prevent activation of the ACAMS NOT ONLINE TIMEOUT alarm. If the ACAMS is expected to be offline for more than 2 hours, the CON is notified and the ACAMS unit may be replaced rather than serviced in place.

Upon completion of ACAMS servicing, the computer interface module is placed in the proper operational mode. Then, the ACAMS monitor is calibrated and/or challenged, in accordance with the requirements of the LQAP, MCP, and local, site-specific agent monitoring plan. Generally, service changing critical components, consumables, or setpoints requires that the instrument be calibrated and challenged before being placed online.

3.4 ACAMS INTERFACE WITH THE PLANT CONTROL SYSTEM

Each ACAMS monitor generates two types of output signals to the plant control system's PLCs, digital and analog. Digital signals indicate the status and mode of operation; analog signals indicate the agent concentration in the applicable hazard level (Z) units. The PLC acquires data from the ACAMS monitors via the computer interface module.

3.4.1 Computer Interface Module

The computer interface module is used in conjunction with an ACAMS monitor to provide computer compatible signals for agent concentration, concentration update, and status signals to reflect the operating mode of the ACAMS monitor. The module has a five-position selector switch that was originally equipped with the following positions: OPERATE, CHALLENGE, CALIBRATE, SERVICE, and REPAIR. After gaining field operating experience, TOCDF found that SERVICE and REPAIR were functionally similar. TOCDF also wanted to add a second challenge position for daily challenges. Thus, REPAIR was replaced with LOQ CHALLENGE.

After encountering problems with some daily challenges being performed with the switch in CHALLENGE rather than LOQ CHALLENGE, TOCDF decided to stop using the original CHALLENGE position. LOQ CHALLENGE was renamed MON CHALLENGE, and is used for all ACAMS challenges as specified in TE-LOP-524, Standard Operating Procedure, ACAMS Operations.

Follow-on sites are currently configured with the original computer interface module positions. The REPAIR position is not planned to be used. The CHALLENGE position will be used for all challenges.

The position of the switch is communicated to the PLC via three digital signals according to the ACAMS truth table (see Section 3.4.2).

3.4.2 ACAMS Digital Output Signals

ACAMS output to the CON includes five digital signals that are input and processed by the PLC. One signal indicates the power status for the ACAMS unit. Power ON is indicated when the ACAMS monitor is connected to the computer interface module and the ACAMS power switch is in the "ON" position. The second digital signal, the concentration update signal, indicates to the PLC that the ACAMS analysis period has been completed and an updated analog value is available (see Section 3.4.3). The remaining three digital signals are designated A, B, and C, and indicate the ACAMS unit status to the PLC.

ACAMS digital outputs are compared to a truth table to generate alarms, malfunctions, and modes of operation. Tables 3.2 and 3.3 show the truth tables for TOCDF and the follow-on sites. The truth tables are similar, except for the following: 1) The MON CHALLENGE state at TOCDF is REPAIR at follow-on sites, 2) Follow-on sites do not have the ALARM TEST mode, and 3) The MALFUNCTION state at follow-on sites does not care what the status of the C signal is.

Table 3.2. TOCDF ACAMS Truth Table of Digital States

MODE	POWER ON	A	B	C	CONC UPDATE	ALARM
Power off	0	—	—	—	—	1
Challenge[a]	1	0	0	0	P	1
Calibrate	1	0	0	1	P	1
Service	1	0	1	0	—	1
MON Challenge	1	0	1	1	—	1
Alarm	1	1	0	1	P	1
Malfunction[b]	1	1	1	0	—	1
Alarm Test[b]	1	1	1	1	—	0
Operate	1	1	0	0	P	0

LEGEND: 0 = Open contact; 1 = Closed contact; (—) = Do not care; P = Read agent concentration on pulse

[a] By procedure, TOCDF does not use the CHALLENGE position on the computer interface module. If the module is inadvertently placed in the CHALLENGE position, there is no change in the CON display (see section 3.4.4).

[b] TOCDF added the ALARM TEST state under ECP TEMP-2526-ACA and changed the MALFUNCTION state from not caring about the C signal to requiring C=0. ANCDF, PBCDF, and UMCDF are reviewing this ECP for potential implementation.

Table 3.3. ANCDF, PBCDF, and UMCDF ACAMS Truth Table of Digital States

MODE	POWER ON	A	B	C	CONC UPDATE	ALARM
Power off	0	—	—	—	—	1
Challenge	1	0	0	0	P	1
Calibrate	1	0	0	1	P	1
Service	1	0	1	0	—	1
Repair[a]	1	0	1	1	—	1
Alarm	1	1	0	1	P	1
Malfunction[b]	1	1	1	—	—	1
Operate	1	1	0	0	P	0

LEGEND: 0 = Open contact; 1 = Closed contact; (—) = Do not care; P = Read agent concentration on pulse

[a] By procedure, follow-on sites will not use the REPAIR position on the computer interface module.

[b] TOCDF changed the MALFUNCTION state from not caring about the C signal to requiring C=0 and added the ALARM TEST state under ECP TEMP-2526-ACA. ANCDF, PBCDF, and UMCDF are reviewing this ECP for potential implementation.

3.4.3 ACAMS Analog Output Signal

Each ACAMS unit generates an analog signal that reports the agent concentration determined by the ACAMS unit. The analog value is updated by the ACAMS after analysis of the sample, at the end of the agent gate[11]. Internal to the ACAMS monitor, the agent concentration is expressed as a voltage between zero and ten volts. The computer interface module includes a voltage to current converter that converts the agent concentration voltage into a 4 to 20 mA current signal for input to the PLC.

In order to allow hazard level measurements up to 512 Z, the ACAMS software switches to a non-linear response mode when the measured concentration equals or exceeds 2.00 Z. The non-linear ACAMS correction curve is composed of nine linear segments correlating ACAMS output voltage from zero to ten volts, to concentration readouts from zero to 512 Z. The nine linear segments are shown in Table 3.4.

Table 3.4. ACAMS Non-Linear Response

Voltage	Concentration		Voltage	Concentration
0.00 – 1.99 V	0 – 1.99 Z		6.00 – 6.99 V	32.0 – 63.9 Z
2.00 – 2.99 V	2.00 – 3.99 Z		7.00 – 7.99 V	64.0 – 127 Z
3.00 – 3.99 V	4.00 – 7.99 Z		8.00 – 8.99 V	128.0 – 255 Z
4.00 – 4.99 V	8.00 – 15.9 Z		9.00 – 9.99 V	256 – 512 Z
5.00 – 5.99 V	16.0 – 31.9 Z			

When an updated agent concentration value is generated, the ACAMS unit also generates a temporary digital signal to the PLC, the concentration update signal or pulse. The concentration update signal remains active for approximately 22 seconds. After the concentration update signal expires, the PLC initiates a five-second timer during which the PLC acquires the updated agent concentration value. The updated agent concentration is displayed on the appropriate Advisor PC screen and is compared to agent alarm setpoints to determine if any alarms should be generated.

The agent concentration remains displayed until the next concentration update signal is received by the PLC, and a new agent concentration value is acquired.

3.4.4 ACAMS CON Display

The status of the plant ACAMS is displayed on Advisor PC screens in the CON. At TOCDF, there are nine different screens that display ACAMS information based on location of the ACAMS units. These screens are shown in Appendix E. ACAMS monitors are identified by station number, as listed in the site-specific agent monitoring

[11] The agent gate is the time period during which the chemical agent of interest elutes from the analytical column into the FPD. Only signals detected during the agent gate are considered for quantification. The agent gate is adjustable and is set to ensure that signals representing air, solvents, or interferants are excluded from the quantification. The agent gate can occur during the sample period, purge period, or overlap both periods. The location of the agent gate depends on the retention time of the agent for each individual ACAMS unit.

plan. The analog output value as well as the ACAMS status is included with the station number. Table 3.5 describes the screen display for each possible status of an ACAMS monitor. When the monitoring level is displayed, the following abbreviations are used: AS = ASC, TW = TWA, ID = IDLH, MP = MPL.

Table 3.5. TOCDF ACAMS CON Display

ACAMS STATUS	DISPLAY COLOR	DISPLAY TEXT	COMMENTS
Power off	Magenta	Monitoring level	Generates ACAMS NOT NORMAL alarm. See Note 1.
Challenge	Green	Monitoring level	No change in indication from OPERATE. See Note 2.
Calibrate	Green	CA	Generates ACAMS NOT NORMAL alarm. See Notes 1 & 2
Service	Green	SV	Generates ACAMS NOT NORMAL alarm. See Notes 1 & 2
MON Challenge	Green	CH	Generates ACAMS NOT NORMAL alarm. See Notes 1 & 2
PLC Alarm	Red (flashing)	Monitoring level	Displays analog updates with most recent level detected.
ACAMS Alarm	Red (flashing)	Monitoring level	Displays analog updates with most recent level detected.
Malfunction	Magenta	MF	Generates ACAMS NOT NORMAL alarm. See Note 1.
Alarm Test	Green	Monitoring level	If alarm test status is indicated for more than 30 seconds, ACAMS goes into MALFUNCTION
Operate	Green	Monitoring level	

Note 1: TOCDF replaced individual alarms associated with ACAMS status with a general alarm designated ACAMS NOT NORMAL (see Section 3.4.5.2).

Note 2: If ACAMS is in CHALLENGE, CALIBRATE, SERVICE, or MON CHALLENGE for more than 1 hour, ACAMS NOT ONLINE/NOT ONLINE TIMEOUT alarm is activated (see Section 3.4.5.2).

3.4.5 ACAMS Alarms

There are two types of alarms associated with ACAMS units: agent alarms and status alarms. Agent alarms indicate an agent concentration in the area being sampled above a predetermined setpoint. Status alarms notify the CON when the ACAMS unit is not in a normal operating configuration and the ACAMS status meets predetermined conditions that are programmed in the PLC.

For a select number of ACAMS units, automatic actions are taken by the plant control system in response to certain ACAMS alarms. These alarms are listed in the alarm and interlock matrices in Appendix C.

3.4.5.1 ACAMS Agent Alarms

There are two types of agent alarms associated with each ACAMS unit. One is generated by the ACAMS software and is transmitted to the CON by setting the A, B, and C digital signals as shown in the truth tables. The second type of agent alarm is generated by the PLC based on the analog agent value sent from the ACAMS unit. The ACAMS unit is limited to a single alarm setpoint; however, multiple alarm setpoints can be programmed in the PLC based on the analog value.

The specific alarm configuration at a site can change based upon the agent, or agents, being monitored and the plant-processing configuration. Site-specific agent monitoring plans are revised as plant monitoring requirements change during the life of the facility.

In general, for areas that require monitoring at the TWA, ASC, GDL, and IDLH levels by the PMCSD Specific MCP, alarm setpoints are set below 1.0 Z to ensure that action is taken prior to the 1.0 Z value being reached. For example, during GB processing at TOCDF, the TWA ACAMS digital alarm was the HAZARD LEVEL alarm, initially set at 0.7 Z to notify workers in the area being monitored to don a mask. The PLC included two alarms, one at the LOQ level, 0.2 Z, and an additional HIGH LEVEL alarm at 9.8 Z. TOCDF later modified the alarm configuration under ECP TEMP-2369-ACA to eliminate the HIGH LEVEL alarm, switch the ACAMS digital alarm to the LOQ value, 0.2 Z, and change the PLC alarm setpoint to 0.7 Z. According to direction from the filed design lessons learned (FDLL) program, the alarm changes implemented at TOCDF under ECP TEMP-2369-ACA will be implemented at the three other sites. Specific ACAMS alarm setpoints can be found in each site’s agent monitoring plan.

Since TOCDF is preparing to start VX munition processing and also will be processing miscellaneous waste leftover from GB campaigns, they will be monitoring for both VX and GB at specific plant locations. The LOQ setpoint for VX ACAMS monitors was set at 0.2 Z by ECP TEMP-2786-ACA. However, after discussions with the State of Utah, TOCDF plans to revise this setpoint to be 0.5 Z to reduce false-positive readings.

TOCDF uses ECL ACAMS monitors to support toxic area entries. Alarms for ECL ACAMS monitors are set just below the threshold values for the PPE being worn. ECL ACAMS units monitoring at the TWA level are used to support toxic area entries in which workers are dressed in Army level B protective clothing. These TWA ACAMS monitors alarm at 40 TWA, which is referred to as the OSHA C ABORT alarm because it is set just below the threshold level of 50 TWA for OSHA level C protective gear. ECL ACAMS units monitoring at the IDLH level are used to support entries into toxic areas in which workers are dressed in DPE. These ACAMS monitors alarm at 400 IDLH, which is referred to as the DPE ABORT alarm because it is set just below the threshold level of 500 IDLH for DPE. These alarms were recently modified to support implementation of redefined PPE levels in a revision to Department of the Army Pamphlet (DA-PAM) 385-61, Toxic Chemical Agent Safety Standards (See FAWB Note B-9).

The ECL ACAMS alarms were added at TOCDF by TEMP-2513-ACA R1. ANCDF and UMCDF have indicated that they plan to add similar alarms; PBCDF is currently reviewing the ECP for potential implementation.

During the GB campaigns, TOCDF added a major agent spill alarm associated with the ACAMS unit monitoring the MDB main exhaust duct, monitoring station DUC313, MON-ACAM-180. The alarm setpoint is 50 IDLH. The alarm was added by ECP TEMP-2448-MDB. ANCDF and UMCDF have indicated that they plan to add a similar alarm; PBCDF is currently reviewing the ECP for potential implementation.

Furnace duct and common stack ACAMS agent alarms are RCRA alarms for each of the furnaces. These alarms are shown on the induced draft screen for each of the furnaces. These alarms and setpoints are site-specific based on the RCRA permits. Because these alarms result in automatic actions taken by the plant control system, they are listed in the A&I matrices in Appendix C.

3.4.5.2 ACAMS Status Alarms

Table 3.6 shows the two TOCDF ACAMS status alarms and the status for implementation at follow-on sites. The ACAMS NOT NORMAL alarm was created at TOCDF to reduce the number of different alarms that previously existed related to the status of each ACAMS unit. When the ACAMS microprocessor detects a controlled, monitored zone that is not within the specified setpoint range or a component failure or malfunction, a digital signal is generated that activates a local visual signal that also is transmitted to the CON to indicate a malfunction/error condition.

Table 3.6. TOCDF ACAMS Status Alarms

TOCDF Alarm	Alarm Initiation	Status at Follow-on Sites	References
ACAMS NOT NORMAL	Alarm activated when ACAMS power is off, ACAMS is in malfunction[a], or computer interface module is placed in CALIBRATE, SERVICE, or MON CHALLENGE.	All sites currently have old TOCDF alarm configuration with 5 separate status alarms. TOCDF ECP was reviewed by lessons learned program and determined to be mandatory for implementation at all sites. It has not yet been implemented.	TEMP-2369-ACA combined 5 status alarms into a single alarm.
ACAMS NOT ONLINE/NOT ONLINE TIMEOUT	Alarm activated when ACAMS is in CHALLENGE, CALIBRATE, SERVICE, or MON CHALLENGE for more than 1 hour. Alarm will continue to activate every hour until ACAMS is back online.	All sites currently have one-hour timeout timer, but do not have TEMP-2754-ACA implemented. This ECP is under review at all sites.	TEMP-2283-ACA changed not online timer from ¼hr to 1 hr. TEMP-2754-ACA modified code to reset timer after alarm is acknowledged so that alarm will continue to alarm every hour.

[a] For ACAMS monitors using an LVS, TOCDF ECP TEMP-2383-ACA modified ACAMS software and LVS hardware so that ACAMS MALFUNCTION alarm is activated if LVS is left in manual purge mode when the ACAMS is in OPERATE. The ECP is under review at follow-on sites.

SECTION 4
COMPONENT SUMMARY

4.1 ACAMS COMPONENTS

The components of an ACAMS station can be grouped into three equipment categories: the ACAMS monitor, support equipment, and auxiliary equipment. Figure 4-1 shows the major components of a typical ACAMS station, including the ACAMS monitor and support equipment; auxiliary equipment is not shown.

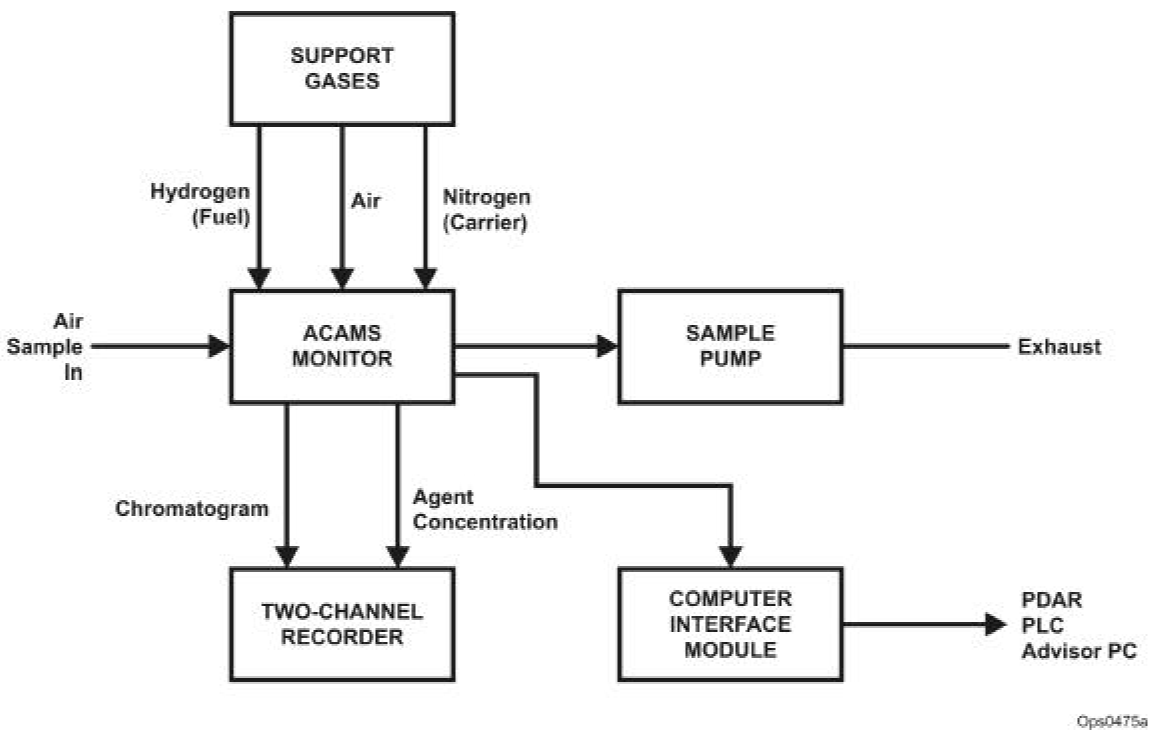

Figure 4-1. Typical ACAMS Station Block Diagram

4.1.1 ACAMS Monitor

The ACAMS monitor houses the analytical, electronic, and mechanical components needed to detect and quantify chemical agent at prescribed human health and safety and process control hazard levels.

4.1.2 ACAMS Support Equipment

ACAMS support equipment includes heat-traced sample lines, ACAMS sample pump, compressed gases, strip chart recorder, and computer interface module.

4.1.2.1 Heat-Traced Sample Line

The heat-traced sample line provides a flow path for sample gases from the sampled location or stack sample probe assembly (ASC ACAMS only) to the ACAMS monitor or sample conditioning system. Heat-traced sample lines are maintained at a temperature above the dew point to prevent condensation formation in the sample lines. If moisture condenses in the sample line, it can be drawn into the ACAMS monitor and render the monitor inoperable. The moisture can saturate the PCT, ruining its ability to adsorb and desorb chemical agent. Expansion of the moisture in the heated zones of the PCT and analytical column can result in a broken PCT or column.

Sample lines are heat-traced using self-regulating heating elements installed parallel to the sample line. The heating elements increase their heat output when the temperature of the sample tube drops and decreases the heat output when the temperature of the sample tube rises.

4.1.2.2 ACAMS Sample Pump

The ACAMS sample pump draws the air sample into the ACAMS monitor through the PCT. Original ACAMS units were supplied to JACADS and TOCDF with a 1/10-hp or 1/15-hp, oil-less, carbon-vane, rotary vacuum pump. Both sites have replaced some of the pumps with higher-capacity, quieter, 600-watt (~0.8 hp) diaphragm pumps[1]. ANCDF, PBCDF and UMCDF ACAMS monitors are equipped with the diaphragm pumps.

The ACAMS sample pump is connected to the back panel of the ACAMS monitor using Teflon tubing. The sample flow rate is controlled using a bleed valve located on the inlet of the pump.

4.1.2.3 Compressed Gases

The ACAMS monitor requires three gases to operate: nitrogen, hydrogen and air. Nitrogen is the carrier gas that is used to flush the agent off the PCT sorbent bed and into the analytical column during the purge period. During the sample period, nitrogen sweeps through the analytical column. Hydrogen is the fuel gas for the flame photometric detector (FPD). Air is the oxidizer that mixes with hydrogen to provide the hydrogen-rich flame required by the FPD.

Nitrogen and hydrogen are supplied from compressed gas cylinders. Air is supplied from the instrument air system. Nitrogen is filtered to remove moisture, hydrocarbons and oxygen. Air and hydrogen are filtered to remove moisture and hydrocarbons. The gases are supplied to the back panel of the ACAMS monitor using copper/Teflon tubing and compression fittings.

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[1] PLL Issue 97-115 discusses replacement of ACAMS sample pumps.

All three gases must be of very high purity. Hydrogen must be 99.999% pure and contain less than 4 ppm water. It is supplied at 50 psig with a flow rate of 100±5 ml/min[2]. Nitrogen must be 99.998% pure and contain less than 4 ppm water. It is supplied at 50 psig with a flow rate of 30±1 ml/min[2]. Air must contain less than 1 ppm hydrocarbons and 5 ppm water. It is supplied at 50 psig with a flow rate of 100±5 ml/min[2].

4.1.2.4 Strip Chart Recorder

The strip chart recorder provides a permanent output and record of the ACAMS monitor signals. The strip chart recorder is connected to the back of the ACAMS and accepts two input signals. Channel "A", uses the black pen to provide a trace of the detector signal output known as a "chromatogram". Channel "B", uses the red pen to provide a record of the agent concentration/hazard level as an output calculated by the ACAMS microprocessor.

4.1.2.5 Computer Interface Module

The majority of the plant ACAMS monitors are linked to the plant control system via a computer interface module. The module is a small metal box with a five-position selector switch. As described in section 3.4.1, the computer interface module provides computer compatible signals for agent concentration, concentration update, and status signals to reflect the operating mode of the ACAMS monitor. It is connected to the back panel of the ACAMS monitor with a standard RS232C data cable. The output of the module is connected to the plant control system PLC input/output modules using a specially fabricated data cable.

4.1.3 ACAMS Auxiliary Equipment

Several additional items of auxiliary equipment are required when operating under certain conditions. These items are the stack sample probe assembly, dilution air-flow controller (DAFC), low volume sampler (LVS), and stream selection or sequential sampling system.

4.1.3.1 Stack Sample Probe Assembly

ASC ACAMS monitors require a stack sample probe assembly and a DAFC. The stack sample probe assembly is designed to withdraw representative stack gas samples from the ducts of the LIC, MPF, DFS and common stack[3]. The dilution air supplied by the DAFC mixes with the exhaust gas sample in the probe assembly to lower the sample temperature, particulate concentration, dew point, and agent concentration by a known percentage. The ACAMS software uses this known dilution ratio to calculate the agent concentration in the exhaust gas sample.

4.1.3.2 Dilution Air Flow Controller

Stack gases are somewhat difficult to sample due to high sample temperature, high particulate content, and high moisture content. The DAFC provides a source of clean dry

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[2] Service gas flow rates are from the ABB Installation, Operation, and Maintenance Manual. Site-specific flow rates can be varied to optimize the performance of an ACAMS in accordance with site-specific SOPs.

[3] Since the dunnage incinerator (DUN) will most likely not be operated at any of the sites, sampling of the DUN exhaust is not listed (see FAWB Note B-1).

dilution air in a known proportion to mix with the sample stream prior to entering the ACAMS monitor. DAFCs are used with all ASC ACAMS monitors.

4.1.3.3 Low Volume Sampler

The LVS is used when an ACAMS unit is required to monitor areas with known or suspected high agent exposure levels up to the IDLH/GDL and MPL levels, with agent concentrations that can exceed 100 milligrams per cubic meter (100 mg/m^3). The LVS is a microprocessor controlled sample device used to limit the size of the sample being collected from an area of known/expected high levels of contamination to a very small known volume, one milliliter (1 ml). The LVS is an integral part of the ACAMS sampling system and injects the 1-ml sample into the ACAMS monitor. The 1-ml sample is passed through the ACAMS PCT using a carrier gas consisting of air from a clean, monitored corridor. The limited sample volume ensures that the instrument will not be contaminated internally and that the detector response will not be saturated beyond the range of the instrument. The LVS can be disconnected from the ACAMS monitor to prevent unnecessary exposure of personnel to agent.

4.1.3.4 Uninterruptible Power Source

The ACAMS monitor, sample pump, and strip chart recorder require 115 volts alternating current (AC). The computer interface module receives power from the ACAMS monitor. An uninterruptable power supply (UPS) is required for all critical ACAMS stations (stacks and furnace ducts) in the event of a power failure. The UPS must have brown-out protection and constant voltage output and be able to operate the ACAMS station for at least 15 minutes during a power failure.

4.2 EQUIPMENT POWER SOURCES

Per the PMCSD Monitoring Concept Plan, all critical ACAMS stations are required to be powered by the UPS system. The TOCDF Agent Monitoring Plan indicates that all ACAMS monitors associated with MDB operations are on the UPS. Follow-on site MDB ACAMS monitors are also on the UPS and are listed, or will be listed, in the site-specific Laboratory Analysis and Monitoring Plan (LAMP).

Table 4.1 lists the power sources for the critical ACAMS based on the source documentation listed in Appendix H. Power sources are characterized as either critical, essential or utility. Critical loads are powered by the UPS panelboards and do not experience an interruption in power if offsite power is lost. Essential loads are required for safe shutdown of the facility, but can tolerate an interruption in power while being loaded on an onsite emergency diesel generator (EDG). Utility loads are not required if offsite power is lost and are not powered by the onsite EDG. Only motive power sources are listed in the table. Hydraulically and pneumatically powered, and non-powered equipment are not included in the table.

Table 4.1 ACAMS Power Sources

Equipment Tag	Monitored Location	Site(s)	Power Source	Power Type
MON-ACAM-101	MDB Area	AN/TE/UM	UPS-PANB-106	Critical
		PB	UPS-PANB-113	Critical
MON-ACAM-102	MDB Area	AN/TE/UM	UPS-PANB-113	Critical
MON-ACAM-103	MDB Area	AN/TE/UM	UPS-PANB-104	Critical
		PB	UPS-PANB-106	Critical
MON-ACAM-104	MDB Area	AN/PB/TE/UM	UPS-PANB-106	Critical
MON-ACAM-105	MDB Area	AN/PB/TE/UM	UPS-PANB-108	Critical
MON-ACAM-106	MDB Area	AN/PB/TE/UM	UPS-PANB-106	Critical
MON-ACAM-107	MDB Area	AN/TE/UM	UPS-PANB-106	Critical
		PB	UPS-PANB-113	Critical
MON-ACAM-108	MDB Area	AN/TE/UM	UPS-PANB-106	Critical
		PB	UPS-PANB-113	Critical
MON-ACAM-109	HVAC Filter	AN/PB/TE/UM	UPS-PANB-117	Critical
MON-ACAM-110	MDB Area	AN/TE/UM	UPS-PANB-113	Critical
		PB	UPS-PANB-104	Critical
MON-ACAM-112	MDB Area	AN/PB/TE/UM	UPS-PANB-106	Critical
MON-ACAM-113	MDB Area	AN/TE/UM	UPS-PANB-107	Critical
		PB	UPS-PANB-108	Critical
MON-ACAM-114	MDB Area	AN/TE/UM	UPS-PANB-107	Critical
MON-ACAM-115	MDB Area	AN/TE/UM	UPS-PANB-107	Critical
		PB	UPS-PANB-108	Critical
MON-ACAM-116	MDB Area	AN/TE/UM	UPS-PANB-107	Critical
MON-ACAM-117	MDB Area	AN/PB/TE/UM	UPS-PANB-108	Critical
MON-ACAM-118	MDB Area	TE	UPS-PANB-106	Critical
MON-ACAM-119	MDB Area	AN/TE/UM	UPS-PANB-104	Critical
		PB	UPS-PANB-113	Critical
MON-ACAM-120	MDB Area	AN/TE/UM	UPS-PANB-108	Critical
		PB	UPS-PANB-107	Critical
MON-ACAM-122	MDB Area	AN/UM	UPS-PANB-108	Critical
		PB	UPS-PANB-107	Critical
		TE	UPS-PANB-121	Critical
MON-ACAM-123	MDB Area	AN/PB/TE/UM	UPS-PANB-113	Critical

Table 4.1 (Cont'd)

Equipment Tag	Monitored Location	Site(s)	Power Source	Power Type
MON-ACAM-124	MDB Area	AN/PB/TE/UM	UPS-PANB-113	Critical
MON-ACAM-125	PMB Area	AN/UM	UPS-PANB-155	Critical
	MDB Area	TE	UPS-PANB-108	Critical
MON-ACAM-126	MDB Area	AN/TE/UM	UPS-PANB-104	Critical
		PB	UPS-PANB-113	Critical
MON-ACAM-127	MDB Area	TE	UPS-PANB-108	Critical
MON-ACAM-129	Common Stack	AN/PB/TE/UM	UPS-PANB-115	Critical
MON-ACAM-130	DUN Stack	AN/UM[a]	UPS-PANB-156	Critical
MON-ACAM-131	MDB Area	TE	UPS-PANB-113	Critical
MON-ACAM-132	HVAC Filter	AN/PB/TE/UM	UPS-PANB-117	Critical
MON-ACAM-133	MDB Area	AN	UPS-PANB-108	Critical
		TE	UPS-PANB-107	Critical
MON-ACAM-134	LIC (No.2 at TE & UM) Exhaust Duct	AN/UM	UPS-PANB-115	Critical
		TE	UPS-PANB-114C	Critical
MON-ACAM-135	HVAC Filter Stack	AN/PB/TE/UM	UPS-PANB-117	Critical
MON-ACAM-136	MDB Area	PB	UPS-PANB-108	Critical
MON-ACAM-137	MDB Area	AN/TE/UM	UPS-PANB-113	Critical
		PB	UPS-PANB-106	Critical
MON-ACAM-138	MDB Area	AN/TE/UM	UPS-PANB-106	Critical
		PB	UPS-PANB-113	Critical
MON-ACAM-140	MDB Area	AN/PB/TE/UM	UPS-PANB-107	Critical
MON-ACAM-141	MDB Area	TE	UPS-PANB-107	Critical
MON-ACAM-142	HVAC Filter	AN/PB/TE/UM	UPS-PANB-117	Critical
MON-ACAM-143	MDB Area	AN/TE/UM	UPS-PANB-107	Critical
MON-ACAM-145	MDB Area	AN/TE/UM	UPS-PANB-106	Critical
		PB	UPS-PANB-108	Critical
MON-ACAM-147	MDB Area	AN/PB/TE/UM	UPS-PANB-108	Critical
MON-ACAM-148	MDB Area	AN/TE/UM	UPS-PANB-106	Critical
		PB	UPS-PANB-113	Critical
MON-ACAM-149	MDB Area	AN/PB/TE/UM	UPS-PANB-106	Critical
MON-ACAM-152	BRA Stack	AN/PB/UM[b]	UPS-PANB-116	Critical

Table 4.1 (Cont'd)

Equipment Tag	Monitored Location	Site(s)	Power Source	Power Type
MON-ACAM-153	MDB Area	TE	UPS-PANB-113	Critical
MON-ACAM-154	MDB Area	AN/TE/UM	UPS-PANB-106	Critical
MON-ACAM-156	MDB Area	AN/TE/UM	UPS-PANB-113	Critical
		PB	UPS-PANB-106	Critical
MON-ACAM-157	MDB Area	AN/PB/TE/UM	UPS-PANB-108	Critical
MON-ACAM-159	MDB Area	AN/TE/UM	UPS-PANB-113	Critical
MON-ACAM-161	HVAC Filter	AN/PB/TE/UM	UPS-PANB-117	Critical
MON-ACAM-162	MDB Area	TE	UPS-PANB-104	Critical
MON-ACAM-163	LIC (No.1 at TE & UM) Exhaust Duct	PB/UM	UPS-PANB-115	Critical
		TE	UPS-PANB-114C	Critical
MON-ACAM-164	MDB Area	AN/TE/UM	UPS-PANB-104	Critical
		PB	UPS-PANB-113	Critical
MON-ACAM-165	MDB Area	AN/TE/UM	UPS-PANB-104	Critical
		PB	UPS-PANB-106	Critical
MON-ACAM-166	MDB Area	AN/TE/UM	UPS-PANB-113	Critical
		PB	UPS-PANB-106	Critical
MON-ACAM-167	MPF Exhaust Duct	AN/PB/UM	UPS-PANB-115	Critical
		TE	UPS-PANB-114C	Critical
MON-ACAM-168	MDB Area	TE	UPS-PANB-104	Critical
MON-ACAM-172	MDB Area	AN/TE/UM	UPS-PANB-107	Critical
MON-ACAM-173	CHB Area	AN/PB/TE/UM	UPS-PANB-121	Critical
MON-ACAM-174	CHB Area	AN/PB/TE/UM	UPS-PANB-121	Critical
MON-ACAM-175	MDB Area	AN/TE/UM	UPS-PANB-104	Critical
		PB	UPS-PANB-106	Critical
MON-ACAM-176	MDB Area	AN/TE/UM	UPS-PANB-106	Critical
		PB	UPS-PANB-113	Critical
MON-ACAM-177	CHB Area	AN/PB/TE/UM	UPS-PANB-121	Critical
MON-ACAM-178	CHB Area	AN/PB/TE/UM	UPS-PANB-121	Critical
MON-ACAM-180	MDB HVAC Exhaust Duct	AN/TE/UM	UPS-PANB-108	Critical
		PB	UPS-PANB-107	Critical
MON-ACAM-181	MDB Area	AN/TE/UM	UPS-PANB-106	Critical
		PB	UPS-PANB-113	Critical

Table 4.1 (Cont'd)

Equipment Tag	Monitored Location	Site(s)	Power Source	Power Type
MON-ACAM-183	DFS Exhaust Duct	AN/PB/UM	UPS-PANB-115	Critical
		TE	UPS-PANB-114C	Critical
MON-ACAM-186	HVAC Filter	AN/PB/TE/UM	UPS-PANB-117	Critical
MON-ACAM-187	HVAC Filter	AN/PB/TE/UM	UPS-PANB-117	Critical
MON-ACAM-188	HVAC Filter	AN/PB/TE/UM	UPS-PANB-117	Critical
MON-ACAM-189	HVAC Filter	AN/PB/TE/UM	UPS-PANB-117	Critical
MON-ACAM-190	HVAC Filter	AN/TE/UM	UPS-PANB-117	Critical
MON-ACAM-195	MDB Area	AN/UM	UPS-PANB-106	Critical
MON-ACAM-216	MDB Area	AN/TE/UM	UPS-PANB-106	Critical
		PB	UPS-PANB-113	Critical
MON-ACAM-218	CHB UPA	AN/PB/TE/UM	UPS-PANB-121	Critical
MON-ACAM-219	MDB Area	AN/PB/TE/UM	UPS-PANB-108	Critical
MON-ACAM-223	Common Stack	AN/PB/TE/UM	UPS-PANB-115	Critical
MON-ACAM-225	Common Stack	AN/PB/TE/UM	UPS-PANB-115	Critical
MON-ACAM-226	MDB Area	AN/UM	UPS-PANB-113[c]	Critical
		TE	UPS-PANB-106	Critical
MON-ACAM-227	MDB Area	AN/TE/UM	UPS-PANB-106	Critical
MON-ACAM-229	CHB UPA	AN/TE/UM	UPS-PANB-121	Critical
	MDB Area	PB	UPS-PANB-106	Critical
MON-ACAM-230	MDB Area	AN/UM	UPS-PANB-113	Critical
		PB	UPS-PANB-106	Critical
		TE	UPS-PANB-108	Critical
MON-ACAM-232	MDB Area	AN/TE/UM	UPS-PANB-108	Critical
		PB	UPS-PANB-107	Critical
MON-ACAM-250	LAB Area	AN/PB/UM	UPS-PANB-130(L)	Critical
MON-ACAM-251	LAB Area	AN/PB/UM	UPS-PANB-130(L)	Critical
MON-ACAM-254	LAB Area	AN/PB/UM	UPS-PANB-130(L)	Critical
MON-ACAM-255	LAB Area	AN/PB/UM	UPS-PANB-130(L)	Critical
MON-ACAM-256	LAB Filter	AN/PB/UM[d]	UPS-PANB-130(L)	Critical
MON-ACAM-258	LAB Stack	AN/PB/UM	UPS-PANB-130(L)	Critical
MON-ACAM-261	PMB Area	AN/UM	UPS-PANB-155	Critical
		TE	PMB-PANB-102	Critical[e]

Table 4.1 (Cont'd)

Equipment Tag	Monitored Location	Site(s)	Power Source	Power Type
MON-ACAM-263	PMB Area	TE	PMB-PANB-102	Critical[e]
MON-ACAM-267	CAL DAAMS Lab	TE	CAL-PANL-UPS5	Critical
MON-ACAM-271	CAL Toxic Lab	TE	CAL-PANL-UPS5	Critical
MON-ACAM-274	CAL Room	TE	CAL-PANL-UPS5	Critical
MON-ACAM-277	CAL Filter	TE	CAL-PANL-UPS1	Critical
MON-ACAM-286	DUN Stack	AN/UM[a]	UPS-PANB-156	Critical
MON-ACAM-287	LAB Area	AN/PB/UM	UPS-PANB-130(L)	Critical
MON-ACAM-288	LAB Area	AN/PB/UM	UPS-PANB-130(L)	Critical
	MPF Discharge Airlock	TE	UPS-PANB-106	Critical
MON-ACAM-289	DUN Duct	AN/UM[a]	UPS-PANB-156	Critical
MON-ACAM-290	MPF Discharge Airlock	AN/UM	UPS-PANB-106	Critical
		PB	UPS-PANB-113	Critical
MON-ACAM-297	DFS Cyclone Enclosure HVAC	AN/PB/UM	UPS-PANB-115	Critical
MON-ACAM-309	CAL Lab Corridor	TE	CAL-PANL-UPS5	Critical
MON-ACAM-310	MDB Area	AN[f]	UPS-PANB-113	Critical
MON-ACAM-311	MDB Area	AN[f, g]	UPS-PANB-108	Critical
MON-ACAM-312	MDB Area	AN	UPS-PANB-108	Critical
		TE	UPS-PANB-107	Critical
MON-ACAM-313	CHB Area	PB	UPS-PANB-121	Critical
	MDB Area	AN/UM	UPS-PANB-108	Critical
		TE	UPS-PANB-113	Critical
MON-ACAM-314	CHB Area	PB	UPS-PANB-121	Critical
	MDB Area	AN/UM[f]	UPS-PANB-108	Critical
		TE	UPS-PANB-113	Critical
MON-ACAM-315	CHB Area	PB	UPS-PANB-121	Critical
	MDB Area	AN/UM[f]	UPS-PANB-108	Critical
MON-ACAM-316	MDB Area	TE	UPS-PANB-106	Critical
MON-ACAM-318	CAL Corridor	TE	CAL-PANL-UPS5	Critical
MON-ACAM-319	CAL Room	TE	CAL-PANL-UPS5	Critical
MON-ACAM-320	CAL Toxic Lab	TE	CAL-PANL-UPS5	Critical
MON-ACAM-322	MDB Area	TE	UPS-PANB-107	Critical

Table 4.1 (Cont'd)

Equipment Tag	Monitored Location	Site(s)	Power Source	Power Type
MON-ACAM-324	MDB Area	TE	UPS-PANB-113	Critical
MON-ACAM-325	MDB Area	TE	UPS-PANB-107	Critical
MON-ACAM-326	MDB Area	TE	UPS-PANB-108	Critical
MON-ACAM-327	MDB Area	TE	UPS-PANB-108	Critical
MON-ACAM-328	MDB Area	TE	UPS-PANB-104	Critical
MON-ACAM-329	MDB Area	TE	UPS-PANB-108	Critical
MON-ACAM-330	DFS Cyclone Encl. HVAC	TE	UPS-PANB-115	Critical
MON-ACAM-331	Common Stack	TE	UPS-PANB-114B	Critical
MON-ACAM-332	Common Stack	TE	UPS-PANB-114B	Critical
MON-ACAM-333	Common Stack	TE	UPS-PANB-114B	Critical
MON-ACAM-335	HVAC Filter Stack	TE	UPS-PANB-117	Critical
MON-ACAM-340	CAL Filter	TE	CAL-PANL-UPS1	Critical
MON-ACAM-345	CAL GC/MS Room	TE	CAL-PANL-UPS5	Critical
MON-ACAM-346	DFS Exhaust Duct	TE	UPS-PANB-114C	Critical
MON-ACAM-347	PFS-FILT-110 (MPF)	PB	UPS-DPNL-105	Critical
	DFS Exhaust Duct	TE	UPS-PANB-114C	Critical
MON-ACAM-348	PFS-FILT-111 (DFS)	PB	UPS-DPNL-105	Critical
	MPF Exhaust Duct	TE	UPS-PANB-114C	Critical
MON-ACAM-349	PFS-FILT-112 (DFS)	PB	UPS-DPNL-105	Critical
	MPF Exhaust Duct	TE	UPS-PANB-114C	Critical
MON-ACAM-352	PFS-FILT-113 (Spare)	PB	UPS-DPNL-105	Critical
MON-ACAM-353	PFS Duct	AN[h]/PB/UM	UPS-DPNL-105	Critical
MON-ACAM-354	PFS Duct	AN[h]/UM	UPS-DPNL-105	Critical
	DFS Exhaust Duct	TE	UPS-PANB-114C	Critical
MON-ACAM-355	PFS Duct	AN[h]/PB/UM	UPS-DPNL-105	Critical
	MPF Exhaust Duct	TE	UPS-PANB-114C	Critical
MON-ACAM-356	MDB Area	AN	UPS-PANB-113	Critical
	PFS-FILT-109 (LIC)	PB	UPS-DPNL-105	Critical
	LIC 1 Exhaust Duct	TE	UPS-PANB-114C	Critical
MON-ACAM-357	PFS Duct	PB/UM	UPS-DPNL-105	Critical
	MDB Area	AN	UPS-PANB-104	Critical
	LIC 2 Exhaust Duct	TE	UPS-PANB-114C	Critical

Table 4.1 (Cont'd)

Equipment Tag	Monitored Location	Site(s)	Power Source	Power Type
MON-ACAM-358	MDB Area	AN	UPS-PANB-104	Critical
MON-ACAM-359	MDB Area	AN	UPS-PANB-107	Critical
	HVAC Filter Stack	TE	UPS-PANB-117	Critical
MON-ACAM-360	HVAC Filter Vestibule	AN/PB/UM[d]	UPS-PANB-117	Critical
	MDB Area	TE	UPS-PANB-107	Critical
MON-ACAM-361	HVAC Filter Vestibule	AN/PB/UM[d]	UPS-PANB-117	Critical
MON-ACAM-362	HVAC Filter Vestibule	AN/PB/UM[d]	UPS-PANB-117	Critical
MON-ACAM-363	HVAC Filter Vestibule	AN/PB/UM[d]	UPS-PANB-117	Critical
MON-ACAM-364	HVAC Filter Vestibule	AN/PB/UM[d]	UPS-PANB-117	Critical
MON-ACAM-365	HVAC Filter Vestibule	AN/PB/UM[d]	UPS-PANB-117	Critical
MON-ACAM-366	HVAC Filter Vestibule	AN/PB/UM[d]	UPS-PANB-117	Critical
MON-ACAM-367	HVAC Filter Vestibule	AN/PB/UM[d]	UPS-PANB-117	Critical
MON-ACAM-368	HVAC Filter Vestibule	AN/UM[d]	UPS-PANB-117	Critical
MON-ACAM-369	LAB Area (Filter @ UM)	PB/UM	UPS-PANB-130(L)	Critical
	MDB Area	TE	UPS-PANB-108	Critical
MON-ACAM-370	LAB Area (Filter @ UM)	PB/UM	UPS-PANB-130(L)	Critical
	PMB Area	TE	PMB-PANB-102	Critical[e]
MON-ACAM-373	MDB Area	TE/PB	UPS-PANB-108	Critical
		UM	UPS-PANB-107	Critical
MON-ACAM-374	MDB Area	TE	UPS-PANB-113	Critical
MON-ACAM-376	MDB Area	PB/UM	UPS-PANB-106	Critical
		TE	UPS-PANB-104	Critical
MON-ACAM-377	MDB Area	PB	UPS-PANB-107	Critical
		TE	UPS-PANB-113	Critical
MON-ACAM-378	MDB Area	TE	UPS-PANB-107	Critical
MON-ACAM-379	MDB Area	TE	UPS-PANB-113	Critical
MON-ACAM-380	MDB Area	TE	UPS-PANB-113	Critical
MON-ACAM-381	MDB Area	TE	UPS-PANB-113	Critical
MON-ACAM-382	MDB Area	TE	UPS-PANB-108	Critical
MON-ACAM-383	MDB Area	TE	UPS-PANB-108	Critical
MON-ACAM-384	MDB Area	TE	UPS-PANB-113	Critical
MON-ACAM-385	MDB Area	TE	UPS-PANB-113	Critical

Table 4.1 (Cont'd)

Equipment Tag	Monitored Location	Site(s)	Power Source	Power Type
MON-ACAM-386	MDB Area	TE	UPS-PANB-104	Critical
MON-ACAM-387	MDB Area	TE	UPS-PANB-107	Critical
MON-ACAM-388	MDB Area	TE	UPS-PANB-107	Critical
MON-ACAM-389	MDB Area	TE	UPS-PANB-107	Critical
MON-ACAM-390	MDB Area	TE	UPS-PANB-113	Critical
MON-ACAM-391	MDB Area	TE	UPS-PANB-107	Critical
MON-ACAM-392	MDB Area	TE	UPS-PANB-106	Critical

[a] DUN exhaust monitoring has been deleted at PB and TE, but is still shown in the AN and UM designs. The DUN is not planned to be operated at any of the sites (see FAWB Note B-1).

[b] TE does not operate the BRA and does not operate MON-ACAM-152.

[c] At UM, MON-ACAM-226 is listed incorrectly as a load on UPS-PANB-106 (ref: RFI C-UMCDF-005).

[d] At UM, MON-ACAM-256 is listed on UPS-PANB-130(L) and MON-ACAM-360 thru –368 are listed on UPS-PANB-117. ECP UMSF982LAB is deleting these ACAMS units (see FAWB Note B-10).

[e] MON-ACAM-261, -263, 370 use a standalone UPS.

[f] At UMCDF, MON-ACAM-310, –311, -314 & -315 are shown on UM-1-G-501, but are not listed on any UPS panels. Per RFIs C-UMCDF-005 and -006, MON-ACAM-310 and -311 were deleted from the design by ECP UMUF799MSS and need to be deleted from UM-1-G-501, and MON-ACAM-314 and –315 are powered by UPS-PANB-108.

[g] At ANCDF, MON-ACAM-311 is shown on design drawings but is being deleted by ECP ANWP0992MDB.

[h] At AN, PFS duct ACAMS are not shown in the referenced design documentation. ECP ANAP533PAS, which adds these monitors, is currently being implemented.

APPENDIX A

Acronyms and Abbreviations

The acronyms and abbreviations listed below are common for all of the programmatic process FAWBs:

A&I	alarm and interlock matrix
AASS	automatic agent sampling system
ABCDF	Aberdeen Chemical Agent Disposal Facility
AC	alternating current
ACAMS	automatic continuous air monitoring system
acfm	actual cubic foot per minute
ACS	agent collection system
ACSWS	acid and caustic storage and wash system
ADC	air dilution controller
AgF	silver fluoride
AHT	agent holding tank
AHU	air handling unit
AMC	Army Materiel Command
ANAD	Anniston Army Depot (Alabama)
ANCDF	Anniston Chemical Agent Disposal Facility
ANSI	American National Standards Institute
AQS	agent quantification system
AR	Army Regulation
ASA	automatic submerged arc
ASC	allowable stack concentration
ASD	adjustable-speed drive
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	acid wash system
AWFCO	automatic waste feed cutoff
BCHS	bulk container handling system
BCS	bulk chemical storage
BDS	bulk drain station
BGCDF	Blue Grass Chemical Agent Disposal Facility
BLAD	blast load attenuation duct
BMS	burner management system
BPS	burster punch station (MIN)
BRA	brine reduction area
BRS	burster removal station (PMD)
BSA	buffer storage area
BSR	burster size reduction machine
Btu	British thermal unit
°C	degrees Celsius
CAMDS	Chemical Agent Munition Disposal System
CAB	combustion air blower
CAL	chemical assessment laboratory

CAS	compressed air system
CBR	chemical, biological, and radiological (filter)
CCB	configuration control board
CCS	central control system
CCTV	closed-circuit television
CDS	central decontamination supply
CDSS	central decontamination supply system
CDTF	Chemical Demilitarization Training Facility
CEHNC	U.S. Army Engineering & Support Center, Huntsville.
CEMS	continuous emission monitoring system
CFR	Code of Federal Regulations
CGA	Compressed Gas Association
CHB	container handling building
CHWS	chilled water supply
CO	carbon monoxide (monitors/analyzers)
COM	communications system
CON	control room
COR	munitions corridor
CPA	client-Parsons authorization
CRO	control room operator
CRT	cathode ray tube
CS	crimp station (PMD)
CSS	campaign select screen
CSD	Chemical Stockpile Disposal (Project)
CV	control variable
CWC	Chemical Weapons Convention
CWS	chilled water supply
DAAMS	depot area air monitoring system
DAFC	dilution airflow controller
db	dry bulb
DC	direct current
DCD	Deseret Chemical Depot
DDESB	Department of Defense Explosives Safety Board
decon	decontamination (solution)
demil	demilitarization
DFS	deactivation furnace system
DICI	digital intercontroller communication input
DICO	digital intercontroller communication output
DMS	door monitoring system
DPE	demilitarization protective ensemble (suit)
DSA	DPE support area
dscf	dry standard cubic foot
DSIC	design and systems integration contractor
DUN	dunnage incinerator
E&M	engineering and maintenance
E-stop	emergency stop
EAC	equipment acquisition contractor
ECF	entry control facility
ECP	engineering change proposal
ECL	engineering control level
ECR	explosive containment room

ECV	explosive containment vestibule
EDG	emergency diesel generator
EHM	equipment hydraulic module
EIC	equipment installation contractor
EONC	enhanced onsite container
EPS	emergency power system
ETL	extreme temperature limit
°F	degrees Fahrenheit
FARS	fuzewell assembly (or adapter) removal station
FAWB	functional analysis workbook
FDLL	field design lessons learned (program)
FDPS	fire detection and prevention system
FEET	FAWB evolvement/evaluation team
FEM	fire extinguishing medium
FIFO	first-in-first-out
FIL	activated carbon and HEPA filter
FPD	flame photometric detector
fpm	feet per minute
FSSS	flame safety shutdown system
ft	feet
GA	general arrangement; nerve agent ethyl N-dimethylphosphoramidocyanidate ($C_5H_{11}N_2O_2P$)
gal	gallon
GB	nerve agent Sarin, isopropyl methyl phosphonofluoridate ($C_4H_{10}FO_2P$)
GC	gas chromatograph
GDL	gross detection level
GEN	emergency generator
GFE	government-furnished equipment
GLD	gross level detector
GPD	gas plasma display
GPL	general population limit
gpm	gallons per minute
gr	grain
H	blister agent mustard, made by the Levinstein process, bis(2-chloroethyl) sulfide or 2,2'-dichlorodiethyl sulfide ($C_4H_8Cl_2S_{1.5}$ [empirical formula])
H_3PO_4	orthophosphoric acid
HCl	hydrochloric acid
HD	blister agent distilled mustard, bis(2-chloroethyl) sulfide or 2,2'-dichlorodiethyl sulfide ($C_4H_8Cl_2S$)
HDC	heated discharge conveyor
HDV	hydraulic directional control valve
HEPA	high-efficiency particulate air (filter)
HLE	high-level exposure
HOA	hand-off-auto
hp	horsepower
hr	hour
HRA	health risk assessment
HT	60% by weight blister agent distilled mustard and 40% agent T [bis[2(2-chloroethylthio)ethyl] ether]
HVAC	heating, ventilating, and air-conditioning
HVC	heating, ventilating, and cooling

HYD	hydraulic power
HYPU	hydraulic power unit
HYVM	hydraulic control valve manifold
I/O	input/output
I-lock	interlock
IAS	instrument air system
icfm	inlet cubic foot per minute (acfm at the inlet)
ICS	instrumentation and control system
ID	induced draft
	inside diameter
IDLH	immediately dangerous to life and health
IGS	inertial gas sampling
in.	inch
in. wc.	inches water column
IR	infrared
ISO	International Standards Organization
JACADS	Johnston Atoll Chemical Agent Disposal System
kW	kilowatt
L	Lewisite (blister agent)
LAB	laboratory
lb	pound
lb/hr	pounds per hour
LCO	limiting condition of operation
ln	line
LIC	liquid incinerator
LIFO	last-in-first-out
LIT	level-indicating transmitter
LOQ	limit of quantification
LOR	local-off-remote
LPG	liquefied petroleum gas
LQAP	Laboratory Quality Assurance Plan
LQCP	Laboratory Quality Control Plan
LR	local-remote
LSB	LSS bottle filling system
LSS	life support system
LVS	low volume sampler
mA	milliamperes
MCC	motor control center
	mine component container
MCP	Monitoring Concept Plan
MDB	munitions demilitarization building
MDM	multipurpose demilitarization machine
MEL	master equipment list
MER	mechanical equipment room
mg/m^3	milligrams per cubic meter
MIG	mine glovebox
MIN	mine machine
MMS	mine and munitions system
MPB	munitions processing bay
MPF	metal parts furnace
MPL	multiposition loader

	maximum permissible limit (for DPE)
MPRS	miscellaneous parts removal station (PMD)
MSB	monitor support building
MSS	munition sampling system
NaOCl	sodium hypochlorite
NaOH	sodium hydroxide
NCRS	nose closure removal station (PMD)
NEMA	National Electrical Manufacturers Association
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NG	natural gas
NRT	near real time
O&M	operations and maintenance
OBV	observation corridor
ONC	onsite container
OS	orientation station (MIN)
OSHA	Occupational Safety and Health Administration
OVT	operational verification testing
P&A	precision and accuracy
P&ID	piping and instrument diagram
PA	public address
PAS	pollution abatement system
PBA	Pine Bluff Arsenal
PBCDF	Pine Bluff Chemical Agent Disposal Facility
PCS	primary cooling system
PCT	preconcentrator tube
PDAR(S)	process data acquisition and recording system
PDE	projectile deformation equipment
PDIT	pressure differential indicator transmitter
PDS	pull and drain station (MDM)
	punch and drain station (MIN)
PFD	process flow diagram
PFS	PAS filter system
pH	potential of hydrogen (a measure of acidity or alkalinity)
PHS	projectile handling system
PID	proportional integral derivative
pig	overpacked shipping container
PKPL	pick-and-place machine (also PPL)
PLA	plant air system
PLC	programmable logic controller
PLL	programmatic lessons learned (program)
PLS	proximity limit sensor/switch
PMB	personnel and maintenance building
PMCD	Program Manager for Chemical Demilitarization
PMCSD	Project Manager for Chemical Stockpile Disposal
PMD	projectile/mortar disassembly (machine)
PML	personnel, maintenance, and laundry (complex or building)
POT	potable water
PPL	pick-and-place machine (also PKPL)
PPS	primary power system
PQAP	Participant Quality Assurance Plan

PRW	process water
PSB	process support building
psig	pounds per square inch, gauge
PSV	pressure safety valve
PUB	process and utility building
PUDA	Pueblo Depot Activity (Colorado)
PWR	power systems (unit substation, uninterruptible power supply, battery rooms, and emergency generator)
RCRA	Resource Conservation and Recovery Act
RDS	rocket drain station
RDTE	research, development, testing, and evaluation
RFI	Request for Information
RHA	residue handling area
RHS	rocket handling system
rpm	revolutions per minute
rps	revolutions per second
RSM	rocket shear machine
RSS	rocket shear station
RTAP	real-time analytical platform
SC	systems contractor
SCBA	self-contained breathing apparatus
scf	standard cubic foot
scfh	standard cubic feet per hour
scfm	standard cubic feet per minute
SCW	secondary cooling water
SCT	systems contractor for training
SDS	spent decon system
sg	specific gravity
SGS	steam generation system
SOP	standing operating procedure
SPS	secondary power system
SRS	slag removal system
TBD	to be determined
TCE	treaty compliance equipment
TEAD	Tooele Army Depot (Utah)
TIP	tray information packet
TM	Army Technical Manual
TMA	toxic maintenance area
TNT	trinitrotoluene (explosive)
TOCDF	Tooele Chemical Agent Disposal Facility
TOX	toxic cubicle
TSCA	Toxic Substances Control Act
TSHS	toxic storage and handling system
TSO	Tight shutoff
TWA	time-weighted average
UE&C	United Engineers and Constructors
UMCDF	Umatilla Chemical Agent Disposal Facility
UPA	unpack area
UPS	uninterruptible power supply
UV	ultraviolet
VCR	video cassette recorder

VX	nerve agent, O-ethyl S-(2-diisopropylaminoethyl) methylphosphonothiolate ($C_{11}H_{26}NO_2PS$)
wc	water column
WTS	water treatment system
XXX	3X level of decontamination
XXXXX	5X level of decontamination (minimum of 1000ºF for 15 minutes)
Z	general designation for monitoring hazard level

APPENDIX B

FAWB Notes

Appendix B contains notes to expand upon the descriptions contained in the text of the FAWB. The notes include related experiences at the Johnston Atoll Chemical Agent Disposal System (JACADS).

B-1 Per discussions held during the comment resolution matrix meeting for the HVAC FAWB on 9-10-98, the programmatic process FAWBs were prepared under the assumption that the DUN, DUN PAS and DUN PFS (at ANCDF) systems will not be used for processing at any of the four sites. Therefore, a programmatic process FAWB for the DUN/DUN PAS/PFS was not developed. Handling and disposal of dunnage are considered site-specific activities that have not yet been determined. PBCDF deleted the DUN from the design by PBAC1000DUN. The DUN is installed at TOCDF and remains in the design at ANCDF. The RCRA and design package for the UMCDF DUN, DUN PAS, and DUN PFS were incorporated under post-construction design update package PC2. The redesigned DUN package PC2, however, was not incorporated into the UMCDF RCRA Permit. The regulators were directed to not review the package. Instead, UMCDF is still trying to determine its best course of action to process both dunnage and spent charcoal.

B-2 Per discussions held during the comment resolution matrix meeting for the PAS FAWB on 11-10-98, the programmatic process FAWBs for the PAS and PFS have been combined into a single PAS/PFS FAWB that applies to ANCDF, PBCDF, TOCDF, and UMCDF.

B-3 The acid/caustic storage and wash system is no longer used at TOCDF and has been removed from the ANCDF, UMCDF, and PBCDF site designs by ECPs ANAC343PAS, R1, UMAC160PAS, R1, and PBAC340PAS, respectively.

B-4 Original ACAMS software was written to support three monitoring levels: TWA, IDLH, and ASC. When monitoring at these 3 levels the ACAMS unit displays the applicable monitoring level. When monitoring at the MPL for GB or HD, the ACAMS displays in units of IDLH. Since 1 MPL is defined as 500 IDLH, the displayed value is simply divided by 500 to determine the MPL value. When monitoring HD at the GDL level, the ACAMS displays in units of IDLH. This can be confusing since there is no PMCD-defined IDLH level for HD. The original ACAMS software, however, had a preprogrammed IDLH level for HD. The PMCD-established GDL value for HD was set to match the HD IDLH value that is in the ACAMS software. Thus, when monitoring HD at the GDL, although the display indicates in IDLH units, the actual units are GDL. When monitoring at an ECL level, the ACAMS operates using a multiplier based on one of the three original monitoring levels. The ACAMS will display the monitoring level that corresponds to the monitoring level that is used as the basis for determining the ECL.

PMCD is currently investigating integration of computers at each ACAMS station that will allow for display in terms of the monitoring levels defined in the PMCD programmatic MCP, which match the monitoring levels described in this FAWB.

B-5 Levinstein mustard (H) and HT, a 60:40"5% mixture of HD and T, respectively, are detected by the ACAMS as HD. The ACAMS detects the mustard, bis(2-chloroethyl) sulfide, which is a primary component in all three blister agents. H is mustard produced by the Levenstein process that contains approximately 70 percent mustard and 30 percent sulfur impurities. HD is H that has been purified by washing and vacuum distillation to significantly increase purity and decrease sulfur impurities. T is a blister agent similar to mustard with a much higher boiling point, higher molecular weight, and significantly higher persistency. The T fraction is not normally detected and measured by the ACAMS due to its higher molecular weight, boiling point, and much longer retention time.

B-6 The real-time analytical platform (RTAP) is a self-contained mobile monitoring platform that combines a gas chromatograph with an automatic continuous environmental monitoring system. It is typically used for storage igloo first entry monitoring. If available, it can be used at TOCDF to monitor the HDC bin enclosure to ensure agent levels are below 0.2 TWA prior to opening the HDC bin enclosure door. TOCDF added the port for agent monitoring of the HDC discharge chute area under ECP TEMP-2761-DFS. ANCDF, PBCDF, and UMCDF are reviewing this ECP for potential implementation.

B-7 TOCDF eliminated the requirement for ASC ACAMS or DAAMS monitoring of the BRA due to verification that the brine is agent free prior to processing in the BRA [TOCDF ECP TEMP-1605-BRA]. The FDLL reviewed the TOCDF ECP and considered the modification to be site specific. The PMCD Environmental and Monitoring Office (EMO) reviewed the modification to determine if a programmatic change would be made. The EMO recommendation stated that the CSD site laboratories must have the ability to monitor with ACAMS and DAAMS on the BRA stack as a redundant measure (redundant to the extraction procedure of the brine process to determine presence of chemical agent). Based on this recommendation, ACAMS-152 remains in the design for ANCDF, PBCDF, and UMCDF as the ACAMS BRA stack monitor. The RCRA permits for these sites also include the requirement for ACAMS/DAAMS monitoring of the BRA stack.

Subsequent to these actions, TOCDF suspended BRA operations and temporarily put the BRA in lay-up status due to the ability to economically ship liquid brine offsite rather than process it onsite. Brine is sampled prior to discharge offsite.

ANCDF has issued ECP ANWF1078SRL to suspend operations in the BRA and implement changes to transfer brine from BRA-TANK-101/102 to tanker trucks in the truck unloading station. This ECP has not yet been implemented into the design drawings.

At PBCDF, ECP PBAC1006BRA R2 adds a brine loading system to allow pumping of brine to a tanker truck for offsite disposal. The system is provided as a backup to the BRA.

Similar to furnace system duct monitoring, ACAMS monitoring of the BRA stack will be dependent on whether or not the system is operated.

B-8 In response to a National Research Council recommendation, JACADS and TOCDF added M8A1 detectors in the UPA to provide rapid response (< 30 sec) to a major agent spill (see PLL Issues 21-9 and 97-60). The M8A1 detector is a gross-level detector that detects GB and VX at or above IDLH concentrations, but does not detect mustard agents. A detector for rapid-response, gross-level mustard monitoring has not yet been specified by PMCD for use in the UPA (see PLL Issue 22-19). ANCDF, PBCDF, and UMCDF do not plan to use gross-level detectors in the UPA.

B-9 Department of the Army Pamphlet (DA-PAM) 385-61, Toxic Chemical Agent Safety Standards, was revised in 2002 and has redefined the requirements for each level of PPE. The OSHA level C referred to in the FAWB text is equivalent to the old level-B PPE, as previously defined in DA-PAM 385-61. TOCDF recently redefined ACAMS monitoring and alarm requirements to support entries in the newly defined PPE levels.

B-10 Personnel vestibules associated the MDB HVAC exhaust air filtration units are monitored by ACAMS at each of the sites. At TOCDF, a single ACAMS unit is used to monitor all of the filter unit sample points during normal operation. The same ACAMS unit is used to monitor the vestibule when the filter unit is offline. At all other sites, dedicated ACAMS units were added by ECPs ANAC510FIL R1, PBAC446FIL R1, and UMAC334FIL R1 as part of the filter unit vestibule designs. TOCDF has modified the sampling sequence by ECPs TEMP-1762-MDB, TEMP-2045-HVC, R2, and most recently by TEMP-2576-ACA. Under ECP UMSF982LAB, UMCDF deleted the dedicated vestibule ACAMS units from the design and incorporated the TOCDF sampling sequence from TEMP-2045-HVC, R2. Modifications made at TOCDF by TEMP-2576-ACA are currently under review at UMCDF. ANCDF and PBCDF are reviewing TEMP-

2045-HVC, R2, TEMP-2576-ACA, and UMSF982LAB for potential implementation at their sites.

B-11 Under ECP TEMP-2468-ECV, TOCDF added ACAMS units to monitor the tray input bypass conveyor airlocks that are used to transfer munition trays from the UPA to the ECV. The ACAMS units are interlocked with the tray input airlock feed gates, UPA-FDDR-101/102, to prevent opening the gates until two ACAMS cycles have been completed and the readings are below the LOQ level. The ACAMS units were added following an incident in which agent was detected in the UPA while unusually high agent levels were present in the ECV. Interlocking the feed gates ensures that, if there is an HVAC imbalance, agent will not migrate from the ECV, through an airlock, and into the UPA.

APPENDIX C

Alarm and Interlock Matrices

Appendix C contains the alarm and interlock (A&I) matrix for each of the four baseline technology sites. The alarms and responses are based on ANCDF code as of July 2002, and TOCDF and UMCDF code as of September 2002, unless otherwise noted. PBCDF alarms and interlocks are based on current design documentation listed in Appendix H and discussions held at PBCDF in August and September 2002.

All ACAMS units that report to the CON have alarms associated with them. All of these alarms, however, are not listed since there are no automatic actions initiated by the plant control system for the majority of ACAMS alarms. The alarms in the A&I matrices are limited to those ACAMS alarms that interlock devices or initiate automatic responses.

Specific guidelines were developed during development of utility system FAWBs for ANCDF and UMCDF that are generally followed in the programmatic FAWBs. Fourteen specific guidelines have been established that define the format and content of entries in the A&I matrices:

1. Analog signals from transmitters (e.g., LITs) are not listed; the alarms are indicated separately.
2. All software prealarms and alarms (e.g., LAHs) that are indicated in the CON are listed. Setpoints and actions are shown where applicable.
3. Equipment and instrument status indication signals (e.g., open/close, on/off) are not listed unless they initiate action.
4. Alarms generated from GFE package units that report to the PLC are listed. If not already available and listed, the GFE internal alarms and actions will be added to the matrix when available from the site systems contractor and *"SC to provide detail"* will be entered into the "remarks" column.
5. For field switch generated alarms, the switch tag is listed, not the alarm tag. For example, a low-low pressure alarm (PALL) generated by the field switch, 13-PSLL-008, is listed as 13-PSLL-008 rather than 13-PALL-008. The purpose for this listing is to distinguish between field switch generated hardwired alarms and alarms generated in the software based on the analog output from a transmitter.
6. Instruments that initiate actions are listed in a vertical column sorted by prefix, loop number, instrument ID, then suffix. For example, for 99-TSH-100A, the prefix is 99, the loop number is 100, the instrument ID is TSH, and the suffix is A). Actions are listed in column across the top of the matrix and include prealarms and alarms.

7. Setpoints are listed for all instruments where applicable. Instrument ranges for analog transmitters are shown in Appendix F. Unless otherwise noted, tank level setpoints are shown from the level transmitter tap.

8. Only hand switches (push buttons) that cause system shutdowns are listed; other software and hardwired hand switches are not listed.

9. Local alarms are not listed.

10. Matrices are grouped by subsystem as applicable within each FAWB. For example, separate matrices are provided in the RHS FAWB for the rocket input feed assembly, the rocket drain station of the RSM, and the rocket shear station of the RSM.

11. Alarms associated with automatic actions are classified as *"alarms"* and alarms without automatic actions are classified as *"prealarms."*

12. Instruments listed in the matrix that are RCRA reportable are designated as such by entering *"RCRA"* in the Remarks column.

13. Clarifications are provided when necessary in the remarks column of the A&I matrices, or in the system and/or operator response column in alarm and system response tables.

14. Device malfunction alarms are not shown unless they initiate automatic actions such as equipment switchovers (e.g., to a standby pump), system shutdowns, or a stop feed signal.

ANNISTON CHEMICAL AGENT DISPOSAL FACILITY

ALARM AND INTERLOCK MATRIX

AUTOMATIC CONTINUOUS AIR MONITORING SYSTEM

1) Interlock TMA Decon Area Hood Door to Decon Vestibule 12-177
2) Stop Feed to DFS
3) Stop Feed to MPF
4) Stop Feed to LIC
5) Stop Feed to BRA
6) Stop Feed to DUN
7) Pre-alarm
8) Alarm

LN	STATION NUMBER	EQUIPMENT TAG NUMBER	DESCRIPTION	SETPOINT/ RANGE	01	02	03	04	05	06	07	08		REMARKS	ALARM BIT B1:XX/XX	ICS-CONR-XXX
1	CYC 258	MON-ACAM-297	DFS CYCLONE ENCLOSURE ACAMS ALARMS	NOTE 1		X								RCRA AWFCO for DFS. Note: Not yet a stop feed in the AN PLC code. See NOTE 2.	2625/00 2651/00	112
2	CYC 258	MON-ACAM-297	DFS CYCLONE ENCLOSURE ACAMS NOT IN OPERATE	SEE REMARKS		X								RCRA AWFCO for DFS. Alarm active if CYC 258 is not in OPERATE (PWR ON, A=1, B=0, C=0). Note: Not yet a stop feed in the An PLC code.	TBD	112
3	DEC 456	MON-ACAM-159	TMA DECON HOOD ROOM 12-177	SEE REMARKS	X									Interlock active for ACAMS LOQ alarm or agent alarm. DICO FROM CONR 117 TO CONR 115. See NOTE 2.	B4:87/01	117
4	PAS 701A/B/C	MON-ACAM-129/225/223	COMMON STACK ACAMS ALARMS	NOTE 1		X	X	X						RCRA AWFCO for DFS, LIC & MPF. See NOTES 2 & 3.	2620/16	112
5	PAS 701A/B/C	MON-ACAM-129/225/223	COMMON STACK ACAMS NOT IN OPERATE	SEE REMARKS		X	X	X						RCRA AWFCO for DFS, LIC & MPF. Alarm active if 2/3 stack ACAMS units are not in OPERATE (PWR ON, A=1, B=0, C=0). SEE NOTE 3.	2620/16	112
6	PAS 702	MON-ACAM-183	DFS DUCT ACAMS ALARMS	NOTE 1		X								RCRA AWFCO for DFS. See NOTE 2.	2620/06	112
7	PAS 702	MON-ACAM-183	DFS DUCT ACAMS NOT IN OPERATE	SEE REMARKS		X								RCRA AWFCO for DFS. Alarm active if PAS 702 is not in OPERATE (PWR ON, A=1, B=0, C=0).	2620/06	112
8	PAS 703	MON-ACAM-167	MPF DUCT ACAMS ALARMS	NOTE 1			X							RCRA AWFCO for MPF. See NOTE 2.	4620/06	113
9	PAS 703	MON-ACAM-167	MPF DUCT ACAMS NOT IN OPERATE	SEE REMARKS			X							RCRA AWFCO for MPF. Alarm active if PAS 703 is not in OPERATE (PWR ON, A=1, B=0, C=0).	4620/06	113
10	PAS 705	MON-ACAM-163	LIC DUCT ACAMS ALARMS	NOTE 1				X						RCRA AWFCO for LIC. See NOTE 2.	2420/06	114
11	PAS 705	MON-ACAM-163	LIC DUCT ACAMS NOT IN OPERATE	SEE REMARKS				X						RCRA AWFCO for LIC. Alarm active if PAS 705 is not in OPERATE (PWR ON, A=1, B=0, C=0).	2420/06	114
12	BRA 801	MON-ACAM-152	BRA PAS STACK	SEE REMARKS					X					ANCDF does not plan to operate the BRA. See FAWB Note B-7. If the BRA is used, the alarm will be active for ACAMS LOQ alarm or agent alarm.	TBD	108

NOTE 1: Per Sept 2000 ANCDF discussions, ACAMS RCRA AWFCO setpoints will be 0.2 ASC (ROHA) and 1.0 ASC (instantaneous). A prealarm at 0.2 ASC (instantaneous) will also be provided. These alarms were not yet incorporated in the PLC code (as of 07/2002). Allowable stack concentration (ASC) for chemical agent are (mg/m3): GB= 0.0003, H/HD/HT= 0.03, and VX=0.0003.
NOTE 2: ANCDF PLC code also has a HIGH LEVEL alarm at 9.8 Z for these ACAMS monitors. TOCDF eliminated the HIGH LEVEL alarm under ECP TEMP-2369-ACA. After FDLL review it was determined that the ECP will be implemented at ANCDF, PBCDF, and UMCDF. Therefore, the HIGH LEVEL alarm is not listed.
NOTE 3: There are three ACAMS units assigned to monitor the common stack. Two ACAMS units are online constantly with offset sampling cycles to ensure sampling 100% of the time. An alarm is generated if the online ACAMS units are not staggered properly.The third ACAMS unit is used when either of the first two is being challenged, calibrated, or serviced.

PINE BLUFF CHEMICAL AGENT DISPOSAL FACILITY

ALARM AND INTERLOCK MATRIX

AUTOMATIC CONTINUOUS AIR MONITORING SYSTEM

1) Not Used
2) Stop Feed to DFS
3) Stop Feed to MPF
4) Stop Feed to LIC
5) Stop Feed to BRA (see BRA FAWB for details)
6) Stop Feed to DUN
7) Pre-alarm
8) Alarm
9) Not Used

LN	STATION NUMBER	EQUIPMENT TAG NUMBER	DESCRIPTION	SETPOINT/ RANGE	01	02	03	04	05	06	07	08	09	REMARKS	ALARM BIT B1:XX/XX	ICS-CONR-XXX
1	BRA 890	MON-ACAM-152	BRA PAS STACK	SEE REMARKS					X					See FAWB Note B-7.	TBD	108
2	CYC 258	MON-ACAM-297	DFS CYCLONE ENCLOSURE ACAMS ALARMS	NOTE 1		X								RCRA AWFCO DFS-20.	2625/00 2651/00	112
3	CYC 258	MON-ACAM-297	DFS CYCLONE ENCLOSURE ACAMS NOT IN OPERATE	SEE REMARKS		X								RCRA AWFCO for DFS. Alarm active if CYC 258 is not in OPERATE (PWR ON, A=1, B=0, C=0).	TBD	112
4	PAS 782	MON-ACAM-163	LIC DUCT ACAMS AGENT ALARM	NOTE 1				X						RCRA AWFCO LIC-17.	2420/06	114
5	PAS 782	MON-ACAM-163	LIC DUCT ACAMS NOT IN OPERATE	SEE REMARKS				X						RCRA AWFCO LIC-17. Alarm active if PAS 782 is not in OPERATE (PWR ON, A=1, B=0, C=0).	2420/06	114
6	PAS 784	MON-ACAM-183	DFS DUCT ACAMS AGENT ALARM	NOTE 1		X								RCRA AWFCO DFS-19.	2620/06	112
7	PAS 784	MON-ACAM-183	DFS DUCT ACAMS NOT IN OPERATE	SEE REMARKS		X								RCRA AWFCO DFS-19. Alarm active if PAS 784 is not in OPERATE (PWR ON, A=1, B=0, C=0).	2620/06	112
8	PAS 786	MON-ACAM-167	MPF DUCT ACAMS AGENT ALARM	NOTE 1			X							RCRA AWFCO MPF-16.	4620/06	113
9	PAS 786	MON-ACAM-167	MPF DUCT ACAMS NOT IN OPERATE	SEE REMARKS			X							RCRA AWFCO MPF-16. Alarm active if PAS 786 is not in OPERATE (PWR ON, A=1, B=0, C=0).	4620/06	113
10	PAS 790A/B/C	MON-ACAM-129/225/223	COMMON STACK ACAMS AGENT ALARMS	NOTE 1		X	X	X						RCRA AWFCO DFS-21, LIC-18, MPF-17. SEE NOTE 2.	2620/16	112
11	PAS 790A/B/C	MON-ACAM-129/225/223	COMMON STACK ACAMS NOT IN OPERATE	SEE REMARKS		X	X	X						RCRA AWFCO. Alarm active if 2/3 stack ACAMS units are not in OPERATE (PWR ON, A=1, B=0, C=0). SEE NOTE 2.	2620/16	112

NOTE 1: Per Sept 2002 PBCDF discussions, ACAMS units monitoring the commn stack, furnace ducts, and the BRA PAS will have a prealarm at 0.2 ASC (instantaneous), and a RCRA AWFCO at 1.0 ASC (instantaneous). Common stack ACAMS units will also have a RCRA AWFCO at 0.2 ASC (ROHA). Allowable stack concentration (ASC) for chemical agent are (mg/m3): GB= 0.0003, H/HD/HT= 0.03, and VX=0.0003.

NOTE 2: There are three ACAMS units assigned to monitor the common stack. Two ACAMS units are online constantly with offset sampling cycles to ensure sampling 100% of the time. An alarm is generated if the online ACAMS units are not staggered properly.The third ACAMS unit is used when either of the first two is being challenged, calibrated, or serviced.

TOOELE CHEMICAL AGENT DISPOSAL FACILITY

ALARM AND INTERLOCK MATRIX

AUTOMATIC CONTINUOUS AIR MONITORING SYSTEM

1) Interlock TMA Decon Area Hood Door to Decon Vestibule 12-177
2) Interlock Door from UPA to Tray Input Bypass Conv Airlock
3) Stop Feed to DFS
4) Stop Feed to MPF
5) Stop Feed to LIC #1
6) Stop Feed to LIC #2
7) Stop Feed to BRA
8) Stop Feed to DUN
9) Pre-alarm
10) Alarm

LN	STATION NUMBER	EQUIPMENT TAG NUMBER	DESCRIPTION	SETPOINT/ RANGE	01	02	03	04	05	06	07	08	09	10	REMARKS	ALARM BIT B1:XX/XX	ICS-CONR-XXX
1	AL 211V	MON-ACAM-326	TRAY INPUT BYPASS CONV #1 AIRLOCK (LINE A)	SEE REMARKS		X									Interlock UPA-FDDR-101 from opening until 2 consecutive ACAMS cycles have readings < LOQ alarm. See FAWB Note B-11.	B0036/00	101B
2	AL 214V	MON-ACAM-327	TRAY INPUT BYPASS CONV #1 AIRLOCK (LINE B)	SEE REMARKS		X									Interlock UPA-FDDR-102 from opening until 2 consecutive ACAMS cycles have readings < LOQ alarm. See FAWB Note B-11.	B0036/00	104B
3	DEC 456V	MON-ACAM-159	TMA DECON HOOD ROOM 12-177	SEE REMARKS	X										Interlock active for response level alarm (0.2Z) or alarm level alarm (0.5Z). DICO FROM CONR 117 TO CONR 115.	B4:87/01	117
4	PAS 701AG/BG/CG	MON-ACAM-129/225/223	COMMON STACK PLC AGENT ALARM - GB	0.7 ASC			X	X	X	X					SEE NOTES 1 & 2.	2620/06	112
5	PAS 701AG/BG/CG	MON-ACAM-129/225/223	COMMON STACK ACAMS AGENT ALARM - GB	0.2 ASC			X	X	X	X					RCRA AWFCO. SEE NOTES 1 & 2.	2620/06	112
6	PAS 701AG/BG/CG	MON-ACAM-129/225/223	COMMON STACK ACAMS NOT IN OPERATE	SEE REMARKS			X	X	X	X					RCRA AWFCO. Alarm active if 2/3 stack ACAMS are not in OPERATE (PWR ON, A=1, B=0, C=0). SEE NOTE 2.	2620/06	112
7	PAS 701AG/BG/CG	MON-ACAM-129/225/223	COMMON STACK ACAMS NOT STAGGERED	ACAMS NOT STAGGERED			X	X	X	X					RCRA AWFCO. SEE NOTE 2.	1251/14	112
8	PAS 702AV/BV	MON-ACAM-183/354	DFS DUCT VX ACAMS AGENT ALARM	0.5 ASC			X								RCRA AWFCO. SEE NOTES 1 & 3.	2619/06	112
9	PAS 702AV/BV	MON-ACAM-183/354	DFS DUCT VX ACAMS NOT IN OPERATE	SEE REMARKS			X								RCRA AWFCO. Alarm active if both DFS duct VX ACAMS are not in OPERATE (PWR ON, A=1, B=0, C=0). SEE NOTE 3.	2619/06	112
10	PAS 702CG/DG	MON-ACAM-346/347	DFS DUCT GB ACAMS AGENT ALARM	0.2 ASC			X								RCRA AWFCO. SEE NOTES 1 & 3.	2619/06	112
11	PAS 702CG/DG	MON-ACAM-346/347	DFS DUCT GB ACAMS NOT IN OPERATE	SEE REMARKS			X								RCRA AWFCO. Alarm active if both DFS duct GB ACAMS are not in OPERATE (PWR ON, A=1, B=0, C=0). SEE NOTE 3.	2619/06	112
12	PAS 703AV/BV	MON-ACAM-167/355	MPF DUCT VX ACAMS AGENT ALARM	0.5 ASC				X							RCRA AWFCO. SEE NOTES 1 & 3.	4620/06	113
13	PAS 703AV/BV	MON-ACAM-167/355	MPF DUCT VX ACAMS NOT IN OPERATE	SEE REMARKS				X							RCRA AWFCO. Alarm active if both MPF duct VX ACAMS are not in OPERATE (PWR ON, A=1, B=0, C=0). SEE NOTE 3.	4620/06	113
14	PAS 703CG/DG	MON-ACAM-348/349	MPF DUCT GB ACAMS AGENT ALARM	0.2 ASC				X							RCRA AWFCO. SEE NOTES 1 & 3.	4620/06	113
15	PAS 703CG/DG	MON-ACAM-348/349	MPF DUCT GB ACAMS NOT IN OPERATE	SEE REMARKS				X							RCRA AWFCO. Alarm active if both MPF duct GB ACAMS are not in OPERATE (PWR ON, A=1, B=0, C=0). SEE NOTE 3.	4620/06	113
16	PAS 704AV/BV	MON-ACAM-163/356	LIC 1 DUCT ACAMS AGENT ALARM	0.5 ASC					X						RCRA AWFCO. SEE NOTES 1 & 3.	2420/06	114
17	PAS 704AV/BV	MON-ACAM-163/356	LIC 1 DUCT ACAMS NOT IN OPERATE	SEE REMARKS					X						RCRA AWFCO. Alarm active if both LIC 1 duct VX ACAMS are not in OPERATE (PWR ON, A=1, B=0, C=0). SEE NOTE 3.	2420/06	114
18	PAS 705AV/BV	MON-ACAM-134/357	LIC 2 DUCT ACAMS AGENT ALARM	0.5 ASC						X					RCRA AWFCO. SEE NOTES 1 & 3.	2020/06	119

TOOELE CHEMICAL AGENT DISPOSAL FACILITY

ALARM AND INTERLOCK MATRIX

AUTOMATIC CONTINUOUS AIR MONITORING SYSTEM

1) Interlock TMA Decon Area Hood Door to Decon Vestibule 12-177
2) Interlock Door from UPA to Tray Input Bypass Conv Airlock
3) Stop Feed to DFS
4) Stop Feed to MPF
5) Stop Feed to LIC #1
6) Stop Feed to LIC #2
7) Stop Feed to BRA
8) Stop Feed to DUN
9) Pre-alarm
10) Alarm

LN	STATION NUMBER	EQUIPMENT TAG NUMBER	DESCRIPTION	SETPOINT/ RANGE	01	02	03	04	05	06	07	08	09	10	REMARKS	ALARM BIT B1:XX/XX	ICS-CONR-XXX
19	PAS 705AV/BV	MON-ACAM-134/357	LIC 2 DUCT ACAMS NOT IN OPERATE	SEE REMARKS						X					RCRA AWFCO. Alarm active if both LIC 2 duct VX ACAMS are not in OPERATE (PWR ON, A=1, B=0, C=0). SEE NOTE 3.	2020/06	119
20	PAS 706AV/BV/CV	MON-ACAM-331/332/333	COMMON STACK ACAMS AGENT ALARM - VX	0.2 ASC			X	X	X	X					SEE NOTES 1 & 2. Ref: TEMP-2696-PAS.	4605/05	113
21	PAS 706AV/BV/CV	MON-ACAM-331/332/333	COMMON STACK PLC AGENT ALARM - VX	0.2 ASC			X	X	X	X					RCRA AWFCO. SEE NOTES 1 & 2. Ref: TEMP-2696-PAS.	4605/05	113
22	PAS 706AV/BV/CV	MON-ACAM-331/332/333	COMMON STACK VX ACAMS NOT IN OPERATE	SEE REMARKS			X	X	X	X					RCRA AWFCO. SEE NOTE 2. Alarm active if 2/3 stack VX ACAMS are not in OPERATE (PWR ON, A=1, B=0, C=0). Ref: TEMP-2696-PAS.	4605/05	113
23	PAS 706AV/BV/CV	MON-ACAM-331/332/333	COMMON STACK VX ACAMS NOT STAGGERED	ACAMS NOT STAGGERED			X	X	X	X					RCRA AWFCO. NOTE 2. Ref: TEMP-2696-PAS.	4605/02	113

NOTE 1: ACAMS AGENT ALARMSs are generated by the ACAMS unit and transmitted to the CON via a digital signal. PLC AGENT ALARMs are generated by the PLC based on the analog input value from the ACAMS unit. Allowable stack concentration (ASC) for chemical agent are (mg/m3): GB= 0.0003, H/HD/HT= 0.03, and VX=0.0003.

NOTE 2: There are 3 GB ACAMS units and 3 VX ACAMS units asigned to monitor the common stack. Two GB and two VX ACAMS units are online constantly with offset sampling cycles to ensure sampling for both agents 100% of the time. The third ACAMS unit for each agent is used when either of the first two is being challenged, calibrated or serviced.

NOTE 3: Furnace duct ACAMS monitors have standby units that can be placed online when the primary is offline for greater than one hour, as specified in the TOCDF Agent Monitoring Plan.

UMATILLA CHEMICAL AGENT DISPOSAL FACILITY

ALARM AND INTERLOCK MATRIX

AUTOMATIC CONTINUOUS AIR MONITORING SYSTEM

1) Interlock TMA Decon Area Hood Door to Decon Vestibule 12-177
2) Stop Feed to DFS
3) Stop Feed to MPF
4) Stop Feed to LIC 1
5) Stop Feed to LIC 2
6) Stop Feed to BRA (see BRA FAWB for details)
7) Stop Feed to DUN
8) Pre-alarm
9) Alarm

LN	STATION NUMBER NOTE 1	EQUIPMENT TAG NUMBER	DESCRIPTION	SETPOINT	01	02	03	04	05	06	07	08	09	REMARKS	ALARM BIT B1:XX/XX	ICS-CONR XXX
1	DEC 456	MON-ACAM-159	TMA DECON HOOD ROOM 12-177	SEE REMARKS	X									Interlock active for ACAMS LOQ alarm or agent alarm. DICO FROM CONR 117 TO CONR 115. See NOTE 2.	B4:87/01	117
2	PAS 701A/B/C	MON-ACAM-129/225/223	COMMON STACK ACAMS AGENT ALARM	1.0 ASC		X	X	X	X					RCRA AWFCO DFS-21, LIC-18 & MPF-17. Alarm based on instantaneous value. See NOTES 2, 3 & 4.	2620/16	112
3	PAS 701A/B/C	MON-ACAM-129/225/223	COMMON STACK ACAMS CONTINUOUS MONITORING	NOTE 5		X	X	X	X					RCRA AWFCO DFS-21, LIC-18 & MPF-17. SEE NOTES 3 & 4.	2620/16	112
4	PAS 702	MON-ACAM-183	DFS DUCT ACAMS AGENT ALARM	1.0 ASC		X								RCRA AWFCO DFS-19. Alarm based on instantaneous value. See NOTES 2 & 3 .	2620/06	112
5	PAS 702	MON-ACAM-183	DFS DUCT ACAMS NOT IN OPERATE	SEE REMARKS		X								RCRA AWFCO for DFS. Alarm active if PAS 702 is not in OPERATE (PWR ON, A=1, B=0, C=0).	2620/06	112
6	PAS 703	MON-ACAM-167	MPF DUCT ACAMS AGENT ALARM	1.0 ASC			X							RCRA AWFCO MPF-16. Alarm based on instantaneous value. See NOTES 2 & 3.	4620/06	113
7	PAS 703	MON-ACAM-167	MPF DUCT ACAMS NOT IN OPERATE	SEE REMARKS			X							RCRA AWFCO for MPF. Alarm active if PAS 703 is not in OPERATE (PWR ON, A=1, B=0, C=0).	4620/06	113
8	PAS 704	MON-ACAM-163	LIC 1 DUCT ACAMS AGENT ALARM	1.0 ASC				X						RCRA AWFCO LIC-17. Alarm based on instantaneous value. See NOTES 2 & 3.	2420/06	114
9	PAS 704	MON-ACAM-163	LIC 1 DUCT ACAMS NOT IN OPERATE	SEE REMARKS				X						RCRA AWFCO for LIC 1. Alarm active if PAS 704 is not in OPERATE (PWR ON, A=1, B=0, C=0).	2420/06	114
10	PAS 705	MON-ACAM-134	LIC 2 DUCT ACAMS AGENT ALARM	1.0 ASC					X					RCRA AWFCO LIC-17. Alarm based on instantaneous value. See NOTES 2 & 3.	2020/06	119
11	PAS 705	MON-ACAM-134	LIC 2 DUCT ACAMS NOT IN OPERATE	SEE REMARKS					X					RCRA AWFCO for LIC 2. Alarm active if PAS 705 is not in OPERATE (PWR ON, A=1, B=0, C=0).	2020/06	119
12	PAS 706	MON-ACAM-353	DFS PFS REHEATER ACAMS LOQ ALARM	0.2 ASC		X								Eng. STOP FEED for DFS. REF: UMSF1075PAS. See NOTE 2.	2651/10	112
13	PAS 706	MON-ACAM-353	DFS PFS REHEATER ACAMS AGENT ALARM	1.0 ASC		X								RCRA AWFCO for DFS. REF: UMSF1075PAS. See NOTE 2.	2626/16	112
14	PAS 707	MON-ACAM-357	LIC 1 PFS REHEATER ACAMS LOQ ALARM	0.2 ASC				X						Eng. STOP FEED for LIC 1. Ref: UMSF1075PAS. See NOTE 2.	2420/10	114
15	PAS 707	MON-ACAM-357	LIC 1 PFS REHEATER ACAMS AGENT ALARM	1.0 ASC				X						RCRA AWFCO for LIC 1. REF: UMSF1075PAS. See NOTE 2.	2450/10	114
16	PAS 720	MON-ACAM-297	DFS CYCLONE ENCLOSURE ACAMS ALARMS	1.0 ASC		X								RCRA AWFCO DFS-20. Note: Not yet a stop feed in the UMCDF PLC code. See NOTES 2 & 3.	2625/00 2651/00	112
17	PAS 720	MON-ACAM-297	DFS CYCLONE ENCLOSURE ACAMS NOT IN OPERATE	SEE REMARKS		X								RCRA AWFCO for DFS. Alarm active if PAS 720 is not in OPERATE (PWR ON, A=1, B=0, C=0). Note: Not yet a stop feed in the UM PLC code.	TBD	112
18	BRA 801	MON-ACAM-152	BRA PAS STACK	1.0 ASC						X				RCRA AWFCO BRA 15. See NOTES 2 & 3.	2422/14	108
19	TBD	MON-ACAM-354	LIC 2 PFS REHEATER ACAMS LOQ ALARM	0.2 ASC					X					Eng. STOP FEED for LIC 2. Ref: UMSF1075PAS. See NOTE 2.	TBD	119
20	TBD	MON-ACAM-354	LIC 2 PFS REHEATER ACAMS AGENT ALARM	1.0 ASC					X					RCRA AWFCO for LIC 2. REF: UMSF1075PAS. See NOTE 2.	TBD	119
21	TBD	MON-ACAM-355	MPF PFS REHEATER ACAMS LOQ ALARM	0.2 ASC			X							Eng. STOP FEED for MPF. REF: UMSF1075PAS.	TBD	113
22	TBD	MON-ACAM-355	MPF PFS REHEATER ACAMS AGENT ALARM	1.0 ASC			X							RCRA AWFCO for MPF. REF: UMSF1075PAS.	TBD	113

NOTE 1: Station numbers are based on ANCDF and TOCDF, except for PAS 706/707/720, which are from UMCDF PLC code.

NOTE 2: UMCDF PLC code also has a HIGH LEVEL alarm at 9.8 Z for these ACAMS monitors. TOCDF eliminated the HIGH LEVEL alarm under ECP TEMP-2369-ACA. After FDLL review it was determined that the ECP will be implemented at ANCDF, PBCDF, and UMCDF. Therefore, the HIGH LEVEL alarm is not listed.

NOTE 3: Allowable stack concentration (ASC) values for chemical agent are (mg/m3) : GB= 0.0003, H/HD/HT= 0.03, and VX=0.0003. RCRA AWFCO setpoint is 1.0 ASC. Prelarm is also provided.

NOTE 4: There are three ACAMS units assigned to monitor the common stack. Two ACAMS units are online constantly with offset sampling cycles to ensure sampling 100% of the time. The third ACAMS unit is used when either of the first two is being challenged, calibrated, or serviced.

NOTE 5: RCRA AWFCO is initiated if: 1) Less than two ACAMS are online monitoring the exhaust gas, 2) Sampling periods for online ACAMS are not staggered, 3) Online ACAMS is in malfunction while in the sampling mode. Ref: ECPs UMSF981DFS, UMSF973LIC, and UMSF992MPF.

APPENDIX D

PLC Automatic Control Sequences

Appendix D contains a summary of PLC automatic control sequences based on the current versions of the PLC code for each of the sites.

The PLC automatic control sequence summaries were generated based on the control system rung ladders in the PLC code for the ACAMS equipment. The operator interface with the PLCs, the Advisor PC system, stores device information in a database that consists of *tags*, or database records used for storing all necessary information related to a device that is monitored or controlled by the Advisor PC system. **D6** tags are used for discrete devices that may be controlled from the control room. In this appendix, automatic control for all devices with **D6** tags are described, grouped by the Advisor PC screens on which they appear. Details related to **D6** device format can be found in the CSDP Control Systems Software Design Guide. Note that Advisor PC tag numbers may not match P&ID tag numbers exactly since Advisor PC tag numbers are labels in the code that refer to a device that may be more encompassing than the P&ID device.

The August 2002 TOCDF control code had only one **D6**-tag device associated with ACAMS operation. The device is controlled from Advisor PC screen ACX; the PLC logic is shown in Table D.1. ANCDF and UMCDF control code did not have any **D6**-tag devices; PBCDF code was not yet available. If PLC code at any sites other than TOCDF add **D6**-tag devices, they will be included in a future revision of the ACAMS FAWB.

Table D.1. TOCDF ACAMS PLC Automatic Control Sequences
Advisor PC Screen: **ACX**

Device:	**MON-SEQR-101 (typical of 9, see below)**
Advisor PC Tag:	FIL691S
CONR:	C110
Driver Word:	3469
Driver Type:	NA
Auto Spool[1]:	The auto spool relay will be active if either of the following conditions are satisfied: • HVC-FILT-101 blower is not running • HVC-FILT-101 vestibule spool return normal from Advisor relay is not active and HVC-FILT-101 go to spool driver is active
I-LOCK:	There are no software interlocks to prevent spooling or unspooling this device.

HVAC Filter Unit Monitoring Sequencer Device Identifiers:

HVAC Unit	Device	Advisor PC Tag	Driver Word
HVC-FILT-101	MON-SEQR-101	FILT691S	3469
HVC-FILT-102	MON-SEQR-102	FILT681S	3468
HVC-FILT-103	MON-SEQR-103	FILT671S	3467
HVC-FILT-104	MON-SEQR-104	FILT661S	3466
HVC-FILT-105	MON-SEQR-105	FILT651S	3465
HVC-FILT-106	MON-SEQR-106	FILT641S	3464
HVC-FILT-107	MON-SEQR-107	FILT631S	3463
HVC-FILT-108	MON-SEQR-108	FILT621S	3462
HVC-FILT-109	MON-SEQR-109	FILT611S	3461

[1] In spool mode, the ACAMS is aligned to monitor the vestibule continuously.

APPENDIX E
Operator Screens

Appendix E contains Advisor PC screens associated with the operation and control of the ACAMS based on ANCDF control code as of May 2002, TOCDF control code as of January 2003, and UMCDF control code as of June 2002. As Advisor PC screens are available for PBCDF, they will be included in this appendix. Table E.1 provides an index to the screens.

Table E.1 ACAMS Advisor PC Screens

Figure #	Advisor PC Screen Name	Process Screen
E-1	ANCDF CHB Agent Status	ACC
E-2	ANCDF MDB Agent Monitor – 1st Floor	AC1
E-3	ANCDF MDB Agent Monitor – 2nd Floor	AC2
E-4	ANCDF MDB Agent Monitor 1st Floor Platform	ACA
E-5	ANCDF MDB Agent Monitor 2nd Floor Platform	ACB
E-6	ANCDF Exterior MDB ACAMS	ACX
E-7	TOCDF CHB Agent Status	ACC
E-8	TOCDF MDB Agent Monitor – 1st Floor	AC1
E-9	TOCDF MDB Agent Monitor – 2nd Floor	AC2
E-10	TOCDF MDB Agent Monitor 1st Floor Platform	ACA
E-11	TOCDF MDB Agent Monitor 2nd Floor Platform	ACB
E-12	TOCDF Exterior MDB ACAMS	ACX1
E-13	TOCDF Exterior MDB ACAMS	ACX2
E-14	TOCDF ACAMS in GB Mode	ACG1
E-15	TOCDF ACAMS in GB Mode	ACG2
E-16	UMCDF CHB Agent Status	ACC
E-17	UMCDF MDB Agent Monitor – 1st Floor	AC1
E-18	UMCDF MDB Agent Monitor – 2nd Floor	AC2
E-19	UMCDF MDB Agent Monitor 1st Floor Platform	ACA
E-20	UMCDF MDB Agent Monitor 2nd Floor Platform	ACB
E-21	UMCDF Exterior MDB ACAMS	ACX

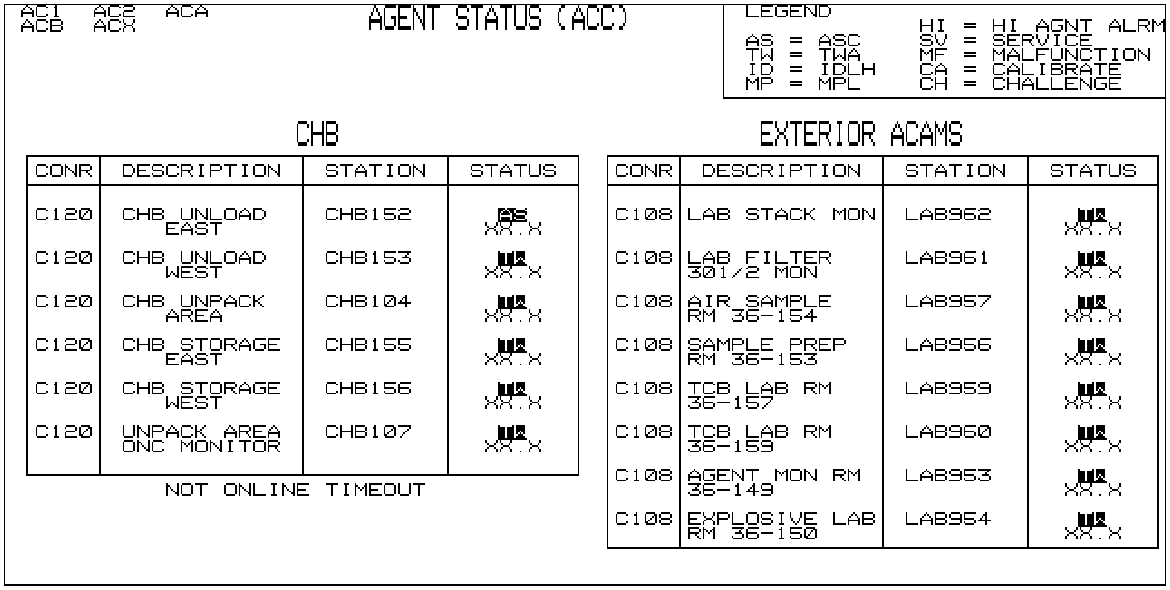

Figure E-1. ANCDF Advisor PC Screen CHB Agent Status (ACC)

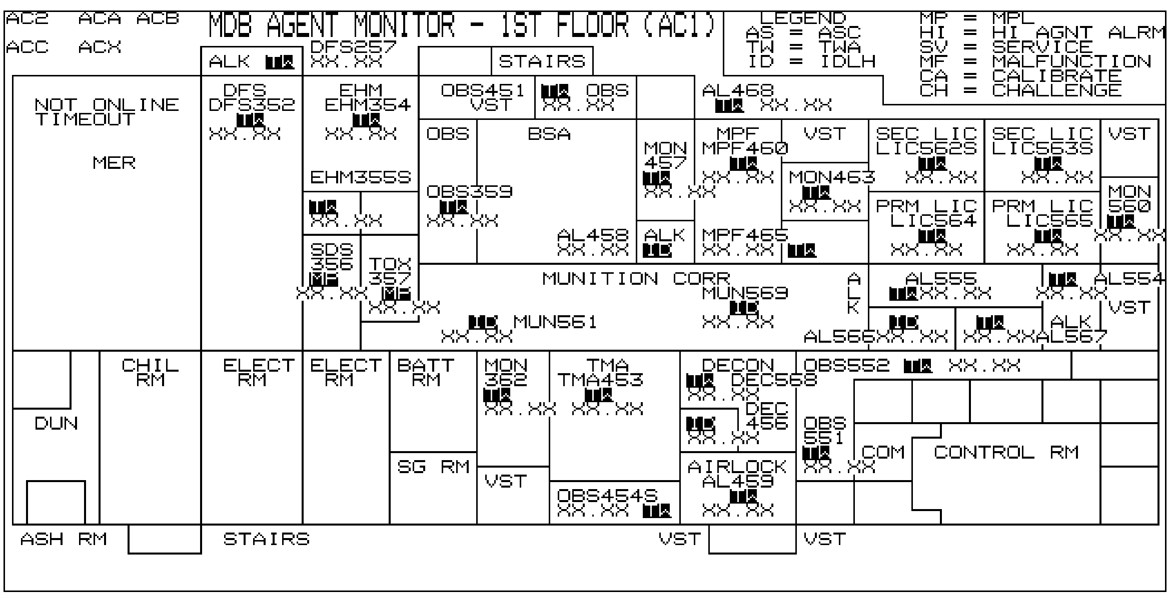

Figure E-2. ANCDF Advisor PC Screen MDB Agent Monitor - 1st Floor (AC1)

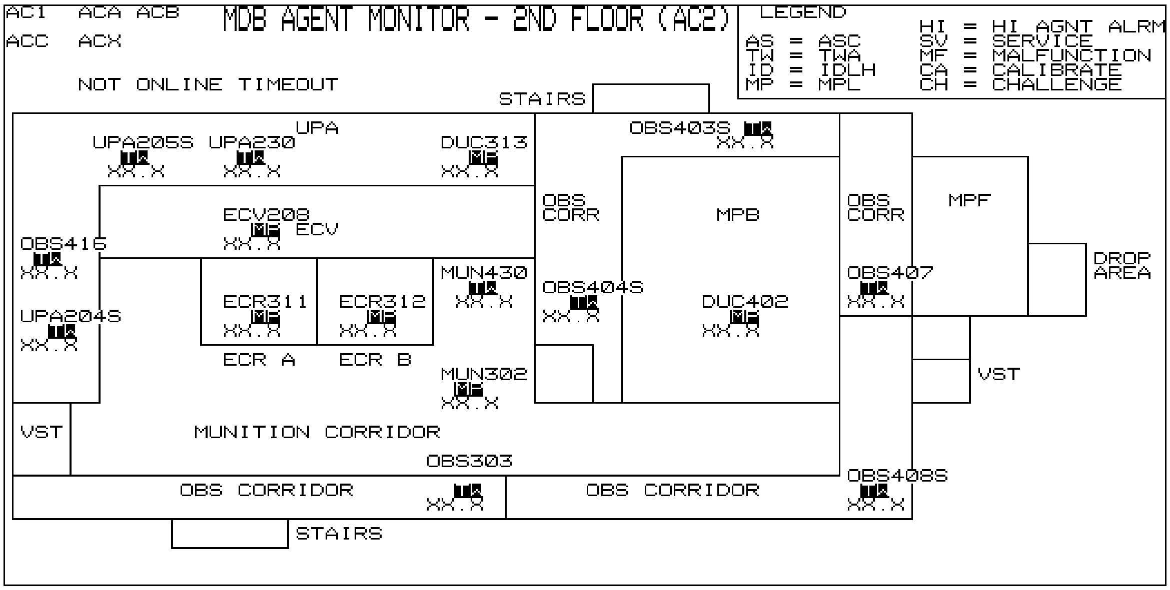

Figure E-3. ANCDF Advisor PC Screen MDB Agent Monitor - 2nd Floor (AC2)

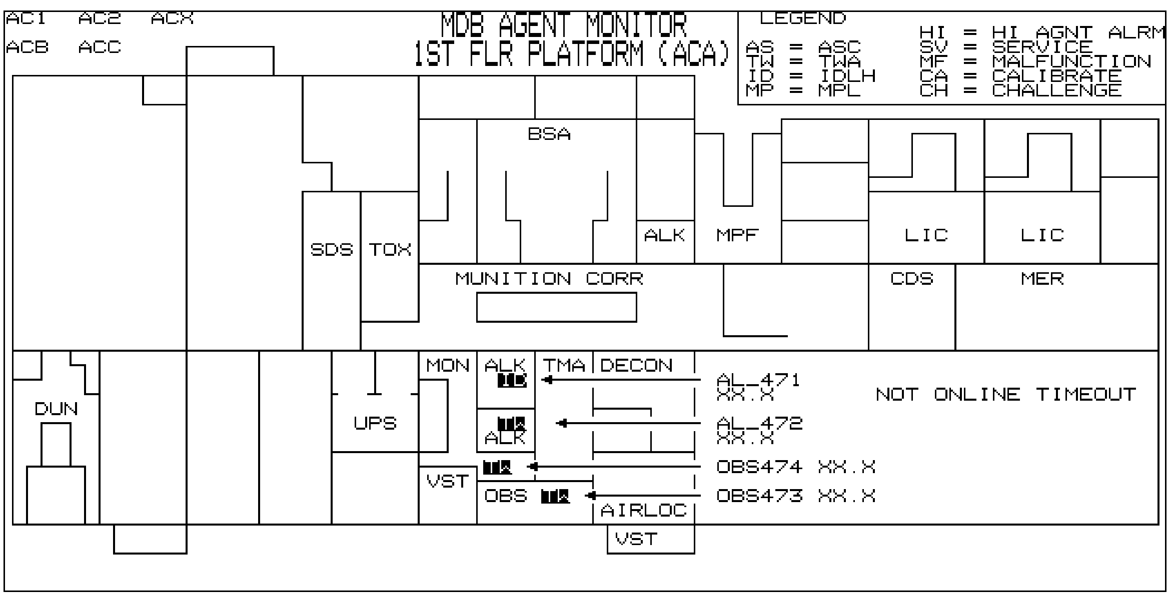

Figure E-4. ANCDF Advisor PC Screen MDB Agent Monitor 1st Floor Platform (ACA)

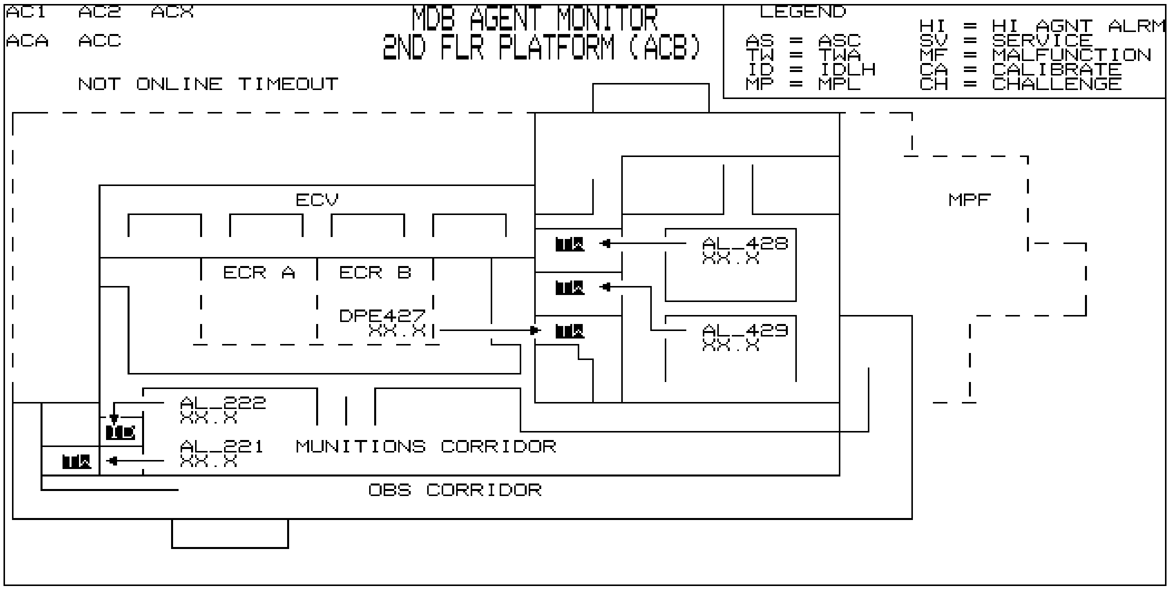

Figure E-5. ANCDF Advisor PC Screen MDB Agent Monitor 2nd Floor Platform (ACB)

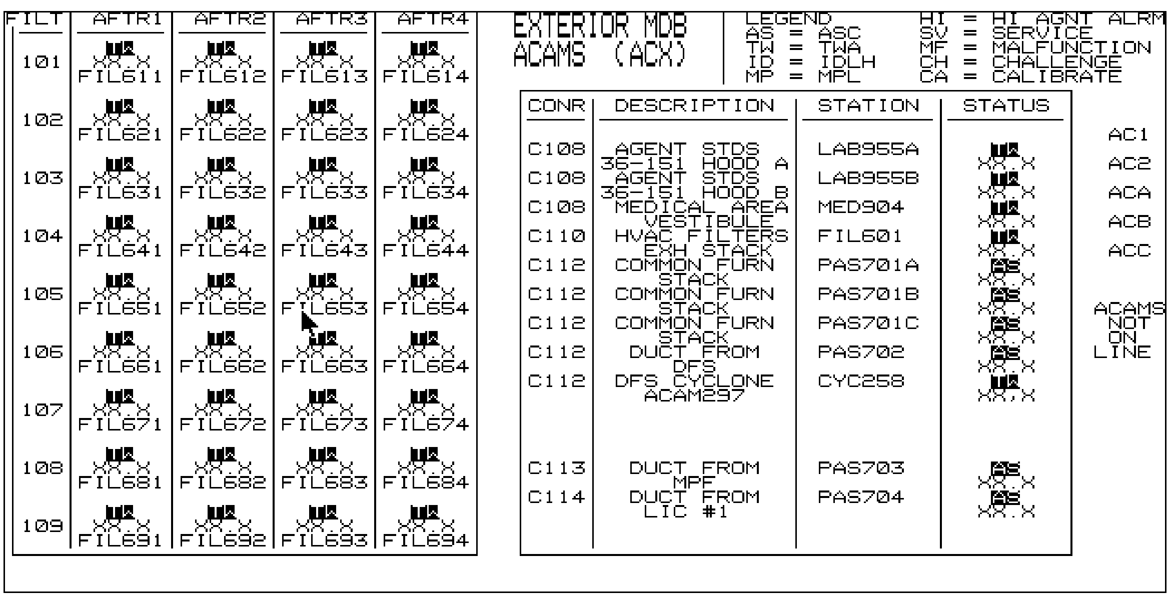

Figure E-6. ANCDF Advisor PC Screen Exterior MDB ACAMS (ACX)

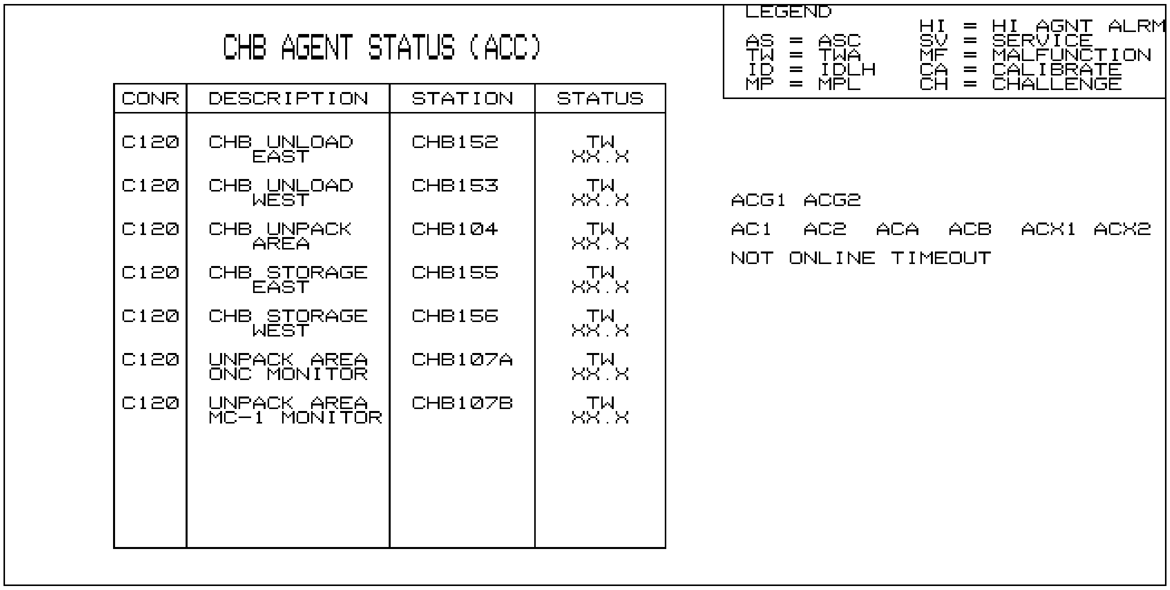

Figure E-7. TOCDF Advisor PC Screen CHB Agent Status (ACC)

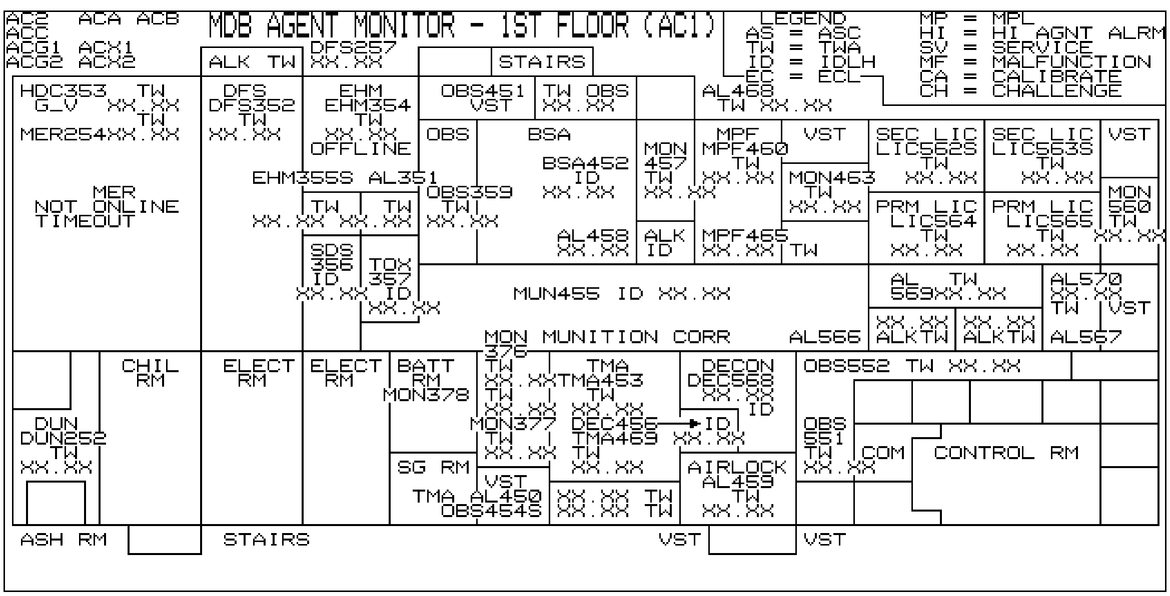

Figure E-8. TOCDF Advisor PC Screen MDB Agent Monitor - 1st Floor (AC1)

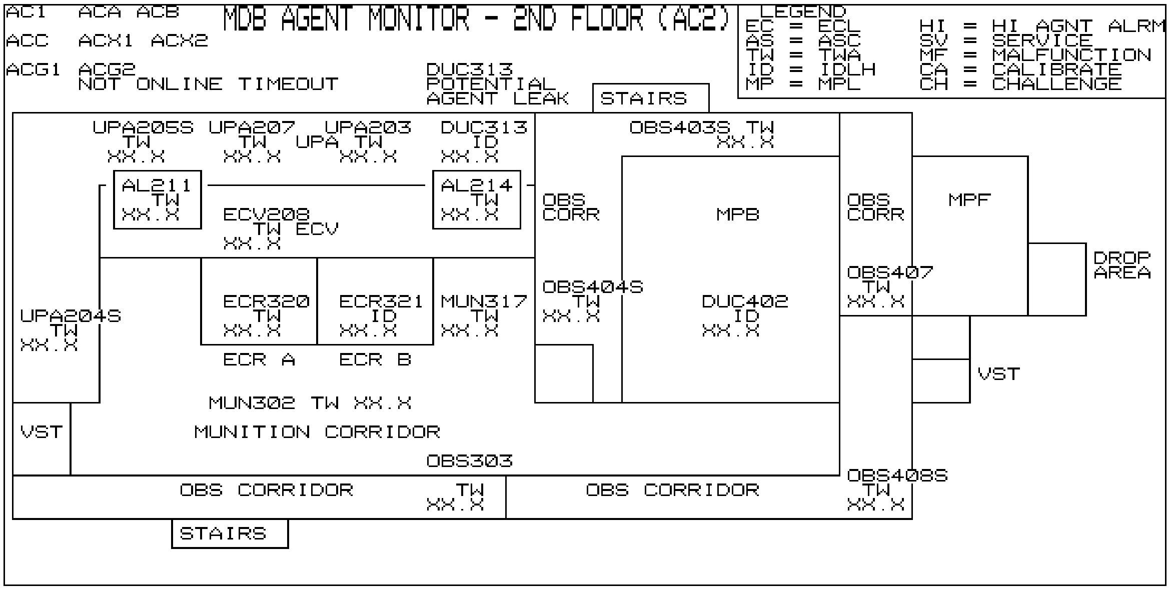

Figure E-9. TOCDF Advisor PC Screen MDB Agent Monitor - 2nd Floor (AC2)

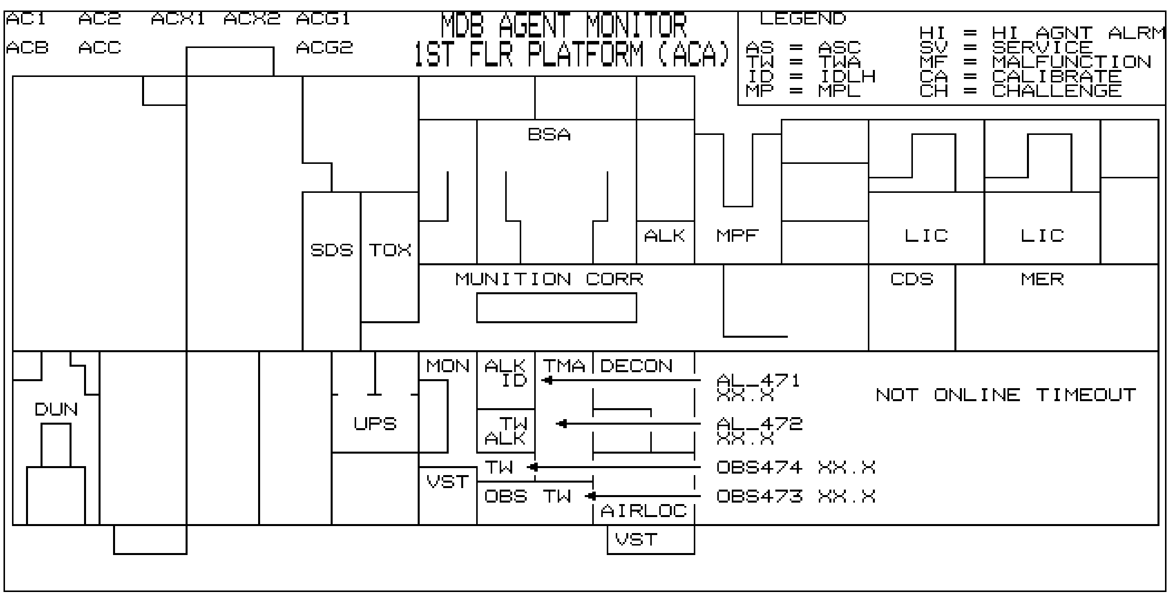

Figure E-10. TOCDF Advisor PC Screen MDB Agent Monitor 1st Floor Platform (ACA)

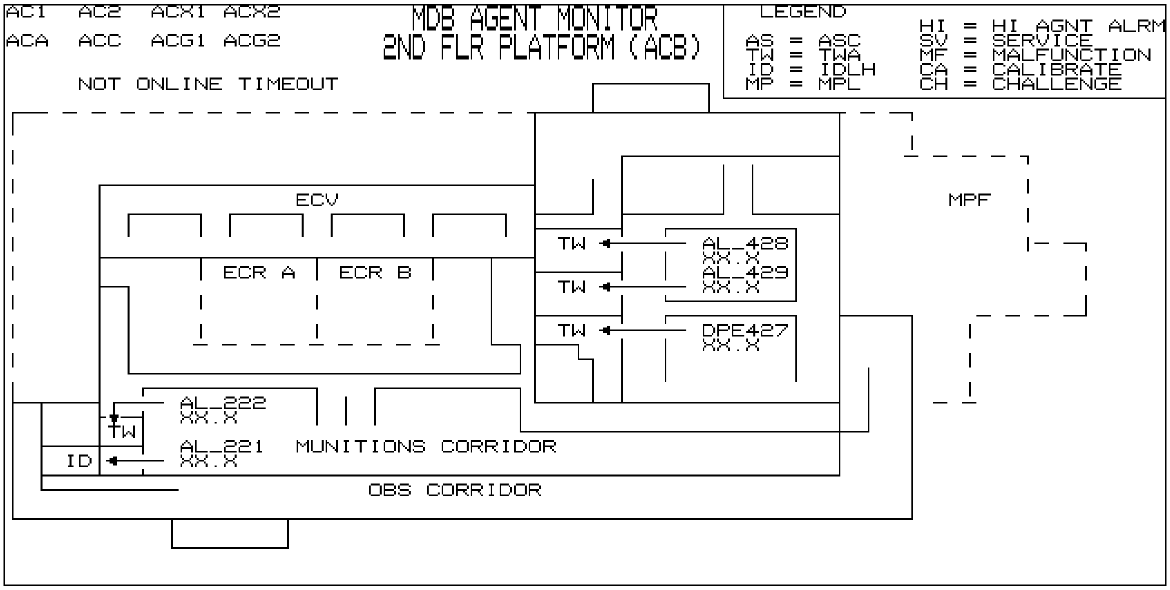

Figure E-11. TOCDF Advisor PC Screen MDB Agent Monitor 2nd Floor Platform (ACB)

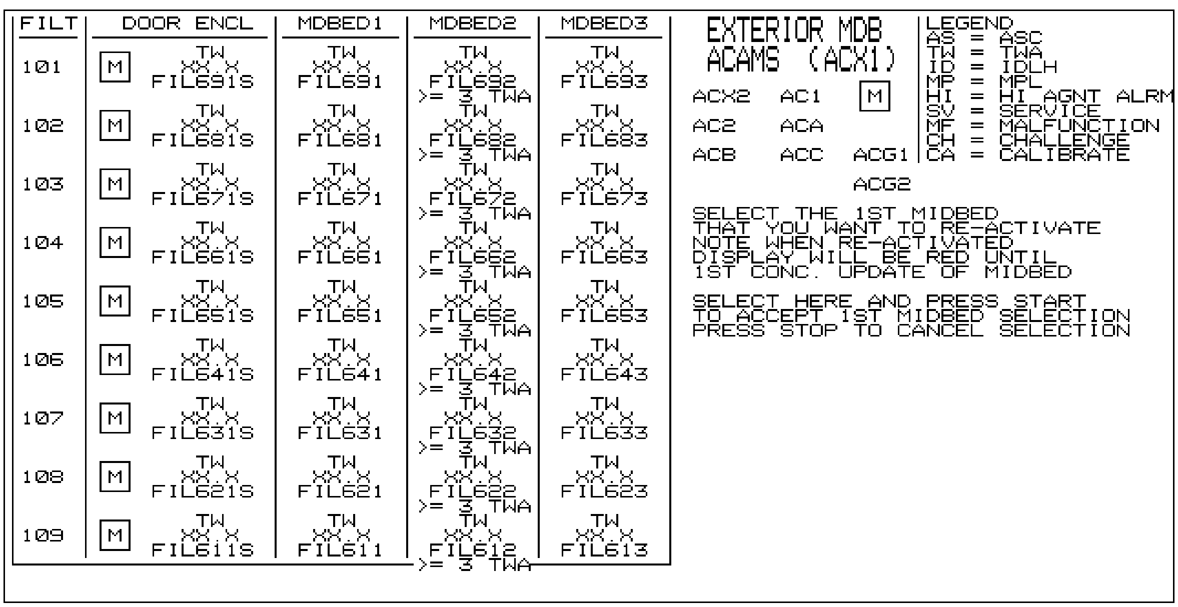

Figure E-12. TOCDF Advisor PC Screen Exterior MDB ACAMS (ACX1)

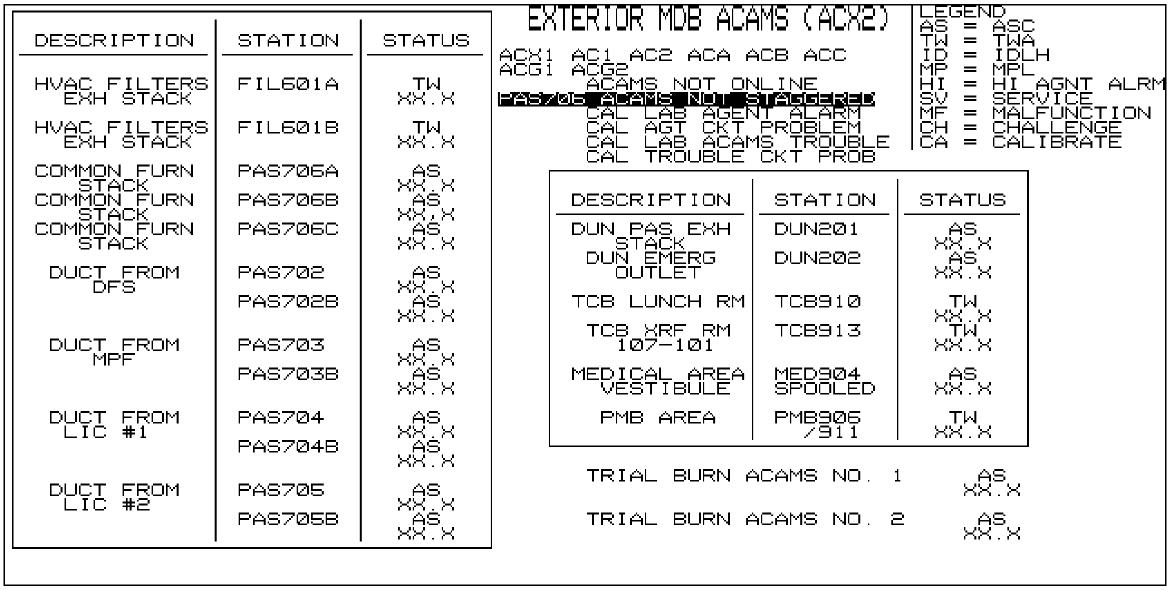

Figure E-13. TOCDF Advisor PC Screen Exterior MDB ACAMS (ACX2)

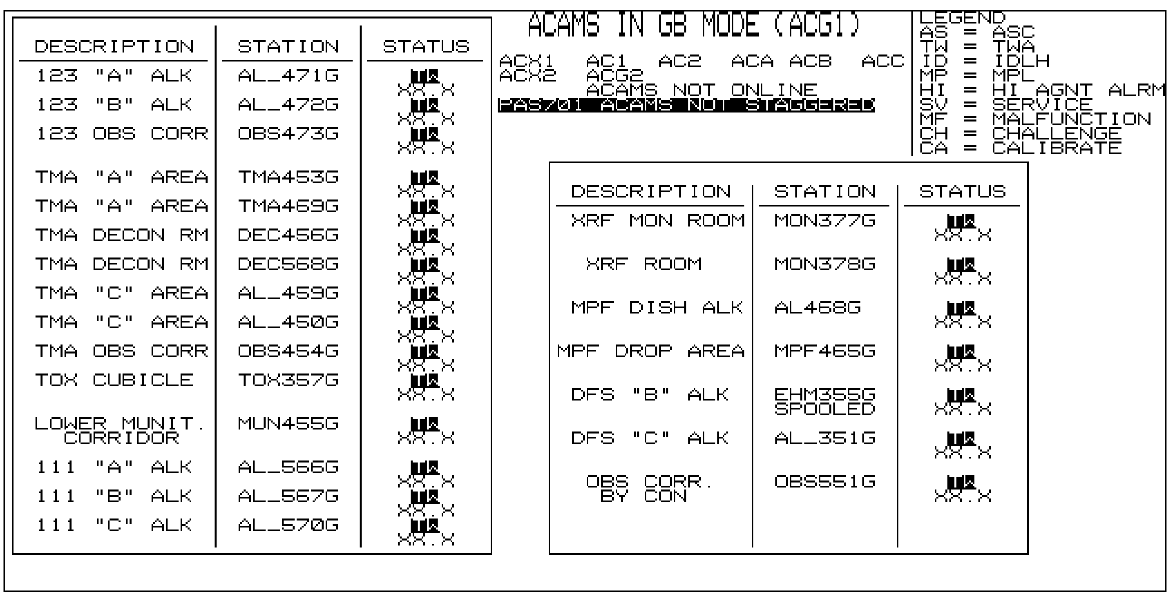

Figure E-14. TOCDF Advisor PC Screen ACAMS in GB Mode (ACG1)

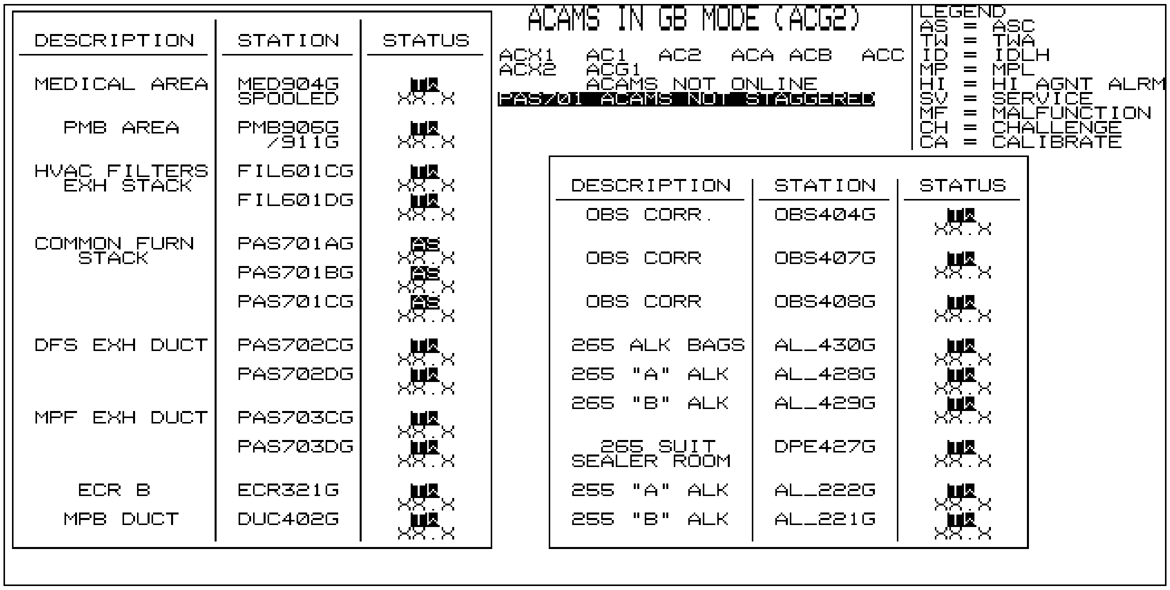

Figure E-15. TOCDF Advisor PC Screen ACAMS in GB Mode (ACG2)

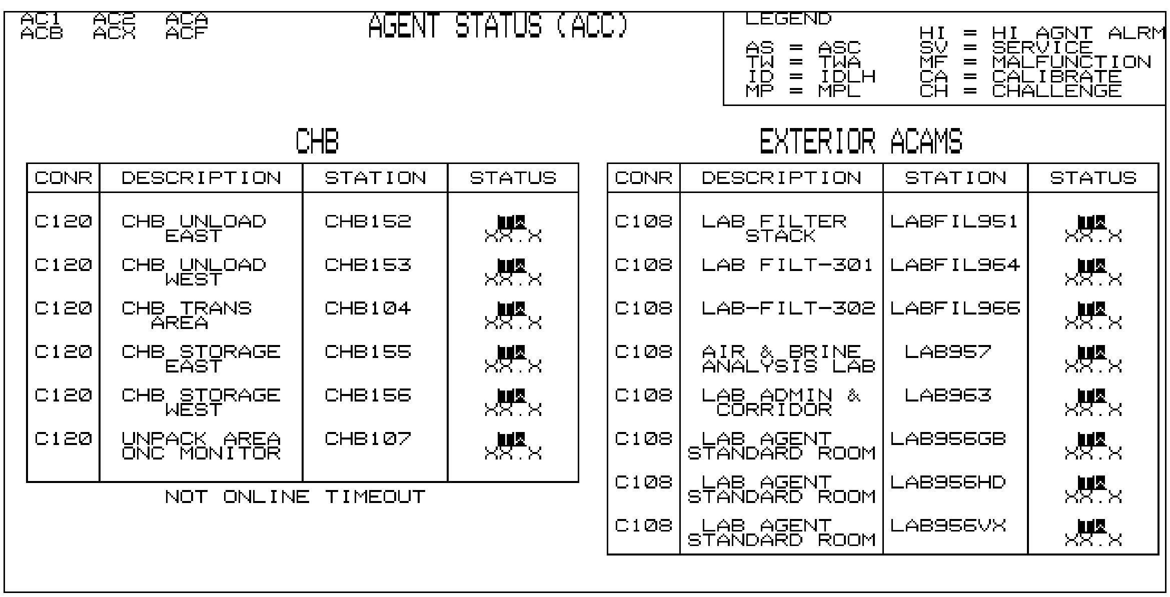

Figure E-16. UMCDF Advisor PC Screen CHB Agent Status (ACC)

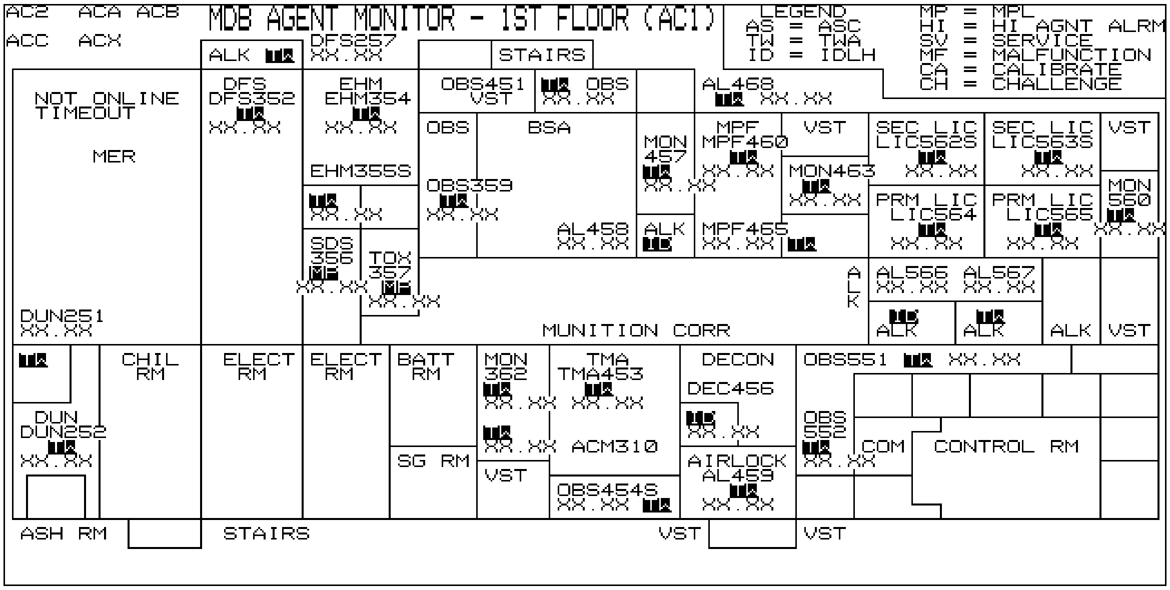

Figure E-17. UMCDF Advisor PC Screen MDB Agent Monitor - 1st Floor (AC1)

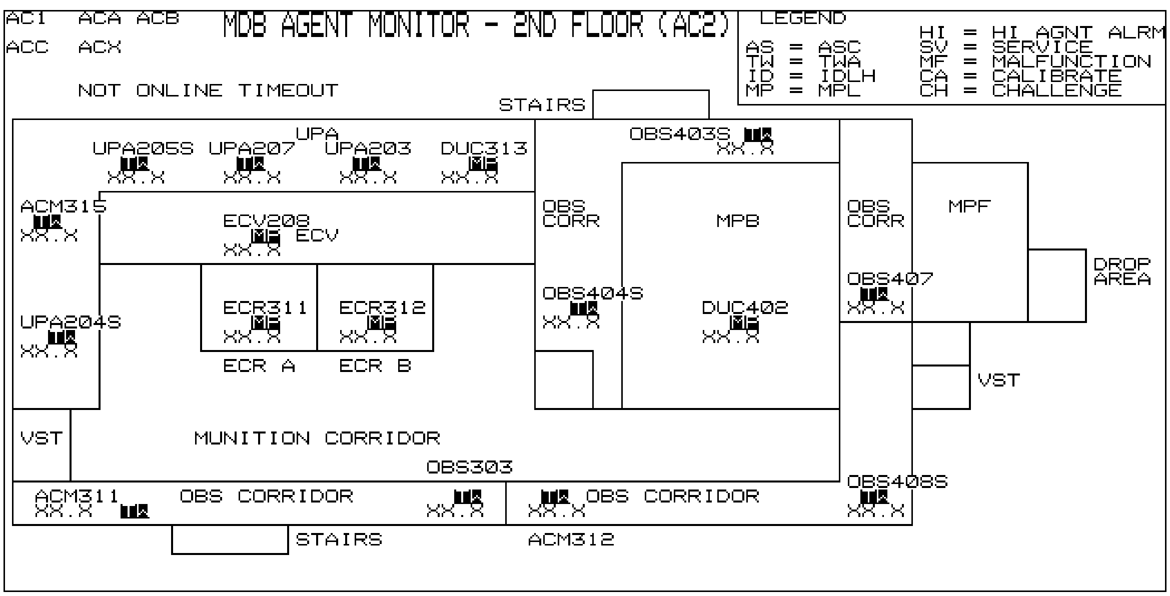

Figure E-18. UMCDF Advisor PC Screen MDB Agent Monitor - 2nd Floor (AC2)

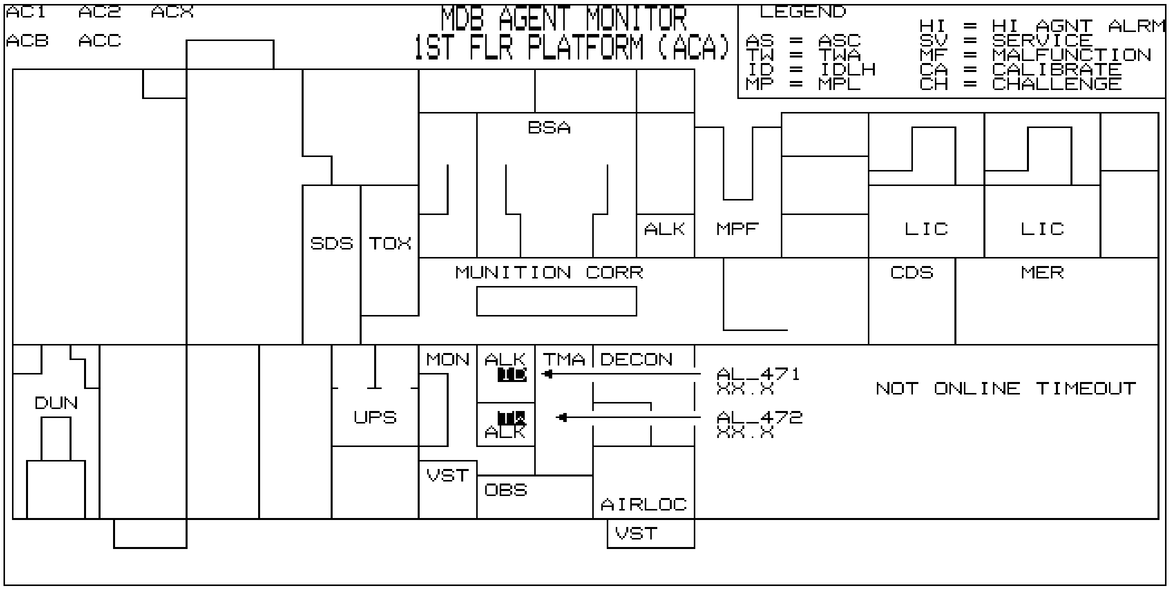

Figure E-19. UMCDF Advisor PC Screen MDB Agent Monitor 1st Floor Platform (ACA)

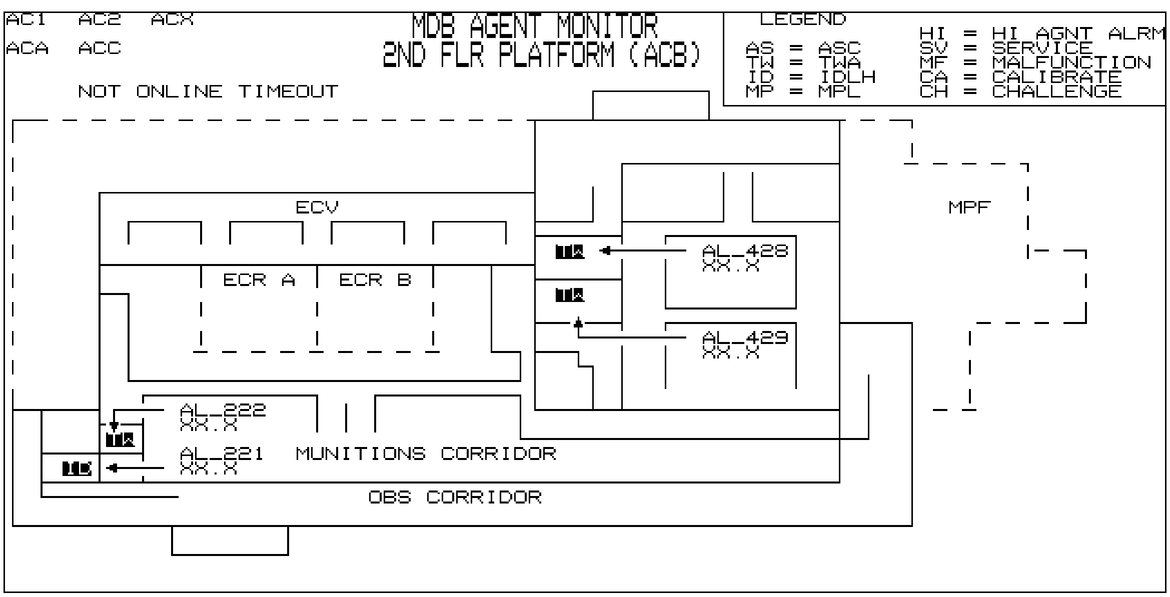

Figure E-20. UMCDF Advisor PC Screen MDB Agent Monitor 2nd Floor Platform (ACB)

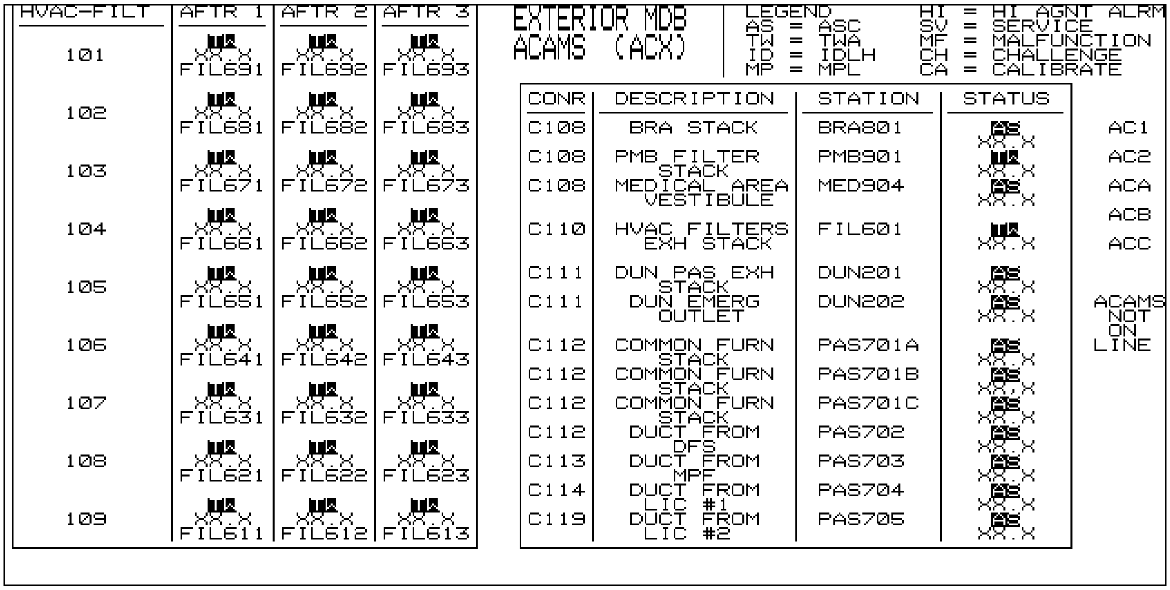

Figure E-21. UMCDF Advisor PC Screen Exterior MDB ACAMS (ACX)

APPENDIX F

Instrument Ranges

None of the instruments listed in the TOCDF Loveland calibration database as of August 2000 were identified as instrumentation in the ACAMS system; therefore there is no instrumentation listed in this appendix. ACAMS base operating parameters for monitoring each of the chemical agents are, or will be, listed in site-specific operating procedures. TOCDF lists ACAMS operating base parameters in TE-LOP-524, Appendix A.

APPENDIX G

Intercontroller Communications

All four of the furnace controllers at TOCDF (ICS-CONR-112 for the DFS; ICS-CONR-113 for the MPF; ICS-CONR-114 for LIC #1; ICS-CONR-119 for LIC #2) include DICOs associated with monitoring of the furnace exhaust. In addition, ICS-CONR-110, which controls HVAC system operations, sends a DICO to ICS-CONR-112 to indicate the status of the HVAC filter ACAMS units, and ICS-CONR-108 sends a DICO to ICS-CONR-112 to indicate the status of the medical area vestibule ACAMS unit.

DICOs associated with ACAMS monitors are listed in Table G.1. DICOs are sorted by the controller from which they are sent (i.e., DICOS from ICS-CONR-110 are listed first and DICOs from ICDS-CONR-119 are listed last). DICOs associated with ACAMS monitors for the DUN/DUN PAS/DUN PFS are not listed (See FAWB Note B-1).

Table G.1 TOCDF ACAMS DICIs/DICOs

To Controller			From Controller				Interpretation		
CONR	Input Word (B4:)	Safe Mask (B4:)	CONR	Output Word	Bit	Description	0	1	Safe
112	023	123	108	081	02	ACAMS not on line		Off line	0
112	027	127	110	081	00	ACAMS not on line		Off line	0
113	031	131	112	083	00	PAS 701 Common Furnace PAS Stack ACAMS Stop Feed	No alarm	Alarm	0
113	031	131	112	083	01	PAS 701 PAS-STACK-101 Common Stack Agent Alarm	No alarm	Alarm	0
113	031	131	112	083	04	PAS 702B Duct from DFS to PAS		Activated	0
113	031	131	112	083	05	PAS 702=PAS 703 Activate		Activated	0
113	031	131	112	083	06	PAS 702=PAS 703 Operating		Normal	0
113	031	131	112	083	07	PAS 702=PAS 703 ACAMS Alarm		Alarm	0
113	031	131	112	083	10	PAS 702=PAS 703B Operating		Normal	0
113	031	131	112	083	11	PAS 702=PAS 703B ACAMS Alarm		Alarm	0

Table G.1 (Cont'd)

To Controller			From Controller				Interpretation		
CONR	Input Word (B4:)	Safe Mask (B4:)	CONR	Output Word	Bit	Description	0	1	Safe
114	031	131	112	085	00	PAS 701 Common Furnace PAS Stack ACAMS Stop Feed		Alarm	0
114	031	131	112	085	01	PAS 701 PAS-STACK-101 Common Stack Agent Alarm		Alarm	0
119	031	131	112	091	00	PAS 701 Common Furnace PAS Stack ACAMS Stop Feed		Alarm	0
119	031	131	112	091	01	PAS 701 PAS-STACK-101 Common Stack Agent Alarm		Alarm	0
119	031	131	112	091	03	PAS 702C Duct from DFS to PAS		Activated	0
112	033	133	113	081	02	PAS703 Duct from MPF to PAS not Online	OK	Alarm	0
112	033	133	113	081	03	PAS702B Duct from DFS to PAS Operating		Normal	0
112	033	133	113	081	04	PAS702B Duct from DFS to PAS ACAMS Alarm		Alarm	0
112	033	133	113	081	05	PAS702 = PAS703B		Activated	0
114	033	133	113	085	01	PAS 704B Duct from LIC No.1 to PAS Operating		1=OK	0
114	033	133	113	085	02	PAS 704B Duct from LIC No.1 to PAS ACAMS Alarm		Alarm	0
114	033	133	113	085	03	PAS702 = PAS 703B		Activated	0
119	033	133	113	091	01	PAS703 = PAS705B Normal		Normal	0
119	033	133	113	091	02	PAS703=PAS705 B Agent Alarm		Agent Alarm	0
112	035	135	114	081	00	PAS-704 Not Online Timer	OK	Alarm	0
112	035	135	114	081	01	PAS-704B&C ACAMS Active	Normal	Trial Burn	0
113	035	135	114	083	00	ACAMS Switching/ PAS-703=704B PAS-705=704C		Activate	0
113	035	135	114	083	01	PAS-704=703C Operating Normal		Operating	0

Table G.1 (Cont'd)

To Controller			From Controller				Interpretation		
CONR	Input Word (B4:)	Safe Mask (B4:)	CONR	Output Word	Bit	Description	0	1	Safe
113	035	135	114	083	02	PAS-704=703C Agent Alarm		Alarm	0
119	035	135	114	091	05	ACAMS Switching/ PAS-704=705C		Activate	0
119	035	135	114	091	06	PAS-704=705C Operating Normal		Operating	0
119	035	135	114	091	07	PAS-704=705C Agent Alarm		Alarm	0
112	041	141	119	081	00	PAS-705 Not Online Timer	OK	Alarm	1
112	041	141	119	081	01	PAS-702C Operating Normal	Offline	Normal	0
112	041	141	119	081	02	PAS-702C Alarm	Normal	Alarm	0
112	041	141	119	081	03	PAS 702=703	Normal	Activate	0
113	041	141	119	083	00	ACAMS Switching/ PAS-703=705B		Activate	1
114	041	141	119	085	06	PAS-704C Operating Normal		Operating	0
114	041	141	119	085	07	PAS-704C Alarm		Alarm	0
114	041	141	119	085	10	PAS-704=705C		Activate	0

APPENDIX H

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AN-7-E-22, Rev.6, 8-10-01	CHB Electrical Panel Schedules
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AN-14-E-10, Rev.4, 12-14-01	PMB Electrical Panel Schedules
AN-23-E-5, Rev.5, 5-12-00	MDB Filter Electrical Panel Schedules
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AN-1-G-515, Rev.1, 9-29-00	MDB Major Equipment Legend – 4, General Arrangement
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