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DEMILITARIZATION PLAN; OPERATION OF THE CHEMICAL AGENT MUNITION--ETC(U)

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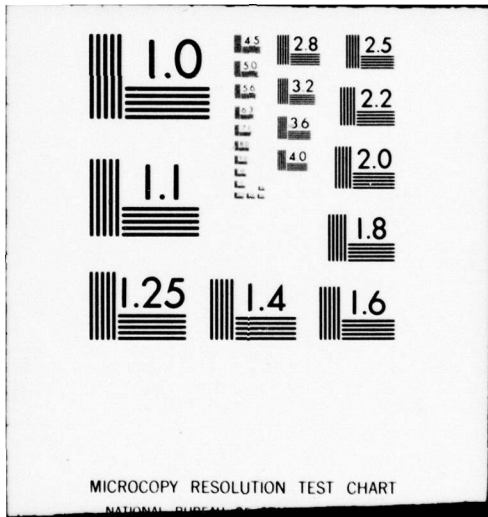
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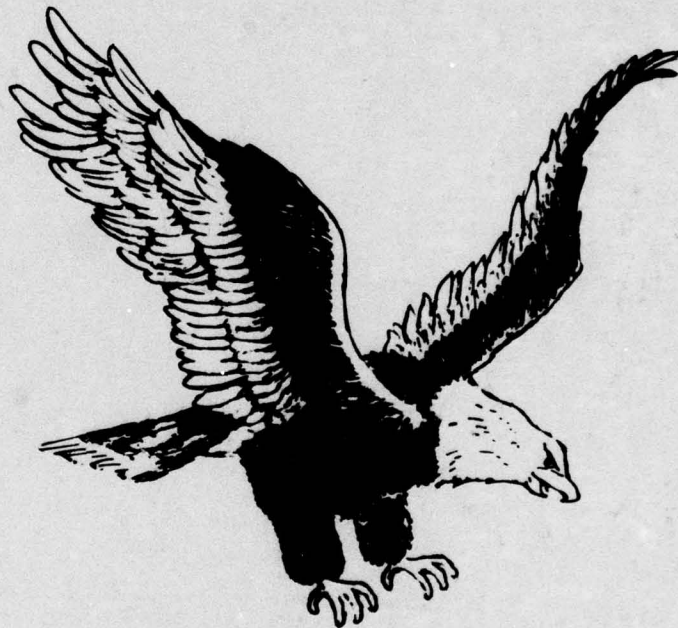
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LEVEL II

①

**OPERATION OF THE
CHEMICAL AGENT MUNITIONS DISPOSAL SYSTEM
(CAMDS)
AT
TOOELE ARMY DEPOT, UTAH**

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MARCH 1977

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HAZARD AND SAFETY ANALYSES

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LEVEL II



TRW REPORT NO. 95436-002

SAFETY ANALYSES AND HAZARD EVALUATION REPORT

FAILURE MODES AND EFFECTS ANALYSIS

FOR

CAMDS

2 OCTOBER 1975

SUBMITTED TO
TOOELE ARMY DEPOT
TOOELE, UTAH 84074

Prepared Under Contract
No. DAAG-49-75-C-0135

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1. INTRODUCTION

The Army is developing a Chemical Agent/Munitions Disposal System (CAMDS) for complete demilitarization and disposal of lethal chemical agents and munitions within the constraints of total containment of hazardous materials, impeccable safety to operating personnel and the civilian population, and stringent environmental control standards. The munition systems to be demilitarized include artillery projectiles with and without explosive bursters, chemical rockets with explosives and propellant, chemical mortars and land mines with explosives, bombs, ton containers, and spray tanks. The CAMDS is intended to disassemble the munitions, destroy the explosive components, destroy or neutralize the lethal agents by thermal or chemical processes, and decontaminate all residual hardware and inert components. The system is to embody absolute safety precautions to prevent release of the chemical agents to the environment and to protect operating personnel.

The CAMDS consists of specialized, remote-controlled machinery for removing explosive components and chemical agents from munitions, two continuous furnace systems for thermal deactivation of energetic materials and decontamination of metal parts, a chemical agent destruction plant, material transport systems, and the required support systems. The CAMDS is being designed, fabricated, and installed on a modular basis by Edgewood Arsenal, Tooele Army Depot, and their contractors. The plant is scheduled to be operational by 1 October 1976 at the South Area of Tooele Army Depot. The plant will be operated by Government personnel.

This report is a CDRL item prepared under a "Reliability and Maintenance Program Analysis" contract awarded to TRW. AEO Specification No. 75-10, Contract Description/Specifications has served as the baseline for this document. The effort involved is the conduct of a systems Failure Mode and Effects Analysis (FMEA) of the CAMDS based on design data and anticipated operating procedures provided by the Government. Hazards analyses already developed for a few of the CAMDS building blocks have been considered in this document. The scope of work performed has been accomplished with the emphasis on potential hazards and failure modes that could conceivably result in an impact on the environment and/or

compromise the health and safety of personnel and the civilian population, rather than the possible maintenance and repairs as a result of failures affecting normal plant operation.

Section 2 provides a summary of the CAMDS building blocks, the munitions to be demilitarized, and the agents employed in these munitions. Section 3 shows the rationale and methodology employed in conduct of the analysis. Section 4 consists of the FMEA charts along with pertinent logic diagrams. The summary and conclusions are presented in Section 5 and include consideration of three significant aspects: environment, safety, and facility operations.

Acknowledgement for their contributions toward preparation of this report is made to Armond Kaloust, E. J. Gearhart, R. A. Paulson, J. Sings and R. Armstrong.

2. CAMDS DESCRIPTION

2.1 GENERAL

The CAMDS site is located at the South Area of Tooele Army Depot Tooele, Utah. All personnel entering the CAMDS facility on foot must go through the Personnel Support Complex (PSC). A 20-foot-wide road provides vehicle access around the perimeter of the CAMDS site. A rail line with a tank car unloading station is located just outside the fenced area. Chemicals are pumped from this unloading station to a bulk chemical storage tank area located inside the fenced area adjacent to the Agent Destruction System (ADS).

All munitions, with the exception of bulk items, will be brought into the fenced area and placed behind a massive barricade identified as the Munition Holding Area (MHA). The munitions stored temporarily in this area are transported to the Unpack Area (UPA) as required for processing.

2.2 BUILDING BLOCK DESCRIPTION

For the purpose of technical and financial management of the program the CAMDS has been subdivided into a number of building blocks. These building blocks include processing subsystems and system integration functions. Those which were considered in the FMEA are listed and briefly described as follows:

- 01 - UPA - Unpack Area
- 02 - ECC - Explosive Containment Cubicle
- 04 - DFS - Deactivation Furnace System
- 05 - MPF - Metal Parts Furnace
- 06 - RDM - Rocket Demil Machine
- 07 - DUN - Dunnage Incinerator System
- 08 - UTL - Utilities
- 09 - EHM - ECC Hydraulics
- 10 - CON - Control Module
- 12 - PSC - Personnel Support Complex
- 13 - ADS - Agent Destruction System
- 14 - ETS - Explosive Treatment System
- 15 - PDM - Projectile Demil Machine

- 18 - PPD - Projectile Pull and Drain Machine
- 19 - CDS - Central Decon System
- 20 - PDF - Projectile Disassembly Facility
- 21 - BIF - Bulk Item Facility
- 22 - MHE - Material Handling Equipment
- 23 - FIL - Filter System
- 24 - MOR - Motar Demil Machine
- 25 - MIN - Mine Demil Machine
- 26 - PIP - Piping
- 27 - ELE - Electrical
- 28 - MOD - Scale Model
- 29 - PER - Perimeter Monitoring
- 30 - CTV - Closed Circuit Television
- 31 - COM - Communications
- 32 - CML - Chemical Laboratory
- 33 - DET - Detectors
- 34 - TDP - Technical Data Package
- 35 - SCS - Site Control System
- 36 - TNG - Training
- 37 - RAM - Repair and Maintenance
- 38 - SMP - System Management and Planning
- 39 - OES - Operational Engineering Support
- 40 - SIT - Initial Test and Site Development
- 41 - SYS - System Integration

01-UPA-Unpack Area. The purpose of the UPA is to provide an area within the CAMDS where the items to be processed in the ECC and PPD can be reinspected, removed from their shipping and storage containers, and prepared for the demilitarization process. The UPA consists of two areas: the unpack operating area and the airlock area. The housing is physically connected to the ECC housing and faces the Personnel Support Complex (PSC).

02-ECC-Explosive Containment Cubicle. The ECC's primary purpose is to retain the fragments and chemical agents that would result from an explosive incident during demilitarization of chemical munitions. All munitions that contain explosive components will be processed through

the ECC to remove the explosive components and cut the explosive into segments small enough to process through the Deactivation Furnace System (DFS). The chemical agent will be drained from rockets and mines in the ECC.

Four separate machines are designed for installation in the ECC one at a time, dependent on the type of munition to be demilitarized. They are the Rocket Demil Machine (RDM), the Projectile Demil Machine (PDM), the Mortar Demil Machine (MOR) and the Mine Demil Machine (MIN). A conveyor especially designed for each machine connects the unpack area with the machine in the ECC. The ECC discharge conveyor for each machine is located in the ECC housing between the ECC and the DFS.

04-DFS-Deactivation Furnace System. The DFS comprises that area of the CAMDS where propellant and explosives are thermally destroyed. Inert materials (metal and glass) processed along with these explosives and propellants are thermally detoxified of agent.

The major components of the DFS are: an air/blast lock, an oil-fired rotary retort, a shrouded electrically heated discharge conveyor, and an air pollution control system. The air pollution control system is comprised of: a cyclone collector, a slagging afterburner, a variable throat venturi scrubber, a quench tower, a packed bed scrubber, a demister, an air exhaust fan, and a stack.

05-MPF-Metal Parts Furnace. The purpose of the Metal Parts Furnace (MPF) is to thermally destroy residual GB and VX agent contamination on munition components without explosives and to thermally detoxify filled ton containers of H, HD and HT, and munitions without explosives. The MPF system consists of the following major areas: punch chamber, vaporization chamber, burnout chamber, 2 afterburners and APC system.

06-RDM-Rocket Demil Machine. The basic purpose of the RDM is to provide a safe means of remotely separating the bulk of the agent from the M55 rocket and to dissect the rocket into sections small enough to be handled by the DFS. The RDM is installed in the ECC.

07-DUN-Dunnage Incinerator. The main purpose of this incinerator is to destroy uncontaminated dunnage consisting of wooden pallets and combustible packing materials which would otherwise accumulate in the

Unpack Area (UPA). The system is designed to handle an average rate of 500 lb/hr.

08-UTL-Utilities. The UTL will provide for steam, water, septic, compressed air, hydraulic pressure and air-conditioning needs in the CAMDS site.

Process steam is required for the Metal Parts Furnace and Agent Destruction System and the steam will also heat the CAMDS site in the winter. A water distribution system provides for all site needs for fire protection, process and potable water. Compressed air is available to support operations in the UPA, ECC, PDF and BIF. Hydraulic pressure is provided to support equipment in the UPA, ECC, PDF, BIF and ADS.

09-EHM-ECC Hydraulics. The ECC Hydraulic System supplies the hydraulic fluid at the required flow rates and pressure for the ECC, the equipment that is installed in the ECC, and for the ECC input and output conveyors. A similar system is installed in the PDF to supply hydraulic power for the PPD and the BIF.

10-CON-Control Module. The basic purpose of the CON is to provide a building to house operators, control panels, computers, and closed circuit TV monitors for those CAMDS operations which will be automated.

12-PSC-Personnel Support Complex. The PSC is an assembly of portable modules serving as the facility for the issue and storage of protective clothing and coveralls, disposal of dirty clothing, change and storage of clothes, toilet requirements, eating facilities, and personnel showers. The protective clothing storage/change module is connected to a filter/ventilation system and a hot-waste collection system.

13-ADS-Agent Destruction System. The ADS is that area of the CAMDS designed for bulk detoxification of agents GB and VX with only one agent being processed at any time, and will also process plant waste containing GB, VX and mustard.

All agent processing will be performed in "toxic" areas, while the remainder of the ADS housing will contain the brine bulk reduction (drying) and utility units. The processing of chemical agents GB and

VX within the ADS is referred to as detoxification and the toxic process module includes all necessary process equipment such as process scrubbers, pumps, heat exchanges, reactors, and agitators as well as "holding" tanks. A bulk reduction area provides for the automatic and continuous processing of the detoxified liquor and contains all equipment necessary to reduce the detoxified liquor to a dry product or sludge which will not produce either a hazard or nuisance from dust, solid fumes, or corrosion.

14-ETS-Explosive Treatment System. The ETS is the area of the CAMDS where sludge and dissolved explosives from spent decontamination solution from the ECC are removed. The filtered spent decon is then pumped to the ADS for final disposal. The ETS is comprised of bag-type filter units, charcoal absorption columns, tanks, pumps, piping, and the necessary controls.

15-PDM-Projectile Demil Machine. All burstered and/or fused projectiles will be processed in the PDM. The machine is installed in the ECC and will receive the munitions via the UPA on ECC Input Conveyor. Once inside the ECC, the PDM will saw the nose closure or fuze from the projectile to expose the burster or supplementary charge for removal by the appropriate removal device. Projectiles that have had their energetic materials removed will undergo further processing in the PPD machine. (See Building Block 18).

18-PPD-Projectile Pull and Drain Machine. The basic function of the PPD is to remove the nose closure from non-burstered projectiles, pull the burster well, and remove VX and GB agents from projectiles. The PPD is located in the Projectile Disassembly Facility (PDF) and is contained within an interior housing. The PPD includes the following stations: PPD load station, nose closure removal station, burster well weld cutting station, burster well pull station, drain station, and PPD unload station.

19-CDS-Central Decon System. The CDS mixes, stores, and supplies calcium hypochlorite decon solution to all areas of the CAMDS for VX and mustard operations. The CDS also stores sodium hydroxide decon solution prepared in the ADS for supply, on demand, to the PPD, BIF and MPF. The CDS occupies a chamber in the PDF and includes as major

components: a decon supply tank, a vacuum conveyor used to transfer hypochlorite powder from shipping drums to the supply tank, two holding tanks, and ancillary control and monitoring equipment.

20-PDF-Projectile Disassembly Facility. The purpose of the PDF is to provide a facility to house the Projectile Pull and Drain Machine, (PPD), Central Decon System (CDS), and the Bulk Item Facility (BIF). There will be no explosives in this area. Sump drains are installed for the BIF shower, the drain station in the BIF, the BIF holding area, the BIF airlock, the PPD shroud, and the PPD.

21-BIF-Bulk Item Facility. The BIF is the area of CAMDS designated for demilitarization of large nerve agent-filled munitions and bulk containers and will process agents GB and VX. The Facility housing incorporates a toxic drain area, agent area, a control room, and an enclosed holding/preparation area. The BIF includes material handling equipment to off-load the bulk items into the holding/preparation area, transport the items into and out of the drain bays, and deliver the items to the input conveyor of the MPF.

22-MHE-Material Handling Equipment. The MHE is utilized in the CAMDS to provide conveyors for the transfer of munitions and munition components to various locations inside the toxic areas. All munitions except bulk items will be processed by the material handling equipment.

23-FIL-Filter System. The filter/ventilation system will assure that exhaust air (minimum of 25 changes per hour) from normally contaminated areas is filtered for agent removal prior to release to the atmosphere. In addition, the system will exhaust (minimum of six changes per hour) from areas where occasional or trace contamination might occur.

24-MOR-Mortar Demil Machine. The purpose of the MOR is to remove the M8 fuse and M14 burster from the 4.2-inch mortar. The mortar machine is located inside the ECC and is remotely operated by the computer control system. The mortar machine will remove the fuse and burster, then will transfer both items by conveyor to the deactivation furnace for destruction. The mortar round will be conveyed to the PPD for further processing.

25-MIN-Mine Demil Machine. The mine machine is designed to remove and separate the M120 booster and the M38 burster, and then drain the agent cavity prior to sending the mine to the Deactivation Furnace (DFS). The M23, VX land mine will be processed in this machine, which is installed in the ECC.

26-PIP-Piping. The CAMDS piping system transfers or routes air, steam, and process liquids within the site. Detectors are installed on the outer double pipe to sense if any agent is leaking during the transport of GB and VX.

27-ELE-Electrical. The primary purpose of the electrical distribution system is to supply and distribute commercial and emergency standby power throughout the CAMDS site. The CAMDS site contains four power transformers: a 75-kva, 208-volt unit for the well pump, a 300-kva, 208-volt unit for the PSC, a 750-kva, 208-volt unit for the CAMDS demil equipment, and a 1500-kva, 480-volt unit also for the CAMDS demil equipment.

The site also has three diesel engine driven emergency standby generator sets to supply power to critical areas in case of a commercial power failure. One 500-kw unit supplies 480-volts and two 235-kw units supply 208 volts.

28-MOD-Scale Model. Not Applicable.

29-PER-Perimeter Monitoring. The perimeter monitoring network will sample the ambient air quality at points around the CAMDS site to determine the background concentration of various pollutants and demonstrate that no ill effects result from CAMDS operations. The perimeter monitoring network will incorporate eight stations along a perimeter about 2 miles from the site, with each station operating continuously.

30-CTV-Closed Circuit Television. These surveillance systems provide for remote observation of machines, conveyors, and maintenance operations in toxic areas.

31-COM-Communications. The CAMDS "COM" system provides direct communication between all control stations and housings on the CAMDS site; e.g., supervisory personnel at control stations can communicate with maintenance personnel wearing level A protective clothing in contaminated areas.

32-CML-Chemical Laboratory. The CAMDS Chemical Laboratory will provide all the analytical support required for the demilitarization of toxic chemical agents. The primary areas requiring such support will be the Perimeter Monitoring Networks (PER), Detectors, and the ADS, MPF, and DFS.

33-DET-Detectors. The detectors will monitor the CAMDS site for the presence of agents to protect plant operators and the surrounding populace, as well as to monitor the plant processes. These detectors have the capability to detect any agent processed by CAMDS.

34-TDP-Technical Data Package. Not Applicable.

35-SCS-Site Control System. This system exercises master control and monitoring over the CAMDS site.

36-TNG-Training. Not Applicable.

37-RAM-Repair and Maintenance. Not Applicable.

38-SMP-System Management and Planning. Not Applicable.

39-OES-Other EA Support. Not Applicable.

40-SIT-Initial Test and Site Development. Not Applicable.

41-SYS-System Integration. Not Applicable.

2.3 DEMIL SYSTEM APPLICATION

The building blocks are arranged to provide for demilitarization of each of seven general munition configurations, plus bulk items. These configurations, which will be processed at the CAMDS at Tooele, Utah, are listed with their respective agents in Table 2-1.

Figure 2-1 is a composite of munitions inventory, line designations and respective building block application, pinpointing munition/building block demilitarization hardware requirements.

Table 2-1. Munition Configurations

Configuration No.	Munition Type	Agent	Explosive
1	M55 Rocket	GB,VX	3.2-1b Composition B
2	M23 Mine	VX	0.8-1b Composition B
3	105-mm M360, Burstered	GB	1.1-1b Tetrytol
4	105-mm M360, Non-Burstered	GB	None
5	155-mm M110	H	0.41-1b Tetrytol
	155-mm M104	HD	0.41-1b Tetrytol
6	155-mm M121	GB	None
	155-mm M121A1	GB,VX	None
	155-mm M122	GB	None
	8-inch MA26	GB	None
7	4.2-inch Mortar	HD,HT	0.14-1b Tetryl

CAMDS BUILDING BLOCKS

PRESENT ABV.	PRIME RESPONSIBILITY	BUILDING BLOCK
1.	UPA	TEAD UNPACK AREA
2.	ECC	TEAD EXPLOSIVE CONTAINMENT CUBICLE
4.	DFS	EA DEACTIVATION FURNACE SYSTEM
5.	MPF	EA METAL PARTS FURNACE
6.	RDM	TEAD ROCKET DEMIL MACHINE
7.	DUN	EA DUNNAGE INCINERATOR SYSTEM
8.	UTL	TEAD UTILITIES
9.	EHM	TEAD ECC HYDRAULICS
10.	CON	TEAD CONTROL MODULE
12.	PSC	EA PERSONNEL SUPPORT COMPLEX
13.	ADS	EA AGENT DESTRUCTION SYSTEM
14.	ETS	EA EXPLOSIVE TREATMENT SYSTEM
15.	PDM	TEAD PROJECTILE DEMIL MACHINE
18.	PPD	TEAD PROJECTILE PULL AND DRAIN MACHINE
19.	CDS	EA CENTRAL DECON SYSTEM
20.	PDF	TEAD PROJECTILE DISASSEMBLY FACILITY
21.	BIF	EA BULK ITEM FACILITY
22.	MHE	TEAD MATERIAL HANDLING EQUIPMENT
23.	FIL	EA FILTER SYSTEM
24.	MOR	TEAD MORTAR DEMIL MACHINE
25.	MIN	TEAD MINE DEMIL MACHINE
26.	PIP	TEAD PIPING
27.	ELE	TEAD ELECTRICAL
28.	MOD	EA SCALE MODEL
29.	PER	EA PERIMETER MONITORING
30.	CTV	TEAD CLOSED CIRCUIT TELEVISION
31.	COM	TEAD COMMUNICATIONS
32.	CHL	EA CHEMICAL LABORATORY
33.	DET	EA DETECTORS
34.	TDP	PMD TECHNICAL DATA PACKAGE
35.	SCS	TEAD SITE CONTROL SYSTEM
36.	TNG	TEAD TRAINING
37.	RAM	TEAD REPAIR & MAINTENANCE
38.	SMP	TEAD SYSTEM MANAGEMENT AND PLANNING
39.	OES	TEAD OTHER EA SUPPORT
40.	SIT	TEAD INITIAL TEST & SITE DEVELOPMENT
41.	SYS	TEAD SYSTEM INTEGRATION

MUNITIONS INVENTORY		AGENT	EXPLOSIVE	PROPELLANT
DESIGNATION	DIMENSIONS, WEIGHT	TYPE	TYPE	TYPE
Rocket, 115mm, M65	78.0" x 115mm, 57#	GB	MT	MT
Rocket, 115mm, M65	78.0" x 115mm, 57#	10.7#	Comp B	MT, RUSE
Cartridge, 105mm, M360	31.1" x 105mm, 44#	VX	3.2#	M28
Projectile, 155mm, M21A1	26.7" x 155mm, 100#	10.0	Comp B	19.3#, M417
Projectile, 155mm, M21A1	26.7" x 155mm, 100#	GB	3.2#	19.3#, M417
Projectile, 155mm, M21	26.7" x 155mm, 100#	1.6#	None	None
Projectile, 155mm, M22	35.1" x 8", 199#	GB	None	None
Projectile, 155mm, M22	26.7" x 155mm, 100#	6.5#	None	None
Cartridge, 105mm, M360	31.1" x 105mm, 44#	6.5#	None	None
Cartridge, 105mm, M360	31.1" x 105mm, 44#	14.5#	None	None
Projectile, 155mm, M21A1	26.8" x 155mm, 100#	7#	None	None
Projectile, 155mm, M21A1	26.8" x 155mm, 100#	6.0#	None	None
Mine, 2.0" x 1.5", M10	5.0" x 1.5", 95#	1.6#	None	None
Cartridge, 105mm, M360	31.1" x 105mm, 44#	11.7#	None	None
Cartridge, 105mm, M360	27" x 105mm, 44#	11.7#	None	None
Cartridge, 105mm, M360	27" x 105mm, 44#	11.7#	None	None
Cartridge, 105mm, M360	27" x 105mm, 44#	11.7#	None	None

MUNITIONS DEMILITARIZATION LINE DESIGNATIONS

FC #1 M 55 ROCKET GB/VX	FC #2 PROJECTILES/CARTRIDGES GB/VX WITHOUT BURSTERS	FC #3 P/C GB/VX WITH BURSTER	FC #4 PROJECT MUSTARD WITH BURSTER	FC #5 M23 MINE VX	FC #6 4.2" MORTAR MUSTARD

3

COMMENTS:

SUCCESSFUL OPERATION OF THE BUILDING BLOCK HARDWARE INDICATED BY "H" IN A GIVEN MUNITIONS COLUMN IS NECESSARY FOR SUCCESSFUL OPERATION OF THAT MUNITIONS DEMILITARIZATION LINE. MANY FAILURES WITHIN A BUILDING BLOCK WILL REQUIRE THAT DEMILITARIZATION OPERATIONS ON THE MUNITIONS TYPE BEING PROCESSED BE HALTED. MANY OF THESE FAILURES WILL NOT ALLOW CERTAIN MUNITIONS TYPES TO BE DEMILITARIZED BUT WILL ALLOW DEMILITARIZATION OF OTHER MUNITION TYPES. CERTAIN FAILURES WILL REQUIRE THAT ALL DEMILITARIZATION OPERATIONS CEASE (I.E., INOPERATIVE FAILURE OF THE UNPACK AREA'S ECC INPUT CONVEYOR DURING DEMILITARIZATION OF M55 ROCKETS WOULD HALT OPERATIONS ON THAT MUNITION AND WOULD NOT ALLOW DEMILITARIZATION OF MUNITIONS VIA THE FOLLOWING DEMILITARIZATION LINES EITHER:

- o PROJECTILES/CARTRIDGES
GB/VX WITH BURSTERS
- o PROJECTILES MUSTARD
WITH BURSTERS
- o M23 MINE VX
- o 4.2-INCH MORTAR MUSTARD

DEMILITARIZATION OF MUNITIONS VIA THE FOLLOWING DEMILITARIZATION LINES COULD BE STARTED:

- o BULK ITEMS
GB/VX
- o TON CONTAINER
MUSTARD

ANY FAILURE RESULTING IN AN UNPACK AREA AGENT DETECTOR REGISTERING AN UNACCEPTABLE AGENT LEVEL WOULD NOT ALLOW THE DEMILITARIZATION OF ANY OF THE MUNITIONS UNTIL AFTER CLEAN-UP.

the indicated munitions.

operate the PPD and BIF.

the indicated munitions.

the Building Blocks.

servicing the Building Blocks.

indicated munitions.

indicated munitions.

monitoring fails. Checked every 12 hrs.

the CML.

Detectors.

#10.

Figure 2-1. Munition Demilitarization Hardware Requirements

3. ANALYSES

This section describes the procedures employed in conduct of the FMEA. It includes a list of source material employed, definitions of terms used, and describes the rationale and methodology. Section 4 provides the logic flow diagrams and FMEA charts generated.

3.1 DEFINITION OF TERMS

For the purposes of this report in both text and data presentation herein, the following term definitions will apply:

- Building Block - A functional major subsystem which has a specific purpose in the system and is composed of a number of interfacing modules and components.
- Component - A combination of parts, usually self-contained, which performs a particular function (or more than one function) and is usually at the replaceable item level.
- Criticality Index - A quantitative assessment of the relative importance of a failure mode obtained by combining the assigned severity level with the expected or known frequency of failure.
- Failure - The inability of a part, component assembly, etc., to perform its required function within specified limits.
- Failure Analysis - The logical, systematic examination of an item to identify and analyze the cause and mode of failure of the item.
- Failure Mode - The manner in which a hardware item fails.
- Failure Mode Effects Analysis (FMEA) - A technique for system design evaluation which lists elements of that design, determines the effects of modes on system/elements, and documents built-in deterrence or corrective action necessary.
- Failure Rate - The number of failures of an item per unit measure of life in cycles, time, or events as applicable.

For purposes of establishing criticality indexes, failure rates will be qualitatively identified at four levels:

- Level 1, negligible failure probability
- Level 2, low failure probability
- Level 3, 50 percent chance of occurrence during its mission operation
- Level 4, high probability of occurrence during its mission operation.

- Hazard Level - A qualitative measure of hazards stated in relative terms. The following definitions of hazards levels are in consonance with applicable MIL Specifications:

Category I - Negligible. Conditions such that personnel error, environment, design characteristics, procedural deficiencies, or subsystem or component failure or malfunction will not result in personnel injury or system damage.

Category II - Marginal. Conditions such that personnel error, environment, design characteristics, procedural deficiencies or subsystem or component failure or malfunction can be counteracted or controlled without injury to personnel or major system damage.

Category III - Critical. Conditions such that personnel error, environment, design characteristics, procedural deficiencies or subsystem or component failure or malfunction will cause personnel injury or major system damage, or will require immediate corrective action for personnel or system survival.

Category IV - Catastrophic. Conditions such that personnel error, environment, design characteristics, procedural deficiencies or subsystem or component failure or malfunction will cause death or severe injury to personnel, or system loss.

- Human Engineering - The area of human factors which applies scientific knowledge to the design of items to achieve effective man-machine integration and utilization.
- Inherent - Achievable under ideal conditions, generally derived by analysis and potentially present in the design.
- Item - Used herein to denote the lowest level of hardware assembly as a component or part.
- Mission - The objective of task which with the purpose clearly indicates the action to be taken.
- Module - An assembly of components generally at the replacement level.
- Operational - Pertaining to the state of actual usage.
- Redundancy - The existence of more than one means for accomplishing a given function.
- Reliability - The probability that an item subassembly, assembly, or system will perform its intended function for a specified interval under stated conditions.

- Safety - The conservation of human life and its effectiveness and the prevention of damage to equipments consistent with mission requirements.
- System - The functional total of all building blocks required to accomplish a process and representable by a process logic diagram.

3.2 DOCUMENTS REVIEWED

In addition to technical discussions with key engineering and supervisory personnel at both Edgewood Arsenal and Tooele Army Depot, a relatively large number of drawings, test reports, design criteria, and related U.S. Army documents were reviewed by the contractors in preparation for a support of this report. The source of information for the data presented herein is as follows:

MIL-STD-785A	Reliability Program for Systems and Equipment Development and Production
MIL-STD-721B	Definitions of Effectiveness Terms for Reliability, ...
MIL-STD-470	Maintainability Program Requirements
MIL-STD-882	Requirements for Systems Safety Programs
MIL-STD-1472A	Human Engineering Design Criteria for Military Systems ...
AR 702-3	Army Material Reliability Availability and Maintainability
MIL-STD-280A	Definitions of Item Levels Exchangeability Models and Related Terms
AMCP 702-3	Reliability Handbook
FARADA	Failure Rate Data Handbook - Navy FMSAEG
RADC-TR-68-14	Nonelectronic Reliability Handbook, RADC, N.Y.
AR 385 Series	Army Safety Requirements
AMCR 385-100	Army Safety Manual
Project Eagle (August 1974)	Supplement B - Demilitarization and Disposal of the M35 GB Cluster at Rocky Mountain Arsenal
CAMDS (D.L. Pugh)	Overall Test Program Resume
Edgewood Arsenal (NTIS)	Environmental Statement, Demilitarization of Toxic Munitions at U.S. Army Materiel

PMO (Aberdeen) 28 May 1975	Chemical Munition Stockpile Inspection Conducted in Support of the Chemical Agent Munition Disposal System (CAMDS)
EA & TEAD (April 1975)	Design Criteria, CAMDS
Hercules, Inc.	Preliminary Hazards Analysis of a Metal Parts Furnace and Air Pollution Control System
Hercules, Inc.	Failure Mode and Hazardous Effects Analysis of a Metal Parts Furnace and Air Pollution Control System
PMO (TEAD) (Maj. Timpf)	Enclosure 17, Surveillance and Movement of Munitions, to Draft Demilitarization Plan, July 1975
The Marquardt Co.	Engineering Evaluation of the CAMDS Muni- tions Demil Machinery Design. 01. Vol I, 1974
The Marquardt Co.	Engineering Evaluation of the CAMDS Muni- tions Demil Machinery Design, 01, Vol II, 1974
PMO - TEAD (28 May 1975)	Chemical Munition Stockpile Inspection - Support of CAMDS
TEAD	Enclosure 5, Explosive Containment Cubicle Testing and Related Data, to Draft Demil Plan for CAMDS, July 1975
TEAD	CAMDS Test Reports - various series, 1972-75
TEAD	CAMDS Drawings - Aperture Cards, as available
Hercules Inc.	Preliminary Hazards Analysis of a Deactivation Furnace and Air Pollution Control System
Hercules, Inc.	Failure Mode and Hazardous Effect Analysis of Deactivation Furnace and Air Pollution Control System
Hercules, Inc.	Failure Mode and Hazardous Effect Analysis of the Agent Destruction System for CAMDS.

3.3 GENERAL APPROACH

Data in the form of drawings, reports, manufacturer's specifications, coupled with discussions with engineering personnel representing both Edgewood Arsenal and Tooele Army Depot, have served as the basis for indoctrination and familiarization with each of the 37 building blocks which

comprise the CAMDS facility. In many instances the building blocks had progressed in fabrication, assembly, and construction to warrant on the spot evaluation. Test data were available in many cases, and actual tests were witnessed on occasion. The CAMDS Overall Test Program Resume, Revision No. 2, dated 12 February 1975, was also made available, along with the document entitled, "Design Criteria for CAMDS," dated April 1975.

The Army furnished a list of all building blocks, along with the cognizant engineer from each major area of responsibility: AEO, EA, TEAD, and PMO. The assignment of personnel from the aforementioned areas to each of the CAMDS building blocks provided an excellent opportunity to obtain design and operational information with which to evaluate potential hazards and conduct FMEAs. Additionally, analyses conducted by contractors and/or suppliers were incorporated in this document.

Of the 37 building blocks which comprise the CAMDS facility currently under construction at Tooele, Utah, nine were isolated as being exempt from the intent and purposes of this effort. The nine building blocks which are considered exempt are as follows:

- No. 38 - MOD (Scale Model)
- No. 33 - DET (Detectors)
- No. 34 - TDP (Technical Data Package)
- No. 36 - TNG (Training)
- No. 37 - RAM (Repair and Maintenance)
- No. 38 - SMP (System Management and Planning)
- No. 39 - OES (Operational Engineering Support)
- No. 40 - SIT (Initial Test and Site Development)
- No. 41 - SYS (System Integration)

The remaining 28 building blocks were evaluated with particular emphasis on identification of hazards and high probability failure modes that could be considered catastrophic or critical. The results of these analyses could then be utilized to support the Army's Environmental Impact Statement (EIS) that must be prepared prior to actual operation of CAMDS at Tooele.

3.4 RATIONALE

Reliability predictions are "before the fact," while "assessments" are statistical in nature because of the availability of actual data.

To conduct FMEAs by evaluating design, configuration, processes and procedures "before the fact" requires establishment of specific assumptions. These assumptions are, of necessity, qualitative in nature, because of the absence of specific data. In many cases "similarity" will suffice.

In order that the FMEAs and Hazards Evaluation of CAMDS be consistent and easily understood by the reader it may prove beneficial to provide the rationale employed. The family automobile is a vehicular system which consists of mechanical, electromechanical, electrical, hydraulic, chemical, and other technologies that are employed in CAMDS. There is no attempt made herein to liken an automobile to CAMDS but rather to use the automobile as being analogous to a series of building blocks, modules, and/or sub-systems.

Severity levels and failure rate levels can be assigned to the automobile as an integrated vehicle or to any of its subsystems or components. A hazards' evaluation can be ascertained, based on the criticality index of consequences of any given failure.

For example, the likelihood of a flywheel shearing from the crankshaft is obviously very, very low in probability. For lack of a quantitative or assigned numerical value, a level one (1) rating would be assigned. If a data bank existed from the major engine manufacturers, it might well be determined that the likelihood of a flywheel becoming disengaged from the crankshaft is so small as to be considered as one chance in 3 to 5 million. Whether a one (1) is assigned to this probability or a 2.5×10^{-7} , the intent is to identify it as a very low or negligible probability.

However, if the flywheel were to tear loose, it is conceivable that serious injury could occur to the driver or passenger, particularly since the lower legs are in close proximity to the flywheel in the vast majority of automobiles. The flywheel is turning at an undetermined speed and can, via inertia, depart the crankshaft in any one of many directions. A spinning disk may traverse along any of 360 degrees. Further, in order to physically come in contact with the passengers' feet or legs, the flywheel must travel in precisely the right direction, have considerable momentum, and display sufficient energy to tear through an array of steel structure.

We do not, in actual day-to-day driving of our family automobile, assign a high (Category IV) severity level because of the flywheel. Yet, it is absolutely correct to state that a flywheel breaking loose from the engine can bring about catastrophic results. The probability of occurrence (failure rate) is certainly one (1) or less and the severity level could be assigned a four (4). The criticality index, therefore, is (1 x 4) four (4); however, there is no doubt evidence in existence to justify assigning a severity level of three (3), wherein the criticality index would be (1 x 3) three (3).

The fuel pump on the average family automobile can be expected to fail at least once during the "mission" life of the engine. This can be considered as a level (3) failure rate since there is a 50 percent chance of occurrence. However, the severity level is no more than a category one (1) hazard, since failure of the fuel pump results in negligible injury to personnel or system damage. Loss of a fuel pump, therefore, results in a criticality index of three (3) also.

Note: An electrical fuel pump can also be installed so that failure of the engine driven pump will automatically cut in the electric fuel pump.

Fan belt breakage is another common occurrence on automobile engines. The frequency of failure or failure rate is established at three (3), while the hazard is negligible, resulting in a criticality index of (3 x 1) three (3).

Similarly, fan belts can be inspected and/or replaced at periodic intervals to preclude or reduce significantly the likelihood of a belt breaking on a motor trip. Redundant pulleys and belts can also be installed to improve reliability of the system.

The aforementioned discussion is presented to explain the rationale employed in the conduct of the FMEA and Hazard Evaluation accomplished in support of CAMDS. The emphasis has been placed on those building blocks, modules and/or components, the failure of which would result in a critical or catastrophic condition.

Upon examination of each of the 28 building blocks to determine where the emphasis of evaluation must be placed for purposes of the FMEA, several

blocks appear dominant. These blocks designated as the preliminary initial building blocks were studied more intently for specific possible contribution to unsafe CAMDS operation. As studies progressed to component evaluation level, the number of the preliminary critical blocks decreased and changed to a final critical building block designation as follows:

<u>Number</u>	<u>Building Block</u>
01	(UPA) Unpack Area
02	(ECC) Explosive Containment Cubicle
04	(DFS) Deactivation Furnace System
05	(MPF) Metal Parts Furnace
13	(ADS) Agent Destruction System
21	(BIF) Bulk Item Facility

Critical blocks were selected on the basis of their present or potential destructive energy source or lethal toxic release possibility. These criteria are not necessarily reflected in the FMEA charts criticality designations due to inherent safety provisions or deterrent provisions or other mitigating factors. Several building blocks (e.g., ECC Hydraulics) were studied in detail before eliminating them from the critical block lists. All detail information was included in the report. Of particular interest was the Explosive Containment Cubicle (ECC) whose implicit operation is one of a high hazard-generating nature, but whose design emphasis was toward avoidance or minimization in specific detail of the identified possible hazards. It is entirely possible that further studies may modify the list of critical building blocks to some degree.

In this evaluation no single point failure that could be classified as a Category IV (catastrophic) situation was found to exist in any building block. The designs, configurations, processes, and procedures (many of which have been validated via tests) were found to incorporate deterrent features to the extent that two or more failures must occur prior to developing catastrophic conditions.

3.5 DATA PRESENTATION

The data gathered for inclusion in this report are presented in Section 4 which follows. To present these data in an organized, understandable, and consistent fashion a standard format was devised which includes all the

important areas of information. This format contains all elements of the one suggested by the Contract Description and Specification Document. Following is a description of the form and the bases for applicable entries.

3.5.1 Building Block Element

This column includes a two-part number composed of the Building Block number and the consecutively numbered item of that Block which is being considered. The Building Block number is taken from the master list of current Building Blocks numbered from 1 to 41 as provided by AEO office at TEAD. Thus, an item numbered 5.2 is the second component assembly or subsystem being considered in the Metal Parts Furnace Block (No. 5).

3.5.2 Component or Item

This entry contains a descriptive title for the item being addressed. Enough description is included in this entry to firmly identify the item.

3.5.3 Function

Herein is listed the purpose or function of the item/component being described with enough descriptive material to enable a direct correlation with the failure mode to be described. In many cases the function of an element is fairly well included in its name (i e. filter); however, the specific application, type, or use may not be obvious.

3.5.4 Failure Mode/Cause

The specific failure mode being considered for each item is listed. Emphasis is placed upon those modes which obviously (and also not obviously) present the greater personnel or equipment hazard. However, all failure modes are included in the data sheets, regardless of importance, if they were identified during the evaluation. Failure modes most generally fell into the categories of:

- Failure to operate
- Untimely operation
- Faulty operation
- Failure to cease operation when required.

Causes for considered failures may be wide ranging in scope but are traced only as far as needed to establish suspected primary or primary/secondary causes. All possible causes are identified where failure

effects appear critical or catastrophic at either the building block or component levels.

3.5.5 Failure Consequences

The effects of each identified failure mode are analyzed and recorded for impact upon either or both personnel and equipments as applicable. Failure consequences to personnel are emphasized where so identified whether catastrophic or not. Effects of failure modes on equipment are traced to higher levels where appreciable impact is expected. Multiple simultaneous or contributory failures are so noted when the consequences are more serious than failure of single components alone. In those cases where a toxic release is an expected consequence, the release environment is noted so that release to, or confinement within, a controlled (air change-filtered) space is not mistaken for release to an outside (uncontrolled) environment.

3.5.6 Failure Deterrence/Corrective Action

This entry notes methods and provisions for obviating or avoiding the specific failure mode(s) which have been incorporated in the system design. These include fail-safe provisions, protective measures, and maintenance activities as applicable. Although consideration of design changes are specifically not a function of this FMEA, recommendations for corrective actions and additions of safeguards are noted where applicable. It will also be noted that many entries in this volume are of considerable length. This is due to inclusion of rationale for choosing the failure mode or cause, failure consequence or deterrent/corrective action, as well as providing the basis for entries in the final three columns of the form. Rationale is included in the entries of this form so that information provided by this form may better "stand on its own" without cumbersome reference to background text for the complete story.

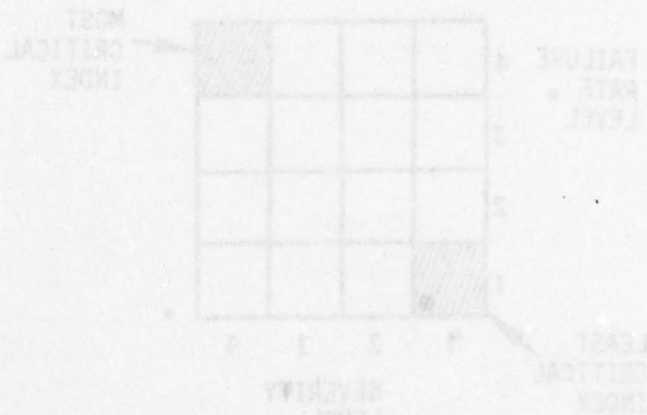
3.5.7 Severity Level

Levels of severity of the identified failure modes are qualitatively established and quantitatively noted. Levels of severity are in general consonance with noted hazards' levels (reference Section 4.1 Definitions) and range through levels 1, 2, 3, 4, parallel in importance to hazards' categories I, II, III, IV, respectively. System and component level analyses are identically rated in this respect.

It should be noted that a criticality index is only an indication of the relative importance of the combination of the two preceding columns and cannot therefore stand by itself. That is, an index of 4 may be composed of a failure mode of high severity and low frequency (probability) of occurrence, or vice versa, or of equal severity and frequency of occurrence. General impact of the failure mode will thus be found from the Severity Level column, while processing rate, reliability, or maintainability impact may be referred to from the Frequency of Failure column. A low criticality index number (1, 2) indicates identification of a relatively less important failure mode.

3.5.10 Source Data

Finally, the sources of the data presented in the FMEA formats are identified in the pages immediately following the FMEA forms. Sources are identified with the Building Blocks to which they apply. In addition to the sources of information noted in these pages any of the references listed in Section 4.2, Reference Documents, may also be applicable.



4. DATA - FMEA CHARTS, LOGIC DIAGRAMS

The information presented in this section is comprised of Failure Mode and Effects Analysis Charts, Logic Diagrams, and Information Source data. Arranged by Building Block sequence number, the data cover all building blocks that may contribute to hazardous operations. FMEA charts are constructed as noted and explained in Section 3.5. Logic Diagrams are generally self-explanatory, with diagrams of Building Block facilities arranged by sequence of hardware utilization, and those of Building Block machines by sequence of operations of the machines. Identified failure modes are noted as sub-tiers of hardware or operational blocks and are directly correlated to modes identified on the FMEA charts. The data sources noted represent major sources of information consulted. Other brief conversations have supported and added to this information but are not noted.

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL **1**
COMPONENT LEVEL **1**

BUILDING BLOCK: NO. 1, UNPACK AREA (UPA)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETECTION OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
1.0 UNPACK AREA (UPA)	<p>PROVIDES AN AREA WITHIN CAMDS WHERE ITEMS TO BE PROCESSED IN THE ECC AND/OR PPD CAN BE REMOVED FROM THEIR SHIPPING AND STORAGE CONTAINERS AND PREPARED FOR THE DEMILITARIZATION PROCESS. THE UPA ALSO HOUSES THE AIR-LOCK WHICH PROVIDES SAFE ENTRY AND EXIT OF THE ECC.</p> <p>PHYSICALLY INTER-FACING HARDWARE CONTAINED IN OTHER BUILDING BLOCKS: MATERIAL HANDLING EQUIPMENT (ECC AND ECC BYPASS CONVEYORS), FILTER SYSTEM LIGHTING SYSTEM DETECTORS PIPING COMMUNICATIONS CLOSED CIRCUIT TV SITE CONTROL SYSTEM CENTRAL DECON SYSTEM UTILITIES ADS</p>	<p>REFERENCE B/B 22</p> <p>REFERENCE B/B 23 REFERENCE B/B 27 REFERENCE B/B 33 REFERENCE B/B 26 REFERENCE B/B 31 REFERENCE B/B 30 REFERENCE B/B 35 REFERENCE B/B 19 REFERENCE B/B 8 REFERENCE B/B 13</p>					

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

BUILDING BLOCK: NO. 1, UNPACK AREA (UPA)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
1.1 MOTORIZED OVERHEAD DOOR	PROVIDES ACCESS TO THE UPA FOR A FORKLIFT LOADED WITH A PALLET OF MUNITIONS.	MODE - DOORS BECOME INOPERATIVE IN AN OPEN, CLOSED, OR INTERMEDIATE POSITION. CAUSE(S) A. MOTOR FAILURE (INOPERATIVE) OR MECHANICAL JAMMING.	<u>EQUIPMENT</u> IF THE DOOR CANNOT BE OPERATED MANUALLY MUNITION DEMILITARIZATION LINES REQUIRED TO PASS THROUGH THE UPA (ALL THOSE UTILIZING THE ECC AND/OR THE PPD) MUST BE HALTED. (CLOSED: LACK OF MUNITION SUPPLY. OPEN: PROCEDURES REQUIRE THAT THE DOOR BE CLOSED BEFORE THE PROCESSING OF MUNITIONS CAN BEGIN TO MAINTAIN PROPER VENTILIZATION.) <u>PERSONNEL</u> AGENT LEAKAGE RESULTING IN POSSIBLE PERSONNEL INJURY AND PROBABLE SHUTDOWN OF ALL MUNITIONS DEMILITARIZATION OPERATIONS.	FAILURE DETERRENCE THE MOTOR WILL BE INCLUDED IN THE PERIODIC MAINTENANCE PROGRAM. CORRECTIVE ACTION THE DOOR CAN BE OPERATED MANUALLY ON AN INTERIM BASIS. BULK ITEMS (GB/VT) BOMBS, SPRAY TANKS AND TON CONTAINERS (MUSTARD) MUNITION DEMILITARIZATION LINES DO NOT USE THE UNPACK AREA. THEREFORE, OPTIONS TO SWITCH TO PROCESSING MUNITIONS VIA THESE LINES COULD BE CONSIDERED IN THE EVENT OF PROJECTED LONG TERM DOWNTIME. (IT IS RECOGNIZED THAT THE REPAIR TIME FOR THIS TYPE OF FAILURE WILL NORMALLY BE MUCH LESS THAN THE TIME REQUIRED TO SWITCH OVER TO PROCESS A DIFFERENT MUNITION.)	1	2	2
1.2 FORKLIFT OPERATIONS WITHIN THE UPA	PLACES PALLET OF MUNITIONS WITHIN THE UPA. REMOVES LARGE DUNNAGE. REMOVES FULL DUNNAGE HOPPERS. REMOVES METAL SCRAP HOPPERS.	MODE - ANY POTENTIAL ACCIDENT OCCURRING DURING FORKLIFT OPERATIONS RESULTING IN EXPLOSION AND/OR AGENT LEAKAGE. CAUSE(S) A. DROPPING A PALLET OF MUNITIONS, RUMBLING INTO MUNITIONS WHILE REMOVING DUNNAGE AND/OR DUNNAGE HOPPERS.	POTENTIAL EXPLOSION. (THIS IS CONSIDERED HIGHLY UNLIKELY DUE TO LARGE DESIGN MARGINS ON THE MUNITIONS AND PAST EXPERIENCE WHICH HAS SHOWN THAT THESE MUNITIONS WILL SURVIVE THIS TYPE OF ACCIDENT.)	FAILURE DETERRENCE A SAFETY PROGRAM WILL BE IN EFFECT (DETECTORS, CONTINGENCY PROCEDURES, ETC.) PROCEDURES REQUIRE THAT DEMILITARIZATION OPERATIONS WILL NOT BE STARTED UNTIL THE FORKLIFT HAS BEEN REMOVED AND THE OVERHEAD DOOR CLOSED. THERE IS AMPLE ROOM IN THE UPA TO OPERATE THE FORKLIFT TO REMOVE LARGE DUNNAGE AND/OR FULL DUNNAGE HOPPERS AFTER THE PALLET OF MUNITIONS IS BROUGHT INTO THE UPA. IT IS NOT PRACTICAL TO REQUIRE THAT ANY LARGE DUNNAGE AND/OR DUNNAGE HOPPERS (WHICH WILL BE REMOVED ONLY AS THEY BECOME FULL) BE REMOVED FROM THE UPA BEFORE THE PALLET OF MUNITIONS IS BROUGHT INTO THE UPA.	3	1	3

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL X
 COMPONENT LEVEL

BUILDING BLOCK: NO. 1. UNPACK AREA (UPA)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
1.3 UPA OPERATOR MANUAL OPERATIONS	REMOVE MUNITIONS FROM THEIR STORAGE CONTAINERS, PLACE RESULTING DAMAGE, IN APPROPRIATE HOPPERS, AND MANUALLY (EXCEPT 155 MM (M10 AND M104), 155 MM (M121, M122, AND M121A1), AND 8-INCH (M426) PROJECTILES WHICH ARE HANDLED VIA MECHANICAL AIDS (JIB CRANE, TILT MACHINE, ETC.) LOAD MUNITIONS ONTO THE APPROPRIATE CONVEYOR (ECC OR ECC BYPASS).	<p>MODE - MECHANICAL DAMAGE.</p> <p>CAUSE(S)</p> <p>A. HANDLING OR ACCIDENT DURING HANDLING RESULTING IN AGENT LEAKAGE (I.E. DROPPING, DISASSEMBLY, STRIKING, ETC.).</p> <p>MODE - PERSONNEL BECOME EXPOSED TO AGENT VIA THE PRECEDING FAILURE MODE OR WHILE WORKING WITH A PREVIOUSLY UNDETECTED "LEAKER." THE OPERATORS (WHO ARE REQUIRED BY SAFETY CONSIDERATIONS WHEN WORKING WITH Banded PALLETS TO BE WEARING LEATHER GLOVES AND FACE SHIELDS) MUST REMOVE THEIR PROTECTIVE GEAR AND PUT ON A GAS MASK OR LEAVE THE AREA IMMEDIATELY.</p> <p>MODE - PERSONNEL PICKUP BANDING, PALLET, ETC., THAT HAVE BECOME CONTAMINATED WITH AGENT.</p> <p>CAUSE(S)</p> <p>A. LEAKAGE.</p>	<p>EQUIPMENT</p> <p>PROBABLE SHUTDOWN OF ALL MUNITIONS DEMILITARIZATION OPERATIONS.</p> <p>PERSONNEL</p> <p>POTENTIAL AGENT LEAKAGE RESULTING IN POSSIBLE PERSONNEL INJURY.</p> <p>POSSIBLE SHUTDOWN OF ALL MUNITIONS DEMILITARIZATION OPERATIONS USING THE UNPACK AREA UNTIL CORRECTED.</p> <p>POSSIBLE PERSONNEL INJURY.</p>	<p>FAILURE DETERRENCE</p> <p>A SAFETY PROGRAM WILL BE IN EFFECT (DETECTORS, CONTINGENCY PROCEDURES, ETC.).</p> <p>MUNITIONS DESIGN IS SUCH THAT IT IS UNLIKELY THAT SUFFICIENT DAMAGE COULD BE MANUALLY INFLECTED ACCIDENTALLY TO RESULT IN A LEAKAGE.</p> <p>FAILURE DETERRENCE SAFETY/TRAINING PROGRAMS WILL INSTRUCT PERSONNEL IN THE PROCEDURES TO BE FOLLOWED TO PRECLUDE THE FAILURE MODE AND/OR TO NEGATE ITS EFFECT.</p> <p>FAILURE DETERRENCE</p> <p>THE PACKAGED MUNITIONS ARE INSPECTED AT THE STORAGE TELLO AND AGAIN BEFORE ENTERING THE UNPACK AREA.</p> <p>CORRECTIVE ACTION</p> <p>INSPECTION IN A CLOSED AREA VIA SNIPPING METHODS IS ALSO BEING CONSIDERED.</p>	3	1	3

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

BUILDING BLOCK: NO. 1, IMPACK AREA (UPA)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
1.3 UPA OPERATOR MANUAL OPERATIONS (CONTINUED)		<p>MODE - PERSONNEL BECOME EXPOSED TO AGENT WHILE WORKING WITH THE M23 MINES.</p> <p>CAUSE(S)</p> <p>A. THE DRUMS (CONTAINING THREE MINES) ARE INSPECTED AT THE IGL00. THE INTERIOR OF THE DRUMS AND THE MINES ARE NOT INSPECTED UNTIL THE DRUMS ARE OPENED IN THE IMPACK AREA. A LEAKER COULD THEREFORE GO UNDETECTED UNTIL THIS POINT.</p> <p>MODE - PERSONNEL BECOME EXPOSED TO AGENT WHILE WORKING WITH THE 105MM M360 CARTRIDGES.</p> <p>CAUSE(S)</p> <p>A. THE CARTRIDGE BOXES (EACH CONTAINING TWO ROUNDS EACH OF WHICH IS PACKAGED IN A FIBERBOARD CONTAINER) ARE INSPECTED FOR VAPOR AT THE IGL00 WITH DETECTORS. THE INTERIOR OF THE BOX AND THE CARTRIDGES ARE NOT INSPECTED VISUALLY UNTIL THE BOXES ARE OPENED IN THE IMPACK AREA. A LEAKER COULD THEREFORE GO UNDETECTED UNTIL THIS POINT. BOXES ARE NOT AIRTIGHT.</p>	<p><u>EQUIPMENT</u></p> <p>PROBABLE SHUTDOWN OF ALL MUNITIONS DEMILITARIZATION OPERATIONS USING THE IMPACK AREA UNTIL CORRECTED.</p> <p><u>PERSONNEL</u></p> <p>POSSIBLE PERSONNEL INJURY.</p>	<p>FAILURE DETERRENCE PERSONNEL ARE REQUIRED TO WEAR LEVEL "B" CLOTHING WHEN WORKING WITH THE MINES. DISCOLORING OF THE STYROFOAM (BETWEEN EACH MINE AND AT THE TOP AND BOTTOM OF THE DRUM) AND/OR DETECTION OF THE DRUM/MINE PAINT IS AN INDICATION OF AGENT LEAKAGE. PROCEDURES REQUIRE THAT THE IMPACK AREA BE VACATED AND THAT THE AREA THEN BE PROPERLY DECONTAMINATED.</p>	2	1	2
			<p>POSSIBLE SHUTDOWN OF ALL MUNITIONS DEMILITARIZATION OPERATIONS USING THE IMPACK AREA UNTIL CORRECTED.</p> <p>POSSIBLE PERSONNEL INJURY.</p>	<p>FAILURE DETERRENCE PERSONNEL ARE NOT CONSIDERED A HIGH POSSIBILITY. PROCEDURES REQUIRE THAT THE IMPACK AREA BE VACATED AND THAT THE AREAS THEN BE PROPERLY DECONTAMINATED. GB IS VERY EASY TO DETECT, AND WILL ACTIVATE AREA ALARMS.</p>	3	1	3

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL **7**
 COMPONENT LEVEL

BUILDING BLOCK: NO. 1. UNPACK AREA (UPA)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETECTION OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
1-3 UPA OPERATOR MANUAL OPERATIONS (CONTINUED)		<p>MODE - MECHANICAL DAMAGE CAUSE(S)</p> <p>A. HANDLING OR ACCIDENT DURING HANDLING RESULTING IN EXPLOSION</p>	<p><u>EQUIPMENT</u></p> <p>SHUTDOWN OF ALL MORTARS DURING OPERATIONS.</p> <p><u>PERSONNEL</u></p> <p>POTENTIAL EXPLOSION RESULTING IN PROBABLE PERSONNEL INJURY.</p>	<p>FAILURE DETECTION MORTARS DESIGN IS SUCH THAT IT IS HIGHLY UNLIKELY THAT SUFFICIENT DAMAGE COULD BE MANUALLY INFLECTED ACCIDENTALLY TO RESULT IN AN EXPLO- SION. OF ALL THE MORTARS THE 4.2 INCH MORTAR IS CONSIDERED TO BE THE ONE POTENTIALLY MOST SUBJECT TO SIG- NIFICANT ACCIDENT DURING HANDLING. THE IGNITION CARTRIDGE AND THE PRO- PELLING CHARGE ARE MANUALLY REMOVED FROM THE MORTAR IN THE UNPACK AREA FOR LATER SHIPMENT TO STORAGE. MIS- HANDLING OR AN ACCIDENT DURING THE DISMANTLING OPERATIONS COULD RESULT IN AN EXPLOSION AND POSSIBLE INJURY TO PERSONNEL. HOWEVER, PROCEDURES REQUIRE THAT THE ENERGIC COMPONENTS BE SEPARATED UPON REMOVAL, AND PER- SONNEL WILL BE REQUIRED TO WEAR PRO- TECTIVE FACE MASKS AND GLOVES DURING THESE OPERATIONS. THE FUSED US999 M980 CARTRIDGE IS ALSO CONSIDERED A POTENTIAL EXPLOSIVE HAZARD (THOUGH LESS SO THAN THE MORTAR) DURING HAND- LING, SINCE THE PROPELLANT CHARGE AND CARTRIDGE CASE ARE REMOVED IN THE UNPACK AREA FOR LATER SHIPMENT TO STORAGE. CARTRIDGE CASES PACKED WITH M980 PROJECTILES ARE NOT REMOVED FROM THEIR FIBER CONTAINERS. CONTAINERS HAVE LIDS AT EACH END. ONE END CON- TAINS THE PROJECTILE. THE OTHER END CONTAINS THE CARTRIDGE CASE. PRE- CAUTIONS SIMILAR TO THOSE USED WHEN WORKING WITH THE MORTAR ARE IN EFFECT.</p>	3	1	3

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLACK LEVEL I
 COMPONENT LEVEL

BUILDING BLACK: NO. 1. UNPACK AREA (UPA)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
1.3 UPA OPERATOR MANUAL OPERATIONS (CONTINUED)		MODE - LOADING OF MUNITIONS ON THE CONVEYOR INCORRECTLY (BACKWARD).	<u>EQUIPMENT</u> DOWNSTREAM MACHINE DESIGN PREVENTS CATASTROPHIC CONSEQUENCES. THE DEWILTZARIZATION PROCESS WOULD HAVE TO BE INTERRUPTED TO REMOVE THE MUNITION.	FAILURE DETERRENCE THE TEG MACHINES AND THE PPD ARE INTERLOCKED SUCH THAT THEY WILL NOT OPERATE IF THE MUNITION IS NOT LOADED CORRECTLY.	1	1	1
1.4 JIB CRANE (FLOOR-MOUNTED REMOTELY OPERATED)	LIFTS 155 MM (M110 AND M121) PROJECTILES FROM THEIR CARRYING TRAY, HOLDS THEM WHILE THE GROUPEE IS REMOVED, AND LOWERS THEM ONTO A TILT MACHINE. LIFTS 155 M (M121, M122, AND M121A1) AND 8-INCH (M426) PROJECTILES FROM THEIR PALLETS, HOLDS THEM WHILE THE STEEL GROUPEE IS REMOVED, AND LOWERS THE PROJECTILE ONTO A TILT MACHINE.	MODE - INOPERATIVE FAILURE. A. PNEUMATICS LEAKAGE OR JAMMING.	IF THE OPERATORS ARE NOT ALLOWED TO PLACE THE PROJECTILES WHICH WEIGH: 155 MM (M110-99 LB; M104-95 LB) 155 MM (M121-100 LB; M122-100 LB; M121A1-100 LB) 8-INCH (M426-199 LB) ON THE CONVEYOR MANUALLY, OR IF A BACKUP MANUAL HOIST IS NOT AVAILABLE, THE PROCESSING OF THIS MUNITION MUST BE HALTED.	FAILURE DETERRENCE THE CRANE WILL BE INCLUDED IN THE PERIODIC MAINTENANCE PROGRAM. CORRECTIVE ACTION OPTIONS TO OPERATE ANY OF THE OTHER MUNITION DEWILTZARIZATION LINES (THE CRANE IS USED ONLY FOR THESE MUNITIONS) COULD BE CONSIDERED. MANUAL CONVEYOR LOADING COULD BE CONSIDERED ONLY IF IT IS WRITTEN INTO THE OPERATIONAL STANDARD OPERATING PROCEDURES (SOP). THERE IS A POSSIBILITY THAT A MANUALLY OPERATED BACKUP HOIST WILL BE PROVIDED	1	1	1

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL <input type="checkbox"/>		COMPONENT LEVEL <input checked="" type="checkbox"/>		BUILDING BLOCK: NO. 1, UNPACK AREA (UPA)			
COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
1.4 JIB CRANE (FLOOR-MOUNTED PNEUMATICALLY OPERATED) (CONTINUED)		MODE - PROJECTILE BEING LIFTED FALLS TO THE FLOOR. CAUSE(S) A. PNEUMATIC OR MECHANICAL FAILURE.	<u>EQUIPMENT</u> PROJECTILE DESIGN IS SUCH THAT STRESSES OF THE MAGNITUDE LIKELY FROM SUCH A FALL COULD BE TOLERATED. HOWEVER A LIMITED NUMBER OF 155 MM PROJECTILES HAVE STRESS CRACKS IN THEM. THESE CODE H MUNITIONS COULD PRESENT A HAZARD IF MIS-HANDLED. <u>PERSONNEL</u> POTENTIAL INJURY TO PERSONNEL STRUCK BY FALLING PROJECTILE.	FAILURE DETERRENCE THE CRANE WILL BE INCLUDED IN THE PERIODIC MAINTENANCE PROGRAM. DESIGN HANDLING PROCEDURES FOR THE CODE H MUNITIONS ARE BEING CONSIDERED. CORRECTIVE ACTION OPERATORS WOULD NOT BE IN DIRECT CONTACT WITH THE PROJECTILE AS IT WAS BEING LIFTED.	2	1	2
1.5 TILT MACHINE	ALLOWS THE REPOSITIONING OF 155 MM (M110 AND M104) PROJECTILES FROM A VERTICAL TO A HORIZONTAL POSITION FROM WHICH THEY ARE ROLLED ONTO THE ECC INPUT CONVEYOR; ALLOWS THE REPOSITIONING OF 155 MM (M121, M122, AND M121A1) AND 8-INCH (M426) PROJECTILES FROM A VERTICAL TO A HORIZONTAL POSITION FROM WHICH THEY ARE ROLLED ONTO THE ECC BYPASS CONVEYOR.	MODE - INOPERATIVE. CAUSE(S) A. JAMMING OR STRUCTURAL FAILURE.	IF THE OPERATORS ARE NOT ALLOWED TO PLACE THE PROJECTILES (MAX. WEIGHT 199 LB) ON THE CONVEYOR MANUALLY THE PROCESSING OF THIS MUNITION MUST BE HALTED.	FAILURE DETERRENCE THE TILT MACHINE WILL BE INCLUDED IN THE PERIODIC MAINTENANCE PROGRAM. CORRECTIVE ACTION OPERATORS TO OPERATE ANY OF THE OTHER MUNITION DEMILITARIZATION LINES COULD BE CONSIDERED. MANUAL CONVEYOR LOADING COULD BE CONSIDERED ONLY IF IT IS WRITTEN INTO THE SOP.	1	1	1

FAILURE MODE AND EFFECT ANALYSIS

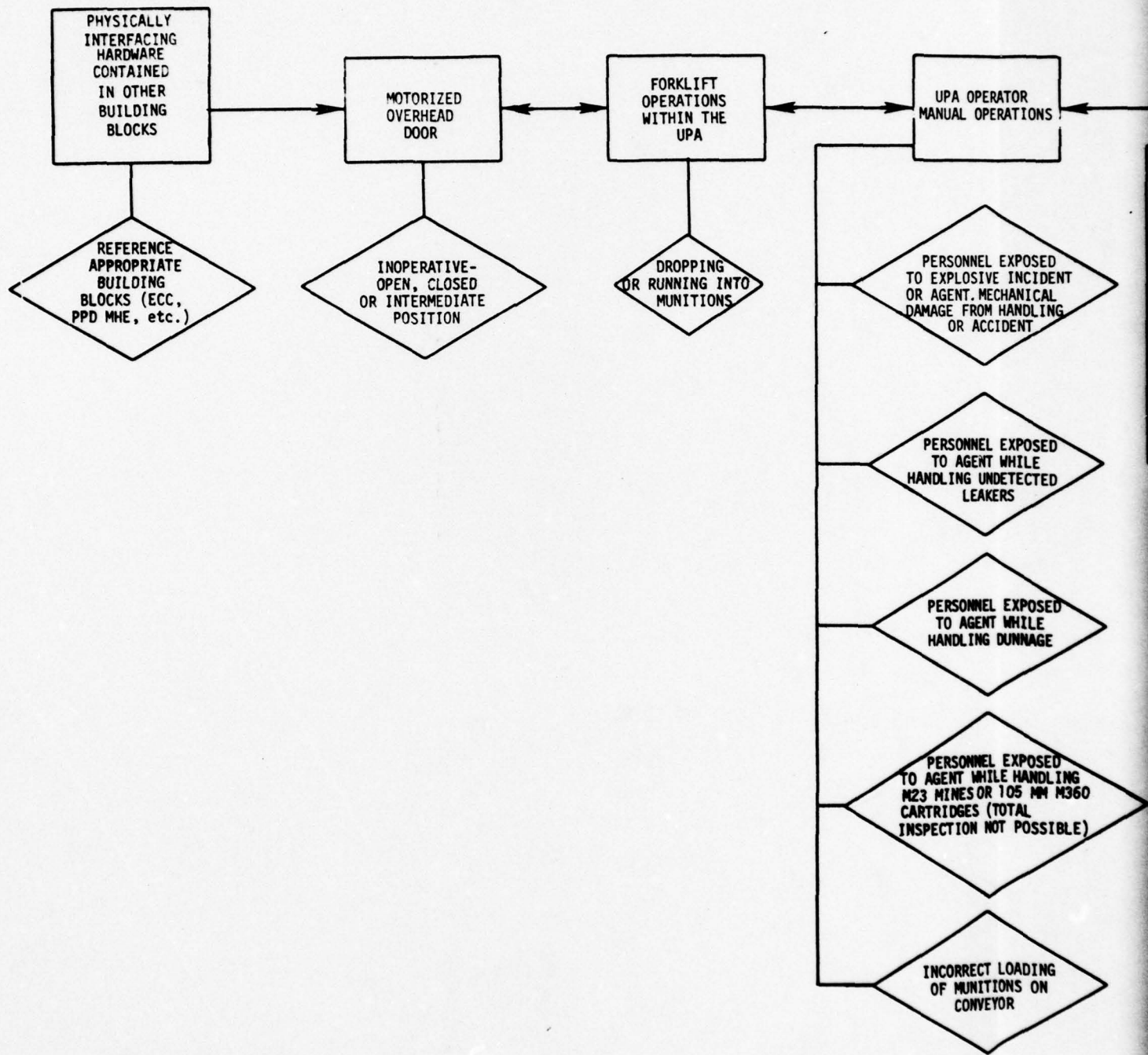
BUILDING BLOCK LEVEL		BUILDING BLOCK: NO. 1. UMPACK AREA (UPA)	
COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL
COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL
SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX	
1.5 TILT MACHINE (CONTINUED)		<p>MODE - A PROJECTILE BEING TILTED FALLS TO THE FLOOR.</p> <p>CAUSE(S)</p> <p>A. MECHANICAL OR STRUCTURAL FAILURE.</p>	<p>EQUIPMENT</p> <p>PROJECTILE DESIGN IS SUCH THAT STRESSES OF THE MAGNITUDE LIKELY FROM SUCH A FALL COULD BE TOLERATED. HOWEVER, A LIMITED NUMBER OF 155 MM PROJECTILES HAVE STRESS CRACKS IN THEM. THESE CODE H MUNITIONS COULD PRESENT A HAZARD IF MISHANDLED.</p> <p>PERSONNEL</p>
2	1	2	<p>FAILURE DETERRENCE OR CORRECTIVE ACTION</p> <p>FAILURE DETERRENCE - THE TILT MACHINE WILL BE INCLUDED IN THE PERIODIC MAINTENANCE PROGRAM. DESIGN MARGINS ON THE PROJECTILES.</p> <p>CORRECTIVE ACTION - SPECIAL HANDLING PROCEDURES FOR THE CODE H MUNITIONS ARE BEING CONSIDERED.</p>
1.6 UMPACK AREA (GENERAL)		<p>MODE - POTENTIAL HAZARD TO PERSONNEL IN THE UMPACK AREA FROM HAZARDOUS CONDITIONS EXISTING IN THE INTERIOR OF THE ECC OF WHICH THEY ARE NOT AWARE (FIRE, EXPLOSIONS, ETC.).</p>	<p>POTENTIAL PERSONNEL INJURY.</p>
2	1	2	<p>FAILURE DETERRENCE OR CORRECTIVE ACTION</p> <p>FAILURE DETERRENCE - THE ECC IS DESIGNED TO ISOLATE ALL POTENTIAL HAZARDOUS CONDITIONS EXISTING WITHIN IT. HOWEVER, THERE IS NO REAL TIME WAY FOR PERSONNEL IN THE ADJACENT UMPACK AREA TO KNOW OF SUCH CONDITIONS.</p> <p>CORRECTIVE ACTION - PROBERT SAFETY PRECAUTIONS WOULD MAKE IT DESIRABLE TO EVACUATE THE UMPACK AREA. PERSONNEL IN THE CONTROL MODULE ARE AWARE OF CONDITIONS IN THE ECC ON A REAL TIME BASIS, BUT UNDER THE PRESENT CONDITIONS WOULD HAVE TO DIAL A TWO-DIGIT NUMBER TO RELAY THE INFORMATION TO THE UMPACK AREA. POSSIBILITIES OF REMOVING THE DIALING REQUIREMENT AND/OR INSTALLING AN AUDIBLE ALARM ARE BEING CONSIDERED.</p> <p>CORRECTIVE ACTION - SCHEDULED DYNAMIC TESTING ON THE ECC WILL GIVE DATA ON ACOUSTICS.</p>
2	1	2	<p>POTENTIAL PERSONNEL INJURY.</p>

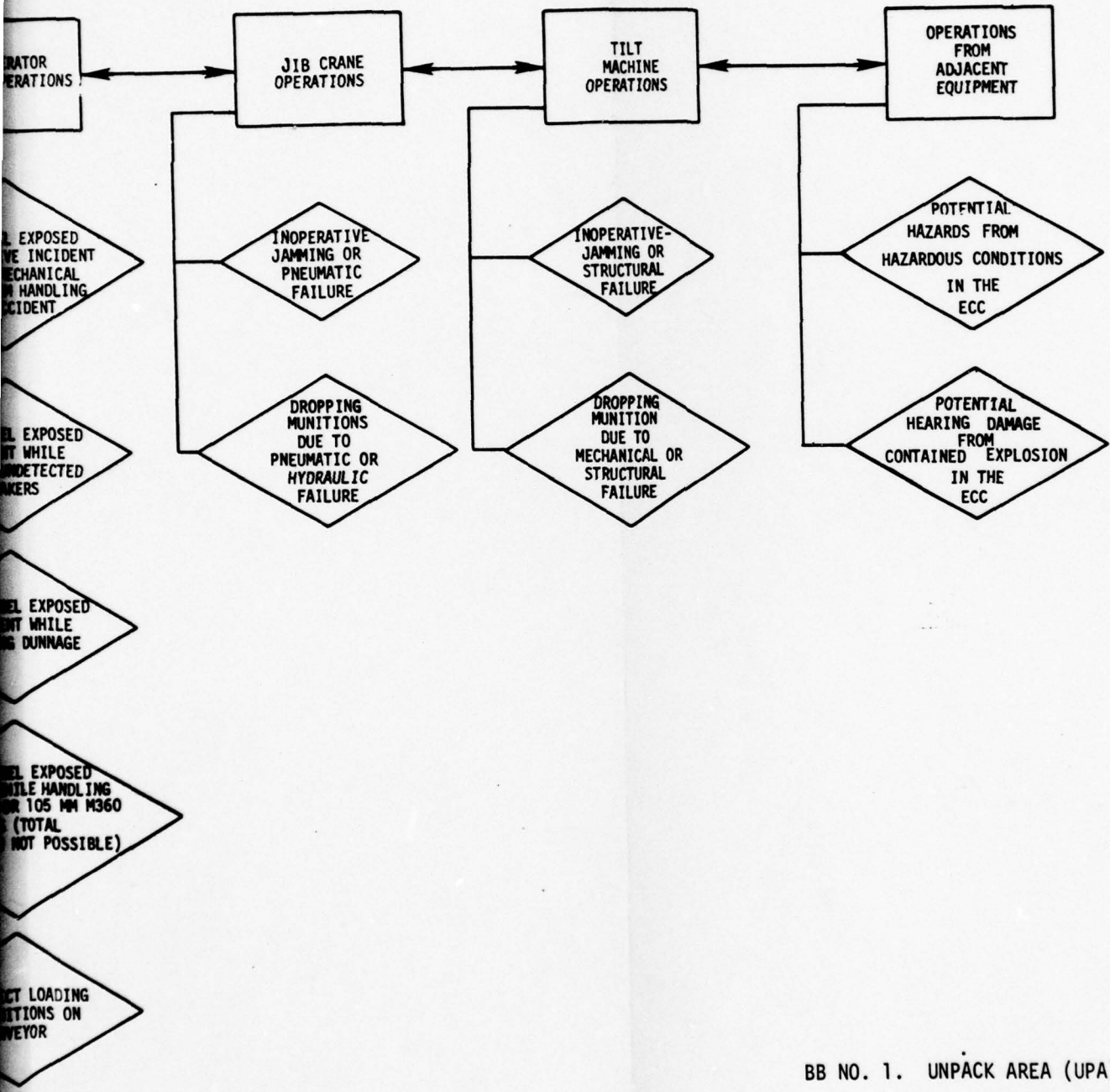
FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL **1**
 COMPONENT LEVEL

BUILDING BLOCK: NO. 1, UNPACK AREA (L.P.A.)

INDEX	CRITICALITY	FREQUENCY OF FAILURE	SEVERITY LEVEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE MODE/CAUSE	FUNCTION	COMPONENT OR ITEM
1.7								UNPACK AREA HARDWARE WHOSE FAILURE MODES ARE OF MINOR CONSEQUENCE OR SO REMOTE THAT THEY ARE NO CONSIDERED FURTHER HEREIN: SCRAP HOPPERS WORK TABLE EMERGENCY SHOWER PERSONNEL DOOR PNEUMATIC VISE FRESH WATER SHOWER OBSERVATION WINDOW FOOT BATH TOOL STORAGE AREA OVERHEAD RAIL AND HOIST TO THE ECC. (NOT USED DURING NORMAL MUNITION DEMILITARIZATION OPERATIONS.)





BB NO. 1. UNPACK AREA (UPA)

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL **I**
COMPONENT LEVEL **I**

EXPLOSIVE CONTAINMENT
BUILDING BLOCK: NO. 2. CURBICLE (ECC)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
2.1 EXPLOSIVE CONTAINMENT CURBICLE	RETAIN FRAGMENTS AND CHEMICAL AGENTS THAT WOULD RESULT FROM AN EXPLOSIVE INCIDENT DURING THE PUNCHING AND DRAINING OF AGENT, REMOVAL OF PROPELLANT, AND SAWING OF STEEL, ALUMINUM, AND FIBER GLASS DURING USE OF THE FOLLOWING BUILDING BLOCKS: NO. 6 ROM NO. 15 PDM NO. 24 MOR NO. 25 MIN	<u>MODE</u> - EXPLOSIVE INCIDENT. <u>MODE</u> - FIRE. <u>CAUSE(S)</u> A. FAULTY DEMIL OPERATION.	<u>EQUIPMENT</u> <u>PERSONNEL</u> POSSIBLE ACOUSTIC DAMAGE TO PERSONNEL.	CORRECTIVE ACTION THIS WILL BE EVALUATED DURING THE ECC/EXPLOSIVE TEST AS A RESULT OF THE TEST APPROPRIATE DESIGN AND OPERATIONAL ACTION WILL BE IMPLEMENTED.	*	3	*
2.2 WALLS, DOORS, AND ACCESS PANELS	RETAIN FRAGMENTS THAT WOULD RESULT FROM AN EXPLOSIVE INCIDENT.	<u>MODE</u> - RUPTURE OF WALLS, DOORS, OR ACCESS PANEL. <u>CAUSE(S)</u> A. FLYING DEBRIS AND OVER-PRESSURE.	DAMAGE TO DEMIL MACHINERY. RELEASE OF AGENT TO LOW PRESSURE AREA SURROUNDING BUILDING TO THE OUTSIDE ATMOSPHERE. SEE 2.2 ALSO. MACHINERY INSIDE THE ECC COULD BE PARTIALLY OR COMPLETELY DESTROYED.	FAILURE DETERRENCE THE ECC IS DESTROYED TO CONTAIN FIRE. CITY COVERAGE PROVIDES VISUAL COVERAGE. FAILURE DETERRENCE WALL THICKNESS IS 2 1/2 INCHES. TESTS CONDUCTED WITH EXPLOSIVES SHOWED A MAXIMUM OF 4-INCH PENETRATION. DOORS ARE INSIDE THE CURBICLE SO THAT HIGHER PRESSURE OR THE IMPACT FROM DEBRIS TENDS TO CLOSE THEM. ALL WELDS WILL BE ULTRASONICALLY TESTED. THE CURBICLE WILL BE HYDROSTATICALLY TESTED AT 250 PSI. ACCESS PANEL TESTS WITH ELECTRICAL AND PNEUMATIC DEVICES HAVE DEMONSTRATED ABILITY TO WITHSTAND EXPLOSIVE CONDITIONS. TESTS WERE CONDUCTED WITHIN A 6-FOOT SPHERE USING 10.4 POUNDS OF C4 EXPLOSIVE. MICROSWITCHES MOUNTED ON THE DOORS ARE REMOTELY MONITORED AND INDICATE IF A DOOR IS CLOSED AND IF IT IS LOCKED. ALL LOCKING PIN CYLINDERS LOCK IN THE CLOSED POSITION IN THE EVENT OF LOSS OF HYDRAULIC	2	4	8
					4	1	4

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL EXPLOSIVE CONTAINMENT
 COMPONENT LEVEL CUBICLE (ECC)

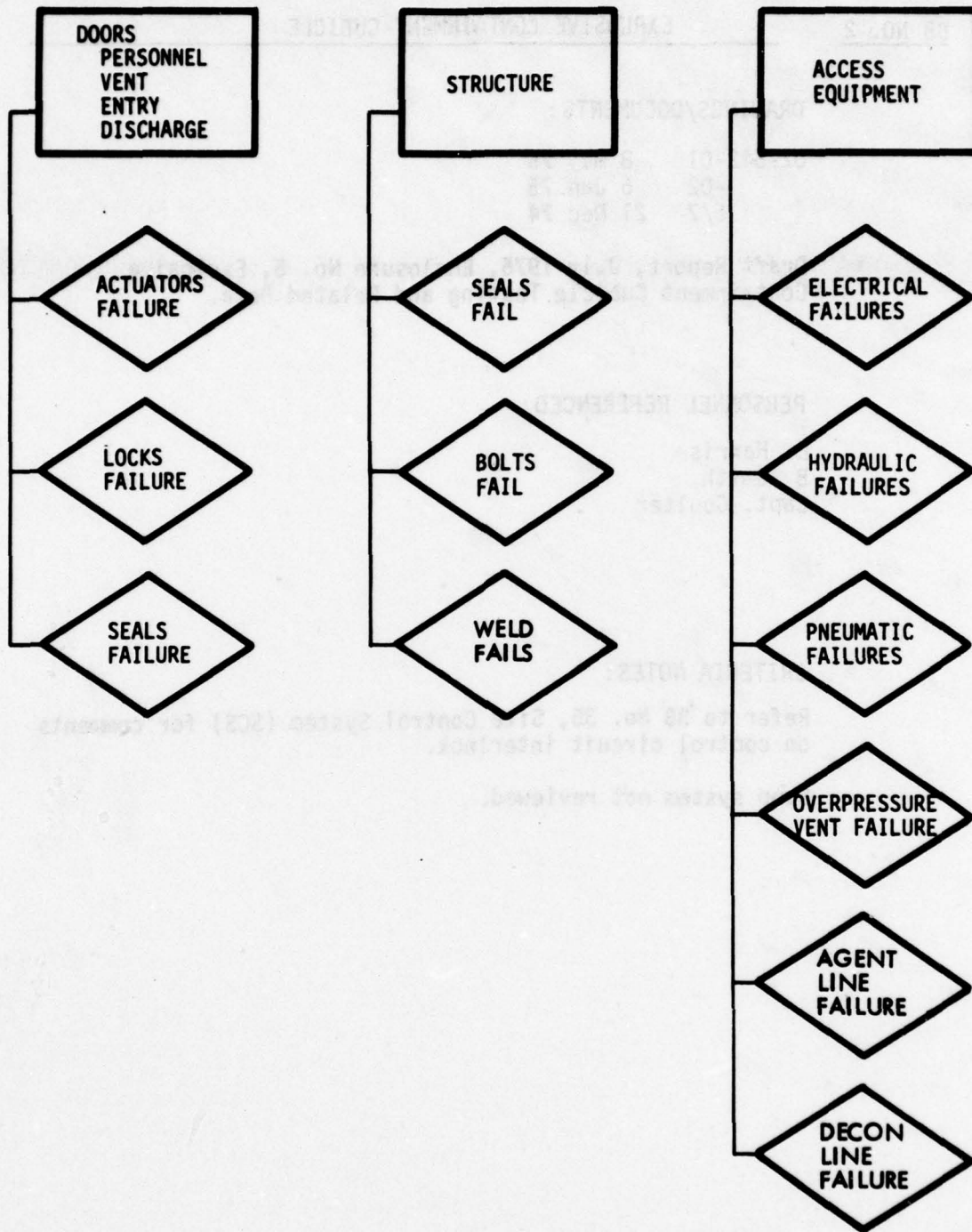
COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
2.2 WALLS, DOORS, AND ACCESS PANELS (CONTINUED)							
2.3 SEALS	RETAIN AGENT THAT WOULD RESULT FROM AN EXPLOSIVE INCIDENT.	<p><u>MODE</u> - SEAL FAILURE.</p> <p><u>CAUSE(S)</u></p> <p>A. OVER PRESSURE COMPRESSION SET, WEAR OUT, DEGRADATION DUE TO EXPOSURE TO DECONTAMINATION SOLUTIONS, AGENT AND HYDRAULIC OIL.</p>	<p><u>EQUIPMENT</u></p> <p>RELEASE OF AGENT FROM THE ECC TO THE LOW PRESSURE AREA SURROUNDING THE ECC. THE SURROUNDING AREA IS EVACUATED BY THE FILTRATION SYSTEM (DB NO. 6).</p>	<p>FAILURE DETERRENCE OR CORRECTIVE ACTION</p> <p>PRESSURE. IT IS PLANNED TO VENT THE ECC THROUGH A MANUAL VALVE TO THE FILTER SYSTEM IN THE EVENT OF AN EXPLOSIVE INCIDENT. THE MANUAL VALVE WILL BE IN A LOCK BOX. THE VALVE AND ASSOCIATED HARDWARE WERE SELECTED ON THE BASIS OF WORST CASE CONDITIONS (EXPLOSION INVOLVING THE LARGEST MINUTON AND AGENT IN THE VAPOR STATE). THE MAXIMUM PRESSURE EXPECTED IS APPROXIMATELY 160 PSI AND THE BLEED DOWN TIME IS APPROXIMATELY 33 MINUTES. INTERNAL LEAKAGE OF THE VALVE WILL NOT BE A PROBLEM SINCE THE LEAKAGE WILL BE TO THE FILTER.</p>	1	3	3

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

BUILDING BLOCK: NO. 2. CURTILE (ECC)
 EXPLOSIVE CONTAINMENT

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE RETRENCH OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
2-3 SEALS (CONTINUED)							
2-4 DOORS	A. INLET AND OUTLET FOR MUNITIONS. B. PERSONNEL ACCESS. C. VENT TO FILTRATION SYSTEM (BB. NO. 22).	<u>MODE</u> - FAILURE TO OPEN, CLOSE OR LOCK WHEN PROGRAMMED. <u>MODE</u> - OPEN DOORS AT THE WRONG TIME (A SECOND ORDER FAILURE) DURING DEMIL OPERATIONS. <u>MODE</u> - FIRE HAZARD TO MAINTENANCE PERSONNEL INSIDE ECC DURING NON-OPERATIONAL MAINTENANCE ACTIVITIES. THIS TYPE MODE NOT NORMALLY CONSIDERED HEREIN DUE TO NON-PROCESSING ACTIVITY AND ITS SECONDARY OR TERTIARY FAILURE LEVEL. *FOR INFORMATION ONLY.	<u>EQUIPMENT</u> ENTRY AND REMOVAL OF CONVEYORS WILL CONFLICT WITH DOORS CAUSING EQUIPMENT DAMAGE. OPEN DOORS AT THE WRONG TIME WOULD PERMIT RELEASE OF AGENT TO THE LOW PRESSURIZATION AREA SURROUNDING THE ECC. THE SURROUNDING AREA IS EVALUATED BY THE FILTRATION SYSTEM (BB HQ. 23). EXIT OF DEBRIS IN THE EVENT OF EXPLOSIVE INCIDENT. POSSIBLE SEVERE DAMAGE TO INSTALLED MACHINES AND EQUIPMENTS <u>PERSONNEL</u> POTENTIAL PERSONNEL INJURY	<u>CORRECTIVE ACTION</u> SEALS WILL BE TESTED AND EVALUATED DURING THE EXPLOSIVE TEST ON THE ECC USING BAGS OVER THE SEALS AND FROM INSIDE THE ECC. <u>FAILURE DETERRENCE</u> TIVITY SWITCHES SENSE THE POSITION OF THE DOORS AND LOCKS. IN THE EVENT THAT THE POSITION IS SENSED IN THE WRONG POSITION, THE COMPUTER PROGRAM IS STOPPED AND FURTHER PROCESSING IS STOPPED. <u>FAILURE DETERRENCE</u> POSITION SWITCHES ON DOORS AND DOOR LOCKS INHIBIT DEMIL OPERATION THROUGH THE CONTROL SYSTEM. <u>FAILURE DETERRENCE</u> MAINTENANCE PERSONNEL WILL PROBABLY CARRY HAND EXTINGUISHERS. DETAILS OF POSSIBLE GENERAL FIRE PROTECTION SYSTEM FOR ALL AREAS OF CAMDS NOT AVAILABLE. <u>CORRECTIVE ACTION</u> DOORS CANNOT BE CLOSED TO SMOTHER FIRE WITHOUT POSSIBLE FURTHER ADVERSE EFFECTS ON ENCLOSED PERSONNEL. A GENERAL ADEQUACY REVIEW OF FIRE PROTECTION SYSTEMS/PROCEDURES SHOULD BE MADE, AND SYSTEMS IMPLEMENTED FOR CAMDS ACUTE AREAS, E.G., ECC.	1	3	3
					4	1	4



BB NO. 2. EXPLOSIVE CONTAINMENT CUBICLE (ECC)

FMEA INFORMATION SOURCES

BB NO. 2

EXPLOSIVE CONTAINMENT CUBICLE

DRAWINGS/DOCUMENTS:

02-512-01 8 May 75
 -02 6 Jun 75
 6/7 21 Dec 74

Draft Report, July 1975, Enclosure No. 5, Explosive Containment Cubicle Testing and Related Data.

PERSONNEL REFERENCED:

E. Harris
B. Smith
Capt. Coulter

CRITERIA NOTES:

Refer to BB No. 35, Site Control System (SCS) for comments on control circuit interlock.

Sump system not reviewed.

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL <input checked="" type="checkbox"/>		BUILDING BLOCK: NO. 4. SYSTEM (DFS)		DEACTIVATION FURNACE			
COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
4.1 ROTARY KILN FURNACE	THERMALLY DEACTIVATE AND DETOXIFY AGENT AND EXPLOSIVE COMPONENTS.	<p><u>MODE</u> - BURNER FAILURE.</p> <p><u>CAUSE(S)</u></p> <p>A. FUEL LINE (OR FILTER) PLUGGED AND FLAME GOES OUT.</p> <p>B. LOSS OF COMBUSTION AIR (BLOWER FAILURE) AND FLAME GOES OUT.</p> <p>C. FUEL TANK EMPTY AND FLAME GOES OUT.</p>	EQUIPMENT SHUTDOWN AND MAINTENANCE.	<p>FAILURE DETERRENCE</p> <p>A LOW TEMPERATURE ALARM IS PROVIDED. AN ULTRAVIOLET FLAME SCANNER IS ALSO PROVIDED. BOTH AUTOMATIC (INTERLOCKED) AND EMERGENCY MANUAL SHUT-DOWN CAPABILITY EXISTS. (AUTOMATIC RELITE CAPABILITY IS PROVIDED.) A LOW LEVEL ALARM IS PROVIDED IN THE FUEL TANK WITH AN INTERLOCK TO THE AUTOMATIC SHUTDOWN SEQUENCE. IN ANY CASE DETOXIFICATION WOULD CONTINUE UTILIZING RESIDUAL HEAT IN THE FURNACE AND AFTERBURNER OPERATIONS. IT IS REGARDED AS EXTREMELY UNLIKELY THAT ANY TOXIC MATERIAL WOULD BE RELEASED TO THE OUTSIDE AREA. (TOXIC RELEASE WOULD BE TO THE AFTERBURNER AND SCRUBBER SYSTEM.)</p> <p>CORRECTIVE ACTION</p> <p>NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.</p>	2	1	2

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

BUILDING BLOCK: NO. 4. SYSTEM (OFS)
 DEACTIVATION FURNACE

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
4.1 ROTARY KILN (CONTINUED)		D. RETORT TEMPERATURE TOO LOW DUE TO FAILURE OF THE TEMPERATURE CONTROL SYSTEM.	<u>EQUIPMENT</u> SHUTDOWN AND MAINTENANCE. <u>PERSONNEL</u>	<u>FAILURE DETERRENCE</u> LOW TEMPERATURE ALARM PROVIDED. A LOW TEMPERATURE IS INTERLOCKED WITH CONVEYOR AND FURNACE ROTATION TACHOMETER. CONTINUOUS TEMPERATURE MONITORING ALSO PROVIDED. A VENTILATED BARRIER ENCLOSURE SURROUNDS THE FURNACE AREA. IN ADDITION, THE EXIT CONVEYOR IS HEATED AND WOULD PROVIDE A BACKUP MODE FOR EXPLOSIVE COMPONENTS DEACTIVATION. THE OCCURRENCE OF TOXIC RELEASE AND/OR DANGER OF LIVE EXPLOSIVES PASSING THROUGH THE RETORT IS REGARDED AS EXTREMELY REMOTE. <u>CORRECTIVE ACTION</u> NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.	3	1	3
		MODE - EXPLOSION CAUSE(S) A. BUILDUP OF MUNITIONS DUE TO JAMMING AND MOTION SENSORS FAIL--BOTH IN AND OUT.	POTENTIAL DAMAGE TO FURNACE: SHUT-DOWN AND MAINTENANCE. POTENTIAL TOXIC RELEASE (VENT TO ATMOSPHERE. THE CONCRETE ENCLOSURE WOULD CONTAIN ALL FRAGMENTS.)	<u>FAILURE DETERRENCE</u> PROPER SPACING OF MUNITIONS. BLAST DISSIPATION GAFFE BETWEEN FURNACE AND CYCLOPE. CYCLOPE DESIGNED TO WITHSTAND OVERPRESSURE. TV SURVEILLANCE PROVIDED (AT THE FURNACE EXIT). MOTION SENSORS ARE PROVIDED BUT ARE NOT INTERLOCKED TO CONVEYOR OPERATION. THE RETORT IS HOUSED WITHIN A PROTECTIVE BARRIER ENCLOSURE. ALSO A GREAT DEAL OF TESTING IN A PILOT PLANT KILN HAS BEEN CONDUCTED WHERE JAMMING OCCURRED. UNDER THESE CONDITIONS, IN NO CASE DID A FAILURE (EXPLOSION) OCCUR (DUE TO JAMMING ONLY). THIS FAILURE MODE CAUSING TOXIC RELEASE TO THE OUTSIDE AREA IS CONSIDERED TO BE VERY REMOTE.	3	1	3

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

BUILDING BLOCK: NO. 4. SYSTEM (DES)
 DEACTIVATION FURNACE

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
4.1 ROTARY KILN (CONTINUED)		<p><u>MODE</u> - LACK OF EXCESS AIR FOR COMBUSTION.</p> <p><u>CAUSE(S)</u> FAILURE OF INDUCED DRAFT FAN.</p> <p><u>MODE</u> - RETORT TEMPERATURE TOO HIGH.</p> <p><u>CAUSE(S)</u> A. TEMPERATURE CONTROL (AIR/FUEL RATIO, TOTAL FLOW RATES, ETC.) SYSTEM FAILS.</p>	<p><u>EQUIPMENT</u></p> <p>SHUTDOWN AND MAINTENANCE.</p> <p><u>PERSONNEL</u></p> <p>POTENTIAL TOXIC RELEASE TO SIX LEVEL VENTILATION AREA AND ABSOLUTE CHARCOAL FILTER SYSTEM.</p>	<p><u>CORRECTIVE ACTION</u> IT IS RECOMMENDED THAT THE MOTION SENSORS BE INTERLOCKED TO THE CONVEYOR FEED.</p> <p><u>FAILURE DETERRENCE</u> THE DRAFT FAN IS INTERLOCKED WITH FURNACE OPERATION; AUTOMATIC SHUTDOWN IS INITIATED IN THE EVENT THAT THE FAN FALLS. THE POSSIBILITY OF BOTH FANS AND AUTOMATIC SHUTDOWN FAILING (AND THE CHARCOAL FILTERING SYSTEM) CAUSING TOXIC RELEASE TO THE OUTSIDE AREA IS REGARDED AS EXTREMELY REMOTE.</p> <p><u>CORRECTIVE ACTION</u> NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.</p> <p><u>FAILURE DETERRENCE</u> HIGH TEMPERATURE ALARM PROVIDED. CONTINUOUS TEMPERATURE MONITORED ON CHART.</p> <p><u>CORRECTIVE ACTION</u> NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.</p>	2	2	4

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

DEACTIVATION FURNACE
 BUILDING BLOCK: NO. 4. SYSTEM (DPS)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
4.1 ROTARY KILN (CONTINUED)		<p><u>MODE</u> - LOSS OF KILN ROTATION.</p> <p><u>CAUSE(S)</u></p> <p>A. FAILURE OF DRIVE MOTOR AND MOTION SENSING SYSTEM FAILS.</p>	<p><u>EQUIPMENT</u></p> <p>POSSIBLE EXPLOSION DUE TO MUNITION BUILDUP AT ENTRANCE. CONCRETE ENCLOSURE MAINTENANCE.</p> <p><u>PERSONNEL</u></p> <p>POTENTIAL TOXIC RELEASE TO OUTSIDE AREA. THE CONCRETE ENCLOSURE WOULD CONTAIN ALL FRAGMENTS.</p>	<p><u>FAILURE DETERRENCE</u></p> <p>LOSS OF ROTATION ALARM PROVIDED. AUTO SYSTEM SHUTDOWN PROVIDED.</p> <p><u>FAILURE DETERRENCE</u></p> <p>PROPER SPACING OF MUNITIONS. BLAST DISSIPATION BAFFLE BETWEEN FURNACE AND CYCLONE. CYCLONE DESIGNED TO WITHSTAND OVERPRESSURE. TV SURVEILLANCE PROVIDED (AT THE FURNACE EXIT). MOTION SENSORS ARE PROVIDED BUT ARE NOT INTERLOCKED TO CONVEYOR OPERATION. THE RETORT IS HOUSED WITHIN A PROTECTIVE BARRIER ENCLOSURE. ALSO A GREAT DEAL OF TESTING IN A PILOT PLANT KILN HAS BEEN CONDUCTED WHERE JAMMING OCCURRED. UNDER THESE CONDITIONS, IN NO CASE DID A FAILURE (EXPLOSION) OCCUR (DUE TO JAMMING ONLY). THIS FAILURE MODE CAUSING TOXIC RELEASE TO THE OUTSIDE AREA IS CONSIDERED TO BE VERY REMOTE.</p> <p><u>CORRECTIVE ACTION</u></p> <p>IT IS RECOMMENDED THAT THE MOTION SENSORS BE INTERLOCKED TO THE CONVEYOR FEED.</p>	3	1	3

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL: **COMPONENT LEVEL** **DEACTIVATION FURNACE SYSTEM (JFS)**

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
4.2 CYCLONE	REMOVAL OF LARGE FIBER GLASS PARTICLES EMITTED FROM ROTARY KILN.	<p><u>MODE</u> - HIGH TEMPERATURE.</p> <p><u>CAUSE(S)</u></p> <p>A. RETORT TEMPERATURE CONTROL SYSTEM FAILS.</p> <p>B. EXCESSIVE BURNING IN ROTARY KILN DUE TO EXPLOSIVES BUILDUP.</p> <p><u>MODE</u> - BLAST DAMAGE.</p> <p><u>CAUSE(S)</u></p> <p>A. EXPLOSION IN ROTARY KILN.</p>	<p><u>EQUIPMENT</u></p> <p>POTENTIAL EQUIPMENT DAMAGE. SHUTDOWN AND MAINTENANCE.</p> <p>POTENTIAL EQUIPMENT DAMAGE. SHUTDOWN AND MAINTENANCE.</p> <p>POTENTIAL EQUIPMENT DAMAGE. SHUTDOWN AND MAINTENANCE.</p> <p>POTENTIAL EQUIPMENT DAMAGE. SHUTDOWN AND MAINTENANCE.</p> <p>POTENTIAL EQUIPMENT DAMAGE. SHUTDOWN AND MAINTENANCE.</p>	<p><u>FAILURE DETERRENCE</u></p> <p>HIGH TEMPERATURE ALARM ON DEACTIVATION FURNACE (ALSO CONTINUOUS MONITORING OF TEMPERATURE). HIGH TEMPERATURE MATERIALS OF CONSTRUCTION INFILTRATION COOLING AIR IN THE ENTRANCE END OF THE FURNACE.</p> <p><u>CORRECTIVE ACTION</u></p> <p>NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.</p> <p><u>FAILURE DETERRENCE</u></p> <p>BLAST ATTENUATION DIRT SYSTEM INSTALLED BETWEEN DEACTIVATION FURNACE AND CYCLONE. ALSO CYCLONE HOUSED WITHIN A SHROUDED AND VENTILATED AREA (VENTED AT SIX CHANGES/HOUR THROUGH ABSOLUTE CHARCOAL FILTERS).</p> <p><u>CORRECTIVE ACTION</u></p> <p>NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.</p> <p><u>FAILURE DETERRENCE</u></p> <p>ΔP MONITORED ACROSS CYCLONE (WITH ALARM). ACCESS PORT FOR CLEANING INTERVAL MAY BE SHORTENED.</p> <p><u>CORRECTIVE ACTION</u></p> <p>NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.</p>	2	2	4
		<p><u>MODE</u> - SYSTEM BLOCKAGE.</p> <p><u>CAUSE(S)</u></p> <p>A. EXIT VALVE (DUMP) OR LINE BLOCKED WITH FIBER GLASS AND OPERATOR TAKES NO ACTION.</p>	<p>SHUTDOWN AND MAINTENANCE.</p>	<p><u>CORRECTIVE ACTION</u></p> <p>NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.</p>	2	1	2

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL COMPONENT LEVEL

BUILDING BLOCK: NO. 4. SYSTEM (DPS)

DEACTIVATION FURNACE

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	INDEX CRITICALITY
4.3 SLAGGING AFTERBURNER	THERMAL DECOMPOSITION OF RESIDUAL CHEMICAL AGENTS AND REMOVAL OF FINE FIBER GLASS PARTICLES (AS A SLAG).	<p><u>MODE</u> - BURNER FLAME OUT.</p> <p><u>CAUSE(S)</u></p> <p>A. LOSS OF FUEL-LINE PLUGGED AT FILTER.</p> <p>B. BLOWER FAILURE (LOSS OF COMBUSTION AIR).</p> <p>C. FUEL SUPPLY TANK EMPTY.</p>	<p><u>EQUIPMENT</u></p> <p>SHUTDOWN AND MAINTENANCE.</p>	<p><u>FAILURE DETERRENCE</u></p> <p>REDUNDANT FUEL OIL SUPPLY FILTERS. ULTRAVIOLET FLAME SCANNER INTER-LOCKED WITH BURNER FUEL AND AIR SUPPLY FOR AUTO SHUTDOWN. AFTER-BURNER TEMPERATURE IS CONTINUOUSLY MONITORED. LOW PRESSURE AIR ALARMS IN FUEL TANK. THE TOXIC RELEASE SHOULD BE MINIMAL (IF ANY) TO THE SCRUBBING SYSTEM SINCE RESIDUAL HEAT WILL DETORTIFY FLUE GASES. SCRUBBERS REMOVE AGENT.</p> <p><u>CORRECTIVE ACTION</u></p> <p>NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.</p>	2	2	4
		<p><u>MODE</u> - AFTERBURNER TEMPERATURE TOO HIGH.</p> <p><u>CAUSE(S)</u></p> <p>A. FAILURE OF AFTERBURNER CONTROLLER FUNCTION (AIR AND FUEL TO BURNERS) OR FAILURE OF THERMOCOUPLE IN BURNER CHAMBER.</p>	<p><u>EQUIPMENT</u></p> <p>POSSIBLE DAMAGE. SHUTDOWN AND MAINTENANCE.</p>	<p><u>FAILURE DETERRENCE</u></p> <p>HIGH TEMPERATURE ALARM WITH A CONTINUOUS TEMPERATURE MONITOR.</p> <p><u>CORRECTIVE ACTION</u></p> <p>NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.</p>	2	1	2
		<p><u>MODE</u> - AFTERBURNER TEMPERATURE TOO LOW.</p> <p><u>CAUSE</u></p> <p>A. FAILURE OF BURNER CONTROL SYSTEM. AUTO SHUTDOWN SYSTEM FAILS.</p>	<p>POTENTIAL TOXIC VAPOR RELEASE TO CAUSTIC SCRUBBING SYSTEM (LACK OF DECOMPOSITION).</p>	<p><u>FAILURE DETERRENCE</u></p> <p>LOW TEMPERATURE ALARM WITH INTERLOCK TO EMERGENCY (AUTO) SHUTDOWN. THE TOXIC RELEASE SHOULD BE MINIMAL (IF ANY) TO THE SCRUBBING SYSTEM SINCE RESIDUAL HEAT WILL DETORTIFY FLUE GASES. SCRUBBERS REMOVE AGENT. THE RELEASE OF TOXIC MATERIAL TO THE OUTSIDE AREA IS REGARDED AS EXTREMELY REMOTE.</p> <p><u>CORRECTIVE ACTION</u></p> <p>NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.</p>	2	1	2

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL <input type="checkbox"/>		BUILDING BLOCK: NO. 4. SYSTEM (DFS)		DEACTIVATION FURNACE				
COMPONENT LEVEL <input checked="" type="checkbox"/>		FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
4.4	GAS QUENCH TOWER	SUPER SATURATION OF HOT FLUE GASES FROM SLANGING AFTERBURNER PRIOR TO ENTERING VENTURI SCRUBBER.	<p><u>MODE</u> - HIGH QUENCH ZONE TEMPERATURE.</p> <p><u>CAUSE(S)</u></p> <p>A. INLET PUMP OR CONTROL VALVE FAILS AND OPERATOR FAILS TO TAKE ACTION.</p> <p>B. QUENCH MAKEUP WATER VALVE FAILS AND OPERATOR FAILS TO TAKE ACTION.</p> <p><u>MODE</u> - EMPTY QUENCH TOWER</p> <p><u>CAUSE(S)</u></p> <p>LEVEL CONTROL VALVE IN DOWNSTREAM SCRUBBER TOWER FAILS OR QUENCH BRINE PUMP (P-302) FAILS, OR CONTROL VALVE FAILS.</p>	<p><u>EQUIPMENT</u></p> <p>POSSIBLE TOWER DAMAGE.</p> <p>POSSIBLE TOWER DAMAGE.</p> <p>POSSIBLE TOWER DAMAGE (LOSS OF FLOW TO QUENCH TOWER AND VENTURI SCRUBBER).</p>	<p><u>FAILURE DETERRENCE</u></p> <p>HIGH TEMPERATURE ALARM - AUTO SYSTEM SHUTDOWN PROVIDED.</p> <p>LOW PRESSURE AND FLOW ALARM. REMOTE MANUALLY OPERATED REDUNDANT VALVE PROVIDED.</p> <p>REWRITE MANUAL VALVE WITH EMERGENCY WATER SUPPLY.</p> <p><u>CORRECTIVE ACTION</u> NONE RECOMMENDED.</p> <p><u>FAILURE DETERRENCE</u></p> <p>LOW LEVEL AND FLOW ALARMS ARE PROVIDED FOR BOTH THE QUENCH TOWER AND VENTURI SCRUBBER. (THE SCRUBBER TOWER ALSO HAS FIVE LEVEL ALARMS AND A PRESSURE ALARM.) IN ADDITION A TEMPERATURE SHITC: (VENTURI SCRUBBER FUE GAS OUTLET) WOULD INITIATE EMERGENCY WATER FLOW FROM THE 3000-GALLON HEAD TANK. FINALLY, AUTOMATIC FURNACE AND AFTERBURNER SHUTDOWN WOULD BE INITIATED.</p> <p><u>CORRECTIVE ACTION</u> NONE RECOMMENDED.</p>	2	1	2

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL <input type="checkbox"/>		BUILDING BLOCK: NO. 4. SYSTEM (DFS)		DEACTIVATION FURNACE			
COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
4.5	VENTURI SCRUBBER	PARTICULATE COLLECTION AND CHEMICAL SCRUBBING.					
		<p><u>MODE</u> - LOSS OF BRINE FLOW TO VENTURI.</p> <p><u>CAUSE(S)</u></p> <p>A. VENTURI BRINE PUMP (FLOW FROM SCRUBBER TOWER) FAILS (LOSS OR REDUCED SCRUBBING ACTION).</p> <p>B. REMOTE FLOW CONTROLLER FAILURE.</p> <p><u>MODE</u> - VENTURI THROAT PLUG MISALIGNMENT.</p> <p><u>CAUSE(S)</u></p> <p>A. THROAT PLUGGED OR CLOSED DUE TO MALFUNCTION OF ELECTRICAL DIFFERENTIAL PRESSURE CONTROLLER CAUSING FURNACE OVERPRESSURIZATION.</p> <p>B. THROAT OPEN TOO FAR DUE TO PRESSURE CONTROLLER MALFUNCTION - LOSS OR REDUCED SCRUBBING ACTION.</p>	<p><u>EQUIPMENT</u></p> <p><u>PERSONNEL</u></p> <p>POSSIBILITY OF RELEASE OF GASES TO CAUSTIC SCRUBBER.</p> <p>POSSIBILITY OF RELEASE OF GASES TO CAUSTIC SCRUBBER.</p> <p>POSSIBLE TOXIC RELEASE TO CAUSTIC SCRUBBER AND FURNACE HOUSING (SIX-LEVEL ATR CHANGE AREA THROUGH CHARCOAL FILTERS).</p> <p>SHUTDOWN AND MAINTENANCE</p> <p>SHUTDOWN AND MAINTENANCE</p>	<p>FAILURE DETERRENCE</p> <p>AUTO OPEN BYPASS VALVE AND LEVEL CONTROL VALVE. LOW PRESSURE ALARM. HIGH TEMPERATURE ALARM WITH AUTO SHUTDOWN OF FURNACE AND AFTERBURNER.</p> <p>LOW FLOW ALARM. MANUAL FLOW ADJUSTMENT PROVIDED. HIGH TEMPERATURE ALARM WITH AUTO SHUTDOWN OF FURNACE AND AFTERBURNER.</p> <p>CORRECTIVE ACTION NONE RECOMMENDED.</p> <p>FAILURE DETERRENCE</p> <p>HIGH DIFFERENTIAL PRESSURE ALARM. PROVISION FOR MANUAL CONTROL OF THROAT PLUG. AUTOMATIC SHUTDOWN OF FURNACE AND AFTERBURNER.</p> <p>LOW DIFFERENTIAL PRESSURE ALARM. PROVISION FOR MANUAL CONTROL OF THROAT PLUG.</p> <p>CORRECTIVE ACTION NONE RECOMMENDED.</p>	2	1	2

FAILURE MODE AND EFFECT ANALYSIS

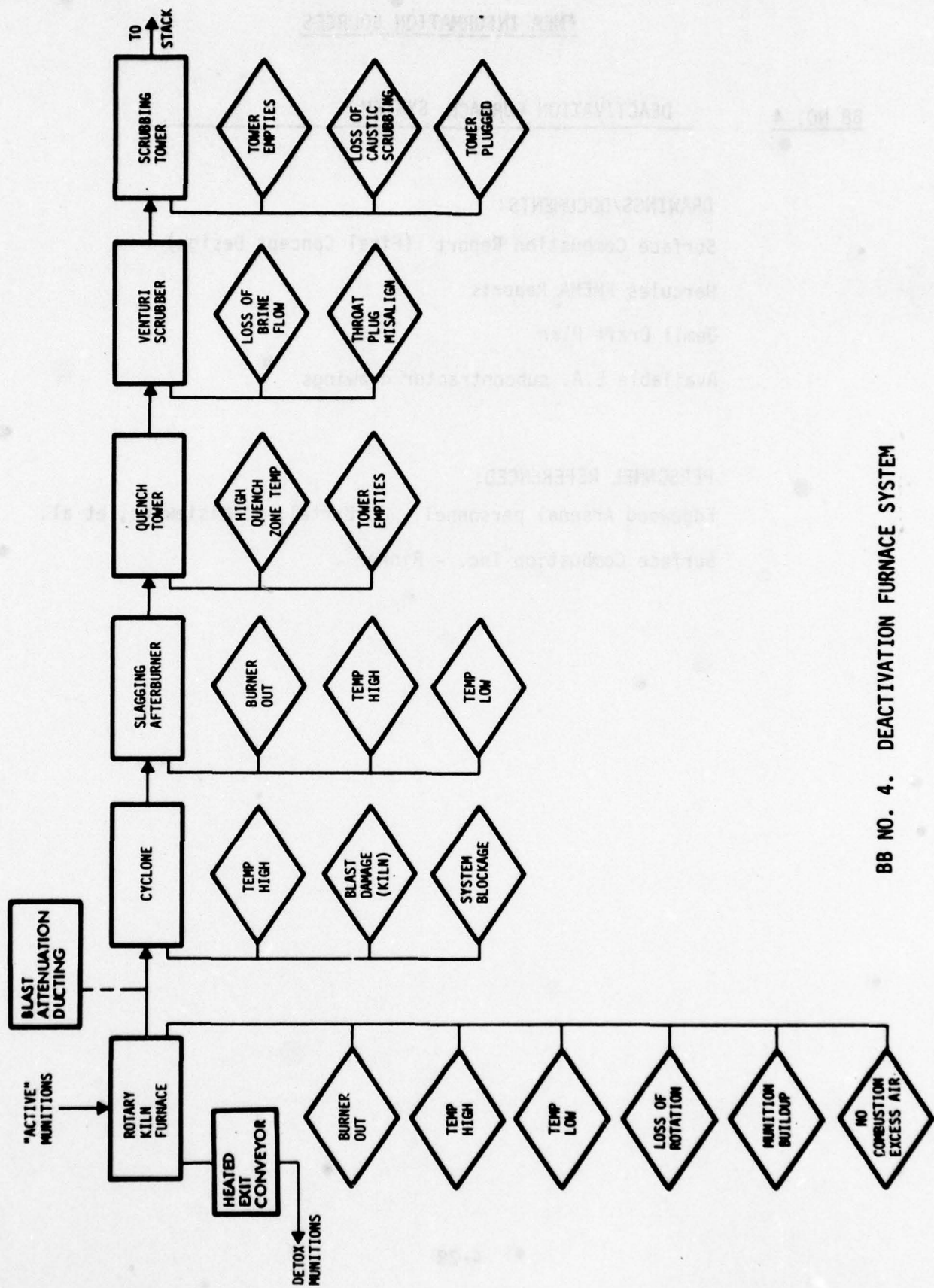
BUILDING BLOCK LEVEL <input type="checkbox"/>		COMPONENT LEVEL <input checked="" type="checkbox"/>		DEACTIVATION FURNACE SYSTEM (DFS)			
COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
4.6 SCRUBBING TOWER	TO REMOVE FLUE GAS CONTAMINANTS THAT REQUIRE LONGER CONTACT TIMES.	<p><u>MODE</u> - TOWER EMPTY.</p> <p><u>CAUSE(S)</u></p> <p>A. FAILURE OPEN OF LEVEL CONTROL VALVE AND AUTO SHUTDOWN SYSTEM FAILS.</p> <p><u>MODE</u> - LOSS OF CAUSTIC SCRUBBING CAPABILITY.</p> <p><u>CAUSE(S)</u></p> <p>A. CAUSTIC PUMP FAILURE AND OPERATOR FAILS TO TAKE ACTION.</p> <p>B. PH CONTROL FAILURE AND OPERATOR FAILS TO TAKE ACTION.</p> <p><u>MODE</u> - TOWER PLUGGED.</p> <p><u>CAUSE(S)</u></p> <p>A. DEMISTER AND/OR PACKED SECTION PLUGGED - REDUCED GAS FLOW AND FURNACE/AFTERBURNER OVER PRESSURIZATION. OPERATOR FAILS TO TAKE ACTION.</p> <p><u>MODE</u> - TOWER OVERFILLS.</p> <p><u>CAUSE(S)</u></p> <p>A. PLUGGED PURGE PUMP SUCTION OR LEVEL CONTROL VALVE FAILURE.</p>	<p><u>EQUIPMENT</u></p> <p>POTENTIAL EQUIPMENT DAMAGE. SHUTDOWN AND MAINTENANCE.</p> <p><u>PERSONNEL</u></p> <p>EMISSION STANDARDS MAY BE EXCEEDED (BUT NOT AGENT).</p> <p>EMISSION STANDARDS MAY BE EXCEEDED (BUT NOT AGENT).</p> <p>SHUTDOWN AND MAINTENANCE.</p> <p>SHUTDOWN AND MAINTENANCE.</p>	<p><u>FAILURE DETERRENCE</u></p> <p>LOW LEVEL ALARM AND AUTO SHUTDOWN PROVIDED (FURNACE AND AFTERBURNER AUTO DE-ENERGIZE LEVEL CONTROL VALVE.)</p> <p><u>CORRECTIVE ACTION</u></p> <p>NONE REQUIRED.</p> <p><u>FAILURE DETERRENCE</u></p> <p>LOW PRESSURE ALARM ON PUMP (ALSO MANUAL SWITCH CAPABILITY TO A STANDBY PUMP IS PROVIDED) LOW PH ALARM PROVIDED. MANUALLY ADJUST CONTROL VALVE.</p> <p><u>CORRECTIVE ACTION</u></p> <p>NONE REQUIRED.</p> <p><u>FAILURE DETERRENCE</u></p> <p>HIGH DIFFERENTIAL PRESSURE ALARM TO SAFE MODE CONDITION (MANUALLY INITIATE FURNACE AND AFTERBURNER SHUTDOWN IF Δ P TOO HIGH).</p> <p><u>CORRECTIVE ACTION</u></p> <p>NONE REQUIRED.</p> <p><u>FAILURE DETERRENCE</u></p> <p>MANUALLY PURGE SUCTION LINE. AUTO SHUTDOWN OF FURNACE AND AFTERBURNER.</p> <p><u>CORRECTIVE ACTION</u></p> <p>NONE REQUIRED.</p>	2	1	2

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

BUILDING BLOCK: NO. 4. SYSTEM (DFS)
 DEACTIVATION FURNACE

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
4.7 A. DEACTIVATION FURNACE INPUT CONVEYOR (ROCKET) B. DEACTIVATION FURNACE INPUT CONVEYOR (PROJECTILE) C. DEACTIVATION FURNACE INPUT CONVEYOR (MINE) D. DEACTIVATION FURNACE INPUT CONVEYOR (MORTAR)	TRANSPORT DEMILLED MUNITION ELEMENTS TO THE DEACTIVATION FURNACE.	<u>MODE</u> - FAILURE TO CONVEY MUNITION. <u>CAUSE(S)</u> ACTUATION MOTOR FAILURE. <u>MODE</u> - EXPLOSIVE AND/OR PROPELLANT FIRE FROM CHIPS GENERATED DURING PROCESSING.	<u>EQUIPMENT</u> MUNITIONS LINE INTERRUPTION WHILE ERROR IS CORRECTED. <u>PERSONNEL</u> POTENTIAL AGENT RELEASE TO ATMOSPHERE AND/OR PERSONNEL EXPOSURE.	FAILURE DETERRENCE EACH CONVEYOR HAS A SENSOR TO DETECT MOTION. (REFERENCE BB NO. 35 SCS) FAILURE DETERRENCE A MAINTENANCE PROGRAM WILL REMOVE THE MATERIAL. NO SOURCE OF IGNITION HAS BEEN IDENTIFIED FROM THE CONVEYORS. THEREFORE, THIS FAILURE MODE REPRESENTS AT LEAST A SECOND ORDER OCCURRENCE.	1	4	4
					3	1	3



BB NO. 4. DEACTIVATION FURNACE SYSTEM

FMEA INFORMATION SOURCES

BB NO. 4

DEACTIVATION FURNACE SYSTEM

DRAWINGS/DOCUMENTS:

Surface Combustion Report (Final Concept Design)

Hercules FMEHA Reports

Demil Draft Plan

Available E.A. subcontractor drawings

PERSONNEL REFERENCED:

Edgewood Arsenal personnel - J. Bartel, R. Misiewicz, et al.

Surface Combustion Inc. - Rinker

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL <input checked="" type="checkbox"/>		COMPONENT LEVEL <input checked="" type="checkbox"/>		BUILDING BLOCK: NO. 5. FURNACE (MPF)			METAL PARTS	
COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX	
5.1 METAL PARTS FURNACE (PUNCHING CHAMBER)	TO PIERCE BULK ITEMS PRIOR TO VOLATILIZATION AND BURNING (ACTS AS ENTRANCE CUBICLE FOR OTHER ITEMS).	<u>MODE</u> - BULK CONTAINER NOT OPENED SUFFICIENTLY AND CONTAINER LEAVES PUNCH AREA. <u>CAUSE(S)</u> A. HYDRAULIC FAILURE OF PUNCH.	<u>EQUIPMENT</u> POTENTIAL DAMAGE SHUTDOWN AND MAINTENANCE. <u>PERSONNEL</u> TOXIC RELEASE, BUT ONLY IF EXPLOSION OCCURS. OTHERWISE INCOMPLETE BURNING OF MUSTARD.	FAILURE DETERRENCE PUNCH TRAVEL LENGTH ALARM PROVIDED. POSITION SWITCH ON ROLLER TRAY INTER- LOCKED TO PUNCH TV MONITORING. THE MODE WHERE THE CONTAINER REACHES THE BURNOUT CHAMBER, WHERE SERIOUS DAMAGE COULD OCCUR (IF CONTAINER FILLED AND NOT PUNCHED). IS REGARDED AS EXTREMELY REMOTE. THE SERIES REDUNDANT SURVEILLANCE AND INTERLOCKING FEATURES SEEM TO BE ENTIRELY ADEQUATE TO PRECLUDE A SERIOUS CONSEQUENCE. CORRECTIVE ACTION NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.	3	1	3	
		<u>MODE</u> - MUSTARD SPILL DURING PUNCH OPERATION. <u>CAUSE(S)</u> A. BULK CONTAINER HOLDING FIXTURE NOT SECURE.	POTENTIAL DAMAGE SHUTDOWN AND MAINTENANCE IF MUSTARD-AIR MIXTURE REACHES EXPLOSIVE PROPORTIONS AND IGNITION SOURCE IS PRESENT. TOXIC GAS RELEASE TO PRIMARY FUME BURNER.	FAILURE DETERRENCE PUNCH COLLAR DESIGNED TO FIT CLOSELY OVER CONTAINER AND THE COLLAR WILL BE VENTED TO THE PRIMARY FUME BURNER. TV MONITOR THROUGH VIEW PORT FOR PROPER POSITION OF COLLAR. DECON SOLUTION IS ALSO AVAILABLE IN LOADING AREA. MUSTARD SPILL AND THEN FORMATION OF AN EXPLOSIVE MIXTURE WITH AIR AND THEN AN EXPLOSION IS REGARDED AS EXTREMELY REMOTE. CORRECTIVE ACTION NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.	3	1	3	

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

METAL PARTS
 BUILDING BLOCK: NO. 5. FURNACE (RPF)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
5.2 METAL PARTS FURNACE (VOLATILIZATION CHAMBER)	CONTROLLED VOLATILIZATION OF AGENT.	MODE - CONTAINER DAMAGED BY INNER OR OUTER DOORS. <u>CAUSE(S)</u> A. MECHANICAL FAILURE OF DOOR DRIVE MECHANISM AND INTERLOCK FAILURE.	EQUIPMENT SHUTDOWN AND MAINTENANCE. PERSONNEL POTENTIAL TOXIC (MUSTARD AGENT) RELEASE TO AFTERBURNER.	FAILURE DETERRENCE THE FURNACE DOORS ARE INTERLOCKED AND AUTOMATICALLY SEQUENCED. THE OCCURRENCE OF THIS MODE IS REGARDED AS EXTREMELY REMOTE. CORRECTIVE ACTION NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.	2	1	2
METAL PARTS FURNACE (VOLATILIZATION CHAMBER)	CONTROLLED VOLATILIZATION OF AGENT.	MODE - BURNER FLAME OUT. <u>CAUSE(S)</u> A. LINE BLOCKAGE (FILTER). B. LOSS OF COMBUSTION AIR DUE TO BLOWER FAILURE. C. FUEL SUPPLY TANK EMPTY.	SHUTDOWN AND MAINTENANCE.	FAILURE DETERRENCE ULTRAVIOLET FLAME SCANNER AND LOW TEMPERATURE ALARM PROVIDED AS ARE REUNDANT FILTERS, FUEL PUMPS AND BLOWERS. A LOW LEVEL ALARM IS PROVIDED ON THE FUEL TANK. EMERGENCY SHUTDOWN CAPABILITY IS PROVIDED. CORRECTIVE ACTION NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.	2	2	4

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

METAL PARTS
 BUILDING BLOCK: NO. 5. FURNACE (MPF)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
5.2 METAL PARTS FURNACE (VOLATILIZATION CHAMBER (CONTINUED)		<p><u>MODE</u> - TEMPERATURE TOO HIGH.</p> <p><u>CAUSE(S)</u></p> <p>A. FAILURE OF TEMPERATURE CONTROL SYSTEM, AND HIGH TEMPERATURE SHUTDOWN IS NOT INITIATED.</p>	<p><u>EQUIPMENT</u></p> <p>POTENTIAL DAMAGE TO EQUIPMENT SHUTDOWN AND MAINTENANCE.</p>	<p>FAILURE DETERRENCE HIGH TEMPERATURE ALARM PROVIDED. FOR VERY HIGH TEMPERATURE AN AUTOMATIC FOG SPRAY PURGE TO CHAMBER IS INITIATED. EMERGENCY SHUTDOWN CAPABILITY IS PROVIDED.</p> <p>CORRECTIVE ACTION NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.</p>	2	2	4
		<p><u>MODE</u> - FAILURE OF PURGE SYSTEM.</p> <p><u>CAUSE(S)</u></p> <p>A. LOSS OF STEAM AND PRESSURE SWITCH FAILS (LOSS OF PURGE FOR EMERGENCY SHUTDOWN AS WELL AS STEAM FOR BURNER OPERATION).</p>	<p>SHUTDOWN AND MAINTENANCE.</p>	<p>FAILURE DETERRENCE STEAM PRESSURE SWITCH INTERLOCKED WITH FURNACE OPERATION. EMERGENCY WATER SUPPLY PROVIDED. EMERGENCY SHUTDOWN CAPABILITY PROVIDED.</p> <p>CORRECTIVE ACTION NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.</p>	1	2	2

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

BUILDING BLOCK: NO. 5. METAL PARTS
 FURNACE (PPF)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
5.2 METAL PARTS FURNACE (VOLATILIZATION CHAMBER) (CONTINUED)		<p>MODE - DOOR TO PUNCH CHAMBER OPENS DURING VOLATILIZATION AND MUSTARD AGENT/ AIR MIXTURE FORMS.</p> <p>CAUSES</p> <p>A. OPERATOR OPENS DOOR IN ERROR AND INTERLOCK SYSTEM FAILS.</p>	<p><u>EQUIPMENT</u> DAMAGE SHUTDOWN AND MAINTENANCE.</p> <p><u>PERSONNEL</u> TOXIC RELEASE TO CHARCOAL FILTER SYSTEM SHOULD AN EXPLOSION OCCUR.</p>	<p>FAILURE DETERRENCE ALL DOORS ARE INTERLOCKED AND SEQUENCED. MANUAL SWITCHES ARE OPERATIVE DURING THE AUTOMATIC OPERATION. THE OCCURRENCE OF THE MODE IS REGARDED AS EXTREMELY RARE.</p> <p>CORRECTIVE ACTION NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.</p>	3	1	3
5.3 METAL PARTS FURNACE (BURNOUT CHAMBER)	REMOVE RESIDUAL AGENT AND PROVIDE FINAL THERMAL TREATMENT FOR DETOXIFIED CONTAINER.	<p>MODE - BURNER FLAME OUT.</p> <p>CAUSE(S)</p> <p>A. LINE BLOCKAGE (FILTER). B. LOSS OF COMBUSTION AIR DUE TO BLOWER FAILURE. C. FUEL SUPPLY TANK EMPTY.</p> <p>MODE - TEMPERATURE TOO HIGH.</p> <p>CAUSE(S)</p> <p>A. FAILURE OF TEMPERATURE CONTROL SYSTEM, AND HIGH TEMPERATURE SHUTDOWN IS NOT INITIATED.</p>	<p>SHUTDOWN AND MAINTENANCE.</p> <p>POTENTIAL DAMAGE TO EQUIPMENT SHUTDOWN AND MAINTENANCE.</p>	<p>FAILURE DETERRENCE ACTIVELY FLAME SCANNER AND LOW TEMPERATURE ALARM PROVIDED AS ARE REDUNDANT FILTERS, FUEL PUMPS AND BLOWERS. A LOW LEVEL ALARM IS PROVIDED ON THE FUEL TANK. EMERGENCY SHUTDOWN CAPABILITY IS PROVIDED.</p> <p>CORRECTIVE ACTION NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.</p> <p>FAILURE DETERRENCE HIGH TEMPERATURE ALARM PROVIDED. FOR VERY HIGH TEMPERATURE AN AUTOMATIC FOG SPRAY PURGE TO CHAMBER IS INITIATED. EMERGENCY SHUTDOWN CAPABILITY IS PROVIDED.</p> <p>CORRECTIVE ACTION NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.</p>	1	1	1
					2	1	2

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL <input type="checkbox"/>		METAL PARTS FURNACE (MPF)	
COMPONENT LEVEL <input checked="" type="checkbox"/>		BUILDING BLOCK: NO. 5. FURNACE (MPF)	
COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL
5.4 PRIMARY FUME BURNER * AUXILIARY FUME BURNER	INCINERATION OF FUMES FROM THE METAL PARTS FURNACE.	<p><u>MODE</u> - FLAME EXTINGUISHED.</p> <p><u>CAUSE</u></p> <p>A. FUEL BLOCKAGE B. COMBUSTION AIR LOSS (BLOWER FAILURE) C. FUEL SUPPLY INSUFFICIENT (TANK FILL PROBLEM).</p> <p><u>MODE</u> - TEMPERATURE TOO HIGH.</p> <p><u>CAUSE</u></p> <p>TEMPERATURE CONTROL SYSTEM FAILS AND HIGH TEMPERATURE SHUTDOWN IS NOT INITIATED.</p> <p><u>MODE</u> - TEMPERATURE TOO LOW.</p> <p><u>CAUSE</u></p> <p>TEMPERATURE CONTROL SYSTEM FAILS AND LOW TEMPERATURE SHUTDOWN IS NOT INITIATED.</p>	<p><u>EQUIPMENT</u></p> <p>SHUTDOWN MAINTENANCE.</p> <p><u>PERSONNEL</u></p> <p>MINOR TOXIC VAPOR RELEASE TO CAUSTIC SCRUBBER SECTION IF AUXILIARY BURNER FAILS. (IF PRIMARY BURNER FAILS, THE AUXILIARY BURNER WOULD ACT AS REDUNDANT BACK-UP.)</p>
			<p><u>FAILURE DETERRENCE OR CORRECTIVE ACTION</u></p> <p>FAILURE DETERRENCE * ULTRAVIOLET FLAME SCANNER AND LOW TEMPERATURE ALARM WITH INTERLOCK TO SHUTDOWN. DOUBLE FILTERS TO PRECLUDE LINE BLOCKAGE. REDUNDANT BLOWERS. DRYGEN ANALYZER PROVIDED FOR COMBUSTION CONTROL. LEVEL ALARM IN FUEL TANKS. EMERGENCY SHUTDOWN CAPABILITY PROVIDED. THIS MODE OF FAILURE IS REGARDED AS EXTREMELY REMOTE.</p> <p>CORRECTIVE ACTION NOT FURTHER CORRECTIVE ACTION IS RECOMMENDED.</p> <p>FAILURE DETERRENCE ULTRAVIOLET FLAME SCANNER AND HIGH TEMPERATURE ALARM PROVIDED. STEAM ADDITION TO VOLATILIZATION CHAMBER FOR VERY HIGH TEMPERATURE. AN AUTOMATIC FOG SPRAY PURGE IS APPLIED TO VOLATILIZATION CHAMBER AND EMERGENCY FURNACE SHUTDOWN IS INITIATED.</p> <p>CORRECTIVE ACTION NONE RECOMMENDED.</p> <p>FAILURE DETERRENCE * ULTRAVIOLET FLAME SCANNER AND LOW TEMPERATURE ALARM PROVIDED. STEAM ADDITION TO VOLATILIZATION CHAMBER FOR VERY LOW TEMPERATURE. AN AUTOMATIC FOG SPRAY PURGE IS APPLIED TO VOLATILIZATION CHAMBER AND EMERGENCY FURNACE SHUTDOWN IS INITIATED.</p> <p>CORRECTIVE ACTION NONE RECOMMENDED.</p>
			<p><u>FAILURE DETERRENCE OR CORRECTIVE ACTION</u></p> <p>FAILURE DETERRENCE * ULTRAVIOLET FLAME SCANNER AND LOW TEMPERATURE ALARM PROVIDED. STEAM ADDITION TO VOLATILIZATION CHAMBER FOR VERY LOW TEMPERATURE. AN AUTOMATIC FOG SPRAY PURGE IS APPLIED TO VOLATILIZATION CHAMBER AND EMERGENCY FURNACE SHUTDOWN IS INITIATED.</p> <p>CORRECTIVE ACTION NONE RECOMMENDED.</p>

*NOTE: THE PRIMARY AND AUXILIARY FUME BURNERS ACT AS A SERIES REDUNDANT BURNER SYSTEM.

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL **X**
 COMPONENT LEVEL

BUILDING BLOCK: NO. 5. METAL PARTS
 FURNACE (MPF)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
5.5 QUENCH TOWER	SUPER SATURATION OF HOT FLUE GASES FROM SLAGGING AFTERBURNER PRIOR TO ENTERING VENTURI SCRUBBER	<p><u>MODE</u> - HIGH QUENCH ZONE TEMPERATURE.</p> <p><u>CAUSE(S)</u></p> <p>A. INLET PUMP OR CONTROL VALVE FAILS AND OPERATOR FAILS TO TAKE ACTION.</p> <p>B. QUENCH MAKEUP WATER VALVE FAILS AND OPERATOR FAILS TO TAKE ACTION.</p>	<p><u>EQUIPMENT</u></p> <p>POSSIBLE TOWER DAMAGE.</p> <p>POSSIBLE TOWER DAMAGE.</p>	<p>FAILURE DETERRENCE HIGH TEMPERATURE ALARM - AUTO SYSTEM SHUTDOWN PROVIDED.</p> <p>LOW PRESSURE AND FLOW ALARM. REMOTE MANUALLY OPERATED REDUNDANT VALVE PROVIDED.</p> <p>REMOTE MANUAL VALVE WITH EMERGENCY WATER SUPPLY.</p> <p>CORRECTIVE ACTION NONE RECOMMENDED.</p>	3	1	3
		<p><u>MODE</u> - EMPTY QUENCH TOWER.</p> <p><u>CAUSE(S)</u></p> <p>LEVEL CONTROL VALVE IN DOWNSTREAM SCRUBBER TOWER FAILS OR QUENCH BRINE PUMP (P-202) FAILS, OR CONTROL VALVE FAILS.</p>	<p>POSSIBLE TOWER DAMAGE (LOSS OF FLOW TO QUENCH TOWER AND VENTURI SCRUBBER).</p>	<p>FAILURE DETERRENCE LOW LEVEL AND FLOW ALARMS ARE PROVIDED FOR BOTH THE QUENCH TOWER AND VENTURI SCRUBBER. (THE SCRUBBER TOWER ALSO HAS FIVE LEVEL ALARMS AND A PRESSURE ALARM.) IN ADDITION A TEMPERATURE SWITCH (VENTURI SCRUBBER FLUE GAS OUTLET) WOULD INITIATE EMERGENCY WATER FLOW FROM THE 2000-GALLON HEAD TANK. FINALLY, AUTOMATIC PURSAGE AND AFTERBURNER SHUTDOWN WOULD BE INITIATED.</p> <p>CORRECTIVE ACTION NONE RECOMMENDED.</p>	3	1	3

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

METAL PARTS
 BUILDING BLOCK: NO. 5. FURNACE (MPF)

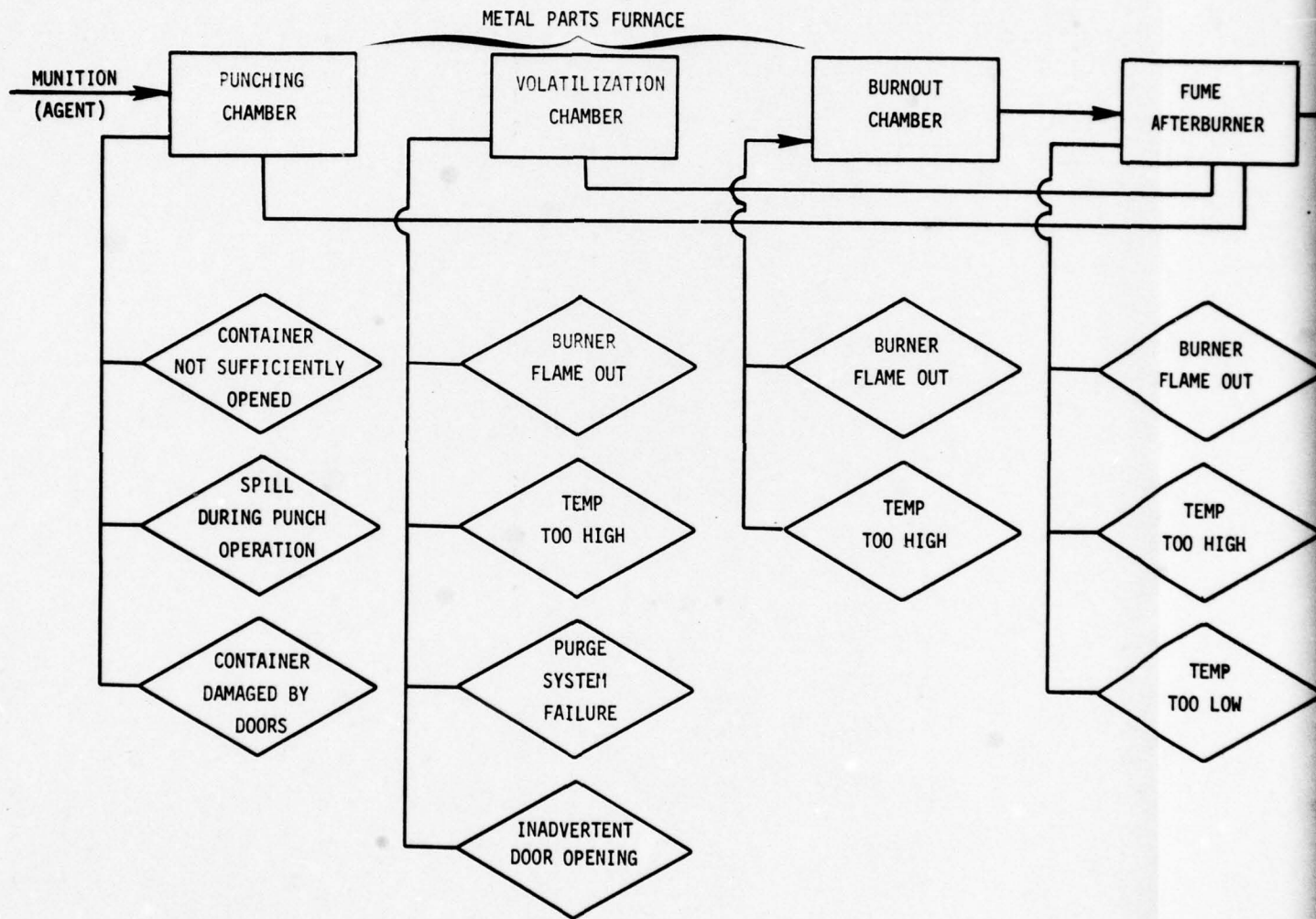
COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
5.6 VENTURI SCRUBBER	PARTICULATE COLLECTION AND CHEMICAL SCRUBBING.	<p><u>MODE</u> - LOSS OF BRINE FLOW TO VENTURI. CAUSE(S)</p> <p>A. VENTURI BRINE PUMP (FLOW FROM SCRUBBER TOWER) FAILS (LOSS OR REDUCED SCRUBBING ACTION).</p> <p>B. REMOTE FLOW CONTROLLER FAILURE.</p> <p><u>MODE</u> - VENTURI THROAT PLUG MISALIGNMENT.</p> <p><u>CAUSE(S)</u></p> <p>A. THROAT PLUGGED OR CLOSED DUE TO MALFUNCTION OF ELECTRICAL DIFFERENTIAL PRESSURE CONTROLLER CAUSING FURNACE OVERPRESSURIZATION</p> <p>B. THROAT OPEN TOO FAR DUE TO PRESSURE CONTROLLER MALFUNCTION LOSS OR REDUCED SCRUBBING ACTION.</p>	<p><u>EQUIPMENT</u></p> <p>POSSIBILITY OF RELEASE OF GASES TO CAUSTIC SCRUBBER.</p> <p>POSSIBILITY OF RELEASE OF GASES TO CAUSTIC SCRUBBER.</p> <p>SHUTDOWN AND MAINTENANCE</p> <p>SHUTDOWN AND MAINTENANCE</p>	<p>FAILURE DETERRENCE: AUTO OPEN BYPASS VALVE & LEVEL CONTROL VALVE. LOW PRESSURE ALARM. HIGH TEMPERATURE ALARM WITH AUTO SHUTDOWN OF FURNACE AND AFTER-BURNER.</p> <p>LOW FLOW ALARM. MANUAL FLOW ADJUSTMENT PROVIDED. HIGH TEMPERATURE ALARM WITH AUTO SHUTDOWN OF FURNACE AND AFTERBURNER.</p> <p><u>CORRECTIVE ACTION</u> NONE RECOMMENDED.</p> <p>FAILURE DETERRENCE: HIGH DIFFERENTIAL PRESSURE ALARM. PROVISION FOR MANUAL CONTROL OF THROAT PLUG. AUTOMATIC SHUTDOWN OF FURNACE AND AFTERBURNER.</p> <p>LOW DIFFERENTIAL PRESSURE ALARM. PROVISION FOR MANUAL CONTROL OF THROAT PLUG.</p> <p><u>CORRECTIVE ACTION</u> NONE RECOMMENDED.</p>	2	1	2

FAILURE MODE AND EFFECT ANALYSIS

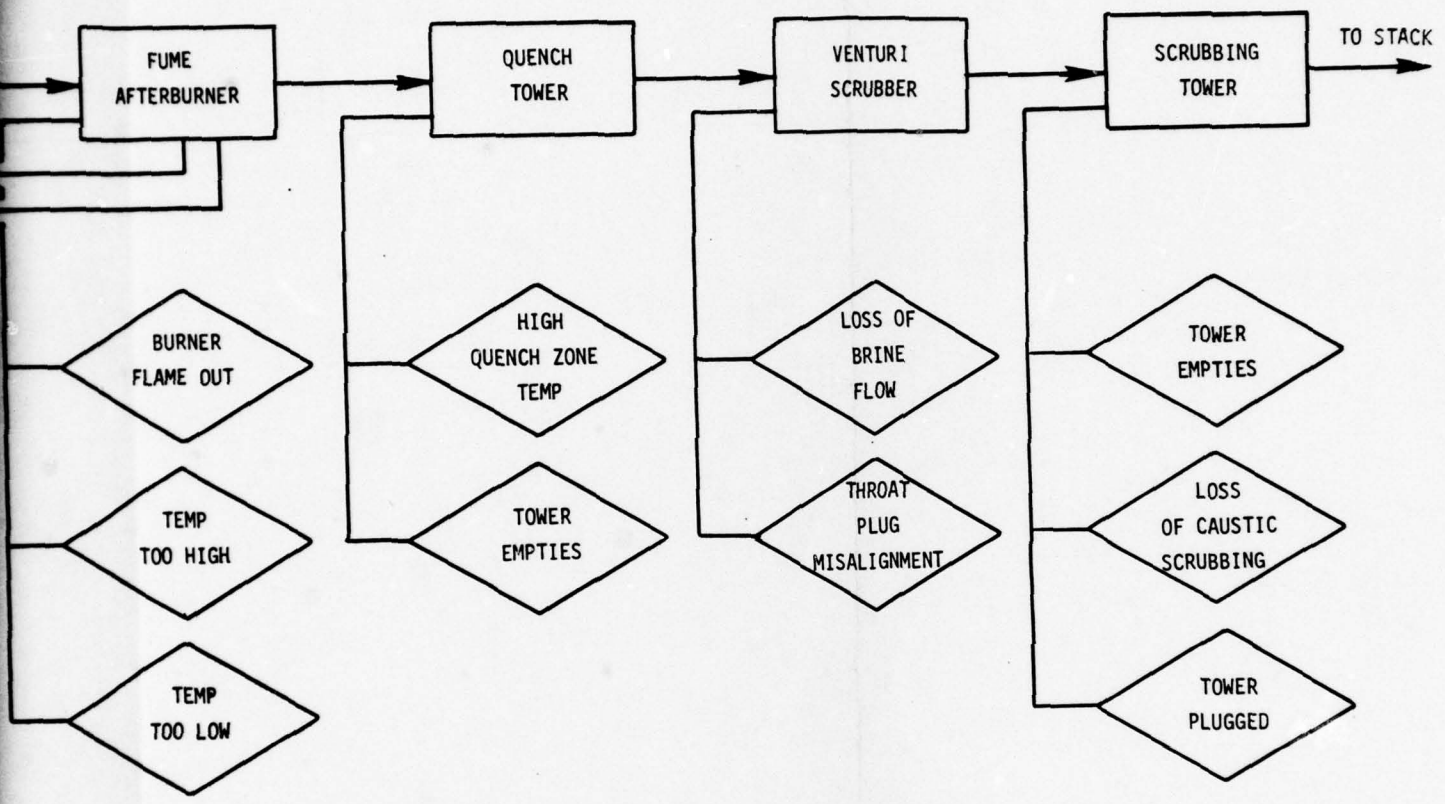
BUILDING BLOCK LEVEL
 COMPONENT LEVEL

METAL PARTS
 BUILDING BLOCK: NO. 5. FURNACE (MFF)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
5.7 SCRUBBING TOWER	TO REMOVE FLUE GAS CONTAMINANTS THAT REQUIRE LONGER CONTACT TIMES.	<p><u>MODE</u> - TOWER EMPTY.</p> <p><u>CAUSE(S)</u></p> <p>A. FAILURE OPEN OF LEVEL CONTROL VALVE AND AUTO SHUTDOWN SYSTEM FAILS.</p> <p><u>MODE</u> - LOSS OF CAUSTIC SCRUBBING CAPABILITY.</p> <p><u>CAUSE(S)</u></p> <p>A. CAUSTIC PUMP FAILURE AND OPERATOR FAILS TO TAKE ACTION.</p> <p>B. RH CONTROL FAILURE AND OPERATOR FAILS TO TAKE ACTION.</p> <p><u>MODE</u> - TOWER PLUGGED.</p> <p><u>CAUSE(S)</u></p> <p>A. DENISTER AND/OR PACKED SECTION PLUGGED - REDUCED GAS FLOW AND FURNACE/AFTERBURNER OVERPRESSURIZATION. OPERATOR FAILS TO TAKE ACTION.</p> <p><u>MODE</u> - TOWER OVERFILLS.</p> <p><u>CAUSE(S)</u></p> <p>A. PLUGGED PURGE PUMP SUCTION OR LEVEL CONTROL VALVE FAILURE.</p>	<p><u>EQUIPMENT</u></p> <p>POTENTIAL EQUIPMENT DAMAGE. SHUTDOWN AND MAINTENANCE.</p> <p>SHUTDOWN AND MAINTENANCE.</p> <p>SHUTDOWN AND MAINTENANCE.</p> <p><u>PERSONNEL</u></p> <p>EMISSION STANDARDS MAY BE EXCEEDED (BUT NOT AGENT).</p> <p>EMISSION STANDARDS MAY BE EXCEEDED (BUT NOT AGENT).</p>	<p>FAILURE DETERRENCE LOW LEVEL ALARM AND AUTO SHUTDOWN PROVIDED (FURNACE AND AFTERBURNER AUTO DE-ENERGIZE LEVEL CONTROL VALVE.)</p> <p><u>CORRECTIVE ACTION</u> NONE REQUIRED.</p> <p>FAILURE DETERRENCE LOW PRESSURE ALARM ON PUMP (ALSO MANUAL SWITCH CAPABILITY TO A STANDBY PUMP IS PROVIDED) LOW PH ALARM PROVIDED.</p> <p><u>CORRECTIVE ACTION</u> MANUALLY ADJUST CONTROL VALVE. NONE REQUIRED.</p> <p>FAILURE DETERRENCE HIGH DIFFERENTIAL PRESSURE ALARM TO SAFE MODE CONDITION (MANUALLY INITIATE FURNACE AND AFTERBURNER SHUTDOWN IF ΔP TOO HIGH).</p> <p><u>CORRECTIVE ACTION</u> NONE REQUIRED.</p> <p>FAILURE DETERRENCE MANUALLY PURGE SUCTION LINE. AUTO SHUTDOWN OF FURNACE AND AFTERBURNER.</p> <p><u>CORRECTIVE ACTION</u> NONE REQUIRED.</p>	2	1	2



2



NO. 5. METAL PARTS FURNACE (MPF)

FMEA INFORMATION SOURCES

BB No. 5

METAL PARTS FURNACE

DRAWINGS/DOCUMENTS :

Draft Demil Plan for CAMDS

Hercules, Inc. series of FMEHA Reports

Final Concept Design Report - Metal Parts Furnace and
Concept Design Changes

Available E.A. subcontractor drawings

PERSONNEL REFERENCED:

Edgewood Arsenal personnel discussions - J. Bartel, R. Misiewicz,
R. Roux, et al.

Surface Combustion personnel - F. Rinker

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK: NO. 6. ROCKET DEMIL MACHINE (ROM)

BUILDING BLOCK LEVEL:
 COMPONENT LEVEL:

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
6.0 ROCKET DEMIL MACHINE (ROM)	THE ROM IS USED TO DRAIN THE AGENT FROM THE ROCKET WARHEAD AND TO CUT THE ROCKET INTO SECTIONS SMALL ENOUGH TO PROCESS THROUGH THE DEACTIVATION FURNACE. DURING OPERATION THE ROM IS INSTALLED WITHIN THE EXPLOSIVE CONTAINMENT CUBICLE (ECC).		<u>EQUIPMENT</u>				
6.1 FUNCTIONALLY INTERFACING BUILDING BLOCKS BB NO. 2 ECC BB NO. 9 FHM BB NO. 22 MHE BB NO. 30 CTV BB NO. 31 COM BB NO. 14 ETS BB NO. 13 ADS	EXPLOSIVE CONTAINMENT CUBICLE HYDRAULIC PRESSURE SUPPLY ROCKET ECC INPUT CONVEYOR, OR, ROM INPUT CONVEYOR, ROCKET ECC DISCHARGE AND SEGREGATING CONVEYOR) REMOTE VISUAL MONITOR REMOTE AUDIO MONITOR DECON SOLUTION AND WASTE TREATMENT AGENT DESTRUCTION						
6.2 ROCKET ECC INPUT CONVEYOR	RECEIVE MUNITIONS FROM UNPACK AREA PERSONNEL, EXTENDS INTO THE ECC AND MATES WITH AN INTERMEDIATE CONVEYOR OR THE DEMIL MACHINE. TRANSPORT THE MUNITION TO THE NEXT HARDWARE ITEM, AND RETRACTS TO CLEAR THE ECC, ALLOWING ITEM IN DOOR CLOSURE.	MODE - MUNITIONS LOADED BACKWARDS BY UNPACK AREA PERSONNEL. <u>CAUSE(S)</u> A. HUMAN ERROR.	MUNITIONS LINE INTERUPTION WHILE ERROR IS CORRECTED.	FAILURE DETERRENCE A CONVEYOR MOUNTED SENSOR DETECTS PROPER ORIENTATION.	1	4	4

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK: NO. 6. ROCKET DEMIL MACHINE (DDM)

BUILDING BLOCK LEVEL:
COMPONENT LEVEL:

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
6.2 ROCKET ECC INPUT CONVEYOR (CONTINUED)		<p><u>MODE</u> - FAILURE OF THE CONVEYOR TO MOVE IN THE ECC AND MATE WITH THE INTERMEDIATE CONVEYOR OR DEMIL MACHINE.</p> <p><u>CAUSE(S)</u></p> <p>A. FAILURE OF THE CONVEYOR POSITIONING MECHANISM.</p> <p><u>MODE</u> - FAILURE TO CONVEY MUNITION.</p> <p><u>CAUSE(S)</u></p> <p>A. ACTUATION MOTOR FAILURE.</p> <p><u>MODE</u> - FAILURE OF CONVEYOR TO RETRACT FROM THE ECC.</p> <p><u>CAUSE(S)</u></p> <p>A. FAILURE OF THE CONVEYOR POSITIONING MECHANISM</p> <p><u>MODE</u> - POSSIBLE CONTAMINATION OF THE CONVEYOR AT THE INTERMEDIATE CONVEYOR OR DEMIL MACHINE CONTACT POINT.</p>	<p><u>EQUIPMENT</u></p> <p>FAILURE TO MATE CORRECTLY WILL NOT ALLOW THE NEXT STEP IN THE PROCESS TO BEGIN.</p> <p>MUNITIONS LINE INTERRUPTION WHILE FAILURE IS CORRECTED.</p> <p>FAILURE TO RETRACT CORRECTLY WILL NOT ALLOW THE NEXT STEP IN THE PROCESS TO BEGIN.</p> <p>CONTAMINATED HARDWARE (CONVEYORS) ARE RETRACTED INTO THE UNPACK AREA (ATLOCK).</p>	<p>FAILURE DETERRENCE LIGHT SWITCHES INDICATE PROPER ALIGNMENT AND WAITING.</p> <p>FAILURE DETERRENCE DOWNSTREAM CONVEYOR DETECTS ARRIVAL OF MUNITION WITH SENSORS INSURING DETECTION OF MOTOR FAILURE.</p> <p>FAILURE DETERRENCE LIGHT SWITCHES INDICATE PROPER RETRACTION.</p> <p>FAILURE DETERRENCE THE ATLOCK AREA IS MAINTAINED AT A NEGATIVE PRESSURE RELATIVE TO THE BALANCE OF THE UNPACK AREA. AGENT SENSORS ARE LOCATED IN THE UNPACK AREA. STANDARD OPERATING PROCEDURES FOR PERSONNEL MINIMIZE POTENTIAL FOR EXPOSURE.</p>	1	4	4
					2	4	8

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL **2**
 COMPONENT LEVEL **2**

(ROM)
 BUILDING BLOCK: NO. 6. ROCKET DEMIL MACHINE

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SCENARIO LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
6.2 ROCKET ECC INPUT CONVEYOR (CONTINUED)	POWERED ROLLERS AND PUSH CYLINDER(S) MOVE MUNITIONS TO DEMIL STATIONS.	<u>MODE</u> - POWERED ROLLER FAILURE. <u>CAUSE(S)</u> A. ELECTRIC MOTOR FAILURE.	<u>EQUIPMENT</u> MUNITION LINE INTERRUPTION UNTIL FAILURE IS CORRECTED.	FAILURE DETERRENCE THE COMPUTER OR MACHINE HAS A SENSOR TO DETECT FOR THE FAILURE TO THEN TRANSFER OF THE MUNITION TO THE DEMIL STATION. FAILURE WOULD BE DETECTED BY THE SENSE OF THIS TRANSFER, HALTING THE DEMIL PROCEDURE.	1	4	4
		<u>MODE</u> - PUSH CYLINDER FAILURE. <u>CAUSE(S)</u> A. HYDRAULIC FAILURE.	MUNITION LINE INTERRUPTION UNTIL FAILURE IS CORRECTED.	FAILURE DETERRENCE LIMIT SWITCHES SENSE BOTH EXTENDED AND RETRACTED PUSH CYLINDER POSITIONS.	1	4	4
	POSITION ROCKET FOR PUNCH AND DRAIN.	<u>MODE</u> - FAILURE OF CONVEYOR TO POSITION ROCKET IN PROPER PUNCH AND DRAIN LOCATION.	PUNCH HOLES WOULD NOT BE IN THE SPECIFIED LOCATION TO ALLOW PROPER AGENT DRAINAGE.	FAILURE DETERRENCE THE ROCKET IS MOVED INTO POSITION BY THE CONVEYOR. MOVEMENT IS STOPPED WHEN THE ROCKET BAND STRIKES THE ROLLER ON THE SAW TANK. A BACKUP STOP IS PROVIDED BY THE NUMBER 5 SAW CLAMPS WHICH ARE CLOSED DURING THE POSITIONING SEQUENCE. THE ROCKET IS PREVENTED FROM "BOUNCING" BACK BY THE LAST ROLLER ON THE INPUT CONVEYOR. THERE IS ALMOST 5 INCHES OF POSSIBLE AXIAL MOVEMENT. HOWEVER, THERE IS APPROXIMATELY 1 FOOT OF AGENT CAVITY ON EITHER SIDE OF THE PLANNED PUNCH POINT. A MICROSWITCH SENSES IF THE ROCKET IS IN THE PROPER POSITION. THE COMPUTER CONTROL SYSTEM AUTOMATICALLY HALTS ROM OPERATIONS AND ALL PRECEDING FUNCTIONS, WHEN THE ROCKET IS IMPROPERLY POSITIONED.	1	2	2

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL: (RM)
 COMPONENT LEVEL: 1

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
6.3 PUNCH CLAMP	HOLDS THE ROCKET IN POSITION FOR PUNCHING.	<u>MODE</u> - FAILURE OF PUNCH CLAMP TO SECURE ROCKET.	<u>EQUIPMENT</u> PUNCH HOLES COULD BE IN WRONG PLACE AND SUBSEQUENT MOVEMENT COULD PREVENT PROPER DRAINING	FAILURE DETERRENCE A MICROSWITCH SENSES IF THE CLAMP IS IN THE PROPER POSITION. THE COMPUTER CONTROL SYSTEM AUTOMATICALLY HALTS ROCKET OPERATIONS AND ALL PRECEDING FUNCTIONS WHEN THE CLAMP IS IMPROPERLY POSITIONED.	1	2	2
6.4 PUNCHES	PUNCH HOLES IN THE ROCKET TO ALLOW AGENT DRAINING.	<u>MODE</u> - FAILURE OF PUNCH CLAMP TO RELEASE AT COMPLETION OF DRAIN.	THE ROCKET CANNOT PROCEED TO THE NEXT STATION.	FAILURE DETERRENCE SEE ENTRY ABOVE.	1	2	2
		<u>MODE</u> - FAILURE OF PUNCHES TO OPERATE OR COMPLETELY PIERCE ROCKET.	AGENT DRAINING CANNOT BE ACCOMPLISHED. SUBSEQUENT SAMING WOULD RESULT IN AGENT DRAINING INTO THE DECON TANK.	FAILURE DETERRENCE THE DIFFERENTIAL PRESSURE SWITCH INDICATES WHEN/IF DRAINING IS COMPLETE. IT WILL ALSO INDICATE IF/WHEN NO DRAINING HAS OCCURRED. THE SWITCH POSITION IS TIED INTO THE COMPUTER SYSTEM WHICH WOULD AUTOMATICALLY HALT ROCKET OPERATIONS IN THE EVENT OF THIS FAILURE.	1	2	2
		<u>MODE</u> - FAILURE OF PUNCHES TO RETRACT AFTER PIERCING THE ROCKET.	POTENTIAL DAMAGE TO THE PUNCHES AND/OR ACTUATOR IF ATTEMPT IS MADE TO MOVE ROCKET TO THE NEXT STATION. NOTE THE PUSH ROD OPERATES FROM 100 PSI WITH A 1/4-INCH BORE (=175 LB FORCE).	FAILURE DETERRENCE A MICROSWITCH SENSES IF THE PUNCH "OUT STROKE" MOVEMENT HAS OCCURRED. THE SWITCH POSITION IS TIED INTO THE COMPUTER SYSTEM WHICH WOULD AUTOMATICALLY HALT ROCKET OPERATIONS IN THE EVENT OF THIS FAILURE.	1	2	2

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL COMPONENT LEVEL (RPM)

BUILDING BLOCK: NO. 6. ROCKET DERAIL MACHINE

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
6.5 PUSH CYLINDER	MOVES ROCKET TO SAW POSITION.	<p>MODE - PUSHROD DOES NOT TRAVEL FULL STROKE.</p> <p>CAUSE(S)</p> <p>A. LACK OF SUFFICIENT HYDRAULIC PRESSURE.</p>	<p>EQUIPMENT</p> <p>THE ROCKET WILL NOT BE SECTIONED AT THE PRESCRIBED POINTS. SECTIONED ROCKETS WOULD BE THE WRONG SIZE FOR THE FURNACE, AND THE POSSIBILITY EXISTS THAT ALL SECTIONS WOULD NOT BE HELD BY THE CLAMPS, PERMITTING SOME TO DROP INTO THE SAW TANK.</p>	<p>FAILURE DETERRENCE: THE OPERATOR MOVES THE ROCKET UNTIL THE ROCKET RING CATCHES ON A SADDLE. (THIS IS ALSO THE END OF THE PUSH CYL. STROKE. THE SWITCH THAT MOVES FORWARD. IF THE SWITCH DOES NOT FUNCTION, THE COMPUTER SYSTEM WILL AUTOMATICALLY HALT OR OPERATIONS BEFORE SAMING CAN BEGIN. NOTE: THE POST-SAMING SADDLE AND THE HYDRAULIC VALVE OPERATE FROM THE SAME HYDRAULIC VALVE SO THAT IF THE SADDLE DID NOT POSITION TO CATCH THE ROCKET THE PUSH CYL. WOULD NOT MOVE THE ROCKET ANYWAY. (THIS ASSURES THAT THE ROCKET WILL NOT BE PUSHED BEYOND THE LIMIT POINT. THE ECC DISCHARGE AND SEGREGATING CONVEYOR CAT WHISKER LIMIT SWITCHES MIGHT DETECT SEGMENTS WHICH HAVE BEEN SECTIONED IMPROPERLY.</p>	1	2	2
6.6 SAW CLAMPS	CLAMPS AND HOLDS ROCKET FOR STAKING AND SAMING.	<p>MODE - FAILURE TO CLAMP AND HOLD PROPERLY</p>	<p>SAMING OPERATIONS COULD RESULT IN MECHANICAL DAMAGE TO THE EQUIPMENT (SAW BLADE BINDING OF BREAKAGE, ETC.).</p>	<p>FAILURE DETERRENCE: THERE WOULD BE NO INDICATION IF ANY OR ALL OF THE CLAMPS DO NOT CLOSE. WORSE CASE WOULD OCCUR IF EHM VALVE V3 REMAINS CLOSED, SINCE IT CONTROLS MORE OF THE CLAMPS THAN ANY OTHER VALVE. MONITORING OF THE INDIVIDUAL SAW MOTOR CURRENT WOULD INDICATE A BROKEN OR JAMMED SAW BLADE. THIS WOULD RESULT IN SHUTDOWN OF THE ROM LINE. IMPROPER SAMING RESULTING IN ONLY MISPLACEMENT OF A SEGMENT WOULD NOT BE EVIDENT UNTIL SENSING (COUNTING) BY CAT WHISKER LIMIT SWITCHES IN THE SEGREGATOR TRAY SO INDICATED.</p>	2	2	4

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL COMPONENT LEVEL BUILDING BLOCK: NO. 6. ROCKET DEMIL MACHINE (RDM)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
6.7 STAKER	THE STAKER DIMPLES THE ROCKET CASE TO HOLD THE PROPELLANT POSITIONING SPRING IN A COMPRESSED POSITION.	<u>MODE</u> - STAKER FAILS TO IMPALE THE ROCKET CASE. MAY ALLOW SUBSEQUENT MOVEMENT OF THE PROPELLANT AFTER SAWING.	<u>EQUIPMENT</u> SUBSEQUENT TO SAWING, THE EXPANDING SPRING COULD INTERLOCK THE PROPELLANT SEGMENTS, FOLLOWING WHICH, PROPELLANT IS TO FURNACE AT ONCE IF NOT CORRECTED.	FAILURE DETERRENCE THERE IS NO IMMEDIATE FEEDBACK TO INDICATE IF THE STAKER PROPERLY DIMPLES THE ROCKET CASE. HOWEVER, INTERLOCKED PROPELLANT SEGMENTS WOULD BECOME EVIDENT AT THE SEGREGATOR CONTROLLER WHERE CAT WHISKER LIMIT SWITCHES ARE USED TO SENSE (COUNT) THE SEGMENTS. INDICATION OF AN IMPROPER SEGMENT COUNT WOULD RESULT IN AUTOMATIC SHUTDOWN OF THE RDM BY THE CONTROL SYSTEM.	1	4	4
6.8 CARRIAGE	MOVABLE MOUNTING PLATFORM FOR THE SAM IDLER ROLLERS (4), ROCKET CLAMPS (7) AND IMPALING PUNCHES (ON SECOND SET OF CLAMPS), IMPALING PUNCHES (ADJACENT TO THE FOURTH SET OF CLAMPS), AND MOTOR-DRIVEN RADIAL SAM. THE CARRIAGE LOWERS THESE COMPONENTS WITH THE CLAMPED ROCKET INTO THE SLUDGE TANK CONTAINING DECON SOLUTION PRIOR TO SAWING.	<u>MODE</u> - FAILURE OF THE CARRIAGE TO LOWER PRIOR TO SAWING OR TO RAISE AFTER SAWING.	<u>SAWING OPERATIONS</u> PRIOR TO CARRIAGE LOWERING COULD RESULT IN FIRE/EXPLOSIONS.	FAILURE DETERRENCE LIMIT SWITCHES INDICATE WHEN THE CARRIAGE IS IN THE FULLY LOWERED OR RAISED POSITIONS. THE CONTROL CENTER WILL ALLOW THE SAWING STEP TO TAKE PLACE UNLESS AN INDICATION IS RECEIVED THAT THE CARRIAGE IS FULLY LOWERED.	2	2	4
6.9 TANK CONTAINING DECON SOLUTION	THE SAM TANK SOLUTIONS FOR GB AND VX ROCKETS SUPPRESS SPARKS AND COOL THE BLADES DURING THE SAWING OPERATION. THE SAM TANK SOLUTION USED WITH VX ROCKETS WILL NOT DECONTAMINATE THE ROCKETS.	<u>MODE</u> - LOW SOLUTION LEVEL IN THE TANK. <u>CAUSE(S)</u> A. AN UPSTREAM VALVE FAILURE.	A FIRE/EXPLOSION MAY RESULT FROM HEAT BUILDUP DURING CUTTING.	FAILURE DETERRENCE THE TANK CONTAINS LEVEL SENSORS. A LOW LEVEL INDICATION AUTOMATICALLY SHUTS DOWN THE RDM OPERATION.	1	2	2

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

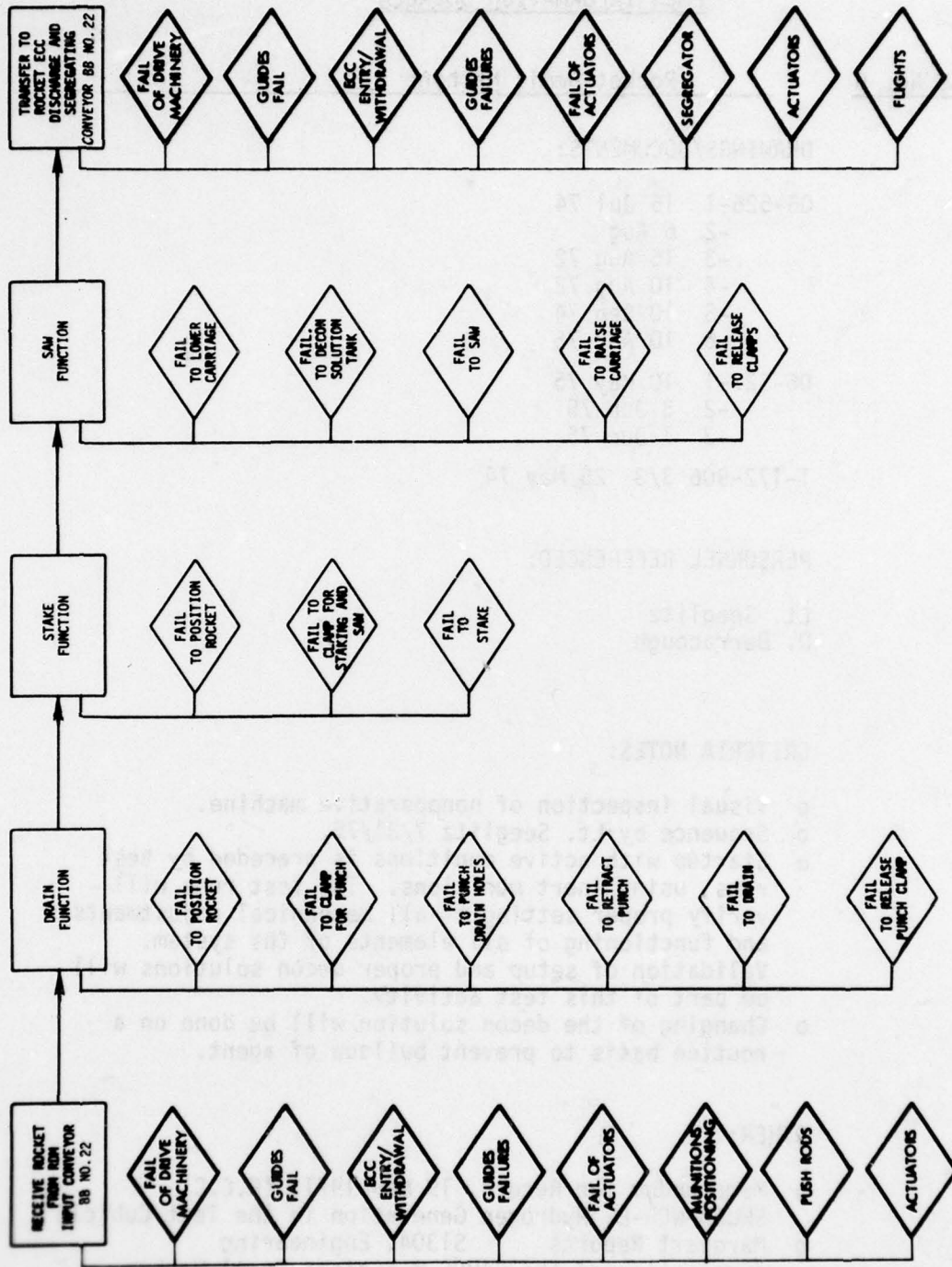
(FROM)
 BUILDING BLOCK: NO. 6. ROCKET DEMIL MACHINE

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
6.10 RADIAL SAMS (6)	THE SIX RADIAL SAMS SECTION THE ROCKET AT PREDETERMINED POINTS PRODUCING SEVEN ROCKET SEGMENTS.	<u>MODE</u> - FAILURE OF THE SAMS TO SAW OR COMPLETELY SAW THE ROCKET. CAUSE(S) A. SAW BLADE FAILURE, MOTOR FAILURE, ETC.	<u>EQUIPMENT</u> ONE OR MORE EXCESSIVE LARGE ROCKET SEGMENTS WOULD BE PRODUCED. THESE SEGMENTS UNDETECTED AND UNCORRECTED COULD ALLOW TOO MUCH PROPELLANT INTO A FURNACE AT ONCE.	<u>FAILURE DETERRENCE</u> MONITORING OF THE INDIVIDUAL SAW MOTOR CURRENTS WOULD INDICATE IMPROPER SAW OPERATION. SENSING (COUNTING) BY LIMIT SWITCHES IN THE SEGREGATOR TRAY WOULD DETECT A LARGE ROCKET SEGMENT BY INDICATING THAT A SEGMENT WAS MISSING.	2	2	4
6.11 SAW CLAMPS	RELEASE THE ROCKET SEGMENTS AT THE PROPER TIME, ALLOWING THEM TO FALL INTO THE MOVABLE TRAY OF THE ECC DISCHARGE AND SEGREGATING CONVEYOR (BB NO. 22).	<u>MODE</u> - FAILURE TO RELEASE THE ROCKET SEGMENT AT THE PRESCRIBED TIME CAUSED BY INADEQUATE CLAMP PRESSURE (PRE-RELEASE) OR STICKING (FAIL TO RELEASE). THE STAKED BURSTER SEGMENT OR THE PROPELLANT STAKED SEGMENT COULD POSSIBLY STICK.	THE CORRECT NUMBER OF SEGMENTS (LESS THAN THE CORRECT NUMBER) WILL NOT BE CONTAINED IN THE TRAY. THE IMMEDIATE EFFECT WOULD NOT BE SERIOUS EVEN IF UNDETECTED. THE SEGMENT COULD FALL IN THE DECOM TANK, REQUIRING MANUAL REMOVAL.	<u>FAILURE DETERRENCE</u> SWITCHES ON THE SEGREGATOR WOULD DETECT THE ERROR IF THE PRESCRIBED NUMBER OF ROCKET SEGMENTS WERE NOT PRESENT AND WOULD SUBSEQUENTLY SHUTDOWN THE ROM OPERATION.	1	2	2
6.12 ROCKET ECC DISCHARGE AND SEGREGATING CONVEYOR	EXTENDS INTO THE ECC AND MATES WITH AN INTERMEDIATE CONVEYOR OR THE DEMIL MACHINE. TRANSPORTS THE MUNITION COMPONENTS TO THE NEXT CONVEYOR, AND RETRACTS TO CLEAR THE ECC, ALLOWING ITEM OUT DOOR CLOSURE. ALSO SEGREGATES PORTIONS OF THE MUNITIONS.	<u>MODE</u> - FAILURE OF THE CONVEYOR TO MOVE IN THE ECC AND MATE WITH THE INTERMEDIATE CONVEYOR OR DEMIL MACHINE. CAUSE(S) A. FAILURE OF THE CONVEYOR POSITIONING MECHANISM.	FAILURE TO MATE CORRECTLY WILL NOT ALLOW THE NEXT STEP IN THE PROCESS TO BEGIN.	<u>FAILURE DETERRENCE</u> LIMIT SWITCHES INDICATE PROPER ALIGNMENT AND MATING.	1	4	4

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL (RDM)
 COMPONENT LEVEL BUILDING BLOCK: NO. 6. ROCKET DEMIL MACHINE

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
6.12 ROCKET ECC DIS-CHARGE AND SEGREGATING CONVEYOR (CONTINUED)		<p><u>MODE</u> - FAILURE TO CONVEY MUNITION.</p> <p><u>CAUSE(S)</u></p> <p>A. ACTUATION MOTOR FAILURE.</p> <p><u>MODE</u> - FAILURE OF CONVEYOR TO RETRACT FROM THE ECC.</p> <p><u>CAUSE(S)</u></p> <p>A. FAILURE OF THE CONVEYOR POSITIONING MECHANISM.</p> <p><u>MODE</u> - THE ROCKET ECC DISCHARGE AND SEGREGATING CONVEYOR FAILURE TO SEGREGATE SEGMENTS OF THE ROCKET.</p> <p><u>MODE</u> - POTENTIAL FIRE FROM EXPLOSIVE AND/OR EXPLOSIVE CHIPS GENERATED DURING PROCESSING.</p>	<p><u>EQUIPMENT</u></p> <p>MUNITIONS LINE INTERRUPTION WHILE ERROR IS CORRECTED.</p> <p>FAILURE TO RETRACT CORRECTLY WILL NOT ALLOW THE NEXT STEP IN THE PROCESS TO BEGIN.</p> <p>FAILURE TO SEGREGATE SEGMENTS OF THE ROCKET PRIOR TO ENTRY IN DEACTIVATION FURNACE COULD CAUSE AN EXPLOSIVE INCIDENT IN THE FURNACE.</p> <p>POTENTIAL AGENT RELEASE TO ATMOSPHERE AND/OR PERSONNEL EXPOSURE.</p>	<p>FAILURE DETERRENCE CONVEYOR HAS A SENSOR TO DETECT MOTION (REFERENCE BB NO. 35 SCS).</p> <p>FAILURE DETERRENCE LIMIT SWITCHES INDICATE PROPER RETRACTION.</p> <p>FAILURE DETERRENCE SWITCHES INDICATE THE SEGREGATION OF EACH PIECE TO THE DEACTIVATION FURNACE INPUT CONVEYOR.</p> <p>FAILURE DETERRENCE NO SOURCE OF IGNITION HAS BEEN IDENTIFIED FROM THE CONVEYOR. THEREFORE, THIS FAILURE MODE REPRESENTS AT LEAST A SECOND ORDER OCCURRENCE. A MAINTENANCE PROGRAM WILL REMOVE THE MATERIAL.</p>	1	4	4
					1	4	4
					2	4	8
					3	1	3



BB NO. 6. ROCKET DEMIL MACHINE (RDM)

FMEA INFORMATION SOURCES

BB No. 6

Rocket Demil Machine

DRAWINGS/DOCUMENTS:

06-526-1 16 Jul 74
-2 6 Aug
-3 15 Aug 72
-4 10 Aug 72
-5 10 Sep 74
-6 10 Apr 75
06-527-1 10 May 75
-2 3 Jun 75
-3 7 Jun 75
T-172-906 3/3 25 May 74

PERSONNEL REFERENCED:

Lt. Seeglitz
D. Barracough

CRITERIA NOTES:

- o Visual inspection of nonoperative machine.
- o Sequence by Lt. Seeglitz 7/31/75.
- o Startup with active munitions is preceded by test runs, using inert munitions. The test runs will verify proper setting of all mechanical adjustments and functioning of all elements of the system. Validation of setup and proper decon solutions will be part of this test activity.
- o Changing of the decon solution will be done on a routine basis to prevent buildup of agent.

OTHER:

- o Memorandum for Record, 19 May 1971, (R.C.C) SMUEA-WCP-E, Hydrogen Generation in the Test Cubicle
- o Marquart Reports S1304, Engineering "Evaluation of the CAMDS Munitions Demil Machinery," Phase 1-Evaluation, Volume 1, August 1974.

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL **1**
 COMPONENT LEVEL **1**

BUILDING BLOCK: NO. 8. UTILITIES (UTL)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
B.1 BOILERS	SERVICES PROCESSES REQUIRING HEAT IN THE ADS DRYERS, METAL PARTS FURNACE, CENTRAL DECONTAMINATION SYSTEM AND EXPLOSIVE TREATMENT SYSTEM.	<u>MODE</u> - LOSS OF HOT WATER/STEAM. <u>CAUSE(S)</u> A. BOILER FAILURE.	<u>EQUIPMENT</u> THE CAMDS FACILITY MUST BE SHUT DOWN. <u>PERSONNEL</u>	FAILURE DETERRENCE THE BOILERS ARE OVERDESIGNED (LARGE DESIGN MARGINS). PERIODIC MAINTENANCE WILL BE ACCOMPLISHED TWICE A YEAR. ONE BOILER IS OPERATING WHILE THE OTHER IS IN MAINTENANCE/STANDBY. NORMAL OPERATION IS TO RUN WITH ONE BOILER "UP" AND THE OTHER ON "IDLE" AND IN AN AUTOMATIC MODE. LOSS OF OUTPUT FROM THE "UP" BOILER AUTOMATICALLY BRINGS THE "IDLE" BOILER ON LINE. NEITHER BOILER IS THE PREFERRED BOILER. BOILER SHUTS DOWN IF ITS WATER LEVEL FALLS BELOW A CERTAIN POINT.	1	2	2
B.2 AIR COMPRESSORS	PROVIDES AIR FOR LEVEL "A" PROTECTIVE SUITS. PROVIDES AIR DEMIL MACHINERY OPERATION.	<u>MODE</u> - LOSS OF AIR SUPPLY. <u>CAUSE(S)</u> A. COMPRESSOR FAILURE.	PRODUCTION SHUT-DOWN OF DEMIL MACHINERY. AIR SUPPLY TO PROTECTIVE SUITS IS LOST.	FAILURE DETERRENCE SOME AIR RESERVE IS RESIDUAL IN THE SUITS. A SEPARATE AIR SUPPLY FOR THE SUITS IS BEING CONSIDERED. THERE ARE TWO COMPRESSORS (EACH 220 SCFM CAPACITY, OUTPUT 100 PSIG AIR). BOTH COMPRESSORS ARE OPERATING (ONE "UP" PUTTING OUT 100 PSIG AIR, THE OTHER ON "IDLE"). IN THE EVENT OF A PRESSURE DROP THE "IDLE" COMPRESSOR COMES ON LINE. COMPRESSOR STATUS IS MONITORED AT THE CONTROL CENTER. TWO RECEIVERS ON THE COMPRESSORS (300 GALLONS) PROVIDE A TEMPORARY SOURCE OF AIR IN THE EVENT OF FAILURE TO BOTH COMPRESSORS, ALLOWING CORRECTIVE ACTION TO BE TAKEN. TWO ADDITIONAL INDEPENDENT TANKS SUPPLYING APPROXIMATELY 15 MINUTES OF RESERVE AIR ALSO MAY BE PROVIDED.	1	2	2

FMEA INFORMATION SOURCES

BB NO. 8

UTILITIES (UTL)

DRAWINGS/DOCUMENTS:

08-525-1 Feb 2'73
08-525-2 Feb 1'73
08-525-3 Nov 6'74
08-525-4 Aug 28'74

Draft Demil Plan for CAMDS at Tooele Army Depot

PERSONNEL REFERENCED:

R. Schorenberg
W. Darling

CRITERIA NOTES :

Design not reviewed for adequacy in size or conformity to Building Codes.

No review of Heating, Air Conditioning, and Water Supply.

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK NO. 9... ECC HYDRAULICS (EPM)

BUILDING BLOCK LEVEL **2**
COMPONENT LEVEL **1**

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
9.0 ECC HYDRAULICS (EPM) REFERENCE TO DS-08-508-02, 5-1.1 (PRELIMINARY UNAPPROVED DRAWING)	THE ECC HYDRAULICS SUPPLIES THE HYDRAULIC REQUIREMENTS FOR THE ECC EQUIPMENT INSTALLED IN THE ECC, AND THE ECC INPUT AND DISCHARGE CONVECTORS.						
9.1 ECC HYDRAULICS INCLUDE THE FOLLOWING COMPONENTS: RESERVOIR ASSEMBLY (INCLUDING: BAFFLE, PIPING, PUMP TO MOTOR COUPLING, CLEAN-OUT PLATES, OIL LEVEL GAGE, FILTER CAP, AND BREATHING ASSEMBLY)	CONTAINS ECC HYDRAULICS SUPPLY	<u>MODE</u> - LOSS OF HYDRAULIC FLUID. <u>CAUSE(S)</u> A. EXTERNAL LEAKAGE.	<u>EQUIPMENT</u> EXCESSIVE LEAKAGE WOULD CONSTITUTE A SAFETY HAZARD. AN INADEQUATE HYDRAULIC SUPPLY TO THE PUMP WOULD RESULT IN AN UNDER-PRESSURE CONDITION IN THE LINES, AT THE CONTROL VALVES, AND AT THE OPERATING UNITS WHICH WOULD NOT ALLOW ANY PORTIONS DEHIL-TARIZATION LINES REQUIRING THE ECC, AND/OR EQUIPMENT INSTALLED IN THE DEHIL-TARIZATION, PUM, POR, OR C-100, AND/OR THE ECC UNIT AND DIS-CHARGE CONVECTORS TO BE OPERATED.	FALLURE DETERRENCE THE RESERVOIR ASSEMBLY WILL BE INCLUDED IN THE PERIODIC MAINTENANCE PROGRAM. TWO OIL LEVEL FLOAT SWITCHES ARE INSTALLED IN THE RESERVOIR. THESE SWITCHES, WHICH ARE INCLUDED IN THE COMPUTER CONTROL PLAN, ARE USED TO DETECT LARGE SCALE HYDRAULIC LOSSES. A HYDRAULIC LOSS LOWERING THE RESERVOIR HYDRAULIC LEVEL SUFFICIENTLY TO ACTIVATE THE FIRST SWITCH WOULD RESULT IN AN INDICATION OF THIS LOSS TO THE COMPUTER CONTROL. CONTINUED LOSS WOULD RESULT IN THE AUTOMATIC SHUTDOWN OF THE PUMP UNIT AND THE ENTIRE DEHIL-TARIZATION LINE.	2	1	2

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL **1**
 COMPONENT LEVEL **2**

BUILDING BLOCK: NO. 9. ECC HYDRAULICS (EWH)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
9.1 RESERVOIR ASSEMBLY (CONTINUED)		<p><u>MODE</u> - CONTAMINATED HYDRAULICS. <u>CAUSE(S)</u> A. COMPONENT WEAR/DETERIORATION, ETC.</p>	<p><u>EQUIPMENT</u> EXCESSIVE CONTAMINATION (IF INTRODUCED INTO THE SYSTEM) COULD RESULT IN DOWNSTREAM VALVE INTERNAL LEAKAGE AND/OR OTHER OUT OF SPECIFICATION OPERATION AND/OR OUT OF SPECIFICATION OPERATION AT THE OPERATING UNITS WHICH COULD IN TURN REQUIRE THE SHUT-DOWN OF ALL DEMILITARIZATION OPERATIONS ASSOCIATED WITH THE ECC.</p>	<p>FAILURE DETERRENCE THERE IS A FILTER LOCATED AT THE INLET OF THE INLET LINE TO ASSURE THAT CONTAMINATED HYDRAULICS IN THE RESERVOIR ARE NOT INTRODUCED INTO THE SYSTEM. THERE IS A FILTER LOCATED AT THE INLET OF THE HYDRAULIC BEAN LINE TO ASSURE THAT CONTAMINATION GENERATED IN THE SYSTEM IS NOT INTRODUCED INTO THE RESERVOIR SUPPLY.</p>	2	1	2
9.2 FILTER (PUMP INTAKE)	<p>FILTER HYDRAULIC FLUID BEFORE IT IS PUMPED THROUGH THE SYSTEM.</p>	<p><u>MODE</u> - CONTAMINATED HYDRAULICS ARE PUMPED INTO THE SYSTEM. <u>CAUSE(S)</u> A. LOSS OF FILTER FUNCTION.</p>	<p>EXCESSIVE CONTAMINATION COULD RESULT IN DOWNSTREAM VALVE INTERNAL LEAKAGE AND/OR OTHER OUT OF SPECIFICATION VALVE OPERATION AT THE OPERATING UNITS WHICH COULD REQUIRE THE SHUTDOWN OF ALL DEMILITARIZATION OPERATIONS ASSOCIATED WITH THE ECC.</p>	<p>FAILURE DETERRENCE THE FILTER WILL BE INSPECTED AS PART OF THE PERIODIC MAINTENANCE PROGRAM.</p>	2	1	2

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

BUILDING BLOCK: NO. 9. ECC HYDRAULICS (ECC)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
9.3 FILTER (RESERVOIR RETURN LINE)	FILTER HYDRAULIC FLUID THAT HAS BEEN PUMPED THROUGH THE SYSTEM TO ASSURE THAT CONTAMINATION GENERATED IN THE SYSTEM IS NOT INTRODUCED INTO THE RESERVOIR SUPPLY.	<u>MODE</u> - CONTAMINATED HYDRAULICS ARE INTRODUCED INTO THE RESERVOIR. <u>CAUSE(S)</u> A. LOSS OF FILTER FUNCTION.	<u>EQUIPMENT</u> THERE IS NO SIGNIFICANT CONSEQUENCE AS LONG AS THE CONTAMINATED HYDRAULICS ARE NOT RECIRCULATED THROUGH THE SYSTEM.	FAILURE DETERRENCE THERE IS A FILTER AT THE PUMP INTAKE TO ASSURE THAT CONTAMINATED HYDRAULICS FROM THE RESERVOIR ARE NOT INTRODUCED INTO THE SYSTEM. THE FILTERS WILL BE INSPECTED AS PART OF THE PERIOD MAINTENANCE PROGRAM.	1	1	1
9.4 SWITCH/FLOAT (UPPER RESERVOIR LEVEL)	THIS SWITCH/FLOAT MECHANISM IS USED TO DETECT LARGE SCALE HYDRAULIC FLUID LOSS. IN THE EVENT THAT THE HYDRAULIC FLUID FALLS TO A GIVEN LEVEL, THE FLOAT ACTUATES THE SWITCH (WHICH IS TIED INTO THE COMPUTER CONTROL SYSTEM) THEREBY INDICATING A LARGE FLUID LOSS.	<u>MODE</u> - PREMATURE SWITCH ACTUATION. <u>CAUSE(S)</u> A. A FAULTY SWITCH OR FLOAT. <u>MODE</u> - FAILURE OF SWITCH TO ACTUATE IN THE EVENT OF EXCESSIVE FLUID LOSS. <u>CAUSE(S)</u> A. A FAULTY SWITCH OR FLOAT. <u>NOTE</u> : THIS CONSTITUTES A DOUBLE FAILURE (EXCESSIVE LOSS OF FLUID AND SWITCH FAILURE).	FAILURE OF LITTLE CONSEQUENCE BUT WOULD REQUIRE INSPECTION AND CORRECTION. NO EXCESSIVE FLUID LOSS SIGNAL AT THE COMPUTER. A CONTINUED FLUID LOSS AND SWITCH FAILURE WOULD RESULT IN THE LOSS OF FLUID BEING UNDETECTED UNTIL THE PUMP UNIT (AND THE DEMILITARIZATION LINE BEING SERVICED BY THE ECC HYDRAULICS) WAS AUTOMATICALLY SHUTDOWN BY THE COMPUTER CONTROL WHEN THE LOWER RESERVOIR LEVEL SWITCH/FLOAT ACTUATED.	FAILURE DETERRENCE THE SWITCH/FLOAT MECHANISM WILL BE INSPECTED AS PART OF THE PERIODIC MAINTENANCE PROGRAM. FAILURE DETERRENCE PROPER OPERATION OF THE LOWER RESERVOIR LEVEL SWITCH/FLOAT WILL SHUT THE PUMP INTAKE (AND ECC DEMILITARIZATION LINE) DOWN AND PREVENT POTENTIAL DAMAGE.	1	*2	2
				*FAILURE OF SWITCH ONLY.			

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
COMPONENT LEVEL

BUILDING BLOCK: NO. 9. ECC HYDRAULICS (ECC)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
9.5 SWITCH/FLOAT (LOWER RESERVOIR LEVEL)	THIS SWITCH/FLOAT MECHANISM IS USED TO DETECT LARGE SCALE HYDRAULIC FLUID LOSS. IN THE EVENT THAT THE HYDRAULIC FLUID FALLS TO A GIVEN LEVEL, THE FLOAT ACTUATES THE SWITCH (WHICH IS TIED INTO THE COMPUTER CONTROL SYSTEM) THEREBY CAUSING THE COMPUTER CONTROL TO SHUT DOWN THE PUMP UNIT (AND THE DEINITIALIZATION LINE BEING SERVICED BY THE ECC HYDRAULICS).	<p><u>MODE</u> - PREMATURE SWITCH ACTUATION.</p> <p><u>CAUSE(S)</u></p> <p>A. FAULTY SWITCH OR FLOAT.</p>	<p><u>EQUIPMENT</u></p> <p>AN ERRONEOUS EXCESSIVE FLUID LOSS SIGNAL AT THE COMPUTER. FAILURE WOULD CAUSE THE COMPUTER CONTROL TO UNEXPECTEDLY SHUT DOWN THE PUMP UNIT (AND THE DEINITIALIZATION LINE BEING SERVICED BY THE ECC HYDRAULICS).</p>	FAILURE DETERRENCE THE SWITCH/FLOAT MECHANISM WILL BE INSPECTED AS PART OF THE PERIODIC MAINTENANCE PROGRAM.	2	1	2
		<p><u>MODE</u> - FAILURE OF SWITCH TO ACTIVATE IN THE EVENT OF EXCESSIVE FLUID LOSS.</p> <p><u>CAUSE(S)</u></p> <p>A. A FAULTY SWITCH OR FLOAT.</p> <p><u>NOTE:</u> THIS CONSTITUTE A TRIPLE FAILURE (EXCESSIVE LOSS OF FLUID, FAILURE OF THE UPPER RESERVOIR LEVEL SWITCH/FLOAT TO ACTIVATE OR PERSONNEL IGNORING THE EXCESSIVE FLUID LOSS INDICATION, AND FAILURE OF THE LOWER RESERVOIR LEVEL SWITCH/FLOAT).</p>	<p>NO EXCESSIVE FLUID LOSS SIGNAL AT THE COMPUTER AND THEREFORE NO COMPUTER CONTROL COMMAND TO SHUT DOWN THE PUMP UNIT (AND THE DEINITIALIZATION LINE BEING SERVICED BY THE ECC HYDRAULICS). LOSS OF FLUID WOULD CONTINUE. EVENTUALLY AN INADEQUATE HYDRAULIC SUPPLY TO THE PUMP WOULD RESULT IN AN UNDER-PRESSURE CONDITION IN THE LINES, AT THE CONTROL VALVES, AND AT THE OPERATING</p>	FAILURE DETERRENCE PROPER OPERATION OF THE UPPER RESERVOIR LEVEL SWITCH/FLOAT WILL ALERT PERSONNEL TO THE EXCESSIVE LOSS OF FLUID. THE SWITCH/FLOAT MECHANISM WILL BE INSPECTED AS PART OF THE PERIODIC MAINTENANCE PROGRAM.	2	*2	4
				*FAILURE OF LOWER RESERVOIR LEVEL SWITCH/FLOAT ONLY.			

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

BUILDING BLOCK: NO. 9. ECC HYDRAULICS (EHP)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
9.5 SWITCH/FLOAT (LOWER RESERVOIR LEVEL) (CONTINUED)							
9.6 ELECTRIC MOTOR AND HYDRAULIC PUMP	THE ELECTRIC MOTOR POWERS THE PUMP WHICH CIRCULATES HYDRAULIC FLUID AT 1000 PSI FROM THE RESERVOIR THROUGH THE ECC HYDRAULICS SYSTEM TO THE ECC. THE EQUIPMENT IS INSTALLED IN THE ECC AND TO THE ECC INPUT AND DISCHARGE CONVEYORS.	<u>MODE</u> - ELECTRIC MOTOR OR PUMP FAILURE (ELECTRICAL MECHANICAL) IN A MODE RENDERING THE UNIT INOPERATIVE AND RESULTING IN AN UNDER-PRESSURE CONDITION IN THE HYDRAULIC LINES. <u>MODE</u> - ELECTRIC MOTOR OF PUMP FAILURE IN A MODE RESULTING IN A POTENTIAL OVERPRESSURE CONDITION IN THE UNIT AND LINES.	<u>EQUIPMENT</u> UNITS WHICH WOULD NOT ALLOW ANY MUNITIONS DEMILITARIZATION LINES REQUIRING THE ECC AND/OR EQUIPMENT INSTALLED IN THE ECC AND/OR THE ECC INPUT AND DISCHARGE CONVEYORS TO BE OPERATED. ALL MUNITIONS DEMILITARIZATION LINES REQUIRING THE ECC (AND/OR EQUIPMENT INSTALLED IN THE ECC - ROM, POM, MOR, OR -PIN) AND/OR THE ECC INPUT AND OUTPUT CONVEYORS MUST BE SHUT DOWN. NOMINAL CASE - OPERATIONAL OUT OF OPERATION OF CONTROL VALVES AND/OR DOWNSTREAM EQUIPMENT. WORST CASE - POTENTIAL RUPTURE OF UNIT OR HYDRAULIC LINES, RESULTING IN DEMILITARIZATION LINE SHUTDOWN AND A HAZARDOUS ENVIRONMENT.	FAILURE DETERRENCE THE ELECTRIC MOTOR AND PUMP WILL BE INCLUDED IN THE PERIODIC MAINTENANCE PLAN. OPTIONS TO OPERATE MUNITIONS DEMILITARIZATION LINES NOT REQUIRING THE ECC AND/OR ITS ASSOCIATED EQUIPMENT (PROJECTILES/CARTRIDGES - GB/VX, WITHOUT BURSTERS, BULK ITEMS - GB/VX, TON CONTAINERS-MUSTARD) CAN BE CONSIDERED. FAILURE DETERRENCE EITHER FAILURE CONSEQUENCE WOULD REQUIRE A DOUBLE FAILURE (THE MOTOR/PUMP FAILURE PLUS A FAILURE IN THE HIGH PRESSURE RELIEF VALVE). THE ELECTRIC MOTOR AND PUMP WILL BE INCLUDED IN THE PERIODIC MAINTENANCE PLAN.	2	*1	2
				*MOTOR/PUMP FAILURE ONLY.			

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK: NO. 9. ECC HYDRAULICS (ECC)

BUILDING BLOCK LEVEL:
 COMPONENT LEVEL:

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
9.7 RELIEF VALVE	THE HIGH PRESSURE RELIEF VALVE PROVIDES PROTECTION FOR THE ECC HYDRAULIC SYSTEM IN THE EVENT OF AN OVERPRESSURE CONDITION.	<p><u>MODE</u> - LOSS OF SYSTEM HYDRAULIC FLUID AND PRESSURE.</p> <p><u>CAUSE(S)</u></p> <p>A. EXTERNAL LEAKAGE OR RELIEF VALVE OPERATION AT PRESSURES BELOW SPECIFICATION (1000 PSI).</p>	<p><u>EQUIPMENT</u></p> <p>THE RESULTING UNDER-PRESSURE CONDITION (MINIMUM OPERATING PRESSURE ALLOWABLE IS APPROXIMATELY 900 PSI) IN THE LINES, AT THE CONTROL VALVES, AND AT THE OPERATING UNITS WOULD NOT ALLOW ANY HAZARDOUS DEMILITARIZATION LINES REQUIRING THE ECC, AND/OR EQUIPMENT, INSTALLED IN THE ECC, AND/OR THE ECC INPUT AND DISCHARGE CONVEYORS TO BE OPERATED.</p>	FAILURE DETERRENCE THE RELIEF VALVE WILL BE INCLUDED IN THE PERIODIC MAINTENANCE PROGRAM.	2	2	4
		<p><u>MODE</u> - FAILURE TO VENT (UNDER THE CONDITION OF EXCESSIVE LINE PRESSURE).</p> <p><u>CAUSE(S)</u></p> <p>A. THE RELIEF VALVE NOT OPERATING AT PRESSURES ABOVE SPECIFICATION (1000 PSI). NOTE: THIS CONSTITUTES A DOUBLE FAILURE (EXCESSIVE LINE PRESSURE AND RELIEF VALVE FAILURE).</p>	<p>WHEN THE RESULTING OVERPRESSURE CONDITION REACHES APPROXIMATELY 1500 PSI PUMP AND/OR VALVE OPERATIONAL PROBLEMS WOULD BEGIN TO OCCUR, NECESSITATING THE CESSATION OF DEMILITARIZATION OPERATIONS INVOLVING THE ECC AND ITS ASSOCIATED EQUIPMENT</p>	FAILURE DETERRENCE THE RELIEF VALVE WILL BE INCLUDED IN THE PERIODIC MAINTENANCE PROGRAM.	3	*1	3
				*RELIEF VALVE FAILURE ONLY.			

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

BUILDING BLOCK: NO. 9. ECC HYDRAULICS (EHM)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
9.8 SENSOR, TEMPERATURE	PROVIDES DATA FOR REMOTE COMPUTER MONITORING OF THE SYSTEM.	<p><u>MODE</u> - FAULTY DATA OUTPUTS.</p> <p><u>CAUSE(S)</u></p> <p>A. SENSOR MALFUNCTION.</p>	<p><u>EQUIPMENT</u></p> <p>FAILURE OF LITTLE CONSEQUENCE, PROVIDED THE FAULTY DATA ARE CHECKED BEFORE ANY ACTIONS ARE TAKEN.</p>	FAILURE DETERRENCE PERIODIC INSPECTION.	1	2	2
9.9 CHECK VALVE	PREVENTS OIL FROM BACK-FLOWING INTO THE PUMP AND ISOLATES (ALONG WITH THE RETURN LINE VALVES) THE ECC HYDRAULIC SYSTEM FROM THE ECC IN THE EVENT OF AN EXPLOSIVE INCIDENT IN THE ECC.	<p><u>MODE</u> - INTERRUPTION OF HYDRAULIC SUPPLY TO THE ECC AND ITS ASSOCIATED EQUIPMENT.</p> <p><u>CAUSE(S)</u></p> <p>A. CHECK VALVE FAILING IN A CLOSED MODE.</p> <p><u>MODE</u> - HYDRAULIC FLUID BACKFLOW INTO THE PUMP.</p> <p><u>CAUSE(S)</u></p> <p>A. CHECK VALVE FAILS OPEN.</p> <p><u>MODE</u> - HIGH UPSTREAM PRESSURE SURGE.</p> <p><u>CAUSE(S)</u></p> <p>A. OPEN OR LEAK FAILURE OF THE CHECK VALVE COINCIDING WITH AN EXPLOSIVE INCIDENT IN THE ECC. NOTE: THIS CONSTITUTES A DOUBLE FAILURE (EXPLOSIVE INCIDENT IN THE ECC AND A CHECK VALVE FAILURE).</p>	<p>DEMILITARIZATION OPERATIONS INVOLVING THE ECC AND ITS ASSOCIATED EQUIPMENT WOULD CEASE.</p> <p>FAILURE OF LITTLE CONSEQUENCE (MUT-SINCE TYPE FAILURE).</p> <p>THAT PORTION OF THE ECC HYDRAULICS (EHM) SYSTEM UP-STREAM OF THE CHECK VALVE WOULD NOT BE ISOLATED FROM THE EFFECTS OF AN EXPLOSION IN THE ECC.</p>	<p>FAILURE DETERRENCE THIS FAILURE MODE SHOULD BE VERY REMOTE SINCE THE NORMAL SYSTEM OPERATING PRESSURE IS APPROXIMATELY 1000 PSI AND A DOWNSTREAM PRESSURE DIFFERENTIAL OF AS LITTLE AS APPROXIMATELY 5 PSI WOULD NORMALLY OPERATE THE CHECK VALVE.</p> <p>FAILURE DETERRENCE FAILURE WOULD BE FIXED DURING MAINTENANCE.</p> <p>CORRECTIVE ACTION THE CHECK VALVE SHOULD BE INSPECTED/TESTED PERIODICALLY.</p> <p>THE CHECK VALVE COULD BE FUNCTIONALLY TESTED BY CLOSING THE RETURN LINE NORMALLY CLOSED ISOLATION VALVES VENTING (THROUGH THE RELIEF VALVE) THE PUMP OUTPUT LINE TO A PRESSURE LOWER THAN THE LINE DOWNSTREAM OF THE CHECK VALVE, AND THEN OBSERVING THE ACCUMULATOR PRESSURE GAUGE FOR A DROP IN PRESSURE WHICH WOULD INDICATE A CHECK VALVE LEAK.</p> <p>*CHECK VALVE FAILURE ONLY.</p>	2	1	2
					2	*2	4

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLACK LEVEL
 COMPONENT LEVEL

BUILDING BLACK: NO. 9, ECC HYDRAULICS (EHH)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETECTION OR CORRECTIVE ACTION	SEVERITY LEVEL	PROBABILITY OF FAILURE	CRITICALITY INDEX
9.10 HYDRAULIC ACCUMULATOR (BLADDER TYPE, NITROGEN-CHARGED)	THE ACCUMULATOR ASSURES A STEADY-STATE HYDRAULIC OUTPUT FROM THE ECC HYDRAULICS AT VARIOUS LOAD DEMAND.	<p><u>MODE</u> - LOSS OF HYDRAULIC FLUID.</p> <p><u>CAUSE(S)</u></p> <p>A. EXTERNAL LEAKAGE OR RUPTURE.</p>	<p><u>EQUIPMENT</u></p> <p>EXCESSIVE LEAKAGE WOULD CONSTITUTE A SAFETY HAZARD. IT WOULD ALSO RESULT IN AN UNDER-PRESSURE CONDITION IN THE LINES, AT THE CONTROL VALVES, AND AT THE OPERATING UNITS WHICH WOULD NOT ALLOW ANY MAINTENANCE DEMILITARIZATION LINES REQUIRING THE ECC AND/OR ITS ASSOCIATION EQUIPMENT TO BE OPERATED.</p>	<p>FAILURE DETECTION THE ACCUMULATOR WILL BE INCLUDED IN THE PERIODIC MAINTENANCE PROGRAM. THE ACCUMULATOR WILL INCLUDE A PRESSURE GAUGE WHICH WILL INDICATE A LEAKAGE IN THE SYSTEM.</p>	2	1	2
		<p><u>MODE</u> - HYDRAULIC FLUID CONTAMINATED WITH NITROGEN.</p> <p><u>CAUSE(S)</u></p> <p>A. PERFORATION OF, OR PHYSICAL FAILURE OF, THE BLADDER.</p>	<p>EXCESSIVE CONTAMINATION COULD EFFECT DOWNSTREAM VALVES AND/OR OPERATING UNITS (OUT OF SPECIFICATION CHARACTERISTICS).</p>	<p>CORRECTIVE ACTION THE BLADDER SHOULD BE INCLUDED IN THE PERIODIC MAINTENANCE/INSPECTION PROGRAM.</p>	2	2	4

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
9.11 PRESSURE REDUCING VALVES (2) *	THAT PRESSURE REDUCING VALVES ARE USED TO LOWER THE SYSTEM PRESSURE TO VALVES (AND OPERATING UNITS) IMMEDIATELY DOWNSTREAM. THE AMOUNT OF REDUCTION IS SET IN ACCORDANCE WITH THE REQUIREMENTS OF THE PARTICULAR MACHINE IN THE ECC.	MODE - DOWNSTREAM PRESSURE (TO THE SEQUENCE VALVES, CONTROL VALVES AND OPERATING UNITS) OUT OF SPECIFICATION. CAUSE(S) A. OUT OF SPECIFICATION (HIGH OR LOW) OPERATION OF THE PRESSURE REDUCING VALVES.	EQUIPMENT SUCCESSFUL OPERATION OF THE PARTICULAR MACHINE IN THE ECC DEPENDS ON "IN SPECIFICATION" OPERATION OF THE PRESSURE REDUCING VALVES. OUT OF SPECIFICATION OPERATION COULD RESULT IN FAILURE/SHUTDOWN OF THE DEMILITARIZATION LINE BEING RUN AT THAT TIME. THE FOLLOWING TABLE INDICATES WHICH DOWNSTREAM CONTROL VALVES AND OPERATING UNITS ARE AFFECTED BY REDUCING VALVE OPERATION.	FAILURE DETERRENCE THE "PRESSURE REDUCING VALVES ARE ADJUSTABLE."	2	2	4
PRESSURE REDUCING VALVE	DOWNSTREAM SEQUENCE VALVE	DOWNSTREAM OPERATING UNIT (ROCKET DEMIL MACHINE)	DOWNSTREAM OPERATING UNIT (PROJECTILE DEMIL MACHINE)	DOWNSTREAM OPERATING UNIT (MINE DEMIL MACHINE)	N/A	N/A	N/A
1	V1	SAW CLAMP NO. 5	BURSTER SAM JAM NO. 2	FCR HYDRAULIC MOTOR			
1	V3	SAW CLAMP NOS. 1, 2, 4, 6, AND STAKE	BURSTER SAM JAM NO. 1	CLAMPING CYLINDER			
1	V4	NOT USED FOR THIS MACHINE	BURSTER PULL	BOOSTER RETAINING RING PULLER			
1	V6	SWINGS	NOT USED FOR THIS MACHINE	RETAINING RING COLLET EXPANDER			
2	V2	SAW CLAMPS NOS. 3 AND 7	AP PUSH AND SWINGS	PUNCH CYLINDER			
2	V15	NOT USED FOR THIS MACHINE	NOT USED FOR THIS MACHINE	OUTPUT CONVEYOR (SEGREGATOR)			
2	V16	DISCHARGE & SEGREGATOR CONVEYOR	SEGREGATOR CONVEYOR	INPUT CONVEYOR			

*THIS QUANTITY IS BEING INCREASED TO FIVE (5) VALVES.

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

BUILDING BLOCK: NO. 9. ECC HYDRAULICS (EHH)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERMINANCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
9.11 PRESSURE REDUCING VALVES (2) (CONTINUED)	DOWNSTREAM SEQUENCE VALVE DOWNSTREAM CONTROL VALVE - 2 2 V17 V5	DOWNSTREAM OPERATING UNIT (ROCKET DEMIL MACHINE) ROCKET ECC INPUT CONVEYOR NOT USED FOR THIS MACHINE. N/A	DOWNSTREAM OPERATING UNIT (PROJECTILE DEMIL MACHINE) OUTSIDE INPUT CONVEYOR SWING AND SAW PUSH N/A	DOWNSTREAM OPERATING UNIT (MORTAR DEMIL MACHINE) DATA NOT AVAILABLE 90-DEGREE MINE TURNER N/A	N/A	N/A	N/A
9.12 SEQUENCE VALVES (2)	DOWNSTREAM OF EACH PRESSURE REDUCING VALVE THE HYDRAULIC LINE DIVIDES INTO TWO LINES. ONE OF THESE TWO LINES LEADS DIRECTLY TO SOME OF THE DOWNSTREAM CONTROL VALVES. THE OTHER LINE IS ROUTED BEFORE GOING TO SOME OTHER DOWNSTREAM CONTROL VALVES. SETTING A SEQUENCE VALVE AT OTHER THAN FULL FLOW LIMITS FLOW IN THAT LINE AND MAKES THE UNINHIBITED LINE THE PREFERRED FLOW PATH. THE SEQUENCE VALVES ARE NOT PLANNED TO BE USED AT THIS TIME (BUT MAY BE LATER) AND ARE THEREFORE SET AT FULL FLOW. FOR THESE REASONS THESE VALVES ARE NOT CONSIDERED FURTHER IN THIS ANALYSIS.						

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TRW ENVIRONMENTAL SERVICES REDONDO BEACH CA

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DEMILITARIZATION PLAN; OPERATION OF THE CHEMICAL AGENT MUNITION--ETC(U)

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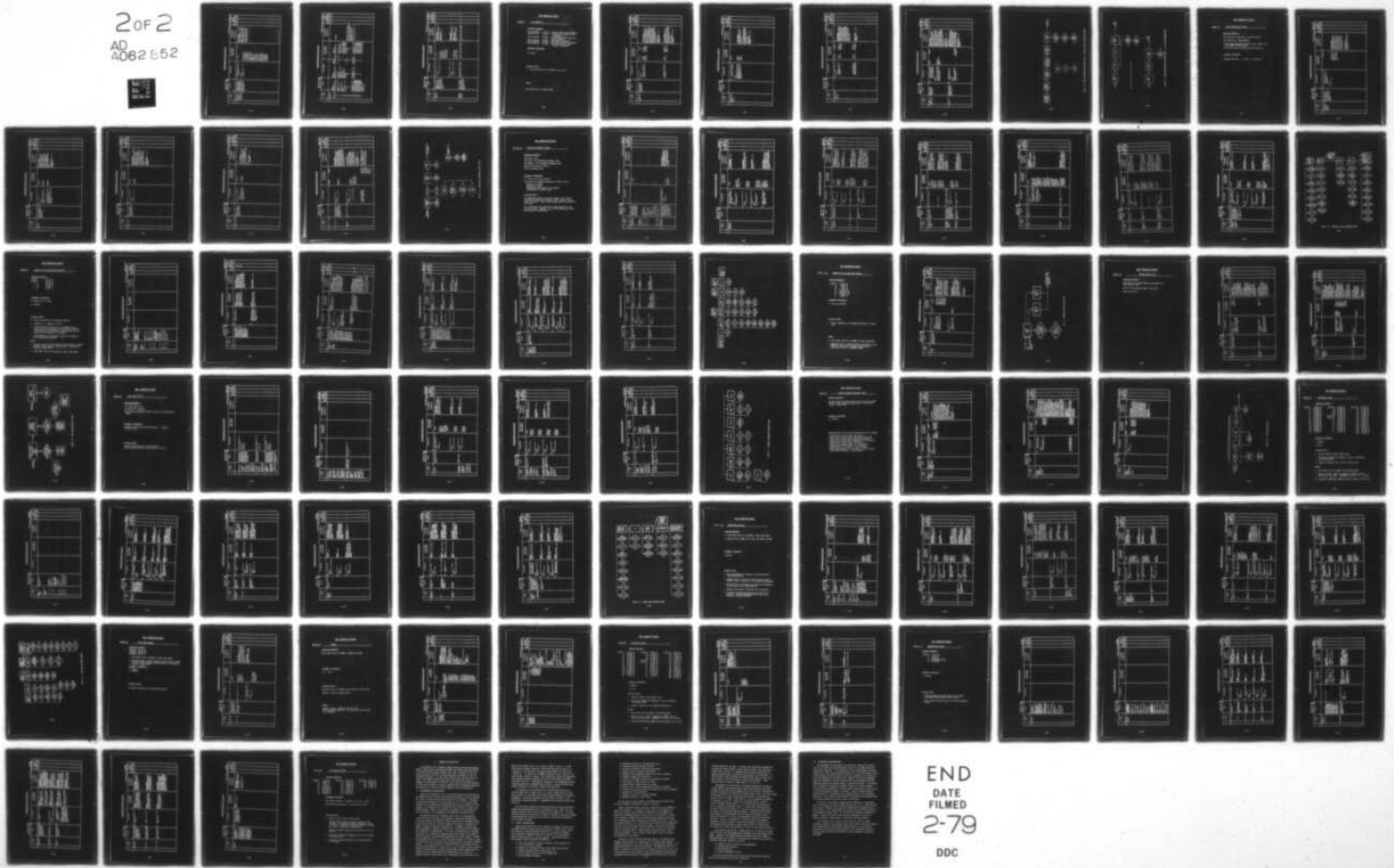
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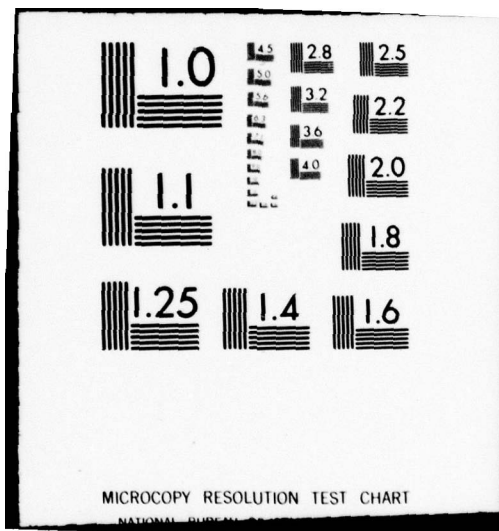
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FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

BUILDING BLOCK: NO. 9. ECC HYDRAULICS (EHM)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
9.13 CONTROL VALVES (32 UNITS POSITION 4 WAY, CLOSED CENTER, 2 UNITS POSITION 4 WAY, 3 POSITION, 3/4 INCH PORTS 35 GPM)	THESE VALVES CONTROL HYDRAULIC FLUID FLOW TO THE VARIOUS DOWNSTREAM OPERATING UNITS OF THE ECC. THE EQUIPMENT IS STALLED IN THE ECC (ROOM, PANEL, UNIT AND DIS-CHARGE CONVEYORS).	<p><u>MODE</u> - DOWNSTREAM PRESSURE TO THE OPERATING UNIT NOT CONTROLLED TO SPECIFICATION.</p> <p><u>CAUSE(S)</u> A. INTERNAL LEAKAGE OR VALVE FAILING CLOSED.</p>	<p><u>EQUIPMENT</u></p> <p>THE PROPER FUNCTION OF THE OPERATING UNIT WOULD BE LOST. THE CONSEQUENCE DEPENDS ON THE CRITICALITY OF FUNCTION PERFORMED BY THE OPERATING UNIT. THE FUNCTION OF EACH OPERATING UNIT DOWNSTREAM OF A GIVEN VALVE IS GIVEN IN THE FOLLOWING TABLE (DATA FOR VALVES 1, 2, 3, 4, 5, 6, 15, 16, AND 17 ARE GIVEN IN PARAGRAPH 9.11). THE FAILURE CONSEQUENCE AND CORRECTIVE ACTION FOR EACH OPERATING UNIT IS GIVEN IN THE PMEA ADDRESSING ITS PARTICULAR BUILDING BLOCK.</p>	<p>FAILURE DETERRENCE MOST OF THE OPERATING UNITS CONTAIN SWITCHES INDICATING THEIR PROPER FUNCTION. WHEN THE UNIT IS DETERMINED TO BE MALFUNCTIONING, AND THE TROUBLE IS TRACED TO THE VALVE, REPLACE/REPAIR WOULD BE REQUIRED. THE HYDRAULIC SYSTEM USES FILTERS TO PREVENT CONTAMINATION OF THE HYDRAULIC FLUID AND VALVE SEALS.</p>	2	*4	8

*WITHIN THE BLOCK OF 34 UNITS.

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK: NO. 9. ECC HYDRAULICS (EHP)

BUILDING BLOCK LEVEL:
COMPONENT LEVEL:

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
9.13 CONTROL VALVES (CONTINUED)						
V1, V2, V3, V4, V5, V6, V15, V16, V17 (SEE PARAGRAPH 9.11.)	DOWNSTREAM OPERATING UNIT (ROCKET DEHIL MACHINE)	DOWNSTREAM OPERATING UNIT (PROJECTILE DEHIL MACHINE)	DOWNSTREAM OPERATING UNIT (MINE DEHIL MACHINE)			
V7	NOT USED FOR THIS MACHINE	DATA NOT AVAILABLE	BOOSTER PULLER ROD			
V8	CARRIAGE	DATA NOT AVAILABLE	BOOSTER PULLER HEAD			
V9	PROPELLANT STAKER	DATA NOT AVAILABLE	PUNCH TURNER CYLINDER			
V10	NOT USED FOR THIS MACHINE	DATA NOT AVAILABLE	BOOSTER PULLER POSITIONER			
V11	SAM NOS. 1, 3, 5, AND 6	DATA NOT AVAILABLE	FPCR POSITION CYLINDERS			
V12	SAM NOS. 2 AND 4	DATA NOT AVAILABLE	NOT USED ON THIS MACHINE			
V13	PUNCH CLAMP	DATA NOT AVAILABLE	NOT USED ON THIS MACHINE			
V14	NOT USED ON THIS MACHINE	DATA NOT AVAILABLE	NOT USED ON THIS MACHINE			
V18	ECC COMPONENT	ECC COMPONENT	ECC COMPONENT			
V19	NOT USED FOR THIS MACHINE	DATA NOT AVAILABLE	VENT DOOR - SHING CYL, CLOSE CYL			
V20	NOT USED FOR THIS MACHINE	DATA NOT AVAILABLE	ITEM IN, VERT, ITEM OUT, HIGH EXP OUT DRS-PIN CYL (4)			
V21	NOT USED FOR THIS MACHINE	DATA NOT AVAILABLE	ITEM IN, VERT, ITEM OUT, HIGH EXP OUT DRS-PIN CYL (4)			
V22	NOT USED FOR THIS MACHINE	DATA NOT AVAILABLE	ITEM IN DR-SHING CYL, CLOSE CYL			
V23	NOT USED FOR THIS MACHINE	DATA NOT AVAILABLE	PERSONNEL DOOR - PIN CYL (3)			
V24	NOT USED FOR THIS MACHINE	DATA NOT AVAILABLE	PERSONNEL DOOR - SHING CYL (2)			
V25	NOT USED FOR THIS MACHINE	DATA NOT AVAILABLE	EXTERIOR PERSONNEL DOOR LOCK CYL (4)			
V26	ECC COMPONENT	ECC COMPONENT				
V27	NOT USED FOR THIS MACHINE	DATA NOT AVAILABLE	NOT USED ON THIS MACHINE			
V28	NOT USED FOR THIS MACHINE	DATA NOT AVAILABLE	NOT USED ON THIS MACHINE			
V29	NOT USED FOR THIS MACHINE	DATA NOT AVAILABLE	NOT USED ON THIS MACHINE			
V30	NOT USED FOR THIS MACHINE	DATA NOT AVAILABLE	NOT USED ON THIS MACHINE			
V31	NOT USED FOR THIS MACHINE	DATA NOT AVAILABLE	NOT USED ON THIS MACHINE			
V32	NOT USED FOR THIS MACHINE	DATA NOT AVAILABLE	NOT USED ON THIS MACHINE			
V33	NOT USED FOR THIS MACHINE	DATA NOT AVAILABLE	NOT USED ON THIS MACHINE			
V34	NOT USED FOR THIS MACHINE	DATA NOT AVAILABLE	NOT USED ON THIS MACHINE			
V35	ITEM ROLLERS (4), P20 ROLLER POSITIONING SADDLE	DATA NOT AVAILABLE	NOT USED ON THIS MACHINE			

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK: NO. 9. ECC HYDRAULICS (EHP)

BUILDING BLOCK LEVEL:
 COMPONENT LEVEL:

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETECTION OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
9.14 EXPLOSION PROTECTION VALVES (2)	THESE VALVES, WHICH ARE NORMALLY OPEN, CLOSE AUTOMATICALLY IN THE EVENT OF AN EXPLOSIVE INCIDENT IN THE ECC THEREBY PROTECTING THE ECC HYDRAULIC RESERVOIR FROM THE EFFECTS OF THE EXPLOSION.	<u>MODE</u> - THE VALVE/VALVES FAIL CLOSED. <u>CAUSE(S)</u> A. ELECTRICAL/MECHANICAL FAILURE.	<u>EQUIPMENT</u> THE ECC HYDRAULIC FLOW PATH WOULD BE BLOCKED, REQUIRING THE SHUT-DOWN OF THE ECC. EQUIPMENT INSTALLED IN THE ECC, AND THE ECC INPUT AND DISCHARGE CONVEYORS.	FAILURE DETECTION THESE VALVES WILL BE INCLUDED IN THE PERIODIC MAINTENANCE PROGRAM. <u>CORRECTIVE ACTION</u> REPAIR/REPLACE THE VALVES.	1	1	1
9.15 PROJECTILE DISASSEMBLY FACILITY HYDRAULICS	THIS SYSTEM (SIMILAR TO THE ECC HYDRAULICS) SUPPLIES HYDRAULIC POWER TO THE PROJECTILE PUMP AND ORBIT EQUIPMENT AT THE BULK TRENCH FACILITY.	<u>MODE</u> - THE VALVE/VALVES FAIL OPEN. <u>CAUSE(S)</u> A. VALVE ELECTRICAL/MECHANICAL FAILURE. SYSTEM SIMILAR TO THE ECC HYDRAULICS (REFERENCE PARAGRAPHS 9.1 THROUGH 9.14).	POSSIBLE DAMAGE TO THE ECC HYDRAULIC SYSTEM IN THE EVENT OF EXPLOSIVE INCIDENT IN THE ECC. SYSTEM SIMILAR TO THE ECC HYDRAULICS (REFERENCE PARAGRAPHS 9.1 THROUGH 9.14).	FAILURE DETECTION THESE VALVES WILL BE INCLUDED IN THE PERIODIC MAINTENANCE PROGRAM. <u>CORRECTIVE ACTION</u> REPAIR THE DAMAGED ECC HYDRAULIC SYSTEM AND REPAIR/REPLACE THE VALVES. SYSTEM SIMILAR TO THE ECC HYDRAULICS (REFERENCE PARAGRAPHS 9.1 THROUGH 9.14).	2	2	4
					N/A	N/A	N/A

FMEA INFORMATION SOURCES

BB NO. 9

ECC HYDRAULICS

DRAWINGS/DOCUMENTS :

TCDS 08-308-02	1 May 75	Hydraulic Power Pack (Schematic)
TCDS 02-311-26	10 May 75	ECC Hydraulic Schematic (Door Mechanisms)
TCDS 06-306-04	No Date	Rocket Demil System, Hydraulic Piping Schematic
TCDS 06-306-50	No Date	RDM Hydraulic Schematic
TCDS 15-607-03	3 Feb 75	PDM System, Hydraulic Schematic
TCDS 25-607-02	No Date	M23 Mine Machine Systems Hydraulic Schematic

PERSONNEL REFERENCED :

Tim Thomas

CRITERIA NOTES :

o Visual inspection of incomplete unit on site

OTHER :

Draft Demil Plan for CAMDS (TEAD)

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL **1**
COMPONENT LEVEL **7**

AGENT DESTRUCTION
BUILDING BLOCK: NO. 13. SYSTEM (ADS)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	PROBABILITY OF FAILURE	CRITICALITY INDEX
13.1 VX DETOXIFICATION/NEUTRALIZATION AREA	VX DETOXIFICATION BY ACID CHLORINATION FOLLOWED BY CAUSTIC NEUTRALIZATION.	MODE - VX/CHLORINE FIRE. CAUSE(S) A. C1, ADDED TO REACTOR VESSEL CONTAINING VX, BUT WITH INSUFFICIENT OR NO HCl PRESENT. B. VX AND HCl INSUFFICIENTLY MIXED PRIOR TO C1 ADDITION TO THE REACTOR VESSEL.	<u>EQUIPMENT</u> DAMAGE TO EQUIPMENT SHUTDOWN AND MAINTENANCE. <u>PERSONNEL</u> POTENTIAL TOXIC RELEASE TO SCRUBBER AND CHARCOAL FILTER SYSTEM.	A. FAILURE DETERRENCE THE SIX STEP AUTOMATED SEQUENCE IS SUFFICIENTLY INTERLOCKED (I.E., TANK SELECTS, HCl ADDITION SEQUENCE PREVENTS REACTOR SELECTION) TO PREVENT THE PROGRESSIVE EFFECT OF C1. HCl SEQUENCE IS ALSO SUCH THAT C1 CANNOT BE ADDED TO THE BATCH TANK UNTIL THE VX AND HCl ARE HOMOGENIZED. FINALLY SHOULD ALL PRIOR INTERLOCKS FAIL, A REACTOR HIGH TEMPERATURE OVERRIDE OF C1 ADDITION IS PROVIDED. THE OCCURRENCE OF THIS MODE IS REGARDED AS EXTREMELY REMOTE. CORRECTIVE ACTION NO FURTHER CORRECTIVE ACTION IS RECOMMENDED. B. FAILURE DETERRENCE ACTAYTOR OPERATION INTERLOCKED TO PRECLUDE INITIATION OF STEP 6 (C1 ADDITION). REACTOR HIGH TEMPERATURE OVERRIDE OF C1 ADDITION IS PROVIDED. THE OCCURRENCE OF THIS MODE IS REGARDED AS VERY REMOTE. CORRECTIVE ACTION NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.	3	1	3
			<u>SHUTDOWN AND MAINTENANCE.</u> POTENTIAL TOXIC RELEASE TO SCRUBBER AND CHARCOAL FILTER SYSTEM.		2	1	2

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL: **7**
 COMPONENT LEVEL: **2**

AGENT DESTRUCTION
 BUILDING BLOCK: NO. 13. SYSTEM (AOS)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETECTION OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
13.1 VX DETOXIFICATION/ NEUTRALIZATION AREA (CONTINUED)		<p><u>MODE</u> - HIGH TEMPERATURE OR RUNAWAY REACTION (ACID CHLORINATION).</p> <p><u>CAUSE(S)</u></p> <p>A. COOLING WATER SYSTEM FAILURE - PUMPS (2), VALVE OR FLOW CONTROL REGULATOR AND FAILURE OF REACTOR HIGH TEMPERATURE OVERRIDE INTERLOCK AND OPERATOR FAILS TO TAKE ACTION.</p>	<p><u>EQUIPMENT</u></p> <p>POTENTIAL EQUIPMENT DAMAGE SHUTDOWN AND MAINTENANCE.</p>	<p>A. FAILURE INTERFERENCE HIGH REACTOR TEMPERATURE INTERLOCK TO PREVENT FURTHER Cl₂ ADDITION. BOTH PUMPS WOULD HAVE TO FAIL (COOLING TOWER).</p> <p>SEVERAL ITEMS (INCLUDING INTERLOCK FAILURE AND OPERATOR INTERLOCK) MUST OCCUR IN SERIES, THUS THE OCCURRENCE OF THIS MODE IS REGARDED AS EXTREMELY RARE.</p> <p>CORRECTIVE ACTION BY FURTHER CORRECTIVE ACTION IS RECOMMENDED.</p>	2	1	2

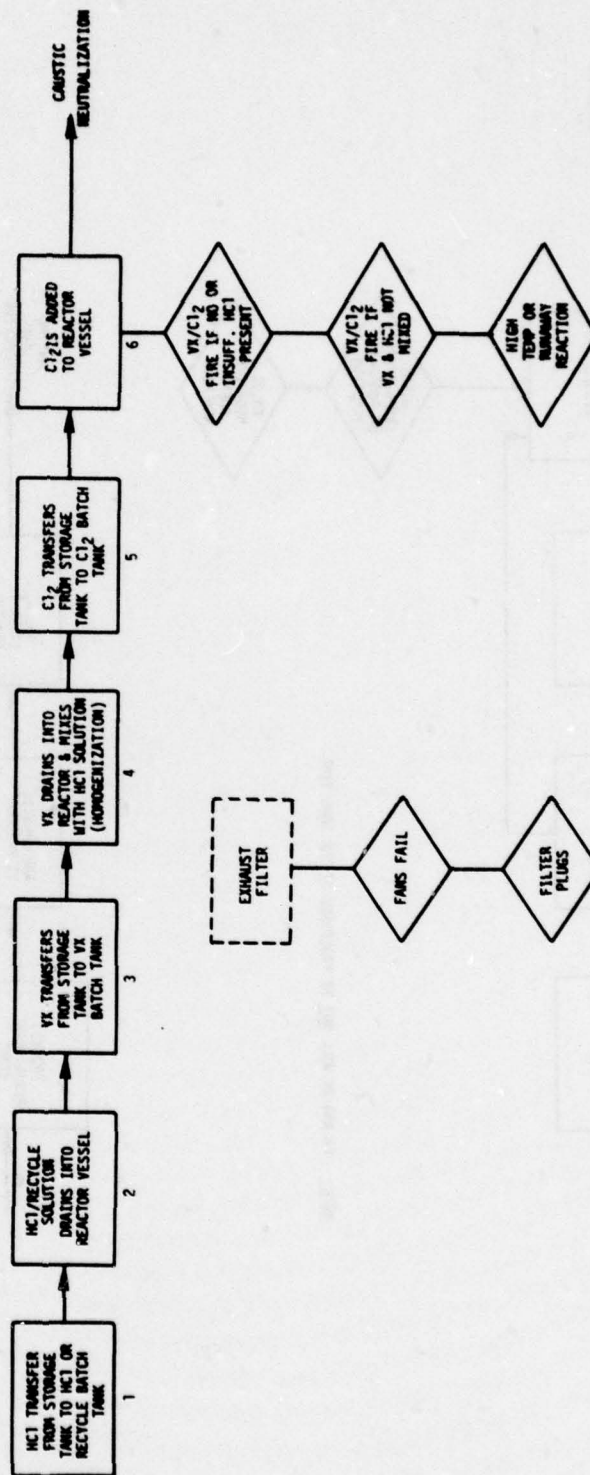
FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL: **E** AGENT DESTRUCTION
 COMPONENT LEVEL: **E** SYSTEM (AOS)

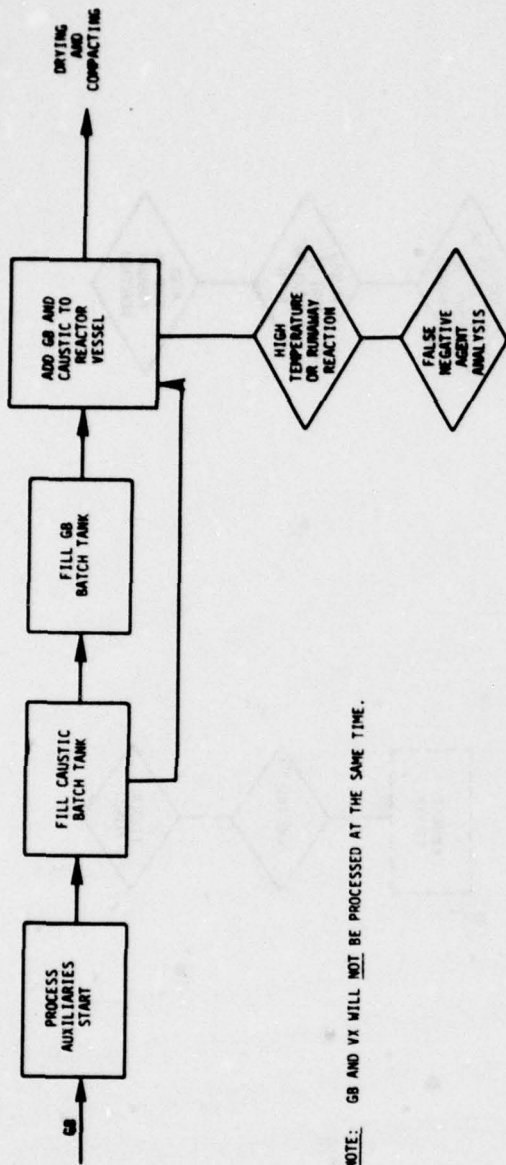
COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSOANEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
13.1 VX DETOXIFICATION/ NEUTRALIZATION AREA (CONTINUED)		<p><u>MODE</u> - FAILURE OF EXHAUST SYSTEM. <u>CAUSE(S)</u></p> <p>A. BOTH EXHAUST FANS FAIL AND DIFFERENTIAL PRESSURE ALARMS FAILS.</p> <p>B. EXCESSIVE PRESSURE BUILDUP IN FILTERS ALARMS FAILURE AND OPERATOR FAILS TO PERFORM ROUTINE MAINTENANCE.</p>	<p><u>EQUIPMENT</u></p> <p>SHUTDOWN AND MAINTENANCE.</p> <p><u>PERSOANEL</u></p> <p>POTENTIAL DIFFUSION OF TOXIC VAPORS OUT OF TOXIC AREA.</p> <p>SHUTDOWN AND MAINTENANCE. POTENTIAL DIFFUSION OF TOXIC VAPORS OUT OF TOXIC AREA.</p>	<p>FAILURE DETERRENCE DUAL EXHAUST BLOWERS (ONE FOR EACH DOUBLE CAPACITY FILTER BANK) ARE PROVIDED WITH ADEQUATE WARNING SHOULD ONE BLOWER FAIL. ALSO FOR THE CASE OF PRESSURE BUILDUP (FILTER PLUGGING) THE BUILDUP WOULD BE SLOW ALLOWING ADEQUATE TIME FOR REPLACEMENT. THE SERIES FAILURE OF BOTH BLOWERS, ALARMS, BACKUP SYSTEM PLUS FAILURE TO INITIATE AN EMERGENCY SHUTDOWN RENDERS THIS MODE AS BEING EXTREMELY REMOTE.</p> <p>CORRECTIVE ACTION NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.</p>	3	1	3

FAILURE MODE AND EFFECT ANALYSIS

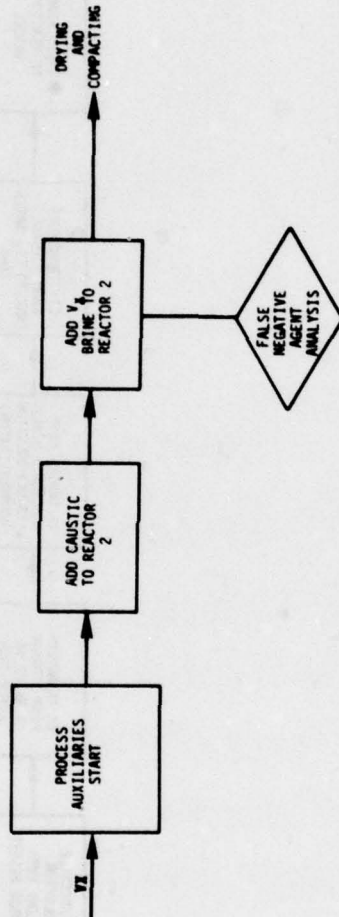
BUILDING BLOCK LEVEL <input checked="" type="checkbox"/> A		AGENT DESTRUCTION SYSTEM (AS)					
COMPONENT LEVEL <input type="checkbox"/> B							
COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERMINANCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
13.2 GB AGENT DETOXIFICATION NEUTRALIZATION AREA	CAUSTIC (10% NaOH AQUEOUS SOLUTION) NEUTRALIZATION OF NERVE AGENT GB.	<u>MODE</u> - HIGH TEMPERATURE OR RUNAWAY REACTION AFTER GB AND CAUSTIC ARE SIMULTANEOUSLY ADDED TO DETOX REACTOR FROM INDIVIDUAL BATCH TANKS. <u>CAUSE(S)</u> A. FAILURE OF RECIRCULATION WATER FLOW OR PUMP, AND GB FEED VALVE OPERATION, AND FAILURE OF AUTOMATIC INTERLOCK SYSTEM.	<u>EQUIPMENT</u> SHUTDOWN AND MAINTENANCE POSSIBLE EQUIPMENT DAMAGE.	FAILURE DETERMINANCE INTERLOCK FEATURE BETWEEN COOLING WATER JACKET TEMPERATURE, REACTOR TEMPERATURE AND THE CLOSING OF THE GB VALVE IN THE BATCH TANK AUTOMATIC PROVISION FOR INCREASING H ₂ O FLOW TO JACKET. THERE IS A REACTOR INTERLOCKS FAIL. THERE IS A REACTOR HIGH TEMPERATURE OVERRIDE OF AGENT BUILT INTO THE SYSTEM LOGIC. IN ADDITION, MANUAL CAPABILITY OF INCREASING WATER FLOW AND DECREASING GB FLOW IS PROVIDED. THE CONSIDERABLE NUMBER OF IN SERIES FAILURES THAT MUST OCCUR RENDER THIS MODE AS BEING EXTREMELY REMOTE. CORRECTIVE ACTION: NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.	2	1	2
13.3 GB OR VX AGENT ANALYSIS	TO ANALYZE FOR PRESENCE OF AGENT AFTER VX ACID CHLORINATION, GB CAUSTIC NEUTRALIZATION, ETC.	<u>MODE</u> - AGENT ANALYSIS INDICATES NONE PRESENT WHEN IN FACT THERE IS. <u>CAUSE(S)</u> A. PROCESS FAILS TO COMPLETELY DETOXYFIFY BUT SUBSEQUENT ANALYSIS SHOWS NEGATIVE RESULTS.	POSSIBLE EXPOSURE OF TOXIC MATERIAL TO PERSONNEL.	FAILURE DETERMINANCE LABORATORY TESTS HAVE INDICATED THAT SHOULD A BATCH OF AGENT COMPLETE THE REQUIRED CYCLE THE CHANCES OF HAVING LIVE AGENT PRESENT IS VERY REMOTE. IN ADDITION THE ANALYSIS OF THE SAMPLE "FAILS" IN A SAFE MANNER; I.E., THERE WILL BE FALSE POSITIVE BUT NOT FALSE NEGATIVE READINGS. CORRECTIVE ACTION: NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.	3	1	3



BB NO. 13 AGENT DESTRUCTION SYSTEM (ADS) - (VX/GB CAUSTIC NEUTRALIZATION)



NOTE: GB AND VX WILL NOT BE PROCESSED AT THE SAME TIME.



BB NO. 13 AGENT DESTRUCTION SYSTEM (ADS) - (VX ACID CHLORINATION)

FMEA INFORMATION SOURCES

BB NO. 13

AGENT DESTRUCTION SYSTEM

DRAWINGS/DOCUMENTS:

Microprocessor Logic Dwg. No. ECDS13-851-02

P&ID Drawing No. ECDS13-660-06

Sterns-Roger Conceptual Process Design of ADS I & II
and Concept Design Changes

Preliminary Hazards Analysis of ADS (Hercules)

PERSONNEL REFERENCED:

Edgewood Personnel - J. Bartel, T. Gervasoni

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

BUILDING BLOCK: W. 14. SYSTEM (ETS)
 EXPLOSIVE TREATMENT

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
14.1 ROUTINE MAINTENANCE OF MECHANICAL FILTERS AND CHARCOAL ADSORPTION COLUMNS	TO PERIODICALLY REMOVE AND REPLACE COLUMN FILTER MATERIALS (POLY BAGS AND CHARCOAL). THE SPENT MATERIALS ARE THEN SENT TO THE DEACTIVATION FURNACE/ SCRUBBER.	<p><u>MODE</u> - SPILLAGE OF SLUDGE SATURATED BAGS OR SPENT DECON SATURATED CHARCOAL DURING MANUAL TRANSPORT TO THE FURNACE AREA.</p> <p><u>CAUSE(S)</u> A. OPERATOR ERROR.</p>	<p><u>PERSONNEL</u></p> <p>RELEASE OF EXPLOSIVE SLUDGE AND/OR SPENT DECON TO OUTSIDE AREA (DURING TRANSIT TO FURNACE, OTHERWISE SPILL IS TO SUMP AREA).</p>	<p>FAILURE DETERRENCE THE SLUDGE IS NOT EXPLOSIVELY SENSITIVE (AS DEMONSTRATED BY EXTENSIVE TESTING). HOWEVER, THE EXPLOSIVE SLUDGE SHOULD NOT BE ALLOWED TO DRY OUT. THE VACUUM METHOD OF SHEEPING CHARCOAL OUT OF COLUMNS MINIMIZES SPILLAGE. (VENT IS TO FACILITY AIR FILTER SYSTEM IN ANY CASE.) RELEASED MATERIAL HAS BEEN DETOXIFIED. PERSONNEL WEARING LEVEL B CLOTHING.</p> <p>CORRECTIVE ACTION IT IS RECOMMENDED THAT SPILLAGE GOING TO THE SUMP BE RECYCLED BACK THROUGH THE ETS.</p>	2	2	4

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

BUILDING BLOCK: NO. 14. SYSTEM (ETS) EXPLOSIVE TREATMENT

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
14.2 MECHANICAL FILTER	FIRST LINE MECHANICAL FILTER OF SLUDGE FROM ECC (LARGE PARTICLES OF EXPLOSIVE, METAL, FIBER GLASS, ETC.).	<p>MODE - FILTER PLUGS. CAUSE(S) A. EXCESSIVE SLUDGE BUILDUP. FAILURE TO PERFORM ROUTINE MAINTENANCE. B. AN ARTIFICIAL PLUGGING OCCURS DUE TO OPERATOR ERROR - I.E., DURING BAG REPLACEMENT THE OPERATOR FAILS TO SWITCH TO THE OTHER FILTER. (BOTH FILTER INLET VALVES CLOSED.)</p>	<p>EQUIPMENT SHUTDOWN; AND MAINTENANCE. SHUTDOWN AND MAINTENANCE.</p>	<p>FAILURE DETERRENCE THE FILTER BAGS ARE REPLACED PERIODICALLY. HOWEVER, SHOULD AN EXCESSIVE PRESSURE DROP OCCUR AN INTERLOCK AND ALARM IS PROVIDED WITH THE ECC. IN ANY CASE, THE PRESSURE BUILDUP SHOULD BE SLOW (EXCEPT WHEN VALVES ARE INADVERTENTLY CLOSED) ALLOWING MANUAL OPERATION TO BE PERFORMED IN A TIMELY MANNER. CORRECTIVE ACTION NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.</p>	2	1	2

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

BUILDING BLOCK: NO. 14. SYSTEM (ETS) EXPLOSIVE TREATMENT

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
14.3 SURGE TANK	HANDLES FLOW OF SPENT DECON BETWEEN MECHANICAL FILTERS AND ACTIVATED CHARCOAL FILTERS.	<p>MODE - SURGE TANK OVERFLOW.</p> <p>CAUSE(S)</p> <p>A. HIGH LEVEL SENSOR FAILURE.</p>	<p>EQUIPMENT</p> <p>SHUTDOWN AND MAINTENANCE.</p>	<p>FAILURE DETERRENCE HIGH LEVEL ALARM LEVEL INDICATION INTERLOCKED WITH FILTER INLET VALVE AND SURGE TANK OUTLET VALVE SHOULD MATERIAL BE RELEASED PERSONNEL WOULD TEST FOR TOXIC CONTAMINATION AND WEAR PROTECTIVE LEVEL & CLOTHING IF REQUIRED. SYSTEM IS DESIGNED SUCH THAT THE SPENT DECON IS RELATIVELY NON-TOXIC. (HOWEVER, THIS IS NOT ANALYTICALLY CONFIRMED - HENCE CAUTION OBSERVED WHEN HANDLING SPILLS.)</p> <p>CORRECTIVE ACTION NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.</p>	1	2	2

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL **1**
 COMPONENT LEVEL

EXPLOSIVE TREATMENT
 BUILDING BLOCK: NO. 14. SYSTEM (ETS)

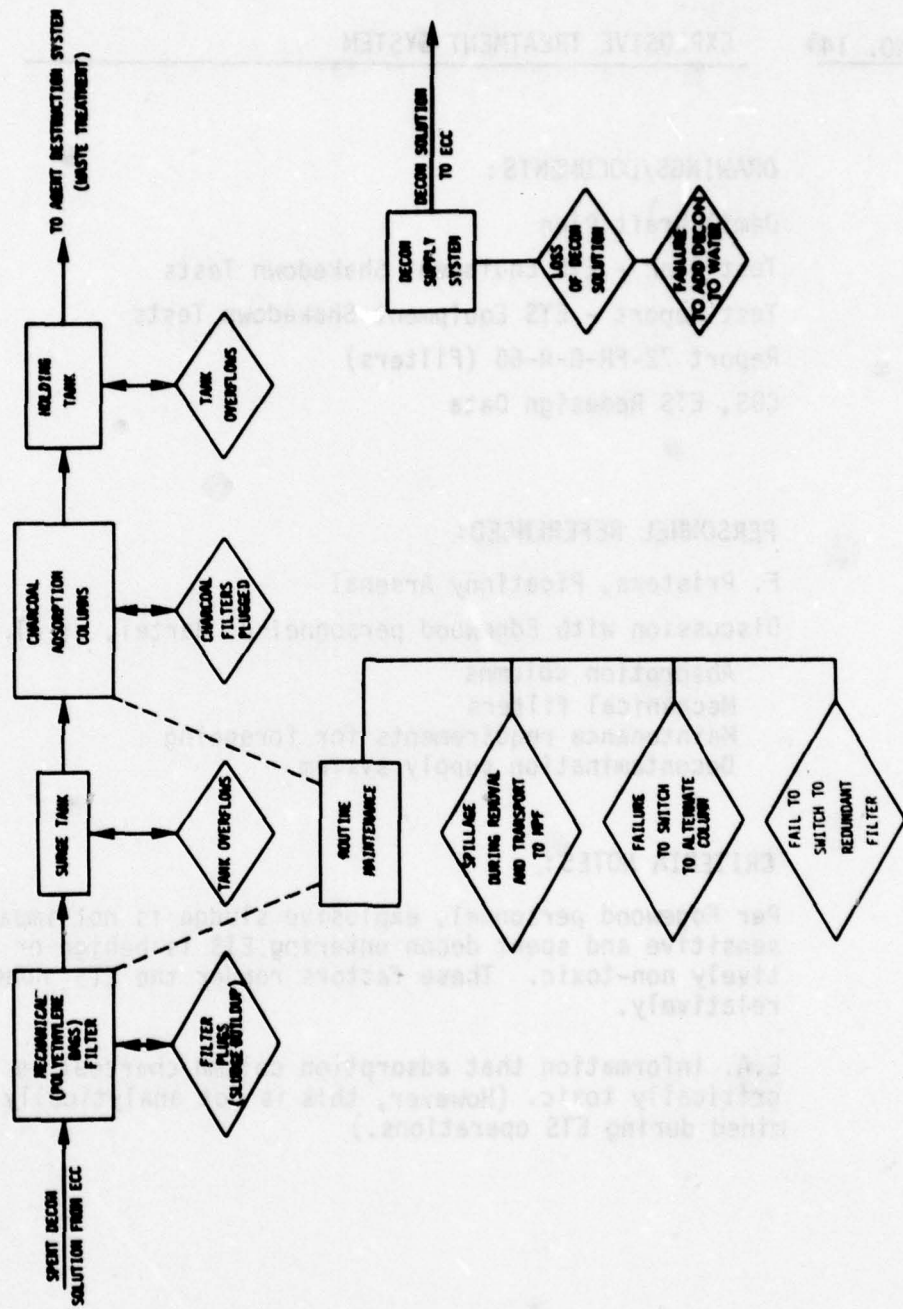
COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETECTION OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
14.4 ABSORPTION COLUMNS	ABSORBS DISSOLVED MATERIALS (EXPLOSIVES) TO PREVENT EXPLOSIVE DUST FROM BEING FORMED IN DRYER.	<p><u>MODE</u> - FILTER(S) SATURATED.</p> <p><u>CAUSE(S)</u></p> <p>A. EXCESSIVE BUILDUP. FAILURE TO MANUAL SWITCH TO THIRD COLUMN, SPENT DECON BYPASSES COLUMNS.</p>	<p><u>EQUIPMENT</u></p> <p>SHUTDOWN AND MAINTENANCE.</p>	<p>FAILURE DETECTION EXCESSIVE PRESSURE DROP ALARM TWO COLUMNS IN OPERATION (IN SERIES) THIRD ONE USED WHEN ROUTINE MAINTENANCE IS PERFORMED ON ONE COLUMN. THE COLUMNS ARE SWITCHED AND CHARCOAL REPLACED ON A PERIODIC BASIS.</p> <p><u>CORRECTIVE ACTION</u> NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.</p>	1	2	2

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

BUILDING BLOCK: NO. 14. SYSTEM (EIS)
 EXPLOSIVE TREATMENT SYSTEM (EIS)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
14.5 HOLDING TANK	HOLD SPENT LIQUID THAT HAS PASSED THROUGH THE FILTER SYSTEM PRIOR TO BEING PUMPED TO THE AGENT DESTRUCTION SYSTEM UNTIL A SUFFICIENT AMOUNT IS PRESENT.	MODE - HOLD TANK OVERFLOW. CAUSE(S) A. HIGH LEVEL ALARM FAILS.	<u>EQUIPMENT</u> SHUTDOWN AND MAINTENANCE.	FAILURE DETERRENCE AUTO SHUTDOWN OF THE TRILET SUPPLY TO THE TANK. SHOULD OVERFLOW/ SPILLAGE OCCUR THE SPENT DECON IS RELATIVELY NON-TOXIC AND MAINTENANCE PERSONNEL ARE WEARING PROTECTIVE LEVEL B CLOTHING. (HOWEVER, THE NON-TOXICITY IS NOT ANALYTICALLY CONFIRMED; HENCE CAUTION IS MAINTAINED WHEN HANDLING SPILLS.)	1	2	2
14.6 DECON SUPPLY SYSTEM	PROVIDE DECON SOLUTION TO ECC.	MODE - LOSS OF DECON SOLUTION. CAUSE(S) A. DECON SUPPLY PUMP FAILURE. B. FAILURE TO FILL SUPPLY TANK. C. FAILURE TO ADD DECON MATERIAL (SODIUM CARBONATE, DURING GB OPERATIONS) TO THE WATER - OPERATOR ERROR.	<u>EQUIPMENT</u> SHUTDOWN AND MAINTENANCE. POTENTIAL DAMAGE TO HEATER AND AGITATOR. SHUTDOWN AND MAINTENANCE. <u>PERSONNEL</u> SPENT DECON WOULD BE MORE TOXIC AS RECEIVED BY THE ECC. HOWEVER, THIS DOES NOT PRESENT A RELEASE OF AGENT TO THE OUTSIDE AREA.	FAILURE DETERRENCE FLOW IS TO ECC ON DEMAND. ECC DECON LEVEL IS MONITORED AND INTERLOCKED TO SAFE MODE SHUTDOWN. THE SUPPLY TANK IS TO BE EQUIPPED WITH A LOW LEVEL ALARM. NO RELEASE OF TOXIC MATERIAL IS ANTICIPATED. CORRECTIVE ACTION NO FURTHER CORRECTIVE ACTION IS RECOMMENDED. ROUTINE PROCEDURES WILL BE AVAILABLE ON MEASUREMENT WITH ALARM DOES NOT APPEAR TO BE OF CRITICAL NATURE AS PLAIN WATER POSSESSES SOME DECON CAPABILITY.	2	1	2



BB NO. 14. EXPLOSIVE TREATMENT SYSTEM (ETS)

FMEA INFORMATION SOURCES

BB. NO. 14

EXPLOSIVE TREATMENT SYSTEM

DRAWINGS/DOCUMENTS:

Demil Draft Plan
Test Plan - ETS Equipment Shakedown Tests
Test Report - ETS Equipment Shakedown Tests
Report 72-FR-G-R-66 (Filters)
CDS, ETS Redesign Data

PERSONNEL REFERENCED:

F. Pristera, Picatinny Arsenal
Discussion with Edgewood personnel-J. Bartel, et al.
Absorption columns
Mechanical filters
Maintenance requirements for foregoing
Decontamination supply system

CRITERIA NOTES:

Per Edgewood personnel, explosive sludge is not impact-sensitive and spent decon entering ETS is benign or relatively non-toxic. These factors render the ETS noncritical relatively.

E.A. information that adsorption column charcoal is not critically toxic. (However, this is not analytically determined during ETS operations.)

FAILURE MODE AND EFFECT ANALYSIS

PROJECTILE DENIL
MACHINE (PCN)

ENLARGING BLACK LEVEL
COMPONENT LEVEL

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	PROBABILITY OF FAILURE	CRITICALITY INDEX
15.2 PROJECTILE ECC INPUT CONVEYOR (CONTINUED)		<p><u>MODE</u> - FAILURE OF THE CONVEYOR TO MOVE IN THE ECC AND MATE WITH THE INTERMEDIATE CONVEYOR OR DENIL MACHINE.</p> <p><u>CAUSE(S)</u></p> <p>A. FAILURE OF THE CONVEYOR POSITIONING MECHANISM.</p>	<p><u>EQUIPMENT</u></p> <p>FAILURE TO MATE CORRECTLY WILL NOT ALLOW THE NEXT STEP IN THE PROCESS TO BEGIN.</p>	<p>FAILURE DETERRENCE LIGHTY SWITCHES INDICATE PROPER ALIGNMENT AND MATING.</p>	1	4	4
		<p><u>MODE</u> - FAILURE TO CONVEY MUNITION.</p> <p><u>CAUSE(S)</u></p> <p>A. ACTUATION MOTOR FAILURE.</p>	<p>MUNITIONS LINE INTERRUPTION WHILE FAILURE IS CORRECTED.</p>	<p>FAILURE DETERRENCE LIGHTY SWITCHES INDICATE ARRIVAL OF MUNITION WITH SENSORS INSURING DETECTION OF MAJOR FAILURE.</p>	1	4	4
		<p><u>MODE</u> - FAILURE OF CONVEYOR TO RETRACT FROM THE ECC.</p> <p><u>CAUSE(S)</u></p> <p>A. FAILURE OF THE CONVEYOR POSITIONING MECHANISM.</p>	<p>FAILURE TO RE-TRACT CORRECTLY WILL NOT ALLOW THE NEXT STEP IN THE PROCESS TO BEGIN.</p>	<p>FAILURE DETERRENCE LIGHTY SWITCHES INDICATE PROPER RETRACTION.</p>	1	4	4
		<p><u>MODE</u> - POSSIBLE CONTAMINATION OF THE CONVEYOR AT THE INTERMEDIATE CONVEYOR OR DENIL MACHINE CONTACT POINT.</p>	<p>CONTAMINATED HARDWARE (CONVEYORS) ARE RE-TRACTED INTO THE IMPACT AREA (BLOCK).</p>	<p>FAILURE DETERRENCE LIGHTY SWITCHES MAINTAINED AT A NEGATIVE PRESSURE RELATIVE TO THE BALANCE OF THE IMPACT AREA. ALERT SENSORS ARE LOCATED IN THE IMPACT AREA. STANDARD OPERATING PROCEDURES FOR PERSONNEL MINIMIZE POTENTIAL FOR EXPOSURE.</p>	2	4	8

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL: <input type="checkbox"/>		PROJECTILE DEMIL MACHINE (PDM)					
COMPONENT LEVEL: <input checked="" type="checkbox"/>		BUILDING BLOCK: NO. 15. MACHINE (PDM)					
COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
15.2 PROJECTILE ECC. INPUT CONVEYOR (CONTINUED)	POWERED ROLLERS AND PUSH CYLINDER(S) MOVE MUNITIONS TO DEMIL STATIONS.	<u>MODE</u> - POWERED ROLLER FAILURE. <u>CAUSE(S)</u> A. ELECTRIC MOTOR FAILURE.	<u>EQUIPMENT</u> MUNITION LINE INTERRUPTION UNTIL FAILURE IS CORRECTED.	FAILURE DETERRENCE THE CONVEYOR OR MACHINE HAS A SENSOR TO DETECT PROPER TRANSFER OF THE MUNITION TO THE PDM. MOTOR FAILURE WOULD BE DETECTED BY THE ABSENCE OF THIS TRANSFER, HALTING THE DEMIL PROCEDURE.	1	4	4
15.3 HYDRAULIC CLAMPS	HOLD PROJECTILE DURING SAWING.	<u>MODE</u> - PUSH CYLINDER FAILURE. <u>CAUSE(S)</u> A. HYDRAULIC FAILURE.	MUNITION LINE INTERRUPTION UNTIL FAILURE IS CORRECTED.	FAILURE DETERRENCE LIMIT SWITCHES SENSE BOTH UP AND RETRACTED PUSH CYLINDER POSITIONS	1	4	4
15.4 PROJECTILE SAW	CUTS THE FUSE OR HOSE CLOSURE PLUG OFF THE PROJECTILE.	<u>MODE</u> - FAILURE TO CLAMP AND/OR HOLD PROPERLY <u>MODE</u> - FAILURE OF THE SAW TO SECTION OR COMPLETELY SECTION THE PROJECTILE. <u>CAUSE(S)</u> A. SAW BLADE FAILURE, MOTOR FAILURE, ETC.	ATTEMPT TO SAW ON AN UNRESTRICTED PROJECTILE COULD RESULT IN THE ITEM FALLING OFF THE MACHINE. THE BURSTER CANNOT BE REMOVED (AT THE NEXT STATION).	<u>CORRECTIVE ACTION</u> LIMIT SWITCHES ARE RECOMMENDED TO BE INCLUDED ON THE PDM TO INDICATE CLOSURE. FAILURE OF THE CONTROL SYSTEM TO RECEIVE THIS SIGNAL WOULD THEN RESULT IN SHUTDOWN OF THE PDM. FAILURE DETERRENCE MONITORING OF THE SAW MOTOR CURRENT WOULD INDICATE IMPROPER SAW OPERATION. A LIMIT SWITCH INDICATES IF THE SAW HAS COMPLETED ITS TOTAL STROKE. THE SAW LOWERS AT A RATE OF 1/8-INCH PER SECOND. FAILURE OF THE CONTROL SYSTEM TO RECEIVE THIS SIGNAL WILL RESULT IN SHUTDOWN OF THE PDM; ANOTHER LIMIT SWITCH INDICATES WHEN THE SAW HAS RETRACTED.	1	2	2

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL <input type="checkbox"/>		PROJECTILE DEMIL EQUIPMENT LEVEL <input checked="" type="checkbox"/>		PROJECTILE DEMIL MACHINE (PDM)			
COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETECTION OR CORRECTIVE ACTION	SEVERITY LEVEL	NUMBER OF FAILURE MODES	CRITICALITY INDEX
15.5 CUTTING OIL/TANK AND PUMP FOR PROJECTILE SAM STATION	PROVIDES COOLING FLUIDS FOR THE SAM DURING CUTTING.	<u>MODE</u> - PUMP FAILURE (IMOPERATIVE).	<u>EQUIPMENT</u> POSSIBLE EXPLOSIVE INCIDENT OR FIRE DUE TO EXCESSIVE HEAT GENERATED DURING SAMING WITHOUT COOLANT.	FAILURE DETERRENCE MONITORING OF SAM CURRENT WILL INDICATE EXCESSIVE LOAD REQUIREMENTS ON THE SAM. ALSO, A COOLANT FLOW MONITORING DEVICE WILL BE USED TO ASSESS COOLANT SYSTEM OPERATIONS.	3	2	6
15.6 LONG HYDRAULIC PUSH CYLINDER (PARTS OF THE PDM INPUT CONNECTOR)	THE CYLINDER PUSHES THE PROJECTILE AND NOSE CLOSURE OR FUSE FORWARD TO A CHUTE. THE NOSE CLOSURE DROPS DOWN THE CHUTE TO THE NOSE CLOSURE FUSE TRIGGER CONVEYOR AND THE PROJECTILE IS PUSHED TO A GATE.	<u>MODE</u> - FILTER CLOGGING. <u>MODE</u> - FAILURE OF THE PUSH ROD TO MOVE THE PROJECTILE AND NOSE CLOSURE. <u>CAUSE(S)</u> A. ACTUATOR/HYDRAULIC SYSTEM FAILURE.	POSSIBLE EXPLOSIVE INCIDENT OR FIRE DUE TO EXCESSIVE HEAT GENERATED DURING SAMING WITHOUT COOLANT.	FAILURE DETERRENCE MONITORING OF SAM CURRENT WILL INDICATE EXCESSIVE LOAD REQUIREMENTS ON THE SAM. ALSO, A COOLANT FLOW MONITORING DEVICE WILL BE USED TO ASSESS COOLANT SYSTEM OPERATIONS. CHIPS WILL BE REMOVED AS A ROUTINE MAINTENANCE PROCEDURE.	3	2	6
15.7 BURSTER REMOVAL STATION CLAMPS	CLAMPS AND HOLDS THE PROJECTILE FOR BURSTER REMOVAL.	<u>MODE</u> - FAILURE TO CLAMP AND HOLD PROPERLY.	THE PROJECTILE WILL NOT BE THE CORRECT POSITION FOR BURSTER REMOVAL. IT WOULD BE IMPOSSIBLE TO PULL THE BURSTER.	FAILURE DETERRENCE THE PROCESS IS MONITORED BY THE CLOSED CIRCUIT TV. CORRECTIVE ACTION LIMIT SWITCHES ARE RECOMMENDED TO BE INCLUDED ON THE PDM TO INDICATE CLOSURE. FAILURE OF THE CONTROL SYSTEM TO RECEIVE THIS SIGNAL WOULD THEN RESULT IN SHUTDOWN OF THE PDM.	1	2	2

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

BUILDING BLOCK NO. 15. MACHINE
 PROJECTILE VEHIC

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETECTION OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
15.8 BURSTER PULLING DEVICE	REMOVES BURSTER FROM THE PROJECTILE.	<p>MODE - FAILURE TO REMOVE THE BURSTER.</p> <p>CAUSE(S)</p> <p>A. LACK OF SUFFICIENT AIR PRESSURE TO ESTABLISH 40 TO 50 POUNDS P (SUPPLY PRESSURE LOW OR DEVICE SEAL FAILURE).</p> <p>B. HYDRAULIC ACTUATOR FAILS TO REMOVE BURSTER (HYDRAULIC SUPPLY FAILURE OR ACTUATOR FAILURE).</p> <p>C. BURSTER JAMMED.</p>	<p><u>EQUIPMENT</u></p> <p>FAILURE TO REMOVE THE BURSTER WILL PREVENT SUBSEQUENT REMOVAL OF THE AGENT AND FURTHER PROCESSING. IF THE BURSTER CANNOT BE REMOVED DUE TO A JAMMED BURSTER, TWO OPTIONS EXIST TO ALLEVIATE THE FAILURE:</p> <p>1) PERSONNEL CAN ENTER THE ECC AND MANUALLY REMOVE THE PROJECTILE (PRACTICAL FOR ONLY SMALLEST HAZITIONS) AND RETURN IT TO THE IMPACT AREA.</p> <p>2) ALLOW THE PROJECTILE TO PROCEED WITHOUT FURTHER PROCESSING AND REMOVE FROM THE CONVEYOR PRIOR TO THE PROJECTILE PULL AND DRAIN OPERATIONS.</p>	<p>FAILURE DETECTION INDICATOR SOUNDS IF THE BURSTER HAS BEEN REMOVED. IF IT HAS NOT, THE CONTROL SYSTEM SHUTS DOWN FURTHER PROCESSING.</p> <p>THE PDM CAN BE REPROGRAMMED TO REPEAT THE BURSTER PULL ATTEMPT.</p>	1	2	2
15.9 BURSTER SAW CLAMPS	CLAMPS AND HOLDS THE BURSTER FOR SECTIONING.	<p>MODE - FAILURE TO CLAMP AND HOLD PROPERLY.</p>	<p>SAWING OPERATIONS COULD RESULT IN MECHANICAL DAMAGE TO THE EQUIPMENT (SAW BLADE BINDING OR BREAKAGE, ETC.).</p>	<p>CORRECTIVE ACTION CLAMP SWITCHES ARE RECOMMENDED TO BE INCLUDED ON THE PDM TO INDICATE CLOSURE. FAILURE OF THE CONTROL SYSTEM TO RECEIVE THIS SIGNAL WOULD THEN RESULT IN SHUT DOWN OF THIS PDM.</p>	1	2	2

FAILURE MODE AND EFFECT ANALYSIS

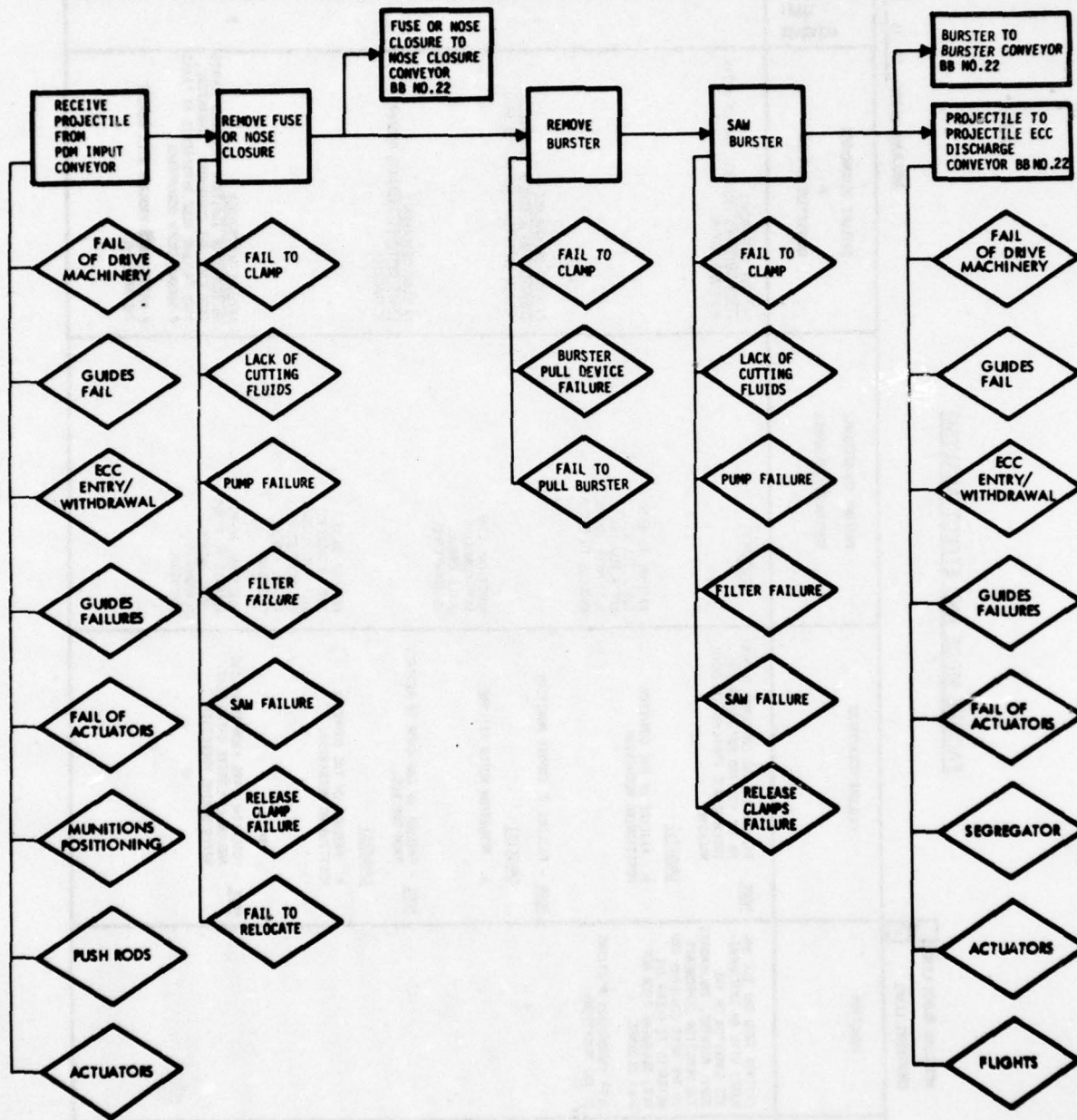
BUILDING BLOCK LEVEL <input type="checkbox"/>		COMPONENT LEVEL <input checked="" type="checkbox"/>		BUILDING BLOCK: NO. 15. MACHINE (PDM)				PROJECTILE DEMIL	
COMPONENT OR ITER	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX		
15.10 BURSTER SAW	SAW THE BURSTER.	<p><u>MODE</u> - FAILURE OF THE SAW TO SECTION OR COMPLETELY SECTION THE BURSTER.</p> <p><u>CAUSE(S)</u></p> <p>A. SAW BLADE FAILURE, MOTOR FAILURE, ETC.</p>	<p><u>EQUIPMENT</u></p> <p>UNWANTED BURSTER COULD DAMAGE THE FURNACE AND WBS COULD DAMAGE THE FURNACE.</p>	FAILURE DETERRENCE MONITORING OF THE SAW MOTOR CURRENT COULD INDICATE IMPROPER SAW OPERATIONS. VISUAL MONITORING VIA REMOTE TV WILL ALSO BE USED TO DETERMINE PROPER OPERATION.	2	2	4		
15.11 CUTTING OIL/TANK AND PUMP FOR BURSTER SAW STATION	PROVIDES COOLING FLUIDS FOR THE SAW DURING CUTTING.	<p><u>MODE</u> - PUMP FAILURE (INOPERATIVE).</p>	<p>POSSIBLE EXPLOSIVE INCIDENT OR FIRE DUE TO EXCESSIVE HEAT GENERATED DURING SAWING WITHOUT COOLANT.</p>	FAILURE DETERRENCE MONITORING OF SAW CURRENT COULD INDICATE EXCESSIVE LOAD REQUIREMENTS ON THE SAW. ALSO, A COOLANT FLOW MONITORING DEVICE WILL BE USED TO ASSESS COOLANT SYSTEM OPERATIONS.	3	2	6		
15.12 BURSTER SAW CLAMPS AND PROJECTILE BURSTER REMOVAL CLAMPS	RELEASE BURSTER SECTIONS TO BURSTER OUTPUT CONVEYOR AND RELEASE PROJECTILE TO ECC DISCHARGE CONVEYOR.	<p><u>MODE</u> - FAILURE TO RELEASE.</p> <p><u>CAUSE(S)</u></p> <p>A. HYDRAULIC SYSTEM AND/OR ACTUATOR FAILURE</p>	<p>POSSIBLE EXPLOSIVE INCIDENT OR FIRE DUE TO EXCESSIVE HEAT GENERATED DURING SAWING WITHOUT COOLANT.</p> <p>PROCESS CANNOT PROCEED TO THE NEXT STEP.</p>	FAILURE DETERRENCE MONITORING OF SAW CURRENT COULD INDICATE EXCESSIVE LOAD REQUIREMENTS ON THE SAW. ALSO, COOLANT FLOW MONITORING DEVICE WILL BE USED TO ASSESS COOLANT SYSTEM OPERATIONS. CLAMPS WILL BE REMOVED AS A ROUTINE MAINTENANCE PROCEDURE.	3	2	6		
				CORRECTIVE ACTION LIMITY SWITCHES ARE RECOMMENDED TO BE INSTALLED ON THE PDM TO INDICATE RELEASE FAILURE OF THE CONTROL SYSTEM TO RECEIVE THIS SIGNAL COULD THEN RESULT IN SHUT DOWN OF THE PDM.	1	1	1		

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

PROJECTILE DEMIL
 BUILDING BLOCK: NO. 15. MACHINE (PDM)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETECTION OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
15.13 A) H. E. ECC DISCHARGE AND SEGREGATING CONVEYOR (PROJECTILE) B) PROJECTILE ECC DISCHARGE CONVEYOR	EXTENDS INTO THE ECC AND MATE WITH AN INTERMEDIATE CONVEYOR OR THE DEMIL MACHINE, TRANSPORTS THE MUNITION COMPONENTS TO THE NEXT CONVEYOR AND RETRACTS TO CLEAR THE ECC, ALLOWING ITEM OUT DOOR CLOSURE. ALSO SEGREGATES PORTIONS OF THE MUNITIONS.	<u>MODE</u> - FAILURE OF THE CONVEYOR TO MOVE IN THE ECC AND MATE WITH THE INTERMEDIATE CONVEYOR OR DEMIL MACHINE. <u>CAUSE(S)</u> A. FAILURE OF THE CONVEYOR POSITIONING MECHANISM. <u>MODE</u> - FAILURE TO CONVEY MUNITION. <u>CAUSE(S)</u> A. ACTUATION MOTOR FAILURE. <u>MODE</u> - FAILURE OF CONVEYOR TO RETRACT FROM THE ECC. <u>CAUSE(S)</u> A. FAILURE OF THE CONVEYOR POSITIONING MECHANISM. <u>MODE</u> - POTENTIAL FIRE FROM EXPLOSIVE AND/OR EXPLOSIVE CHIPS GENERATED DURING PROCESSING.	<u>EQUIPMENT</u> FAILURE TO MATE CORRECTLY WILL NOT ALLOW THE NEXT STEP IN THE PROCESS TO BEGIN. MUNITIONS LINE INTERRUPTION WHILE ERROR IS CORRECTED. FAILURE TO RETRACT CORRECTLY WILL NOT ALLOW THE NEXT STEP IN THE PROCESS TO BEGIN. POTENTIAL AGENT RELEASE TO ATMOSPHERE AND/OR PERSONNEL EXPOSURE.	FAILURE DETERRENCE LIGHTY SWITCHES INDICATE PROPER ALIGNMENT AND MATING. FAILURE DETERRENCE CONVEYOR HAS A SENSOR TO DETECT MOTION (REFERENCE BB NO. 35 SCS). FAILURE DETERRENCE LIGHTY SWITCHES INDICATE PROPER RETRACTION. FAILURE DETERRENCE NO SOURCE OF IDENTIFICATION HAS BEEN IDENTIFIED FROM THE CONVEYORS. THEREFORE, THIS FAILURE MODE REPRESENTS AT LEAST A SECOND ORDER OCCURRENCE. A MAINTENANCE PROGRAM WILL REMOVE THE MATERIAL.	1	4	4
					1	4	4
					1	4	4
					3	1	3



BB NO. 15. PROJECTILE DEMIL MACHINE (PDM)

FMEA INFORMATION SOURCES

BB NO. 15

PROJECTILE DEMILITARIZATION MACHINE

DRAWINGS/DOCUMENTS :

15-533	30 Jul 73
15-533-1	29 Jan 73
" -2	29 Jan 73
" -3	29 Jan 73
" -4	7 Aug 73
" -5	9 Aug 73

PERSONNEL REFERENCED :

L. Johnson (31 Jul 1975)

D. Sorensen

CRITERIA NOTES:

- o Visual inspection of non-operating machine
- o Sequence by L. Thompson (7/31/75)
- o Startup with Active Munitions is preceded by test runs using inert munitions; the test runs will verify proper setting of all mechanical adjustments and functioning of all elements of the system.
- o Electromagnetic charge removal station not reviewed - will not be used at Tooele.

OTHER :

- o Marquardt Report #S-1304, Engineering Evaluation of CAMDS Munitions Demil Machinery Design, Phase 1, Evaluation, Volume 1, August 1974.
- o Draft Demil Plan for the Camds at Tooele, Army Depot

FAILURE MODE AND EFFECT ANALYSIS

PROJECTILE PULL/DRAIN
BUILDING BLOCK: NO. 18. MACHINE (PPF)

BUILDING BLOCK LEVEL
COMPONENT LEVEL

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
18.0 PROJECTILE PULL AND DRAIN MACHINE	REMOVE NOSE CLOSURE FROM NON-BURSTED PROJECTILES. PULL BURSTER WELL. REMOVE VX AND GB AGENT.						
18.1 INTERFACING BUILDING BLOCKS							
NO. 5 MPF	DECONTAMINATES METAL PARTS.						
NO. 13 ADS	DISPOSES OF MUSTARD AGENT.						
NO. 19 CDS	DISPOSES OF VX AND GB AGENT.						
NO. 22 PHE	SUPPLY DECON SOLUTION.						
NO. 23 FIL	90-DEGREE TURN MACHINE PPF OUTPUT CONVEYOR METAL PARTS FURNACE OUTPUT CONVEYOR.						
NO. 26 PIP	FILTERS EXHAUST AIR TO ATMOSPHERE.						
NO. 30 CTV	REMOVE GB AND VX AGENT.						
NO. 31 COM	REMOTE VISUAL MONITOR.						
NO. 35 SCS	REMOTE AUDIO MONITOR. CONTROL SYSTEM.						

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

PROJECTILE FULL/BLAIN
 BUILDING BLOCK: NO. 18. MACHINE (PPD)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CONNECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
18.2 LOAD CONVEYOR	RECEIVES THE PROJECTILE BASE END FIRST FROM THE 90-DEGREE TURN MACHINES MOTOR-DRIVEN BAR (A/B NO. 22, PHE). THE CONVEYOR HAS A SERIES OF CLAMPS MOUNTED ON IT. A CLAMP ATTACHES TO THE BASE OF THE PROJECTILE, SECURING IT TO THE CONVEYOR. AS THE CONVEYOR ADVANCES, THE PROJECTILE MOVES FROM A HORIZONTAL TO A VERTICAL POSITION.	<p><u>MODE</u> - PROJECTILE IS MOVED TO THE CONVEYOR NOSE END FIRST.</p> <p><u>MODE</u> - CONVEYOR CLAMP FAILS TO PROPERLY SECURE THE PROJECTILE TO THE CONVEYOR THROUGH JAM WEAR, FAILURE TO RELEASE THE SPRING LOADED JAMS, OR PRE-RELEASE OF JAMS PRIOR TO LOADING.</p>	<p>EQUIPMENT IT WOULD BE IMPOSSIBLE FOR THE CLAMP TO SECURE (DIMENSIONS INADEQUATE) TO THE NOSE OF THE PROJECTILE PROPERLY. DAMAGE (MECHANICAL) COULD OCCUR TO THE PPD HARDWARE FROM FALLING PROJECTILES PARTIALLY/INADEQUATELY CLAMPED.</p> <p>EQUIPMENT MECHANICAL DAMAGE COULD OCCUR TO THE PPD HARDWARE FROM FALLING PROJECTILES PARTIALLY/INADEQUATELY CLAMPED.</p>	<p>FAILURE DETERRENCE PROJECTILES CONTINUE FROM THE ECC (WHERE EXPLOSIVE MATERIAL WAS REMOVED) MUST BE PROPERLY ORIENTED (BASE FIRST) OR THEIR DISORIENTATION WOULD HAVE BEEN DETECTED EARLIER. PROJECTILES COMING DIRECTLY FROM THE IMPACT AREA CAN BE OBSERVED VIA REMOTE TV. REVERSE PROJECTILE-SENSOR SHOULD BE ADDED.</p> <p>FAILURE DETERRENCE CLAMP OPERATION WILL BE OBSERVED BY TV.</p>	2	1 FROM ECC 2 FROM UPA	2

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL: 18. PROJECTILE PULL/DRAIN
 COMPONENT LEVEL: MACHINE (PPD)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
18.3 NOSE CLOSURE REMOVAL STATION HARDWARE (CLAMPS, CARRIAGE, MOTOR, AND AIR PROBE)	CARRIAGE LOWERS CLAMPS TO THE NOSE CLOSURE. CLAMPS GRIP THE NOSE CLOSURE. MOTOR PROVIDES TORQUE TO UNTHREAD THE NOSE CLOSURE. CARRIAGE RAISES AND SHIFTS THE NOSE CLOSURE OVER A DROP POINT AND SIMULTANEOUSLY SHIFTS A PROBE OVER THE PROJECTILE. THE CLAMPS RELEASE THE NOSE CLOSURE AND THE CARRIAGE LOWERS THE PROBE INTO POSITION TO CHECK THE PROJECTILE FOR A BURSTER. (THIS STEP IS COMPLETED FOR ALL PROJECTILES WHETHER FROM THE ECC OR THE UNPACK AREA.) THE CARRIAGE RAISES THE PROBE, AND THE PROJECTILE IS READY TO PROCEED TO THE NEXT STATION.	<p><u>MODE</u> - FAILURE OF CARRIAGE TO LOWER, RAISE OR SHIFT.</p> <p><u>CAUSE(S)</u> HYDRAULIC FAILURE OR MECHANICAL JAMMING.</p> <p><u>MODE</u> - FAILURE TO CLAMP.</p> <p><u>CAUSE(S)</u> WORN JAWS AND/OR PNEUMATIC FAILURE. MOTOR FAILURE PRECLUDING THE APPLICATION OF TORQUE TO THE NOSE CLOSURE.</p> <p><u>MODE</u> - FAILURE OF PROBE, ALLOWING AN UNREMOVED NOSE CLOSURE OR THE PRESENCE OF A BURSTER TO GO UNDETECTED.</p>	<p>EQUIPMENT THE NOSE CLOSURE WILL NOT BE REMOVED, AND OPERATIONS AT THE NEXT STATION CANNOT BE STARTED.</p> <p>EQUIPMENT IN THE NEXT STATION (BURSTER WELL CUTTING STATION) ATTEMPT TO CUT AN UNREMOVED NOSE CLOSURE COULD DAMAGE THE CUTTING STATION. ATTEMPT TO CUT AN UNREMOVED BURSTER WOULD POSSIBLY RESULT IN AN EXPLOSIVE INCIDENT.</p>	<p>FAILURE DETERRENCE THE CLAMPS ARE 50-IN./LB CLAMPS AND EXERT APPROXIMATELY 3000 POUNDS OF CLAMPING FORCE. (APPROXIMATELY 200 IN./LB OF FORCE ARE REQUIRED TO REMOVE A NOSE CLOSURE.) A PROBE CHECKS THE PROJECTILE FOR THE PRESENCE OF A BURSTER AS THE NEXT STEP AFTER NOSE CLOSURE REMOVAL. IN THE EVENT THAT THE NOSE CLOSURE HAD NOT BEEN REMOVED THE PROBE WOULD SO INDICATE. LIMIT SWITCHES INDICATE WHEN THE CARRIAGE IS LOWERED AND SHIFTED.</p> <p>FAILURE DETERRENCE THESE FAILURES WOULD PRESENT DOUBLE FAILURES: (FAILURE TO REMOVE NOSE CLOSURE AND FAILURE OF THE PROBE TO DETECT BURSTER.) FAILURE OF BURSTER TO BE REMOVED IN THE NEXT STATION. (IMMEDIATELY DETECT AND REMOVAL OF BURSTER IN THE NEXT STATION.) FAILURE OF A BURSTER ON THE IMPACT AREA BY-PASS CONVEYOR ALLOWING THE PROJECTILE TO PROCEED DIRECTLY TO THE PPD AND FAILURE OF THE PROBE TO DETECT THE PRESENCE OF THE BURSTER.</p> <p>NOTE: ALL UNITS FROM THE UNPACK AREA (PROJECTILES STILL WITH NOSE CLOSURE WHEN THEY REACH THE PPD) ARE ASSUMED TO NOT INCLUDE BURSTERS.</p>	1	2	2
					3	1 (DOUBLE FAILURE)	3

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL PROJECTILE PULL/DRAIN
 COMPONENT LEVEL MACHINE (PPD)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
18.4 BURSTER WELL WELD CUTTING STATION HARDWARE (HYDRAULIC CLAMP, VERTICAL BORING MILL)	ONLY PROJECTILES THAT CONTAIN WELDED BURSTER WELLS ARE PROCESSED AT THIS STATION. (ONLY ABOUT 25,000 UNITS OF THIS TYPE WERE MADE) PLUS, THERE WERE AN UNDERSTANDING OF "LEAKERS" THAT WERE FIXED" MANUFACTURE WITH MANUAL WELDING. THE HYDRAULIC CLAMP IS USED TO SECURE THE PROJECTILE DURING MILLING (IN ADDITION TO THE CONVEYOR MOUNTED CLAMP). THE MILL HEAD LOWERS, MILLS OFF THE WELDS, AND RAISES THE HYDRAULIC CLAMP RELEASES AND THE PROJECTILE PROCEEDS TO THE NEXT STATION.	<p><u>MODE</u> - FAILURE OF THE CLAMP TO SECURE OR RELEASE THE PROJECTILE.</p> <p><u>CAUSE(S)</u></p> <p>WORN JAMS AND/OR HYDRAULIC FAILURE.</p> <p><u>MODE</u> - FAILURE OF THE MILLING MACHINE TO LOWER OR RAISE.</p> <p><u>CAUSE(S)</u></p> <p>LOSS OF HYDRAULIC PRESSURE.</p> <p><u>MODE</u> - FAILURE OF THE MILLING PROCESS.</p> <p><u>CAUSE(S)</u></p> <p>MILL MOTOR OR MILL CUTTER FAILURE.</p>	<p>EQUIPMENT POSSIBLE MECHANICAL DAMAGE TO THE MILLING HEAD.</p> <p>EQUIPMENT THE WELD WILL NOT BE REMOVED, AND THE FUNCTION OF THE NEXT STATION CANNOT BE PERFORMED.</p> <p>EQUIPMENT THE WELD WILL NOT BE REMOVED, AND THE FUNCTION OF THE NEXT STATION CANNOT BE PERFORMED.</p>	<p>FAILURE DETERRENCE SWITCHES DETECT CLAMP POSITION.</p> <p>FAILURE DETERRENCE SWITCHES DETECT BOTH LOWERING AND RAISING.</p> <p>FAILURE DETERRENCE "FLY CUTTERS" WILL BE REPLACED DAILY, IF NEEDED, THE MOTOR CURRENT WILL BE MONITORED.</p> <p>CORRECTIVE ACTION CONSIDERING MONITORING VIBRATION TO DETECT CUTTER FAILURES.</p>	1	1	1
					2	2	4

FAILURE MODE AND EFFECT ANALYSIS

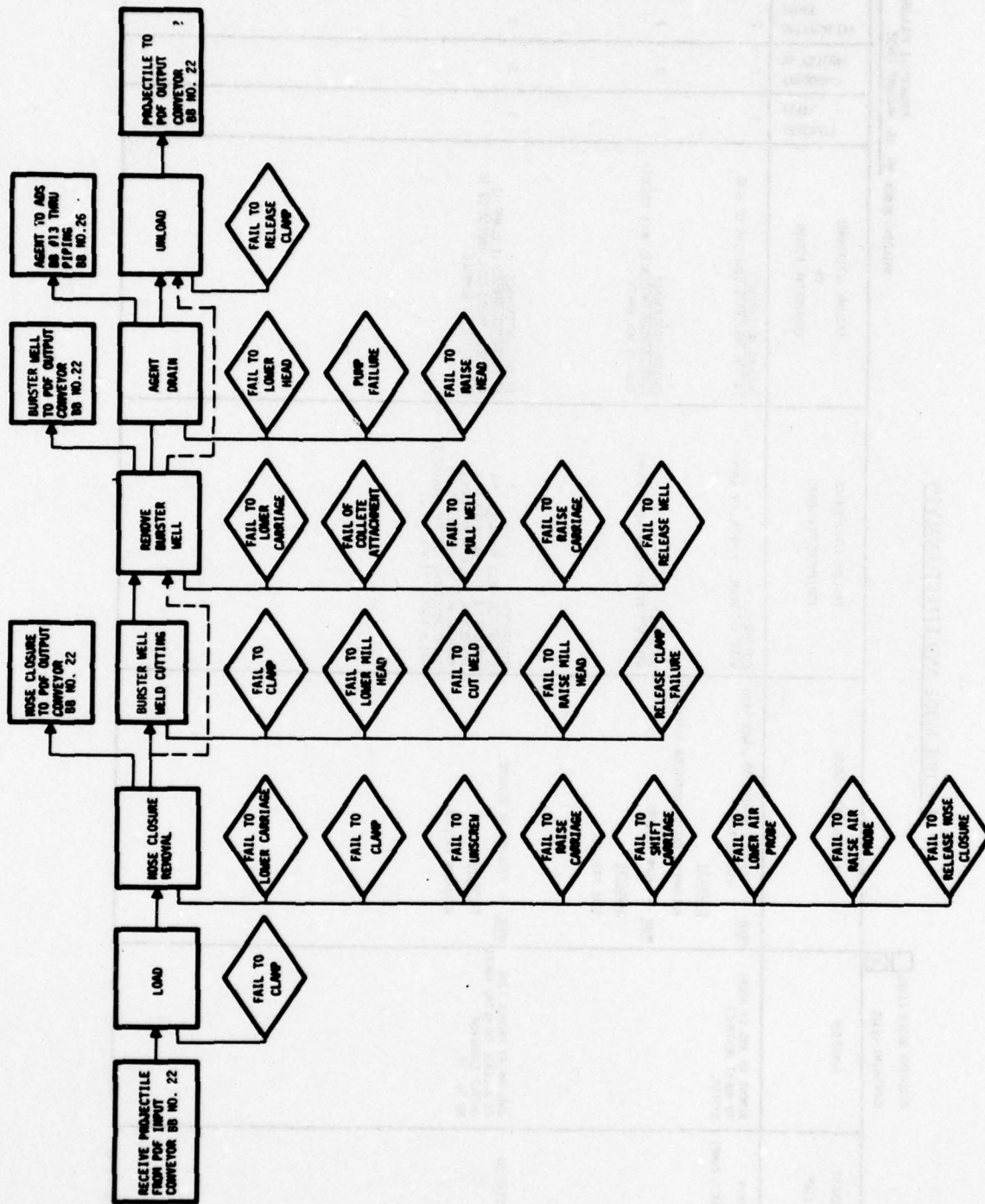
BUILDING BLOCK LEVEL <input type="checkbox"/>		BUILDING BLOCK: NO. 18. MACHINE (PPD)		PROJECTILE PULL/DRAIN				
COMPONENT LEVEL <input checked="" type="checkbox"/>		FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
18.5	BURSTER WELL PULL STATION HARDWARE (CARRIAGE AND COLLAR, COLLET, CHUTE, BELT CONVEYOR, AND DECON SOLUTION)	PULL THE BURSTER WELL FROM THE PROJECTILE AND RELEASE IT INTO THE CHUTE.	<p><u>MODE</u> - FAILURE OF THE CARRIAGE TO LOWER OR RAISE. <u>CAUSE(S)</u> HYDRAULIC FAILURE.</p> <p><u>MODE</u> - FAILURE OF THE COLLAR TO ALIGN WITH THE PROJECTILE PROPERLY. <u>CAUSE(S)</u> PROJECTILE MISALIGNMENT OR MECH- ANICAL DAMAGE TO THE HARDWARE.</p> <p><u>MODE</u> - FAILURE TO PULL THE BURSTER WELL. <u>CAUSE(S)</u> FAILURE OF THE COLLET TO GRIP OR OF THE ACTUATOR TO RETRACT.</p> <p><u>MODE</u> - FAILURE OF THE CHUTE TO OB- TAIN PROPER POSITION BELOW THE BURSTER WELL. <u>CAUSE(S)</u> ACTUATOR FAILURE.</p> <p><u>MODE</u> - FAILURE OF THE COLLET TO RELEASE BURSTER WELL. <u>CAUSE(S)</u> STICKING OR HYDRAULIC FAILURE.</p>	<p>EQUIPMENT THE BURSTER WELL WILL NOT BE PULLED, OR IT WILL NOT BE POSSIBLE TO DISPOSE OF IT.</p> <p>EQUIPMENT GOOD CONTACT SURFACES (COLLAR TO PROJECTILE) FOR ALIGNING WILL NOT BE OBTAINED, POSSIBLY RESULTING IN MECHANICAL DAMAGE TO THE EQUIPMENT.</p> <p>EQUIPMENT THE PROCESSSES AT THE NEXT STATION CANNOT BE ACCOMPLISHED.</p> <p>EQUIPMENT THE BURSTER WELL MAY NOT BE CONVEYED TO THE METAL PARTS FURNACE.</p> <p>EQUIPMENT THE BURSTER WELL MAY NOT BE CONVEYED TO THE METAL PARTS FURNACE.</p>	<p>FAILURE DETERRENCE LIMIT SWITCHES INDICATE CARRIAGE POSITION (MAXIMUM UP AND MAXIMUM DOWN).</p> <p>FAILURE DETERRENCE CHUTE PINS ASSURE PROPER ALIGNMENT.</p> <p>FAILURE DETERRENCE A SWITCH INDICATES IF THE COLLET HAS BEEN LOWERED DOWN INSIDE THE PROJECTILE. ANOTHER SWITCH INDICATES IF THE COLLET WAS PULLED UP. TWO PHOTOELECTRIC CELLS ARE USED TO IN- DICATE THE PRESENCE OR ABSENCE OF A BURSTER WELL ATTACHED TO THE COLLET.</p> <p>FAILURE DETERRENCE LIMIT SWITCHES INDICATE CHUTE POSITION</p> <p>FAILURE DETERRENCE TWO PHOTOELECTRIC CELLS ARE USED TO INDICATE THE PRESENCE OR ABSENCE OF A BURSTER WELL ATTACHED TO THE COLLET. THE BOTTOM OF THE BURSTER WELL IS ALWAYS AT THE SAME POSITION WHEN PULLED FROM THE PROJECTILE (EVEN THROUGH THE WELL LENGTH MAY VARY BE- TWEEN 12 3/4 AND 26 1/2 INCHES)</p>	1	2	2
						2	2	4
						1	2	2
						1	2	2
						1	2	2

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL **1**
 COMPONENT LEVEL **1**

PROJECTILE PULL/DRAIN
 BUILDING BLOCK: NO. 18. MACHINE (PPD)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
18.6 AGENT DRAIN STATION (HEAD, DRAIN PUMP)	REMOVE GB AND VX AGENT TO AGENT DESTRUCT SYSTEM.	<u>MODE</u> - FAILURE OF HEAD TO LOWER INTO PROJECTILE. CAUSE(S) ALIGNMENT AND/OR ACTUATOR FAILURE. <u>MODE</u> - PUMP FAILURE. CAUSE(S) SEAL FAILURE.	EQUIPMENT WILL NOT PERMIT PUMPING OF AGENT. EQUIPMENT WILL NOT PERMIT PUMPING OF AGENT.	FAILURE DETERRENCE SWITCH INDICATES LOWERING OF HEAD. FAILURE DETERRENCE LEVEL SENSOR INDICATES WHEN PROJECTILE IS 99% EMPTY.	1	2	2
18.7 UNLOAD STATION CLAMPS	UNCLAMP AT PROPER TIME TO RELEASE TO METAL PARTS OUTPUT CONVEYOR BB NO. 22.	<u>MODE</u> - FAILURE TO UNCLAMP. CAUSE(S) ACTUATOR FAILURE.	EQUIPMENT WILL ADVANCE. THE PROJECTILE WILL BE MOVED TO A HORIZONTAL POSITION AND JAM THE MACHINE WHEN IT RETURNS TO THE START POSITION. IF THE PROJECTILE HAS H AGENT, IT WILL SPILL.	FAILURE DETERRENCE LIGHTY SWITCH SENSES IF CLAMP IS RELEASED. PHOTO CELL INDICATES IF PROJECTILE IS REMOVED.	1	2	2



FMEA INFORMATION SOURCES

BB No. 18 PROJECTILE PULL AND DRAIN MACHINE

DRAWINGS/DOCUMENTS:

18-534-1	25 May 75
-2	2 May 75
-3	1 May 75
-4	1 May 75
-5	28 April 75
-6	29 April 75
-7	30 April 75
-8	6 May 75

PERSONNEL REFERENCED:

R. Stevens (7/30/75)

CRITERIA NOTES:

- o Visual Inspection of non-operating machine in model shop.

OTHER:

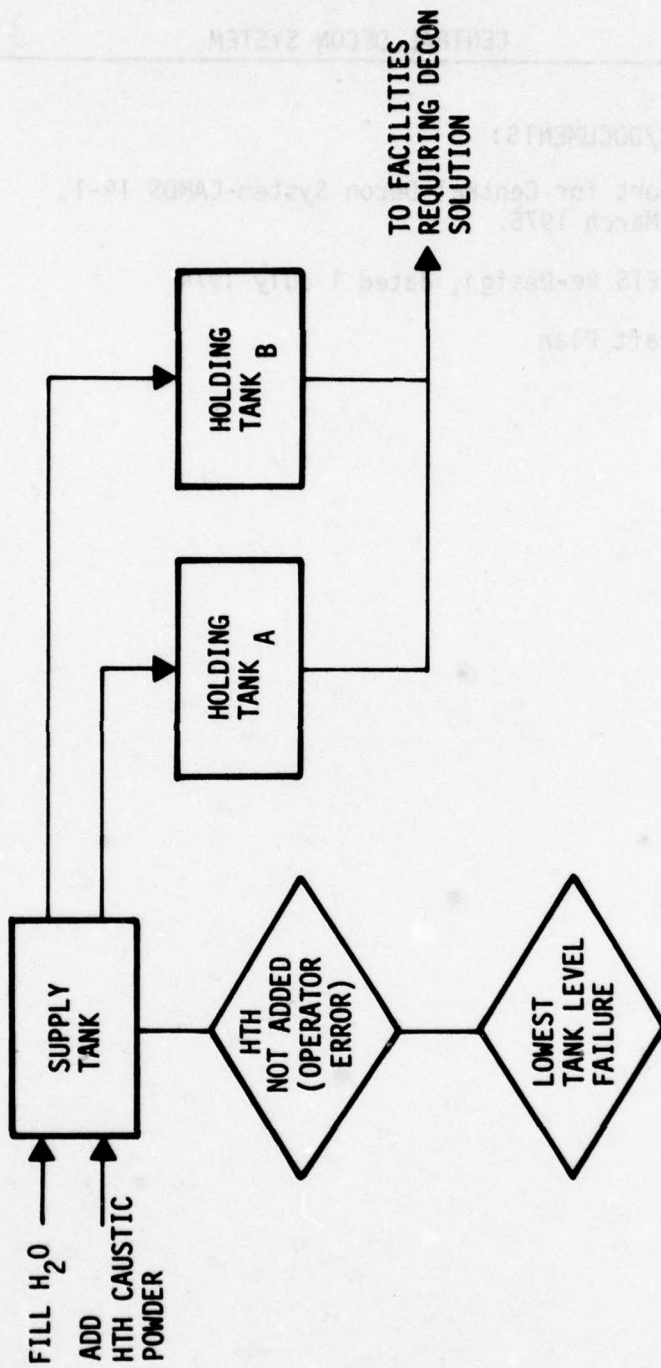
- o Draft Demil Plan for the CAMDS at Tooele Army Depot
- o Marquardt Report S-1314 Engineering Evaluation of the CAMDS Munitions Demil Machinery Design Phase I, Evaluation Volume II, (December 1974).

FAILURE MODE AND EFFECT ANALYSIS

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
19.1 DECON MIXING TANK	MIX CALCIUM HYPOCHLORITE WITH WATER TO FORM DECON SOLUTION FOR VX/MUSTARD AGENT OPERATIONS.	<p><u>MODE</u> - LOSS OF DECON SOLUTION.</p> <p><u>CAUSE(S)</u></p> <p>A. OPERATOR FAILS TO TRANSFER HYPOCHLORITE POWDER OR VACUUM TRANSFER DEVICE FAILS. OPERATOR FAILS TO TAKE ACTION AND PLAIN WATER IS PIPED TO AREAS REQUIRING DECON SOLUTION.</p> <p><u>MODE</u> - TANK LEVEL TOO LOW.</p> <p><u>CAUSE(S)</u></p> <p>A. LOW SET POINT FAILS REFILL AND LEVEL DROPS BELOW LOWEST SET POINT.</p>	<p><u>EQUIPMENT</u></p> <p>POTENTIAL TOXIC EFFLUENT WHERE DECON SOLUTION IS NORMALLY USED. HOWEVER, THIS WOULD ULTIMATELY BE PROCESSED BY THE ADS OR ETS AND DOES NOT REPRESENT AN AGENT RELEASE TO THE OUTSIDE AREA.</p> <p><u>PERSONNEL</u></p>	<p>FAILURE DETERRENCE PH MONITOR TO BE USED AS AN INDICATOR (BUT NOT FOR CONTROL). IN ADDITION, PERIODIC TITRATION FOR CHLORINE LEVEL WILL BE CARRIED OUT TO MONITOR STRENGTH OF SOLUTION. ALSO, THE SOLUTION IS YELLOWISH AND "MILKY" (DOES NOT LOOK LIKE PLAIN WATER).</p> <p>THIS MODE DOES NOT APPEAR TO BE OF A CRITICAL NATURE, SHOULD IT OCCUR. (EVEN PLAIN WATER HAS SOME DECON CAPABILITY.) HOWEVER, NO AUTOMATIC CONTROL OF POWDER FEED IS KNOWN.</p>	2	2	4
			<p><u>EQUIPMENT</u></p> <p>SHUTDOWN AND MAINTENANCE.</p>	<p>FAILURE DETERRENCE WHEN LOWEST SET POINT IS REACHED THE HEATER AND ACTIVATOR ARE AUTOMATICALLY SHUT OFF. IN ADDITION, THE POWDER FEED TO THE CONTROL MODULE HAS THE FEED STOPPED BY THE ADS. THE COS IS PLACED IN MANUAL MODE. TEMPERATURE MONITORING WITH AUTOMATIC STEADY SHUT OFF IS ALSO PROVIDED.</p> <p>CORRECTIVE ACTION NONE RECOMMENDED.</p>	1	2	2

BUILDING BLOCK LEVEL: 4
COMPONENT LEVEL: 4

CENTRAL DECON SYSTEM (CDC)
BUILDING BLOCK: NO. 19.



NO. 19 CENTRAL DECON SYSTEM (CDC)

FMEA INFORMATION SOURCES

BB NO. 19

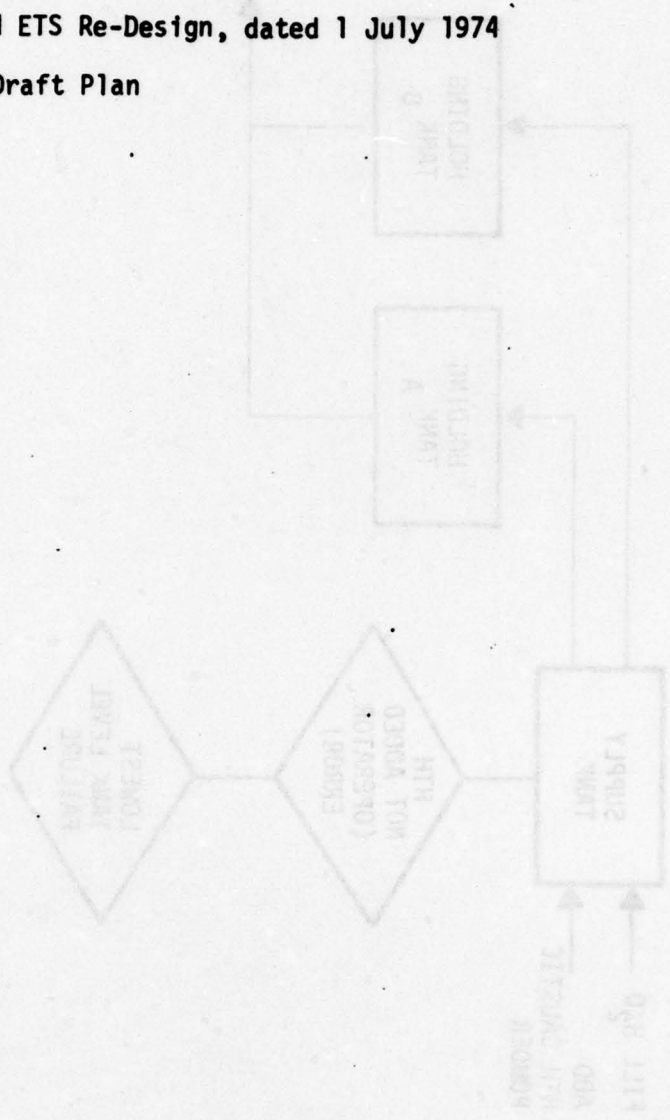
CENTRAL DECON SYSTEM

DRAWINGS/DOCUMENTS:

Test Report for Central Decon System-CAMDS 19-1,
dated 6 March 1975.

CDS and ETS Re-Design, dated 1 July 1974

Demil Draft Plan



FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

BULK ITEMS
 BUILDING BLOCK: NO. 21, FACILITY (BIF)

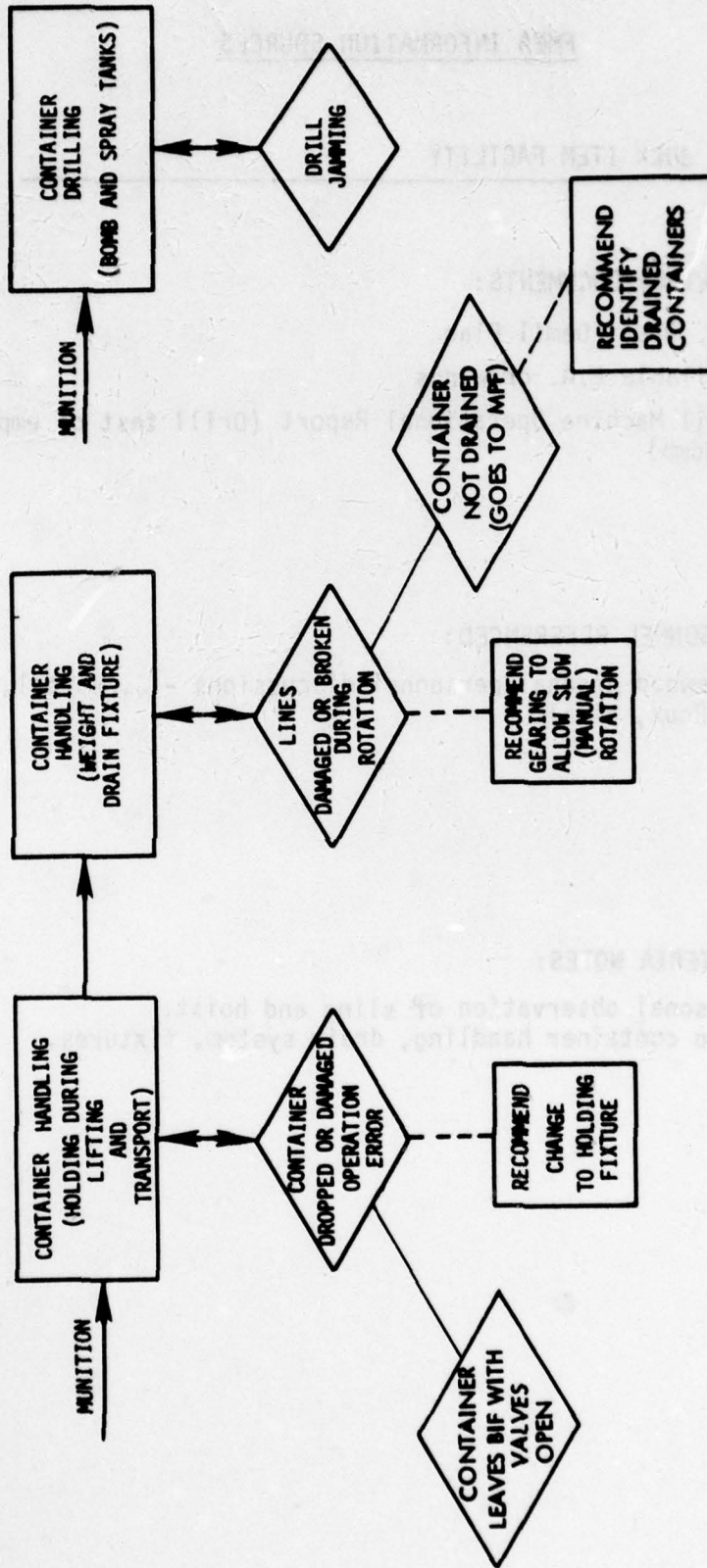
COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
21.1 CONTAINER HANDLING (LIFTING)	FORKLIFT WITH CONTAINER SLING TO MOVE CONTAINER FROM TRUCK TO BIF.	MODE - CONTAINER DAMAGED. CAUSE(S) A. FORKLIFT DAMAGES OR CONTAINER IS DROPPED DUE TO OPERATOR ERROR. (OPERATOR FAILS TO SECURE JAMS OF CONTAINER SLING TO CONTAINER.)	PERSONNEL POTENTIAL TOXIC RELEASE TO OUTSIDE AREA.	FAILURE DETERRENCE PERSONNEL WEARING PROTECTIVE CLOTHING. DECON SOLUTION AVAILABLE. A SAFETY PROCEDURE WILL BE PROVIDED. SAFETY HOOKS ARE PROVIDED ON TON CONTAINER HANDLING SLING (BUT NOT FOR BOMB OR SPRAY TANK). THE POSSIBILITY OF RUPTURE OF CONTAINER IS CONSIDERED REMOTE. CORRECTIVE ACTION ● A MODIFICATION OF THE TON CONTAINER HANDLING SLING SUCH THAT THE JAMS ARE SPRING LOADED IN THE SECURE POSITION, IS RECOMMENDED. (CURRENTLY THE OPERATOR CAN POSITION THE JAMS MANUALLY TO ANY POSITION.) ● SIMILAR CONSIDERATION, INCLUDING SAFETY HOOKS SHOULD BE GIVEN TO THE BOMB AND SPRAY TANK.	3	1	3
21.2 CONTAINER HANDLING (DRAIN FIXTURE)	TO DRAIN AGENT FROM CONTAINER	MODE - EPDM LINES TO TANK ARE BROKEN OR DAMAGED DURING DRAIN OPERATION. CAUSE(S) A. EXCESSIVE ROTATION OF CONTAINER BY OPERATOR - ROTATION TOO FAST AND OPERATOR DOES NOT RELEASE ROTATE BUTTON IN TIME.	POTENTIAL TOXIC RELEASE (TO TOXIC AREA).	FAILURE DETERRENCE A RELEASE WOULD BE TO A TOXIC AREA. FOR SLIGHTLY DAMAGED LINE, A REPAIR MIGHT BE ACHIEVED THROUGH THE ACCESS WINDOW. IN ANY CASE, SHOULD PERSONNEL BE REQUIRED TO ENTER THE TOXIC AREA (AS THEY ARE FOR ROUTINE MAINTENANCE) THEY WOULD BE IN CLASS A CLOTHING.	2	1	2

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL **2**
 COMPONENT LEVEL **1**

BULK ITEMS
 BUILDING BLOCK: NO. 21, FACILITY (BIF) 1

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
21.2 CONTAINER HANDLING (DRAIN FIXTURE) (CONTINUED)		<p>MODE - FILLED (GB/VX) CONTAINER PASSES THROUGH BIF AND IS PROCESSED IN THE METAL PARTS FURNACE.</p> <p>CAUSE(S)</p> <p>A. OPERATOR(S) ERROR - CONTAINER BYPASSES DRAIN AND RINSE AREA AND IS PICKED UP AS AN EMPTY CONTAINER.</p>	<p>SHUTDOWN AND MAINTENANCE WITH DAMAGE TO FURNACE IF CONTAINER EXPLODES.</p> <p>POTENTIAL TOXIC (AGENT) RELEASE TO THE ATMOSPHERE (ENTIRE CONTENTS OF CONTAINER DELIVERED TO THE BURNER/SCRUBBER SYSTEM IN OVER-LOAD CONDITION.)</p>	<p>CORRECTIVE ACTION</p> <p>ADDITION OF APPROPRIATE GEARING TO ALLOW SLOWER ROTATION OF THE CONTAINER, IS RECOMMENDED. WITH THE CURRENT DESIGN, A BELT DRIVE ROTATION RATE SEEMS NECESSARY TO OVERCOME THE INERTIA OF THE CONTAINER. IN ADDITION, AN INTERLOCK ON ROTATION SHOULD BE PROVIDED, PRECLUDING INDUVENT OPERATOR.</p> <p>FAILURE DETERRENCE</p> <p>RIGOROUS TRAINING AND OPERATIONAL PROCEDURES TO BE PROVIDED. FACILITY IS DESIGNED SUCH THAT CONTAINERS MUST PASS THROUGH THE DRAIN AND RINSE AREA TO GET TO THE HOLD AREA PRIOR TO DELIVERY TO THE MPF. AGENT MONITORING INSTRUMENTATION IS PROVIDED IN THE DECON RINSE AREA.</p> <p>CORRECTIVE ACTION</p> <p>IDENTIFY CONTAINERS THAT HAVE BEEN DRAINED. (E.G., AFTER VERIFYING DRAINED WEIGHT, SPRAY PAINT YELLOW BAND AROUND EDGE OF CONTAINER.)</p>	4	1	4
21.3 DRILL MACHINE	TO DRILL HOLE IN BOMB OR SPRAY TANK FOR DRAINAGE PURPOSES.	<p>MODE - DRILL JAMS.</p> <p>CAUSE(S)</p> <p>A. SPIRAL CHIPS MIGRATE UP FLUTES.</p>	SHUTDOWN AND MAINTENANCE.	<p>FAILURE DETERRENCE</p> <p>SHORT DRILL BITS TO BE USED- CHIPS TO BE CONTAINED IN SEALED PLENUM AT LOCATION OF THE PENETRATION TESTS TO DATE HAVE INDICATED THAT THIS IS NOT A SERIOUS PROBLEM.</p> <p>CORRECTIVE ACTION</p> <p>NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.</p>	1	2	2



BB NO. 21. BULK ITEMS FACILITY (BIF)

FMEA INFORMATION SOURCES

BB NO. 21

BULK ITEM FACILITY

DRAWINGS/DOCUMENTS:

E.A. Draft Demil Plan

Available E.A. drawings

Demil Machine Operational Report (Drill test of empty MC-1 Bomb)

PERSONNEL REFERENCED:

Edgewood Arsenal personnel discussions - J. Bartel, R. Roux, et al.

CRITERIA NOTES:

Personal observation of sling and hoist.
Also container handling, drain system, fixtures.

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

BUILDING BLOCK: NO. 22. EQUIPMENT (W/E)

	COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE RETRIEVAL OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
22.1	A. ROCKET ECC INPUT CONVEYOR B. PROJECTILE ECC INPUT CONVEYOR C. HINE ECC INPUT CONVEYOR D. HOKTAR ECC INPUT CONVEYOR (ITEMS A, B, AND D ARE SIMILAR IN DESIGN. ALL ITEMS ARE SIMILAR IN FUNCTION.)	RECEIVE MUNITION FROM IMPACK AREA PERSONNEL. EXTENDS INTO THE ECC AND MATES WITH AN INTERMEDIATE CONVEYOR OR THE DERIL MACHINE. TRANS-PORTS THE MUNITION TO THE NEXT HARDWARE ITEMS. AND RETRACTS TO CLEAR THE ECC, ALLOWING ITEM IN DOOR CLOSURE.	REFER TO THE FOLLOWING BUILDING BLOCKS FOR ANALYSIS: ROM - NO. 6 POM - NO. 15 MTR - NO. 25 MOR - NO. 24					
22.2	A. ROM INPUT CONVEYOR B. POM INPUT CONVEYOR (ITEM A AND B ARE SIMILAR IN DESIGN AND FUNCTION.)	POWERED ROLLERS AND PUSH CYLINDER(S) MOVE MUNITIONS TO DERIL STATIONS.	REFER TO THE FOLLOWING BUILDING BLOCKS FOR ANALYSIS: ROM - NO. 6 POM - NO. 15					
22.3	A. ROCKET ECC DISCHARGE AND SEGREGATING CONVEYOR B. H.E. ECC DISCHARGE AND SEGREGATING CONVEYOR (PROJECTILE) C. PROJECTILE ECC DISCHARGE CONVEYOR OR	EXTENDS INTO THE ECC AND MATES WITH AN INTERMEDIATE CONVEYOR OR THE DERIL MACHINE. TRANS-PORTS THE MUNITION COMPONENTS TO THE NEXT CONVEYOR AND RETRACTS TO CLEAR THE ECC, ALLOWING ITEM OUT DOOR CLOSURE. (ITEMS A, B, D, AND E ALSO SEGREGATE PORTIONS OF THE MUNITIONS.)	REFER TO THE FOLLOWING BUILDING BLOCKS FOR ANALYSIS: ROM - NO. 6 POM - NO. 15 MTR - NO. 25 MOR - NO. 24					

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL:
 COMPONENT LEVEL:

MATERIAL HANDLING
 BUILDING BLOCK: NO. 22. EQUIPMENT (MHE)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETECTION OR CORRECTIVE ACTION	SEVERITY LEVEL	PRIORITY OF FAILURE	CRITICALITY INDEX
22.3 (CONTINUED) D. MINE ECC DIS-CHARGE AND SEGREGATING CONVEYOR E. H.E. ECC DIS-CHARGE AND SEGREGATING CONVEYOR (MORTAR) F. MORTAR ECC DIS-CHARGE CONVEYOR (ITEMS B AND C, AND C AND F ARE SIMILAR IN DESIGN. ALL ITEMS ARE SOMEWHAT SIMILAR IN FUNCTION.)							
22.4 A. DEACTIVATION FURNACE INPUT CONVEYOR (ROCKET) B. DEACTIVATION FURNACE INPUT CONVEYOR (PROJECTILE) C. DEACTIVATION FURNACE INPUT CONVEYOR (WIRE) D. DEACTIVATION FURNACE INPUT CONVEYOR (MORTAR) (ALL ITEMS ARE THE SAME EQUIPMENT.)	TRANSPORT DEHILED MUNITION ELEMENTS TO THE DEACTIVATION FURNACE.	REFER TO THE FOLLOWING BUILDING BLOCK FOR ANALYSIS: DFS - NO. 4					

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL **E**
 COMPONENT LEVEL

BUILDING BLOCK NO. 22. MATERIAL HANDLING EQUIPMENT (MHE)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
22.5 ECC BYPASS CONVEYOR	TO PROVIDE A BYPASS OF THE ECC FOR NON-BURSTED PROJECTILES.	MODE - MUNITIONS LOADED BACKWARDS BY UNPACK AREA PERSONNEL. CAUSE(S) A. HUMAN ERROR.	EQUIPMENT MUNITIONS LINE INTERRUPTION WHILE ERROR IS CORRECTED. ENTRY INTO THE PPD COULD RESULT IN DAMAGES TO THE MAGAZINE AS EMPANATED IN BB NO. 18.	FAILURE DETERRENCE TEMPLATES ARE BEING DESIGNED TO ASSURE PROPER ORIENTATION DURING THE LOADING OPERATION. A TILT TABLE FIXING PROJECTILE ORIENTATION FOR THE 155 MM AND 8-INCH PROJECTILES WILL BE USED.	1	4	4
22.6 A. PDF INPUT CONVEYOR (BURSTED PROJECTILE) B. PDF INPUT CONVEYOR (NON-BURSTED PROJECTILES) C. PDF INPUT CONVEYOR (MORTAR) (ALL TIMES ARE THE SAME EQUIPMENT.)	POWERED ROLLERS MOVE MUNITIONS TO THE PDF.	MODE - POWERED ROLLER FAILURE. CAUSE(S) A. ELECTRIC MOTOR FAILURE.	MUNITION LINE INTERRUPTION UNTIL FAILURE IS CORRECTED.	FAILURE DETERRENCE EACH CONVEYOR HAS A SENSOR TO DETECT MOTION. (REFERENCE BB NO. 38 SCS.)	1	4	4
		MODE - POWERED ROLLER FAILURE. CAUSE(S) A. ELECTRIC MOTOR FAILURE.	MUNITION LINE INTERRUPTION UNTIL FAILURE IS CORRECTED.	FAILURE DETERRENCE EACH CONVEYOR HAS A SENSOR TO DETECT MOTION. (REFERENCE BB NO. 38 SCS.)	1	4	4

FAILURE MODE AND EFFECT ANALYSIS

INCLUDES BLACK LEVEL COMPONENT LEVEL 2

INCLUDES BLUR: NO. 22. EQUIPMENT (MSE) MATERIAL HANDLING EQUIPMENT (MSE)

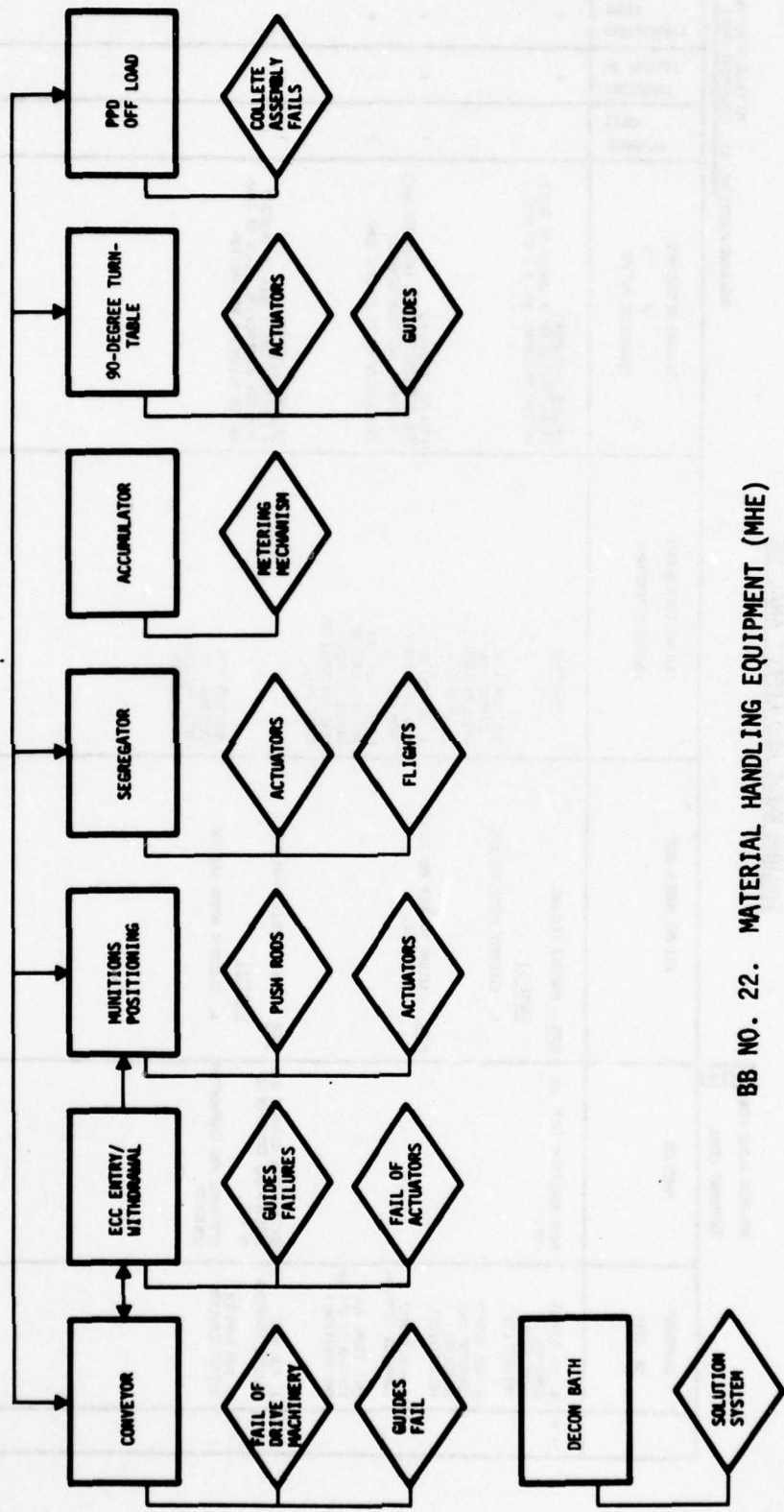
COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETECTION OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
22.7 A. PDF ACCUMULATOR (BURSTER PROJECTILES) B. PDF ACCUMULATOR (NON-BURSTER PROJECTILES) C. PDF ACCUMULATOR (MORTAR) (ALL ITEMS ARE THE SAME EQUIPMENT.)	POWERED BELT MOVES MUNITIONS TO THE PDF.	<u>MODE</u> - POWERED ROLLER FAILURE. <u>CAUSE(S)</u> A. ELECTRIC MOTOR FAILURE.	<u>EQUIPMENT</u> MUNITION LINE INTERRUPTION UNTIL FAILURE IS CORRECTED.	FAILURE DETERRENCE EJECT CONVEYOR HAS A SENSOR TO DETECT MOTION. (REFERENCE BB NO. 35 SCS.)	1	4	4
22.8 A. 90-DEGREE TURN MACHINE (BURSTER PROJECTILES) B. 90-DEGREE TURN MACHINE (NON-BURSTER PROJECTILES) C. 90-DEGREE TURN MACHINE (MORTAR) (ALL ITEMS ARE THE SAME EQUIPMENT.)	MOTOR/CARTRIDGE ROTATES MUNITION 90 DEGREES. POWERED ROLLERS MOVE MUNITIONS TO THE PDF BASE FIRST.	<u>MODE</u> - FAILURE TO ROTATE MUNITION. <u>CAUSE(S)</u> A. MOTOR FAILURE.	<u>MUNITION LINE INTERRUPTION</u> UNTIL FAILURE IS CORRECTED.	FAILURE DETERRENCE TV MONITOR WILL PERMIT VIEWING OF ACCUMULATOR.	1	4	4
		<u>MODE</u> - POWERED ROLLER FAILURE. <u>CAUSE(S)</u> A. ELECTRIC MOTOR FAILURE.	<u>MUNITION LINE INTERRUPTION</u> UNTIL FAILURE IS CORRECTED.	FAILURE DETERRENCE LIMIT SWITCHES INDICATE PROPER ROTATION. A LIMIT SWITCH IS USED TO INDICATE TRANSFER OF MUNITION; LACK OF TRANSFER INDICATION SIGNALS A MALFUNCTION.	1	3	3

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL **2**
 COMPONENT LEVEL

BUILDING BLOCK: NO. 22. EQUIPMENT (ONE)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
22.9 A. PDF OUTPUT CONVEYOR (BURSTER PROJECTILES) B. PDF OUTPUT CONVEYOR (NON-BURSTER PROJECTILES) C. PDF OUTPUT CONVEYOR (MORTAR) (ALL ITEMS ARE SIMILAR IN DESIGN AND FUNCTION.)	MOVE MUNITIONS FROM THE PDF.	<u>MODE - POWERED FAILURE.</u> <u>CAUSE(S)</u> A. ELECTRIC MOTOR FAILURE. <u>MODE - FAILURE TO GRIP AND PICKUP PROJECTILE.</u>	<u>EQUIPMENT</u> MUNITION LINE INTERRUPTION UNTIL FAILURE IS CORRECTED A. MAY NOT RE-MOVE PROJECTILE FROM PPD. B. MAY DROP PROJECTILE, CAUSING DAMAGE TO EQUIPMENT AND SPILLING AGENT (H).	FAILURE DETERRENCE EACH CONVEYOR HAS A SENSOR TO DETECT MOTION (REFERENCE BB. NO. 35 SCS). FAILURE DETERRENCE PHOTO-ELECTRIC SENSOR INDICATES WHEN PROJECTILE HAS BEEN REMOVED. TRANSFER ACTIVITY IS OVER SUPP. FAILURE DETERRENCE A LIMIT SWITCH IS USED TO INDICATE TRANSFER OF MUNITIONS. LACK OF INDICATION SIGNALS A MALFUNCTION.	1	4	4
22.10 A. PDM NOSE CLOSURE CONVEYOR B. PDM BURSTER OUTPUT CONVEYOR	RECEIVE NOSE CLOSURE AND BURSTER AND TRANSFER TO HE ECC. DISCHARGE AND SEGREGATING CONVEYOR.	<u>MODE - POWERED ROLLER FAILURE.</u> <u>CAUSE(S)</u> A. ELECTRIC MOTOR FAILURE.	MUNITION LINE INTERRUPTION UNTIL FAILURE IS CORRECTED.		1	4	4



BB NO. 22. MATERIAL HANDLING EQUIPMENT (MHE)

FMEA INFORMATION SOURCES

BB No. 22

MATERIAL HANDLING EQUIPMENT (MHE)

DRAWINGS/DOCUMENTS:

Marquardt Report #S-1304, Engineering Evaluation of CAMDS Munitions Demil Machinery Design, Phase 1, Evaluation, Volume 1, August 1974.

PERSONNEL REFERENCED:

Lt. Seeglitz

CRITERIA NOTES: (The following conveyors were not reviewed.)

- o Deactivation Furnace Output (MSS Rocket)
- o Deactivation Furnace Output (Burstered Projectiles)
- o Metal Parts Furnace Output (Burstered Projectiles)
- o Metal Parts Furnace Output (Non-Burstered Projectiles)
- o Deactivation Furnace Output (M23 Mine)
- o Deactivation Furnace Output (4.2-inch Mortar)
- o Metal Parts Furnace Output (4.2-inch Mortar)
- o HE Output (4.2-inch Mortar) - being designed
- o Mortar Body Output (4.2-inch Mortar) - being designed
- o Mine Output (M23 Mine) - being designed

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL **7**
COMPONENT LEVEL **1**

BUILDING BLOCK: NO. 23... FILTER SYSTEM (FIL)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
23.1 CHARCOAL FILTERING SYSTEM (11 LOCATIONS THROUGHOUT CAMDS)	TO PROVIDE ABSOLUTE FILTERING CAPABILITY OF AIR IN TOXIC AREAS (AND MAINTAIN NEGATIVE PRESSURE).	<p><u>MODE</u> - FILTERS PLUG OR ARE SATURATED. (REDUNDANT FILTERS IN ADS ONLY)</p> <p><u>CAUSE(S)</u></p> <p>A. EXCESSIVE BUILDUP OF AGENT AND/OR PARTICULATE IN THE HEPA FILTERS.</p>	<p><u>EQUIPMENT</u></p> <p>SHUTDOWN AND MAINTENANCE (NORMALLY WOULD BE DONE ON A ROUTINE BASIS).</p> <p><u>PERSONNEL</u></p> <p>LOSS OF NEGATIVE PRESSURE. POSSIBLE INFILTRATION OF TOXIC VAPORS INTO NONTOXIC AREA.</p>	<p><u>FAILURE DETERRENCE</u></p> <p>A HIGH DP ALARM IS PROVIDED FOR EACH FILTER BANK. LOSS OF FLOW OR NEGATIVE PRESSURE ALSO ACTUATES AN ALARM. ROUTINE MAINTENANCE TO BE PERFORMED ON A PERIODIC BASIS. THE EXCESSIVE BUILDUP WOULD OCCUR OVER A RELATIVELY LONG PERIOD OF TIME, THUS ALLOWING AMPLE TIME FOR OBSERVATION. IN ADDITION, ROUTINE MAINTENANCE (AS WELL AS AN EMERGENCY BACKUP) ALLOWS FOR MANUAL OPERATION AND USE OF OTHER FILTRATION BANKS IN THE SAME AREA. ALSO AGENT SAMPLING (WITH ALARM) IS PERFORMED BETWEEN THE CHARCOAL BANKS. THE THIRD (OR HIGHER) ORDER OF IN SERIES FAILURES REQUIRED REMEDIES THIS MODE OF OCCURRING AS EXTREMELY UNLIKELY.</p> <p><u>CORRECTIVE ACTION</u></p> <p>NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.</p>	3	1	3

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL **X**
COMPONENT LEVEL **I**

BUILDING BLOCK: NO. 23. FILTER SYSTEM (FIL)

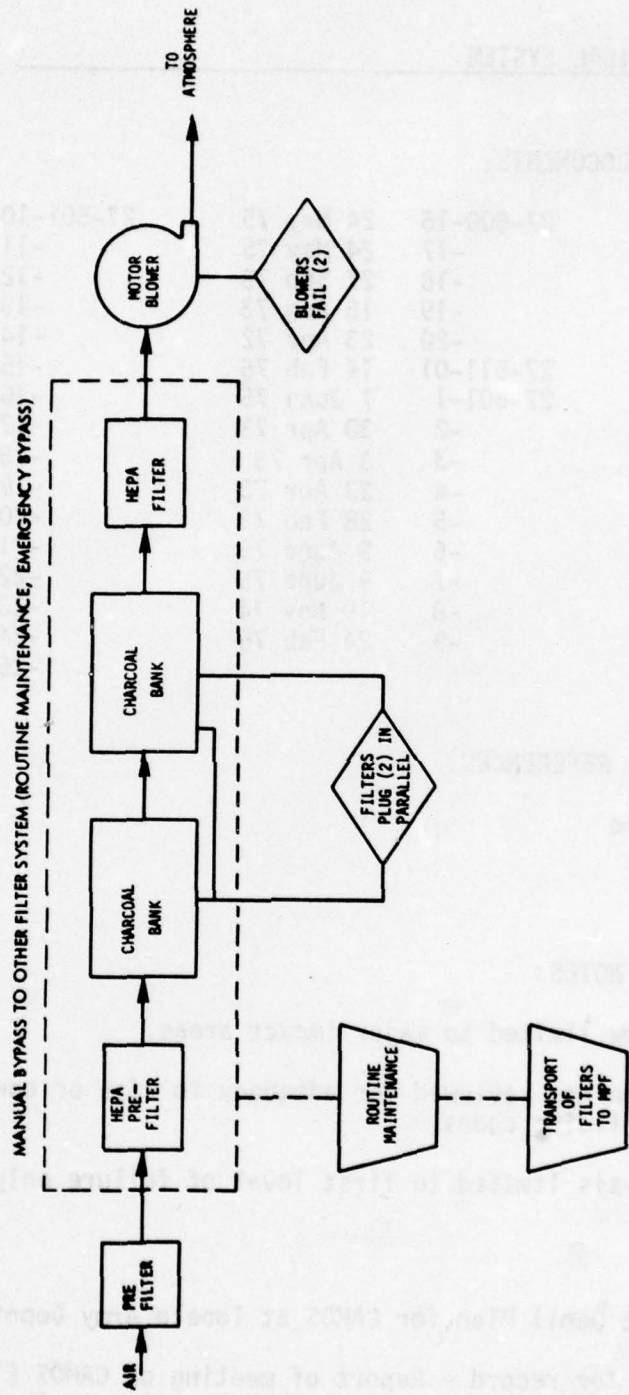
COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
23.1 CHARCOAL FILTERING SYSTEM (11 LOCATIONS THROUGHOUT CAMOS) (CONTINUED)		<p><u>MODE</u> - TOXIC MATERIAL RELEASED DURING ROUTINE MAINTENANCE.</p> <p><u>CAUSE(S)</u></p> <p>A. OPERATOR ERROR DURING REPAIR OR REPLACEMENT OF FILTERS.</p> <p>B. OPERATOR ERROR DURING TRANSFERT OF TOXIC CHARCOAL FILTER MATERIAL TO METAL PARTS POUNDR.</p>	<p><u>PERSONNEL</u></p> <p>POSSIBLE RELEASE OF AGENT-LAYER CHARCOAL FILTERING MATERIAL TO THE OUTSIDE AREA.</p>	<p><u>FAILURE DETERRENCE</u></p> <p>SPECIAL SAFETY PROCEDURES AND EQUIPMENT ARE REQUIRED IN THE REPLACEMENT OF POTENTIALLY CONTAMINATED FILTERS. THE 333 CFM AND 2000 CFM FILTER UNITS EMPLOY THE "BAG IN/BAG OUT" CONCEPT IN WHICH THE FILTERS CAN BE REPLACED FROM OUTSIDE OF THE FILTER UNIT. POLYETHYLENE BAGS COMPLETELY ISOLATE THE FILTERS AND INTERIOR OF THE FILTER HOUSING DURING THE REPLACEMENT PROCEDURE. IN THE LAMBER FILTER UNITS PERSONNEL MUST WEAR PROTECTIVE CLOTHING TO ENTER THE FILTER HOUSING. REMOVE THE USED FILTERS AND SEAL THEM IN POLYETHYLENE BAGS BEFORE REMOVING THEM FROM THE FILTER HOUSING. ALL USED FILTERS WILL BE TRANSPORTED IN SEALED BAGS TO THE METAL PARTS POUNDR FOR DISPOSAL. A MOTOR DISCONNECT SWITCH IS PROVIDED AT EACH FILTER UNIT TO ENABLE MAINTENANCE PERSONNEL TO INSURE THAT THE MOTOR CANNOT BE STARTED WHILE MAINTENANCE IS BEING ACCOMPLISHED.</p> <p>ALL FILTER UNITS WHICH SERVE NEGATIVE PRESSURE TOXIC ENCLOSURES ARE PROVIDED EMERGENCY ELECTRICAL POWER TO INSURE CONTAINMENT OF CONTAMINATION IN THE EVENT OF LOSS OF COMMERCIAL POWER.</p> <p><u>CORRECTIVE ACTION</u> NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.</p> <p><u>FAILURE DETERRENCE</u> CHARCOAL TO BE SEALED IN BAGS. PERSONNEL TO WEAR PROTECTIVE CLOTHING. DECON SOLUTION AND AGENT MONITORING WILL BE PROVIDED.</p> <p><u>CORRECTIVE ACTION:</u> NONE RECOMMENDED.</p>	2	2	4

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK NO. 23. FILTER SYSTEM (FIL)

BUILDING BLOCK LEVEL: **I**
COMPONENT LEVEL: **R**

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETECTION OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
CHARCOAL FILTERING SYSTEM (11 LOCATIONS THROUGHOUT CAMDS) (CONTINUED)		MODE - LOSS OF FILTERING CAPABILITY CAUSE(S) A. BLOWER FAILURE.	EQUIPMENT SHUTDOWN AND MAINTENANCE (NORMALLY PERFORMED IN ANY CASE). PERSONNEL LOSS OF NEGATIVE PRESSURE. POSSIBLE INFILTRATION OF VAPORS FROM THE TOXIC AREA INTO NONTOXIC AREAS.	FAILURE DETERRENCE THERE WOULD BE ADEQUATE WARNING SHOULD THE BLOWER FAIL. BLOWING AND MANUALLY OPERATED DAMPERS ARE PROVIDED BETWEEN FILTER UNITS. IN THE SAME AREA TO PROVIDE BACKUP CAPABILITY (NORMALLY FOR REPAIR OR REPLACEMENT BUT ALSO FOR AN EMERGENCY). IN ADDITION, LOSS OF FLOW OR NEGATIVE PRESSURE ACTUATES AN ALARM. FINALLY, NORMAL ROUTINE MAINTENANCE PROCEDURES SHOULD PRECLUDE THIS MODE FROM OCCURRING. A SERIES OF DETERRENCE FAILURES MUST OCCUR TO ALLOW THIS MODE. THUS, THIS FAILURE MODE CAUSING ANY TOXIC RELEASE IS REGARDED AS EXTREMELY REMOTE. CORRECTIVE ACTION NO FURTHER CORRECTIVE ACTION IS RECOMMENDED.	3	1	3



BB NO. 23. FILTER SYSTEM (FIL)

FMEA INFORMATION SOURCES

BB NO. 23

ELECTRICAL SYSTEM

DRAWINGS/DOCUMENTS:

27-500-1	24 May 75	27-500-16	24 May 75	27-501-10	24 Feb 75
-2	24 May 75	-17	24 May 75	-11	20 Feb 75
-3	27 May 75	-18	27 Sep 73	-12	9 June 75
-4	27 May 75	-19	15 Aug 73	-13	17 Dec 75
-5	27 May 75	-20	23 Apr 72	-14	16 Dec 74
-6	27 May 75	27-511-01	14 Feb 75	-15	16 Dec 74
-7	27 May 75	27-501-1	7 June 75	-16	6 Jan 74
-8	27 May 75	-2	30 Apr 73	-17	2 Oct 72
-9	27 May 75	-3	3 Apr 73	-18	3 Dec 73
-10	27 May 75	-4	23 Apr 73	-19	14 Mar 75
-11	9 June 75	-5	28 Feb 73	-20	4 Feb 75
-12	20 May 75	-6	9 June 75	-21	30 Dec 74
-13	20 May 75	-7	9 June 75	-22	10 Sep 74
-14	24 May 75	-8	19 Nov 74	-23	18 June 75
-15	7 June 75	-9	24 Feb 75	-24	30 May 75
				-25	3 July 75

PERSONNEL REFERENCED:

D. Bodrero

L. Selin

CRITERIA NOTES:

- Review limited to major impact areas.
- Design not reviewed for adequacy in size or conformity to building codes.
- Analysis limited to first level of failure only.

OTHER:

- Draft Demil Plan for CAMDS at Tooele Army Depot
- Memo for record - Report of meeting on CAMDS Electrical and Control Interfaces - SAREA-DM, 25 July 75, J. S. Cauller
- Disposition AMXTE-AEO, CAMDS Electrical System, 14 July 1975.

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

BUILDING BLOCK: NO. 24.
 MORTAR DEMIL MACHINE (M24)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CONNECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
24.0 MORTAR DEMIL MACHINE	SEPARATE MORTAR FUSE AND BURSTER.						
24.1 INTERFACING BUILDING BLOCKS	EXPLOSIVE/AGENT CONTAINMENT. HYDRAULIC PRESSURE SUPPLY. ECC INPUT CONVEYOR HE OUTPUT CONVEYOR MORTAR BODY OUTPUT CONVEYOR. FILTER SYSTEM. PIPING. CLOSED CIRCUIT TELEVISION REMOTE AUDIO MONITOR. SITE CONTROLS SYSTEM.						
NO. 2 ECC							
NO. 9 EHM							
NO. 22 MHE							
NO. 23 FIL							
NO. 26 PIP							
NO. 30 CTV							
NO. 31 COM							
NO. 35 SCS							

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL **1**
 COMPONENT LEVEL **2**

MORTAR DENIL
 BUILDING BLOCK: NO. 24. MACHINE (NO. 1)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
24.2 MORTAR ECC INPUT CONVEYOR	RECEIVE MATERIAL FROM UNPACK AREA PERSONNEL. EXTENDS INTO THE ECC AND MATES WITH AN INTERMEDIATE CONVEYOR OR MACHINES TO POSITION TO THE NEXT HARDWARE ITEM, AND RETRACTS TO CLEAR THE ECC ALLOWING ITEM IN DOOR CLOSURE.	<p>MODE - MATERIALS LOADED BACKWARDS BY UNPACK AREA PERSONNEL.</p> <p>CAUSE(S) - HUMAN ERROR.</p> <p>MODE - FAILURE OF THE CONVEYOR TO MOVE IN THE ECC AND MATE WITH THE INTERMEDIATE CONVEYOR OR DENIL MACHINE.</p> <p>CAUSE(S) - FAILURE OF THE CONVEYOR POSITIONING MECHANISM.</p> <p>MODE - FAILURE TO CONVEY MATERIAL.</p> <p>CAUSE(S) - ACTUATION MOTOR FAILURE.</p> <p>MODE - FAILURE OF CONVEYOR TO RETRACT FROM THE ECC.</p> <p>CAUSE(S) - FAILURE OF THE CONVEYOR POSITIONING MECHANISM.</p> <p>MODE - POSSIBLE CONTINUATION OF THE CONVEYOR AT THE INTERMEDIATE CONVEYOR OR DENIL MACHINE CONTACT POINT.</p>	<p>EQUIPMENT POSITIONING LINE INTERRUPTION WHILE ERROR IS CORRECTED.</p> <p>EQUIPMENT FAILURE TO MATE CORRECTLY WILL NOT ALLOW THE NEXT STEP IN THE PROCESS TO BEGIN.</p> <p>EQUIPMENT POSITIONING LINE INTERRUPTION WHILE FAILURE IS CORRECTED.</p> <p>EQUIPMENT FAILURE TO RETRACT CORRECTLY WILL NOT ALLOW THE NEXT STEP IN THE PROCESS TO BEGIN.</p> <p>EQUIPMENT CONTAMINATED HARDWARE (CONVEYORS) ARE RETRACTED INTO THE UNPACK AREA (AIRLOCK).</p>	<p>FAILURE DETERRENCE CONVEYOR MOUNTED SENSOR DETECTS PROPER ORIENTATION.</p> <p>FAILURE DETERRENCE LIGHT SWITCHES INDICATE PROPER ALIGNMENT AND MATING.</p> <p>FAILURE DETERRENCE DOWNSTREAM CONVEYOR DETECTS ARRIVAL OF MATERIAL WITH SENSORS INSURING DETECTION OF MOTOR FAILURE.</p> <p>FAILURE DETERRENCE LIGHT SWITCHES INDICATE PROPER RETRACTION.</p> <p>FAILURE DETERRENCE THE UNPACK AREA IS MAINTAINED AT A HEALTHY PRESSURE RELATIVE TO THE BALANCE OF THE UNPACK AREA. ALERT SENSORS ARE LOCATED IN THE UNPACK AREA. STOPPING OPERATIONS PROCEDURES FOR PERSONNEL MINIMIZE POTENTIAL FOR EXPOSURE.</p>	1	4	4

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL <input type="checkbox"/>		MORTAR DETAIL					
COMPONENT LEVEL <input checked="" type="checkbox"/>		BUILDING BLOCK: NO. 24. MACHINE (VDR)					
COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
24.2 HYDRAULIC PUSH CONT. CYLINDER	POSITION MORTAR FOR PULLING FUSE AND BURSTER.	MODE - FAILURE TO PROPERLY POSITION THE MORTAR.	EQUIPMENT TRANSLITY TO PULL FUSE AND BURSTER FROM MORTAR.	FAILURE DETERRENCE POSITION SENSOR WILL SENSE PROPER LOCATION OF MORTAR. IF IT IS NOT PROPERLY LOCATED, THE CONTROL SYSTEM WILL AUTOMATICALLY STOP ALL PROCESSING OPERATIONS.	1	3	3
24.3 MORTAR CLAMP	HOLD MORTAR FOR PULLING FUSE AND BURSTER. RELEASE MORTAR BODY TO OUTPUT CONVEYOR AFTER PULLING FUSE AND BURSTER.	MODE - FAILURE TO CLAMP. CAUSE(S) ACTUATOR FAILURE, OR LOW HYDRAULIC PRESSURE. MODE - HANG-UP OF CLAMP. CAUSE(S) ACTUATOR OR CONTROL SYSTEM FAILURE.	EQUIPMENT TRANSLITY TO PULL FUSE AND BURSTER FROM MORTAR. EQUIPMENT POSITION WILL NOT BE EMPTY FOR NEXT MORTAR.	FAILURE DETERRENCE POSITION SENSOR WILL SENSE CLOSED POSITION OF CLAMP. IF IT IS NOT PROPERLY LOCATED, THE CONTROL SYSTEM WILL AUTOMATICALLY STOP ALL PROCESSING OPERATIONS. FAILURE DETERRENCE THE MORTAR POSITION SENSOR WILL SENSE THE RELEASE OF THE CLAMP. IF IT IS NOT PROPERLY LOCATED, THE CONTROL SYSTEM WILL AUTOMATICALLY STOP ALL PROCESSING OPERATIONS.	1	3	3

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL **1**
 COMPONENT LEVEL **1**

MORTAR BENCH
 BUILDING BLOCK: NO. 24. MACHINE (MOR)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
24.4 FUSE AND BURSTER PULL MECHANISM	REMOVE FUSE AND BURSTER FROM MORTAR.	<p><u>MODE</u> - FAILURE TO GRIP FUSE. <u>CAUSE(S)</u> MECHANISM FAILURE OR NONSTANDARD FUSE.</p> <p><u>MODE</u> - FAILURE TO PULL. <u>CAUSE(S)</u> ACTUATOR FAILURE.</p> <p><u>MODE</u> - FAILURE TO PULL. <u>CAUSE(S)</u> JAMMED FUSE AND BURSTER.</p>	<p>EQUIPMENT PRODUCTION STOPPAGE.</p> <p>EQUIPMENT PRODUCTION STOPPAGE.</p> <p>EQUIPMENT WILL REMOVE FROM THE PROCESSING LINE EITHER BY ENTRY INTO THE ECC OR SPECIALLY CONTROLLED SEQUENCE OUT OF THE ECC ON THE CONVEYORS TO A LOCATION THAT IS ACCESSIBLE.</p>	<p>FAILURE DETERRENCE A SENSOR WILL DETECT REMOVAL OF THE FUSE AND BURSTER FROM THE MORTAR. IF IT DOES NOT INDICATE SUCCESSFUL REMOVAL, THE CONTROL SYSTEM WILL AUTOMATICALLY STOP ALL PROCESSING OPERATIONS.</p> <p>FAILURE DETERRENCE A SENSOR WILL DETECT REMOVAL OF THE FUSE AND BURSTER FROM THE MORTAR. IF IT DOES NOT INDICATE SUCCESSFUL REMOVAL, THE CONTROL SYSTEM WILL AUTOMATICALLY STOP ALL PROCESSING OPERATIONS.</p> <p>CORRECTIVE ACTION SPECIAL OPERATING PROCEDURE FOR REMOVAL OF MORTAR.</p>	1	3	3

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

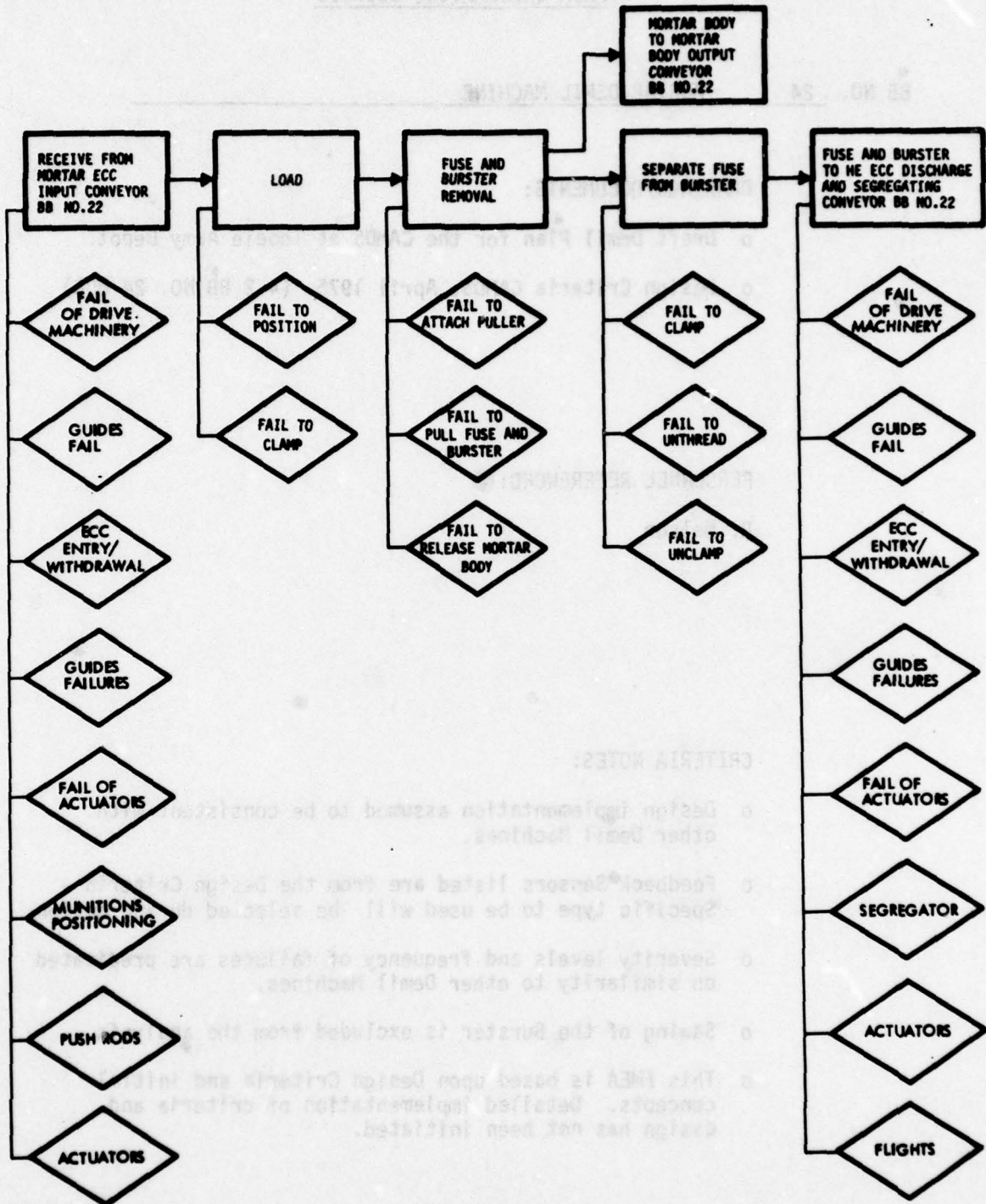
BUILDING BLOCK: NO. 24. BURSTER (HBB)

MONITOR DETAIL

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
24.5 FUSE RELEASE MECHANISM	RELEASE FUSE FROM FUSING HEAD.	MODE - FAILURE TO RELEASE. CAUSE(S) MECHANISM FAILURE.	EQUIPMENT INABILITY TO PULL FUSE AND BURSTER.	FAILURE DETERRENCE A SENSOR WILL DETECT THE RELEASE AND IF THE FUSE IS IN THE PROPER POSITION FOR SEPARATION FROM THE BURSTER. IF IT DOES NOT INDICATE THE PROPER CONDITIONS, THE CONTROL SYSTEM WILL AUTOMATICALLY STOP ALL PROCESSING.	1	3	3
24.6 CLAMP	HOLD BURSTER OR FUSE DURING SEPARATION AND RELEASE TO THE OUTPUT CONVEYOR AFTER SEPARATION.	MODE - FAILURE TO HOLD FOR SEPARATION MODE - FAILURE TO RELEASE AFTER SEPARATION.	EQUIPMENT INABILITY TO SEPARATE BURSTER FROM FUSE. EQUIPMENT HANDUP OF BURSTER OR FUSE IN MACHINE.	FAILURE DETERRENCE A SENSOR WILL DETECT THE CLOSURE AND RELEASE OF THE JAW. IF IT DOES NOT INDICATE PROPER CONDITIONS, THE CONTROL SYSTEM WILL AUTOMATICALLY STOP ALL PROCESSING OPERATIONS.	1	3	3
24.7 FUSE/BURSTER UNCOUPLER	UNTHREADED FUSE FROM BURSTER.	MODE - FAILURE TO UNTHREAD. CAUSE(S) UNCOUPLER FAILURE OR JAWED THREADS.	EQUIPMENT INABILITY TO SEPARATE BURSTER FROM FUSE.	FAILURE DETERRENCE A SENSOR WILL DETECT THE SEPARATION OF THE FUSE FROM THE BURSTER. IF IT DOES NOT INDICATE SEPARATION, THE CONTROL SYSTEM WILL AUTOMATICALLY STOP ALL PROCESSING OPERATIONS.	1	3	3

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL		MORTAR DENIL MACHINE (HOB)		BUILDING BLOCK NO. 24		MORTAR DENIL MACHINE (HOB)	
COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
24-8 A. H.E. ECC DISCHARGE AND SEGREGATING CONVEYOR (MORTAR)	EXTENDS INTO THE ECC AND ARTES WITH AN INTERMEDIATE CONVEYOR ON THE DENIL MACHINE, TRANSPORTS THE MORTAR CONVEYOR TO THE NEXT CONVEYOR AND RETRACTS TO CLEAR THE ECC ALLOWING ITEM OUT DOOR CLOSURE.	<u>MODE</u> - FAILURE OF THE CONVEYOR TO MOVE IN THE ECC AND MATE WITH THE INTERMEDIATE CONVEYOR OR DENIL MACHINE. <u>CAUSE(S)</u> FAILURE OF THE CONVEYOR POSITIONING MECHANISM.	EQUIPMENT FAILURE TO MATE CORRECTLY WILL NOT ALLOW THE NEXT STEP IN THE PROCESS TO BEGIN.	FAILURE DETERRENCE ELECTRIC SWITCHES INDICATE PROPER ALIGNMENT AND MATING.	1	4	4
B. MORTAR ECC DISCHARGE CONVEYOR	ITEM B ALSO SEGREGATES PORTIONS OF THE MORTAR.	<u>MODE</u> - FAILURE TO CONVEY MORTAR. <u>CAUSE(S)</u> ACTUATION MOTOR FAILURE.	EQUIPMENT POSITIONING LINE INTERRUPTION WHILE ERROR IS CORRECTED.	FAILURE DETERRENCE EACH CONVEYOR HAS A SENSOR TO DETECT MOTION. (REFERENCE NO NO. 35 SCS)	1	4	4
		<u>MODE</u> - FAILURE OF CONVEYOR TO RETRACT FROM THE ECC. <u>CAUSE(S)</u> FAILURE OF THE CONVEYOR POSITIONING MECHANISM.	EQUIPMENT FAILURE TO RETRACT CORRECTLY WILL NOT ALLOW THE NEXT STEP IN THE PROCESS TO BEGIN.	FAILURE DETERRENCE ELECTRIC SWITCHES INDICATE PROPER RETRACTION.	1	4	4
		<u>MODE</u> - POTENTIAL FIRE FROM EMPLOSIVE AND/OR EXPLOSIVE CHIPS GENERATED DURING PROCESSING.	PERSONNEL POTENTIAL AGENT RELEASE TO ATMOSPHERE AND/OR PERSONNEL EXPOSURE.	FAILURE DETERRENCE NO SOURCE OF IRRADIATION HAS BEEN IDENTIFIED FROM THE CONVEYORS. THEREFORE, THIS FAILURE MODE REPRESENTS AT LEAST A SECOND ORDER OCCURRENCE. A MAINTENANCE PROGRAM WILL REMOVE THE MATERIAL.	3	1	3



BB NO. 24. MORTAR DEMIL MACHINE (MDM)

FMEA INFORMATION SOURCES

BB NO. 24 MORTAR DEMIL MACHINE

DRAWINGS/DOCUMENTS:

- o Draft Demil Plan for the CAMDS at Tooele Army Depot.
- o Design Criteria CAMDS, April 1975. (4.2 BB NO. 24 MOR)

PERSONNEL REFERENCED:

R. Nelson

CRITERIA NOTES:

- o Design implementation assumed to be consistent with other Demil Machines.
- o Feedback Sensors listed are from the Design Criteria - Specific type to be used will be selected during design.
- o Severity levels and frequency of failures are predicated on similarity to other Demil Machines.
- o Sawing of the Burster is excluded from the analysis.
- o This FMEA is based upon Design Criteria and initial concepts. Detailed implementation of criteria and design has not been initiated.

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK: NO. 25. WIRE DENIL MACHINE (WIN)

BUILDING BLOCK LEVEL: 1
COMPONENT LEVEL: 1

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
25.2 WIRE ECC INPUT CONVEYOR (CONTINUED)		<p><u>MODE</u> - FAILURE TO CONVEY MATERIAL.</p> <p><u>CAUSE(S)</u></p> <p>A. ACTUATION MOTOR FAILURE.</p> <p><u>MODE</u> - FAILURE OF CONVEYOR TO RETRACT FROM THE ECC.</p> <p><u>CAUSE(S)</u></p> <p>A. FAILURE OF THE CONVEYOR POSITIONING MECHANISM.</p> <p><u>MODE</u> - POSSIBLE CONTAMINATION OF THE CONVEYOR AT THE INTERMEDIATE CONVEYOR OR DENIL MACHINE CONTACT POINT.</p>	<p><u>EQUIPMENT</u></p> <p>INATION LINE INTERRUPTION WHILE FAILURE IS CORRECTED.</p> <p>FAILURE TO RETRACT CORRECTLY WILL NOT ALLOW THE NEXT STEP IN THE PROCESS TO BEGIN.</p> <p>CONTAMINATED HARDWARE (CONVEYORS) ARE RETRACTED INTO THE UNPACK AREA (AT/LOCK).</p>	<p>FAILURE DETERRENCE DOWNSTREAM CONVEYOR DETECTS MORIVAL OF POSITION WITH SENSORS INSURING DETECTION OF MOTOR FAILURE.</p> <p>FAILURE DETERRENCE LIMIT SWITCHES INDICATE PROPER RETRACTION.</p> <p>FAILURE DETERRENCE THE AT/LOCK LIMITS MAINTAINED AT A NEGATIVE PRESSURE RELATIVE TO THE BALANCE OF THE UNPACK AREA. ASSET SENSORS ARE LOCATED IN THE UNPACK AREA. STANDARD OPERATING PROCEDURES FOR PERSONNEL MINIMIZE POTENTIAL FOR EXPOSURE.</p>	1	4	4
25.3 HYDRAULIC CLAMP	<p>LIFT WIRE OFF INPUT CONVEYOR.</p> <p>HOLD WIRE DURING PUNCH, DRAIN AND DISASSEMBLY OPERATIONS.</p>	<p><u>MODE</u> - FAILURE TO LIFT WIRE OFF INPUT CONVEYOR.</p> <p><u>CAUSE(S)</u></p> <p>A. ACTUATOR FAILURE.</p> <p><u>MODE</u> - FAILURE TO CLAMP WIRE IN PLACE OR WIRE DENTED AT THE DRAIN POINT.</p>	<p>PRODUCTION STOPS.</p> <p>WIRE COULD LEAVE MACHINE WHEN PUNCHING IS ATTEMPTED, CAUSING MACHINE DAMAGE.</p>	<p>FAILURE DETERRENCE SWITCH ON INPUT CONVEYOR INDICATES WHEN WIRE LEAVES THE CONVEYOR IF THE WIRE IS NOT REMOVED ON SCHEDULE THE CONTROL SYSTEM STOPS PROCESSING OPERATIONS.</p> <p>FAILURE DETERRENCE WHEN THE WIRE IS PROPERLY SECURED, IT IS SEATED ON BUTYL NUMBER. THE LOWER JAM HAS A DRAIN HOLE TO THE ASSENT REMOVAL PUMP. THE PRESSURE ON THIS LINE IS CHECKED BY THE CONTROL SYSTEM. IF IT SHOWS A VACUUM, THE JAMS ARE</p>	1	2	2

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK NO. 25. MINE DENTIL MACHINE (MIN)

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
25-3 HYDRAULIC CLAMP (CONTINUED)							
25-4 HYDRAULIC PUNCHES	PUNCH A HOLE IN THE TOP (VENT) AND TURN 90° AND DIMPLE OUT OF THE MINE (DRAIN).	MODE - FAILURE TO PUNCH CAUSE(S) A. ACTUATOR FAILURE.	<u>EQUIPMENT</u> SEAL ON AGENT DRAIN WOULD LEAK AGENT IN-SIDE THE ECC. VAPORS WOULD BE REMOVED BY THE FILTER SYSTEM. BURSTER REMOVAL WILL NOT BE POSSIBLE - MAY DAMAGE PULL EQUIPMENT AND/OR DROP MINE.	ASSUMED TO BE CLAMPED AND PROCESSING PROCEEDS. IF A VACUUM DOES NOT EXIST, THE CONTROL SYSTEM STOPS THE PROCESSING OPERATION. MINES ARE INSPECTED IN THE IMPACK AREA FOR MECHANICAL DAMAGE (DENTS, ETC.). TO CAUSE A PROBLEM THE DENT WOULD HAVE TO BE IN A SPECIFIC SPOT AND WOULD HAVE TO ESCAPE DETECTION DURING INSPECTION. THE DENT WOULD ALSO HAVE TO BE LARGE ENOUGH TO PREVENT SEALING VIA THE BUTYL RUBBER DRAIN PUNCH SEAL.	1	2	2
25-5 AGENT DRAIN SYSTEM-DEHISTER, SURGE TANK, VACUUM PUMP, DIAPHRAGM TYPE AGENT PUMP, LEVEL SENSORS, SOLENOID VALVES	DRAIN AGENT FROM MINE AND PUMP THROUGH PIPING TO ADS.	MODE - FAILURE TO RETRACT PUNCH (COMPLETELY). CAUSE(S) A. ACTUATOR FAILURE. MODE - FAILURE OF THE VACUUM PUMP TO PULL SUFFICIENT VACUUM.	INABILITY TO DRAIN STOPPING PRODUCTION. POSSIBLE DAMAGE TO MACHINE (PUNCH BREAKAGE).	FAILURE DETERRENCE THE AMOUNT OF AGENT REMOVED IS SENSED BY A LEVEL SENSOR. FAILURE DETERRENCE VENT PUNCH SYSTEM CAN BE OBSERVED ON REMOVE TO. IMPROPERING WILL INDICATE A FAILURE OF THE DRAIN PUNCH. FAILURE DETERRENCE PUNCHES WILL NOT OPERATE BECAUSE SENSORS WILL NOT DETECT A VACUUM WHEN THE JAMS CLOSE.	2	2	4
					1	2	2

FAILURE MODE AND EFFECT ANALYSIS

(NIN)
BUILDING BLOCK: NO. 25. MINE DEMIL MACHINE

BUILDING BLOCK LEVEL:
COMPONENT LEVEL:

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
25.5 AGENT DRAIN SYSTEM-DEMISTER, SURGE TANK, VACUUM PUMP, DIAPHRAGM TYPE AGENT PUMP, LEVEL SENSORS, SOLENOID VALVED (CONTINUED)		<p><u>MODE</u> - AGENT PUMP IMPERATIVE.</p> <p><u>CAUSE(S)</u></p> <p>A. DIAPHRAGM FAILURE, MECHANICAL FAILURE, ETC.</p> <p><u>MODE</u> - SOLENOID VALVES (4) FAIL OPEN OR CLOSED.</p>	<p><u>EQUIPMENT</u></p> <p>DRAINAGE WILL PROCEED AT A SLOWER RATE, AND THE AGENT WILL ACCUMULATE IN THE ECC AND NOT BE TRANSFERRED TO THE ADS. AGENT WILL NOT DRAIN.</p>	<p>FAILURE DETERRENCE THE AGENT LEVEL SENSOR WILL DETECT THE CONTINUED PRESENCE OF AGENT. PRESSURE SWITCH INDICATES WHEN ALL THE AGENT IS REMOVED.</p>	1	2	2
		<p><u>MODE</u> - LEVEL SENSOR FAILS IMPERATIVE OR GIVES AN INACCURATE INDICATION.</p>	<p>THIS FAILURE MODE IS EQUIVALENT TO THE SENSOR SENSING FAILURE AND WOULD RESULT IN THE AUTOMATIC SHUTDOWN OF THE LINE.</p>	<p>FAILURE DETERRENCE LEVEL SENSOR WILL INDICATE FAILURE AND THE SYSTEM AUTOMATICALLY SHUTS DOWN.</p>	1	2	2
25.6 BOOSTER RETAINER RING REMOVAL DEVICE	REMOVE BOOSTER RETAINING RING.	<p><u>MODE</u> - FAILURE OF THE COLLET TO REMOVE THE RETAINING RING.</p> <p><u>CAUSE(S)</u></p> <p>A. WEAR OR HYDRAULIC FAILURE.</p>	<p>THE PROCESS CANNOT PROCEED TO THE NEXT STEP.</p>	<p>FAILURE DETERRENCE FAILURE REMOVE IS INDICATED BY A MICRO-SWITCH ON THE COLLET WILL BE INSPECTED DURING THE MAINTENANCE INTERVAL AND WILL BE REPLACED WHEN ANY WEAR IS NOTED.</p>	1	2	2

FAILURE MODE AND EFFECT ANALYSIS

(MTH)

BUILDING BLOCK: NO. 25. MINE DENIL MACHINE

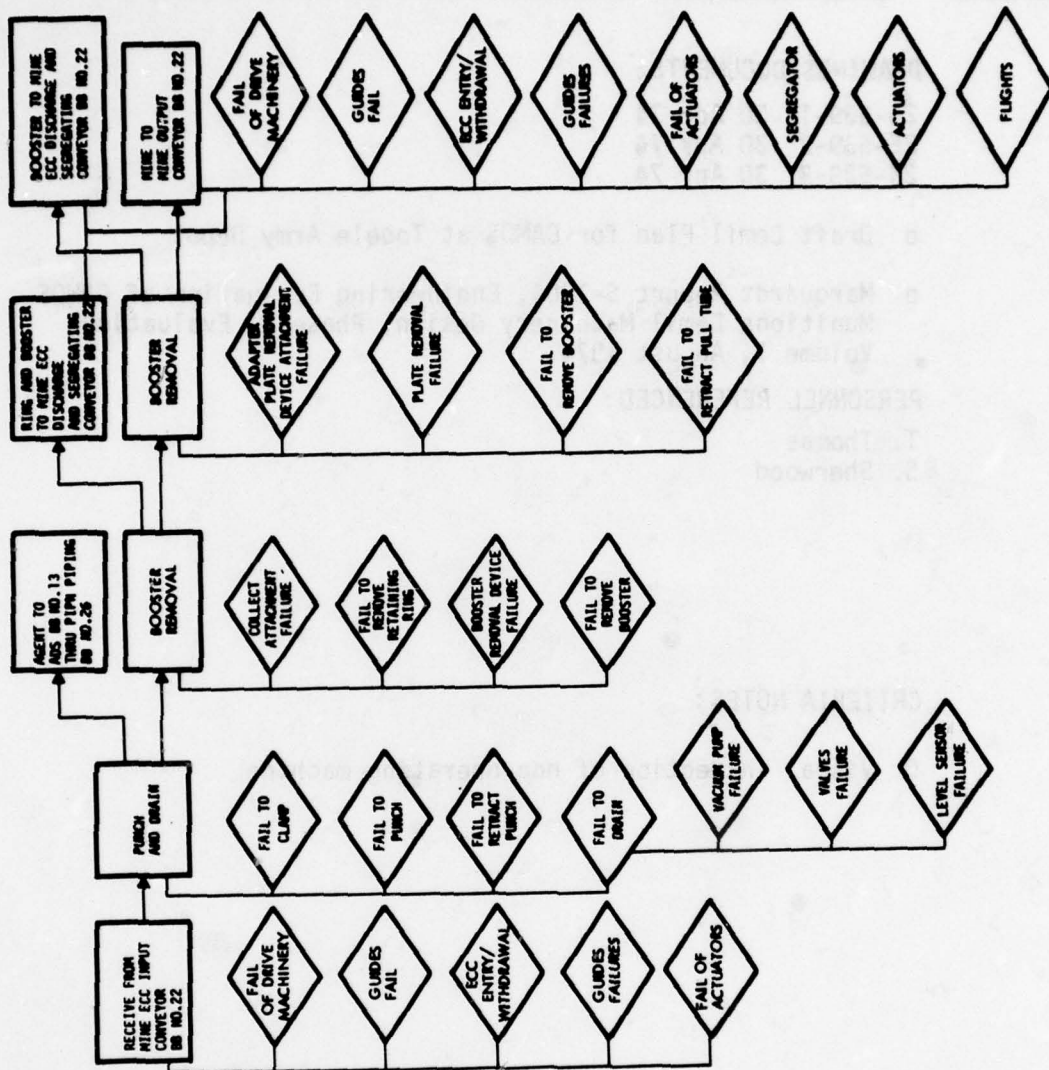
BUILDING BLOCK LEVEL **1**
 COMPONENT LEVEL

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
25.7 BOOSTER REMOVAL DEVICE	REMOVE BOOSTER.	<u>MODE</u> - FAILURE TO REMOVE THE BOOSTER. <u>CAUSE(S)</u> A. LACK OF PROPER PRESSURE SEAL OR HYDRAULIC SYSTEM FAILURE.	<u>EQUIPMENT</u> THE PROCESS CANNOT PROCEED TO THE NEXT STEP IF REMOVED AND IT ENTERS A FURNACE WITH THE BURSTER, THE TOTAL CHARGE WILL BE TOO HIGH (DAMAGE TO THE FURNACE).	FAILURE DETERRENCE BURSTER REMOVAL IS VERIFIED VIA A SENSOR ON THE OUTPUT CHUTE/CONVEYOR.	1	2	2
25.8 ADAPTOR PLATE REMOVAL DEVICE	REMOVE ADAPTOR PLATE.	<u>MODE</u> - DEVICE DOES NOT MOVE FORWARD TO CONTACT THE ADAPTOR. <u>CAUSE(S)</u> A. ACTUATOR OR HYDRAULIC FAILURE. <u>MODE</u> - GUIDE PIN/ALIGNMENT PIN DO NOT PROPERLY ENGAGE THE ADAPTOR. <u>CAUSE(S)</u> A. WEAR OR MECHANICAL DAMAGE. <u>MODE</u> - FAILURE TO TURN ADAPTOR. <u>CAUSE(S)</u> A. HYDRAULIC MOTOR FAILURE OR JAMMED ADAPTOR.	THE ADAPTOR WILL NOT BE REMOVED, AND THE BURSTER, THEREFORE, CANNOT BE REMOVED EITHER.	FAILURE DETERRENCE THE REMOVAL DEVICE MAKES 8 TO 10 REVOLUTIONS AND ONLY 2 OR 3 ARE REQUIRED. THE ADAPTOR REMOVAL HEAD HAS A SPRING LOADED DEVICE WHICH CAUSES THE REMOVED ADAPTER PLATE TO FALL OFF THE HEAD AND INTO A CHUTE. AT THIS POINT THE SWITCH ON THE OUTPUT CONVEYOR SENSES ITS PRESENCE (I.E., SUCCESSFUL REMOVAL). GUIDE PIN/ALIGNMENT PIN WILL BE INSPECTED AT REGULAR INTERVALS.	1	3	3
25.9 BURSTER PULL TUBE	PUSH OUT MAIN CHARGE.	<u>MODE</u> - BURSTER IS NOT REMOVED. <u>CAUSE(S)</u> A. FAILURE TO EXTEND DUE TO ACTUATOR FAILURE.	BURSTER IS NOT REMOVED.	FAILURE DETERRENCE PRESSURE OF THE BURSTER IS MONITORED ON THE CONVEYOR BELT VIA SWITCHES. ALSO, LIMIT SWITCHES ON THE PULL TUBE INDICATE BOTH EXTREMES OF ITS STROKE.	1	2	2

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL (MIN)
 COMPONENT LEVEL 25. MINE DEVIL MACHINE

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
25.10 MINE ECC DIS-CHARGE AND SEGREGATING CONVEYOR	EXTENDS INTO THE ECC AND MATES WITH AN INTER-MEDIATE CONVEYOR OR THE DEVIL MACHINE. TRANSPORTS THE MUNITION COMPONENTS TO THE NEXT CONVEYOR AND RETRACTS TO CLEAR THE ECC, ALLOWING ITEM OUT DOOR CLOSURE. ALSO SEGREGATES PORTIONS OF THE MUNITIONS.	<p><u>MODE</u> - FAILURE OF THE CONVEYOR TO MOVE IN THE ECC AND MATE WITH THE INTERMEDIATE CONVEYOR OR DEVIL MACHINE.</p> <p><u>CAUSE(S)</u></p> <p>A. FAILURE OF THE CONVEYOR POSITIONING MECHANISM.</p> <p><u>MODE</u> - FAILURE TO CONVEY MUNITION.</p> <p><u>CAUSE(S)</u></p> <p>A. ACTUATION MOTOR FAILURE.</p> <p><u>MODE</u> - FAILURE OF CONVEYOR TO RETRACT FROM THE ECC.</p> <p><u>CAUSE(S)</u></p> <p>A. FAILURE OF THE CONVEYOR POSITIONING MECHANISM.</p> <p><u>MODE</u> - POTENTIAL FIRE FROM EXPLOSIVE AND/OR EXPLOSIVE CHIPS GENERATED DURING PROCESSING.</p>	<p><u>EQUIPMENT</u></p> <p>FAILURE TO MATE CORRECTLY WILL NOT ALLOW THE NEXT STEP IN THE PROCESS TO BEGIN.</p> <p>MUNITIONS LINE INTERRUPTION WHILE ERROR IS CORRECTED.</p> <p>FAILURE TO RETRACT CORRECTLY WILL NOT ALLOW THE NEXT STEP IN THE PROCESS TO BEGIN.</p> <p>POTENTIAL AGENT RELEASE TO ATMOSPHERE AND/OR PERSONNEL EXPOSURE.</p>	<p>FAILURE DETERRENCE</p> <p>LIGHT SWITCHES INDICATE PROPER ALIGNMENT AND MATING.</p> <p>FAILURE DETERRENCE</p> <p>EACH CONVEYOR HAS A SENSOR TO DETECT MOTION (REFERENCE BB NO. 35 SCS).</p> <p>FAILURE DETERRENCE</p> <p>LIGHT SWITCHES INDICATE PROPER RETRACTION.</p> <p>FAILURE DETERRENCE</p> <p>NO SOURCE OF IGNITION HAS BEEN IDENTIFIED FROM THE CONVEYORS. THEREFORE, THIS FAILURE MODE REPRESENTS AT LEAST A SECOND ORDER OCCURRENCE.</p> <p>A MAINTENANCE PROGRAM WILL REMOVE THE MATERIAL.</p>	1	4	4
					3	1	3



BB NO. 25. MINE DEMIL MACHINE (MDN)

FMEA INFORMATION SOURCES

BB NO. 25

MINE DEMIL MACHINE

DRAWINGS/DOCUMENTS :

25-539-1 30 Apr 74
25-539-2 30 Apr 74
25-539-3 30 Apr 74

- o Draft Demil Plan for CAMDS at Tooele Army Depot
- o Marquardt Report S-1304, Engineering Evaluation of CAMDS Munitions Demil Machinery Design, Phase 1, Evaluation, Volume 1, August 1974.

PERSONNEL REFERENCED:

T. Thomas
S. Sherwood

CRITERIA NOTES:

- 0 Visual inspection of non-operating machine

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

BUILDING BLOCK: NO. 26. PIPING (PIP)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
26.0 PIPING (PIP)	CONVEY AIR, STEAM, AGENT (GB/YR) DECON SOLUTIONS, SCRUBBER BRINE, AND FUEL OIL WITHIN THE CAMDS FACILITY.						
26.1 AGENT PIPING	TRANSPORT AGENT FROM THE ECC, PPD, AND BIF TO THE ADS FOR DISPOSAL.	<p><u>MODE</u> - AGENT LEAKAGE TO THE FILTER SYSTEM.</p> <p><u>MODE</u> - FAILURE TO POSITION VALVES PROPERLY DURING INITIAL POSITION LINE SETUP.</p> <p><u>CAUSE(S)</u> A. OPERATOR ERROR.</p>	<p><u>EQUIPMENT</u></p> <p>NO SERIOUS CONSEQUENCE IN THE ABSENCE OF A SECOND FAILURE. THE AGENT ENTERS THE FILTER SYSTEM.</p> <p>AGENT WILL NOT DRAIN TO THE ADS AND MAY BE DRAINED ELSEWHERE, AS THE PRIMARY ANOMALY TO EQUIPMENT.</p>	<p>FAILURE DETERRENCE THE PIPING USED IS COAXIAL. (SCHEDULE 80 INSIDE, 3-INCH DIAMETER OUTSIDE, HEATED AND INSULATED, INSIDE PIPE IS WELDED.) AGENT IS RINSED TO A STAND PIPE. DRAINAGE IS VIA GRAVITY. DETECTORS MONITOR THE SHROUD PIPING FOR LEAKS.</p> <p>FAILURE DETERRENCE PERSONNEL TRAINING. PROCEDURES SPECIFY VALVE POSITIONING DURING SETUP.</p>	1	1	1

FMEA INFORMATION SOURCES

BB NO. 26

PIPING

DRAWINGS/DOCUMENTS:

- o Draft Demil Plan for CAMDS at Tooele Army Depot

PERSONNEL REFERENCED:

Lt. J. King

CRITERIA NOTES:

Design Criteria for CAMDS Piping Project, 28 July 1975

Analysis Limited to Agent Piping

OTHER:

Memo for record: SAREA-DM, 26 June 1975.
Piping Interface Meeting , Salt Lake City, 24 June 1975.
(J. K. Bartel)

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

BUILDING BLOCK: NO. 27, ELECTRICAL (BLE)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETECTION OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
27.0 ELECTRICAL SYSTEM	SUPPLY AND DISTRIBUTE COMMERCIAL AND EMERGENCY STANDBY POWER.						
27.1 12 KV LINE TO CAMPS, 120/208 V TRANSFORMERS, 480 V TRANSFORMERS, MAIN CIRCUIT BREAKERS	PRIMARY ELECTRICAL POWER TO ALL 120/208 V AND 480 V LOADS.	<p>MODE - INTERRUPTION.</p> <p>CAUSE(S)</p> <p>A. LINE FAILURE, LIGHTNING, UTILITY FAILURE, TRANSFORMER FAILURE, OVERLOAD OF MAIN BREAKERS, HUMAN ERROR.</p>	<p>EQUIPMENT</p> <p>LOSS OF ELECTRICAL POWER TO FACILITY CAUSING UNSCHEDULED SHUTDOWN OF ALL OPERATIONS.</p> <p>o FURNACES WOULD NOT SUSTAIN COMBUSTION, CAUSING POSSIBLE BUILDUP OF COMBUSTIBLE GASES WITH A CHANCE OF REIGNITION AND EXPLOSION RELEASING AGENT TO CONTAINED AREA.</p> <p>o ADS PROCESS WOULD STOP WITH POSSIBLE EXPLOSION DUE TO BUILDUP OF TOXIC AND AGENT GASES. POSSIBLE RELEASE OF AGENT AND TOXIC GAS TO THE ATMOSPHERE. THIS IS A POSSIBLE RESULT OF THE LOSS OF AGITATION AND/OR COOLING. SEE BR. NO. 13.</p>	<p>FAILURE DETERMINE EMERGENCY GENERATORS AUTOMATICALLY PICK UP THOSE LOADS WHICH ARE NECESSARY TO THE ORDERLY SHUT DOWN OF ALL PRODUCING OPERATIONS. THE GENERATORS WILL BE ON LINE WITHIN 10 SECONDS OF POWER FAILURE TO THE FOLLOWING LOADS:</p> <p>120/208 V SYSTEM</p> <p>(THERE ARE TWO 235-KW 120/208V GENERATORS. IN THE EVENT OF FAILURE OF ONE UNIT THE SECOND WILL AUTOMATICALLY COME ON LINE.)</p> <p>MCC-E CONTROL CENTER</p> <p>UPA FILTER</p> <p>BIF FILTER</p> <p>PDF FILTER (INPUT)</p> <p>AREA LIGHTING</p> <p>HOIST BIF DOCK</p> <p>HPF FILTER</p> <p>IME FILTER</p> <p>ECC FILTER</p> <p>PIP FILTER</p> <p>PANEL E1 - AT POWER DISTRIBUTION MODULE.</p> <p>LIGHTING</p> <p>EXHAUST FAN</p> <p>TELEPHONE EXCHANGE</p> <p>HEATER</p>	1	4	4

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK: NO. 27. ELECTRICAL (ELE)

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERMINANCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
27.1 12 KV LINE TO TRANSFORMERS, 120/200 V TRANSFORMERS, 480 V TRANSFORMERS, MAIN CIRCUIT BREAKERS (CONTINUED)			<p>PERSONNEL</p> <p>LOSS OF LIGHTING WITH POSSIBLE INJURY TO PERSONNEL AND EQUIPMENT. OF SPECIFIC CONCERN ARE THOSE AREAS WHERE PERSONNEL ARE WORKING IN TYPE A SUITS, AND THE CONTROL CENTER.</p>	<p>PANEL E2 - AT CONTROL MODULE.</p> <p>FAILURE DETERMINANCE LIGHTING HEATER/AIR CONDITIONER</p> <p>PANEL E3 - AT CONTROL MODULE.</p> <p>ECC POWER/CONTROL ADS CONTROL MANUAL CONTROLS AGENT INDICATOR POWER/CONTROL DFS CONTROL/POWER HPF CONTROL/POWER ETS/CDC CONTROL/POWER COMPUTER CTV</p> <p>PANEL E4 - AT RR CAR WITH GENERATORS.</p> <p>LIGHTING WATER PUMP HEATERS LOAD BANK FUEL PUMPS BATTERY CHARGER RELAY KIM START (WATER HEATER ON BLOCK OF GENERATORS)</p> <p>[SEE 480V SYSTEM BELOW FOR ADDITIONAL 120/200 V LOADS.]</p> <p>480 V SYSTEM - (ONE 500-HZ GENERATOR)</p> <p>AIR COMPRESSOR BOILER ADS HPF DFS</p> <p>UTILITIES HOUSING 120/200V PANEL-BOARD</p> <p>EMERGENCY BATTERY LAMPERS WITH BUILT-IN CHARGERS AND AUTOMATIC TURN ON WHEN THE CHARGING CIRCUIT IS INTERRUPTED WILL BE INSTALLED IN ALL WORK AREAS TO COVER THE 10 SECONDS LOSS OF POWER.</p>			

FMEA INFORMATION SOURCES

BB NO. 27

ELECTRICAL SYSTEM

DRAWINGS/DOCUMENTS :

27-500-1	24 May 75	27-500-16	24 May 75	27-501-10	24 Feb 75
-2	24 May 75	-17	24 May 75	-11	20 Feb 75
-3	27 May 75	-18	27 Sep 73	-12	9 June 75
-4	27 May 75	-19	15 Aug 73	-13	17 Dec 75
-5	27 May 75	-20	23 Apr 72	-14	16 Dec 74
-6	27 May 75	27-511-01	14 Feb 75	-15	16 Dec 74
-7	27 May 75	27-501-1	7 June 75	-16	6 Jan 74
-8	27 May 75	-2	30 Apr 73	-17	2 Oct 72
-9	27 May 75	-3	3 Apr 73	-18	3 Dec 73
-10	27 May 75	-4	23 Apr 73	-19	14 Mar 75
-11	9 June 75	-5	28 Feb 73	-20	4 Feb 75
-12	20 May 75	-6	9 June 75	-21	30 Dec 74
-13	20 May 75	-7	9 June 75	-22	10 Sep 74
-14	24 May 75	-8	19 Nov 74	-23	18 June 75
-15	7 June 75	-9	24 Feb 75	-24	30 May 75
				-25	3 July 75

PERSONNEL REFERENCED :

D. Bodrero

L. Selin

CRITERIA NOTES :

- o Review limited to major impact areas.
- o Design not reviewed for adequacy in size or conformity to building codes.
- o Analysis limited to first level of failure only.

OTHER:

- o Draft Demil Plan for CAMDS at Tooele Army Depot
- o Memo for record - Report of meeting on CAMDS Electrical and Control Interfaces - SAREA-DM, 25 Jul 75, J. W. Cauller
- o Disposition AMXTE-AEO, CAMDS Electrical System, 14 July 1975.

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

BUILDING BLOCK: NO. 30. CLOSED CIRCUIT TELEVISION (CTV)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETECTION OR CORRECTIVE ACTION	SEVERITY LEVEL	PROBABILITY OF FAILURE	CRITICALITY INDEX
30.0 CLOSED CIRCUIT TELEVISION SYSTEM	VISUAL MONITORING OF WORK AREAS DURING PROCESSING AND MAINTENANCE OPERATIONS. VISUAL MONITORING OF CRITICAL UNMANNED HAZARDOUS AREAS DURING PROCESSING OPERATIONS.	MODE - ERRATIC OPERATION OR COMPLETE FAILURE. CAUSE(S) A. COMPONENT FAILURE.	EQUIPMENT TOTAL LOSS OF VISUAL (TV) MONITORING REQUIRING SHUTDOWN OF OPERATIONS UNTIL REPAIRED.	FAILURE DETECTION A SPARE GENERATOR AND AMPLIFIER ARE MOUNTED NEXT TO PRIMARY UNIT. RE-PLACEMENT OF PRIMARY UNIT IN THE SYSTEM REQUIRES DISCONNECTING ONE CABLE FROM THE PRIMARY UNIT AND CONNECTION TO THE SPARE. A BNC CONNECTOR IS USED AT THE INTER-FACE.	1	4	4
30.1 CENTRAL SYNCHRONIZATION SIGNAL FOR ALL ZATION GENERATOR AND AMPLIFIER	SINGLE SOURCE OF SYNCHRONIZATION SIGNAL FOR ALL TV CAMERAS AND MONITORS.						

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

BUILDING BLOCK: NO. 31. COMMUNICATIONS (CON)

INDEX	CRITICALITY	FREQUENCY OF FAILURE	SEVERITY LEVEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE MODE/CAUSE	FUNCTION	COMPONENT OR ITEM
31.0							VERBAL COMMUNICATIONS BETWEEN ALL WORK AREAS WITHIN CAMDS INCLUDING: PUBLIC ADDRESS TELEPHONE INTERCOM LEVELS A SHITTED PERSONNEL AUDIO MONITOR AT PUBLIC ADDRESS LOCATIONS.	COMMUNICATION SYSTEM
31.1	2	2	2	FAILURE DETERRENCE A. PREVENTIVE MAINTENANCE PROGRAM. B. PREVENTIVE MAINTENANCE PROGRAM.	PERSONNEL A. LOSS OF PERSON-TO-PERSON OR CONFERENCE LINE COMMUNICATION. B. LOSS OF PUBLIC ADDRESS AND AUDIO MONITOR AT PUBLIC ADDRESS LOCATIONS.	MODE - COMPONENT FAILURE PREVENTING PROPER CIRCUIT CONNECTION.	INTERCONNECT CIRCUITS FROM/TO COMMUNICATION POINTS.	EXTENSION CIRCUITS

FMEA INFORMATION SOURCES

BB NO. 31 COMMUNICATION SYSTEM

DRAWINGS/DOCUMENTS:

31-502-1 24 Apr 75
 -2 3 Apr 75
 -3 12 Nov 73
 -4 (unreadable date)
 -5 10 Feb 75

PERSONNEL REFERENCED:

F. Eldridge

CRITERIA NOTES:

- o Identify single items which affect total system performance. (None found to depth studied.)
- o Public Address System viewed as last resort emergency system.

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL <input checked="" type="checkbox"/>		SITE CONTROL SYSTEM (SCS)					
COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
36.0 SITE CONTROL SYSTEM	<p>MASTER CONTROL AND MONITORING OVER THE CAMDS SITE.</p> <p>CONTROL IS ACCOMPLISHED BY COMPUTER BASED AUTOMATIC SYSTEM WITH MANUAL OVERRIDE.</p> <p>MONITORING IS ACCOMPLISHED BY COMPUTER BASED AUTOMATIC SYSTEM WITH PARALLEL VISUAL STATUS INDICATORS.</p> <p><u>THE FOLLOWING ARE SCS CONTROLLED AND MONITORED:</u></p> <ul style="list-style-type: none"> EXPLOSIVE CONTAINMENT CURTICLE ROCKET DENIL MACHINE PROJECTILE DENIL MACHINE PROJECTILE PULL AND DRAIN MACHINE CONVEYORS MORTAR DENIL MACHINE MINE DENIL MACHINE PIPING SYSTEM 						

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL <input checked="" type="checkbox"/>		SITE CONTROL BUILDING BLOCK: NO. 35. SYSTEM (SCS)					
COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE INTERFERENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
35.0 SITE CONTROL SYSTEM (CONTINUED)	<p>THE FOLLOWING ARE SEPARATELY CONTROLLED AND SCS MONITORED:</p> <ul style="list-style-type: none"> UNPACK AREA DEACTIVATION PURCHASE SYSTEM METAL PARTS FURNACE UTILITIES MODULE AGENT DESTRUCTION SYSTEM EXPLOSIVE TREATMENT SYSTEM CENTRAL RECON SYSTEM BULK ITEM FACILITY FILTER SYSTEM AGENT DETECTORS <p>THE FOLLOWING ARE SEPARATELY CONTROLLED AND MONITORED:</p> <ul style="list-style-type: none"> DAMAGE INCUBATOR SYSTEM ELECTRICAL DISTRIBUTION SYSTEM PERJURATOR MONITORING SYSTEM CLOSED CIRCUIT TELEVISION SYSTEM COMMUNICATIONS SYSTEM CHEMICAL LABORATORY 						

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

SITE CONTROL
 BUILDING BLOCK: NO. 35. SYSTEM (SCS)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
35.1 SOFTWARE PROGRAM	PREDETERMINED SEQUENCE OF OPERATIONS.	MODE - ERROR IN PROGRAMMING.	EQUIPMENT IDENTITY OF SEQUENCE OPERATIONS CAUSING POSSIBLE EQUIPMENT DAMAGE.	FAILURE DETERRENCE PROOFING OF THE PROGRAM IS ACCOMPLISHED DURING TEST RUNS USING INERT MATERIALS, PRIOR TO PRODUCTION USING ACTIVE MATERIALS.	2	4	8
CRT TERMINAL	DISPLAY STATUS OF ACTIVITY INCLUDING EQUIPMENT MALFUNCTION IDENTIFICATION.	MODE - FAILURE TO DISPLAY. CAUSE(S) COMPONENT FAILURE.	PERSONNEL EITHER THE OPERATOR OR MONITOR WILL BE WITHOUT DISPLAY.	FAILURE DETERRENCE A BACK-UP UNIT IS OPERATED IN THE ADJACENT CONTROL POINT.	1	2	2
TERMINAL PRINTER	HARD COPY PRINTOUT OF COMPUTER SYSTEM ACTIVITIES.	MODE - FAILURE TO MAKE HARD COPY OF DESIRED DATA. CAUSE(S) COMPONENT FAILURE.	PERSONNEL INCOMPLETE RECORDS.	FAILURE DETERRENCE A BACK-UP UNIT IS OPERATED IN THE ADJACENT CONTROL POINT.	1	2	2
MOVING HEAD DISC	MEMORY FOR COMPUTER SOFTWARE.	MODE - FAILURE TO ISSUE OR RECEIVE DATA ON REQUEST. CAUSE(S) COMPONENT FAILURE.	EQUIPMENT SHUTDOWN OF DENIL PRODUCTION.	FAILURE DETERRENCE ROUTINE MAINTENANCE PROGRAM.	1	2	2
COMPUTER MAIN FRAME	CORE MEMORY AND CENTRAL PROCESSING UNIT.	MODE - FAILURE TO OPERATE. CAUSE(S) COMPONENT FAILURE.	PERSONNEL INABILITY TO CONTROL DENIL OPERATIONS/ POSSIBLE DAMAGE TO EQUIPMENT AND INJURY TO PERSONNEL.	FAILURE DETERRENCE ROUTINE MAINTENANCE PROGRAM.	2	2	4

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL <input type="checkbox"/>		SITE CONTROL BUILDING BLOCK: NO. 35. SYSTEM (SCS) <input checked="" type="checkbox"/>					
COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE RETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
35.1 SOFTWARE PROGRAM (CONTINUED) COMPUTER SYSTEM	CONTROLS SEQUENCE OF COMMANDS IN ACCORDANCE WITH SOFTWARE PROGRAM MONITORS FEEDBACK SIGNALS TO ASSURE THAT COMMANDS HAVE BEEN IMPLEMENTED MONITORS "DOWN STREAM" SYSTEMS TO ASSURE THAT TOTAL PRODUCTION LINE IS FUNCTIONING CORRECTLY SHUTS DOWN PRODUCTION LINE IN A CONTROLLED SEQUENCE IN EVENT OF MALFUNCTION OF DENIL AND CONVEYOR EQUIPMENT.	<u>MODE</u> - LOSS OF POWER.	EQUIPMENT A. IN PROCESS DATA ARE STORED IN COMPUTER. B. FURTHER COMMANDS ARE NOT ISSUED. C. COMPUTER PROGRAM STOPS. D. RELAYS WILL OPEN, STOPPING ALL MACHINERY.	FAILURE RETERRENCE RESTART OPERATIONAL PROCEDURE WHICH INCLUDES: o VERIFICATION OF STATUS OF ALL EQUIPMENT. o RESTART AT APPLICABLE PROGRAM STEP.	1	4	4
MULTIPROGRAMMER	CONTROL SWITCH FOR MOTORS SOLENOID VALVES, ETC. CONNECTS CONTROLLED UNIT TO GROUND.	<u>MODE</u> - SWITCH FAILURE IN CLOSED <u>MODE(S)</u> COMPONENT FAILURE.	EQUIPMENT UNDESCHEDULED OPERATION OF MOTORS, VALVES, ETC. POSSIBLE DAMAGE TO EQUIPMENT AND/OR INJURY TO EQUIPMENT. *THE SEVERITY LEVEL IS INDETERMINATE. THE TIMING OF THE EVENT COULD RESULT IN ANY LEVEL FROM 1 TO 4.	FAILURE RETERRENCE FEEDBACK SIGNALS WILL INDICATE A SCHEDULED CONDITION TO THE COMPUTER AND POSITION INDICATOR LIGHT PANEL. THE COMPUTER WILL AUTOMATICALLY SHUT DOWN THE DENIL OPERATIONS. <u>NOTE</u> : NOT ALL CONTROLLED ITEMS HAVE FEEDBACK TO THE SCS.	•	2	•

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL <input type="checkbox"/>		SITE CONTROL SYSTEM (SCS)					
COMPONENT LEVEL <input checked="" type="checkbox"/>							
COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
35.2 MANUAL OVERRIDE SWITCH PANEL	MANUAL OPERATION OF DENIL PROCESS AS AN OVERRIDE OF THE COMPUTER SYSTEM. ANTICIPATED USE DURING MAINTENANCE PERIODS AND SPECIAL EVENTS.	<u>MODE</u> - OPERATOR ERROR IN SELECTING SWITCHES.	PERSONNEL UNEXPECTED OPERATION OF MOTORS, CLAMPS, PUMPS, DOORS, ETC., WITH POSSIBLE DAMAGE TO EQUIPMENT AND/OR INJURY TO PERSONNEL. *THE SEVERITY LEVEL IS INDETERMINATE. THE TIMING OF THE EVENT COULD RESULT IN ANY LEVEL FROM 1 TO 4.	FAILURE DETERRENCE PANEL OPERATIONS ARE ONLY POSSIBLE THROUGH USE OF A KEY WHICH IS RETAINED BY A CARDS SUPERVISOR. THE KEY SWITCH IS INTERLOCKED WITH THE COMPUTER. USE OF THE KEY BLOCKS ALL COMPUTER GENERATED COMMANDS FROM THE CONTROLLED EQUIPMENT. A RETAILED OPERATION MANUAL (COOK BOOK TYPE) WILL BE USED TO OPERATE THE MACHINE SEQUENCES.	•	1	•
35.3 POSITION INDICATOR LIGHT PANEL	VISUAL INDICATION OF FEEDBACK/STATUS SIGNALS.	<u>MODE</u> - INCORRECT/NO READOUT. CAUSE(S) LAMP OR OTHER COMPONENT FAILURES.	PERSONNEL OPERATOR ACTIONS COULD BE IN ERROR DUE TO WRONG INFORMATION CAUSING EQUIPMENT DAMAGE AND/OR PERSONNEL INJURY.	FAILURE DETERRENCE THIS PANEL IS A BACKUP FOR THE COMPUTER SYSTEM. THE PANEL HAS A LAMP TEST BUTTON ON THE FRONT OF THE PANEL. LAMP STATUS IS INDICATED IN THE MANUAL OPERATION MANUAL.	1	2	2
35.4 CONTROL CIRCUIT WIRING	SWITCHING CIRCUITRY FOR MOTORS, SOLENOID VALVES ETC., FOR DENIL PROCESSING.	<u>MODE</u> - CIRCUIT GROUNDING BETWEEN THE CONTROLLED DEVICE AND ITS CONTROL SWITCH. CAUSE(S) INSULATION FAILURE AND/OR CONTACT OF CONDUCTOR TO GROUND. THE IMPACT OF DECON SOLUTION ON CONVENTIONAL INSULATION IS UNKNOWN. OVER THE LIFE OF THE PROGRAM IT IS EXPECTED THAT THE DECON SOLUTION WILL CONTACT THE WIRING OF THE DENIL MACHINES.	PERSONNEL UNSCHEDULED OPERATION OF DOORS, FANS, SAMS, PUMPS, PUMPS, CLAMPS, CONVEYORS, ETC., CAUSING POSSIBLE DAMAGE TO EQUIPMENT AND/OR INJURY TO PERSONNEL. *THE SEVERITY LEVEL IS INDETERMINATE. THE TIMING OF THE EVENT COULD RESULT IN ANY LEVEL FROM 1 TO 4.	FAILURE DETERRENCE FEEDBACK SIGNALS WILL INDICATE AN UNSCHEDULED CONDITION. THE LIGHT PANEL WILL INDICATE THE FEEDBACK CONDITION. THE COMPUTER WILL AUTOMATICALLY SHUT DOWN THE DENIL OPERATIONS. (NOTE: NOT ALL CONTROLLED ITEMS HAVE FEEDBACK TO THE SCS) CORRECTIVE ACTION RECOMMEND CONSIDERATION OF WIRING OF SWITCHING DEVICES IN THE HOT LEAD OF THE CIRCUITS PER NATIONAL ELECTRIC CODE.	•	4	•

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL <input type="checkbox"/>		SITE CONTROL BUILDING BLOCK: NO. 35. SYSTEM (SCS)					
COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
35.5 BLAST SENSORS INSIDE ECC	SOURCE OF FEEDBACK SIGNAL IN EVENT OF BLAST INSIDE ECC. SWITCHES USED BY THE COMPUTER AND ALL ECC PROCESSING AND TO SHUT OFF THE HYDRAULIC RETURN LINE.	MODE - FAILURE TO OPERATE WITH OVERPRESSURE.	EQUIPMENT: CONTINUED PROCESSING WHICH COULD RELEASE AGENT (THROUGH DOORS OPENING) TO THE FILTRATION SYSTEM AND MIXING OF AGENT WITH HYDRAULIC FLUIDS. IF FIRE WERE PRESENT, IT COULD PROPAGATE OUTSIDE THE ECC.	FAILURE DETERRENCE: ROUTINE MAINTENANCE AND CALIBRATION OF SENSORS. REDUNDANT SENSORS ARE INSTALLED FOR THE SCS AND HYDRAULIC PUMP.	3	1	3
35.6 MICRO SWITCHES	SOURCE OF FEEDBACK SIGNAL FOR "POSITION" OF CLAMPS, DOORS, LOCKS, SAMS, ETC.	MODE - FAILURE TO CHANGE STATE WITH EVENT.	EQUIPMENT: ERROR IN SIGNAL TO COMPUTER WHICH WILL PERMIT CONTINUATION TO THE NEXT STEP OR STOP THE PROCESS WHEN THE OPPOSITE SHOULD OCCUR.	FAILURE DETERRENCE: COMPUTER SOFTWARE PROGRAMS REQUIRE TESTING THE SWITCH CONDITION PRIOR TO AND AFTER EACH EVENT. IN THE EVENT THE DETECTOR SIGNAL IS IN ERROR, THE PROCESS IS STOPPED.	1	4	4
35.7 MOTION SENSORS	SOURCE OF FEEDBACK SIGNAL TO SHOW CONVEYOR OPERATION.	MODE - FAILURE TO PROPERLY FEEDBACK CONVEYOR STATUS.	EQUIPMENT: ERROR IN SIGNAL TO COMPUTER WHICH WILL PERMIT CONTINUATION TO THE NEXT STEP OR STOP THE PROCESS WHEN THE OPPOSITE SHOULD OCCUR.	FAILURE DETERRENCE: COMPUTER SOFTWARE PROGRAMS REQUIRE TESTING THE CIRCUIT PRIOR TO AND AFTER EACH EVENT. IF THE SENSOR FAILS TO SHOW MOTION, WHEN PROGRAMMED, THE COMPUTER PROGRAM STOPS THE CONVEYOR MOTOR AND AUTOMATICALLY RESTARTS THE MOTOR. IF THE CONVEYOR AGAIN FAILS TO SHOW MOTION, THE DEWIL PROCESSING IS AUTOMATICALLY STOPPED.	2	1	2

FAILURE MODE AND EFFECT ANALYSIS

BUILDING BLOCK LEVEL
 COMPONENT LEVEL

SITE CONTROL
 BUILDING BLOCK: NO. 35. SYSTEM (SIS)

COMPONENT OR ITEM	FUNCTION	FAILURE MODE/CAUSE	FAILURE CONSEQUENCE EQUIPMENT/PERSONNEL	FAILURE DETERRENCE OR CORRECTIVE ACTION	SEVERITY LEVEL	FREQUENCY OF FAILURE	CRITICALITY INDEX
35.8 ECC OVERRIDE CIRCUITS	<p>FURNISH PERSONNEL SAFETY WHEN MAINTENANCE AND REPAIR WORK IS DONE INSIDE THE ECC.</p> <p>A KEY SWITCH IS LOCATED OUTSIDE THE ECC. PRIOR TO ENTRY IN THE ECC THE KEY IS GIVEN TO THE MEN ENTERING. REMOVAL OF THE KEY INHIBITS ALL CONTROL CIRCUITS WITHIN THE ECC.</p> <p>BUTTONS ARE INSTALLED AT THE ENDS OF THE ECC. HOLDING THE BUTTON DOWN PERMITS OPERATION OF THE CONTROL CIRCUITS FROM THE CONTROL CENTER.</p>	<p>MODE -</p> <p>ONE MAN HOLDS THE BUTTON DOWN WHILE THE SECOND WORKS ON THE EQUIPMENT. THE WORKING MAN, CLAMP, ACTUATOR, PUNCH, ETC., ARE OPERATED FROM THE CONTROL CENTER.</p>	<p>PERSONNEL POSSIBLE INJURY TO PERSONNEL.</p>	<p>FAILURE DETERRENCE OR CORRECTIVE ACTION</p> <p>FAILURE DETERRENCE STANDARD OPERATING PROCEDURE AND PERSONNEL TRAINING IN ACCORDANCE WITH THE PROCEDURE.</p> <p>RELEASE OF THE BUTTON STOPS FURTHER OPERATIONS.</p>	3	3	9

FMEA INFORMATION SOURCES

BB NO. 35

SITE CONTROL SYSTEM

DRAWINGS/DOCUMENTS :

35-504-1	13 Aug 74	35-504-10	14 Mar 75	35-504-19	15 Sep 74
-2	7 Aug 74	-11	14 Mar 75	-20	30 Jan 75
-3	4 Oct 74	-12	14 Mar 75	-21	14 Mar 75
-4	13 Aug 74	-13	14 Mar 75	-22	10 Feb 75
-5	30 July 74	-14	13 Sep 74	-23	12 Nov 74
-6	20 June 74	-15	13 Oct 74		
-7	25 June 74	-16	18 Oct 74		
-8	13 Sept 74	-17	9 May 75		
-9	24 Oct 74	-18	10 Sep 74		

PERSONNEL REFERENCED:

AEO (TEAD) personnel - D. Bodrero, H. Glick, L. Selin

Hewlett-Packard personnel - S. Nelson and L. Souza

CRITERIA NOTES:

- o Review limited to major impact areas.
- o Software review limited to general structures only. Software will shutdown preceding operations in event of failure. Software will shutdown operations in event of failure in monitored building blocks.
- o Computer diagnostic test will be run each day prior to start up.
- o Design not reviewed for adequacy in size or conformity to building codes.
- o Emergency shutdown procedures are not developed and not reviewed.

5. SUMMARY AND CONCLUSION

For purposes of this document, Safety Analysis and Hazard Evaluation Report, Failure Modes and Effects Analyses, the emphasis has been placed on identified events (agent release, toxic leaks, explosions, and fire) which could pose a hazard to assigned personnel, equipment, or the surrounding environment. No single point failures were found to exist anywhere in the CAMDS building blocks that could conceivably result in Category IV (catastrophic) conditions; two or more failures were required to bring about Category IV results, suggesting that considerable attention has been given to the basic design concepts of each building block.

5.1 ENVIRONMENTAL CONSIDERATIONS

Based on an examination of all the available design and test data for the CAMDS facility at Tooele, Utah, deleterious effects to the environment as a result of demilitarization operations are not probable. The amount of agent being processed in any one operation is of a sufficiently small quantity as to be completely contained and absorbed by a network of filter systems. An accidental spill of agent GB, VX, or mustard is readily and safely handled. Further, the facility is designed to isolate one activity from another in an independent and completely autonomous manner.

The possible emission of chemical agent vapors to the atmosphere resulting from an accidental spill outside of the detoxification areas is the only adverse environmental effect associated with the CAMDS concept. Since only one munition will be involved, the release is limited to the amount of agent in that particular munition. Throughout the demilitarization operations a network of detectors will provide accurate and immediate indication of contamination. If an area of contamination is detected, that area will be chemically decontaminated within minutes and checked to verify that there is no detectable concentration of agent present. Throughout the FMEA data (Section 4), possible agent leakage or spillage is noted as leaking only into a low pressure or filtered area or to caustic scrubbing system, not to the atmosphere; Reference Explosive Containment Cubicle, building blocks (BB) No. 2., items 2.2, 2.3, 2.4. Release of toxic agents to caustic scrubbing areas is noted in Deactivation Furnace System, BB No. 4, items 4.3 and 4.5; Agent Destruction System, BB No. 13., item 13.1. A possible release to fume burners and to afterburners with failures in the

Metal Parts Furnace, BB No. 5, is noted in items 5.1 and 5.2. Of the major failures noted as possible in the Bulk Item Facility, BB No. 21., a rupture in the tank drain line would release agent to a toxic area (item 21.2). If a container is damaged there may be toxic release to an outside area as noted in item 21.1 but considerable testing and experience with container handling indicates this to be a very remote likelihood (reference item 21.1). Additionally, personnel in the immediate area are suited appropriately, decontamination solution is readily available and safety procedures are provided to handle any eventuality.

The afterburner in the Deactivation Furnace/System operates at a minimum temperature of 1600°F; thus, all traces of agents GB or VX that may be present in the Deactivation Furnace gaseous effluent are thermally decomposed. Fiberglass shipping and firing tubes are burned in the Deactivation Furnace/Scrubber at a temperature that minimizes particulate emissions.

No solid waste problems are envisioned because the wood dunnage and combustible packing materials are incinerated on site. There is no discharge of process water nor toxic wastes from the CAMDS site. All brine resulting from the neutralization of agents, scrubbing of waste gas streams, and decontamination processes will be dried on site with the resulting solids placed in storage.

5.2 SAFETY CONSIDERATIONS

Safety considerations have been rigorously executed in the design of the CAMDS facility currently under construction at Tooele, Utah. Experience obtained at Rocky Mountain Arsenal and as a result of numerous tests conducted at Edgewood Arsenal has resulted in the employment of numerous safety measures in the basic design. These design features which augment safety throughout the CAMDS are:

- Fail-safe features on valves, actuators, micro switches, etc.
- Filter ventilation systems
- Numerous air changes per hour in toxic areas (up to 25/hr)
- Detector systems (stacks, detox areas, etc.)
- Alarm systems (audible for entire CAMDS site)
- Back-up systems (standby)

- Redundancy (electrical, storage tanks, etc.)
- Perimeter monitoring (eight stations)
- Airlocks (isolation of one area from another)
- Closed circuit television surveillance
- Automatic flame safeguard controls and alarm on furnaces
- Automatic temperature controllers
- Explosive containment cubicle (certification via tests)
- Fire hydrant system (serves all areas)
- Communications system (serves all areas)
- Burster sensor station (determines existence of burster)
- Projectile positioning sensors (provides for critical alignment)
- Sump drain - level detectors
- Computer controlled - automatic shutdown
- Negative pressure in toxic areas.

All the above are well covered in the CAMDS Demilitarization Plan and other documents referenced in Section 3.2 herein.

Safety, impeccable safety, has been a primary goal of the CAMDS design since inception. In evidence of this, prior to introduction of munitions (possibly unsafe-leaking or ruptured) into the CAMDS area, operational procedures require inspection at the storage igloo. Again, after transport to CAMDS site and before entering the Unpack Area they are reinspected as noted in FMEA data for building block, No. 1, item 1.4. The expected frequency of a leaking munition entering the UPA undetected is very low, with mines the most serious suspect. Since mines are packed three to a closed container, and are thin-walled, removal of individual mines in the Unpack Area is accomplished by personnel wearing Level B protective clothing. This is noted in FMEA item 1.4 with an assigned low probability of occurrence.

The munition route following the Unpack Area is the Explosive Containment Cubicle (BB No. 2), containing four different Demil machines separately operational with a good chance of explosive/fire incident. But the ECC is designed for explosive containment. The FMEA data chart for item 2.1 assesses the possibility of an incident as high, (3). Also, with a high expected failure frequency is seal failures, due to personnel wear, equipments abrasion, exposure to decontamination solution and oil, and to

ordinary mechanical use wear. A periodic seal maintenance program will mitigate the adverse effects of seal misuse; however, the explosive incident type of failure is a randomly occurring type anomaly and will depend on good design and conclusive test results for containment. If the ECC doors or walls rupture, the severity level would be high, due to agent release to the ECC housing, or due to flying debris. These eventualities are covered in FMEA items 2.1, 2.2 and 2.3.

Advancement of the munitions in the demil operations by conveyors to the furnaces and explosive agent destruction operations have been reviewed with possible failure modes, fire, toxic release, and deterrant actions indicated in the respective FMEA data sheet items. The failure modes attributable to the Agent Destruction System result in possible high severity levels as shown in FMEA item 13.1, but accompanying probability of occurrence is very low. Referring to the FMEA charts on the Explosive Treatment System, BB No. 14, all identified failure modes are low in severity and frequency levels. Failure modes identified with the Bulk Item Facility, BB No. 21., have very low failure probabilities as noted on the applicable FMEA data sheets. Examination of all FMEA data sheets on the Deactivation Furnace System and the Metal Parts Furnace shows that in no case is the combined criticality index higher than four. That is, no combination of severity level and probable frequency of failure results in more than a mediocre criticality for the identified failure mode, a result almost entirely of good design and attention to safety considerations in areas of high energy production.

System safety engineering, in compliance with the intent and purpose of MIL-STD-882, has been demonstrated throughout the design phase of the CAMDS. Conduct of the Safety Analyses and Hazard Evaluation (FMEA) as presented herein, has resulted in recognition of safety provisions for all identified hazardous conditions, such as:

- Release of toxic materials to the atmosphere
- Uncontrolled explosions
- Uncontrolled fire
- Critical equipment failure.

No single point failures were found to exist which could result in any of the aforementioned hazardous conditions.

5.3 OPERATIONAL CONSIDERATIONS

An assessment of the sequence of events which comprise the process flow for any given munition being demilitarized in the CAMDS reveals no operational weaknesses. The integration of the semi-autonomous building blocks into a total system concept provides for a unique operational entity. The operational features provide for the pre-inspection of all munitions prior to conveyance to the Unpack Area. Removal of explosive components within the confines of the ECC using remotely operated demilitarization machinery provides for maximum safety to operating personnel. The destruction of explosive components by thermal oxidation in the DFS provides safe and efficient operation. Residual agent contamination of metal parts is nullified by heat treatment in the MPF. Chemical neutralization of agents GB and VX in the ADS has been rendered safe and fully automated. Destruction of the chemical agent mustard in the MPF has been demonstrated to be both economical and safe at other installations.

Virtually all operations contemplated for CAMDS are an improvement to and an extension of proven systems developed by the U.S. Army over the past 6 years. Numerous tests have been conducted and documented, which have resulted in the establishment of procedures governing the operations at the CAMDS at Tooele, Utah. For each and every operation planned for CAMDS, a specific series of tests has been conducted, to prove out esoteric features, safety aspects, efficiency, and human factors.

The inclusion of air locks, personnel showers, backup systems, protective clothing, alarm systems, enunciator systems, television monitoring, communications, the personnel support complex, and the detailed planning and specialized training sessions to be implemented provide an excellent basis on which to evaluate the overall operations concept of the CAMDS.