AD-A286 743

MENTATION PAGE

Form Approved
OMB No. 0704-0188

s estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, g and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this g this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	07/00/92	

4. TITLE AND SUBTITLE
HAZARD AND OPERABILITY STUDY (HAZOP) ROCKY MOUNTAIN ARSENAL, BASIN F LIQUID INCINERATION, TASK IRA 2, FINAL, VERSION 3.0

5. FUNDING NUMBERS
DAAAK15 88 D 0022/0001

6. AUTHOR(S)

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
WOODWARD-CLYDE CONSULTANTS
DENVER, CO

8. PERFORMING ORGANIZATION REPORT NUMBER
92230R07

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
ROCKY MOUNTAIN ARSENAL (CO.). PMRMA
COMMERCE CITY, CO

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

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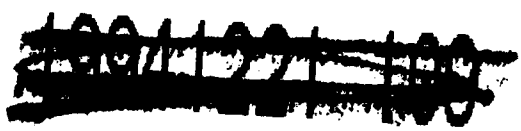
11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

THIS DOCUMENT PRESENTS THE RESULTS OF THE HAZARD AND OPERABILITY (HAZOP) STUDY CONDUCTED IN SEPTEMBER 1991 ON THE SUBMERGED QUENCH INCINERATOR (SQI) PLANNED FOR INSTALLATION AT THE RMA TO INCINERATE THE BASIN F LIQUIDS. THIS HAZOP WAS PERFORMED ON THE 90% DESIGN PACKAGE FROM WESTON. THE RESULTS OF THE HAZOP STUDY WERE SUBMITTED IN OCTOBER 1991 TO THE T-THERMAL AND WESTON DESIGN TEAM FOR THEIR REVIEW AND COMMENT.



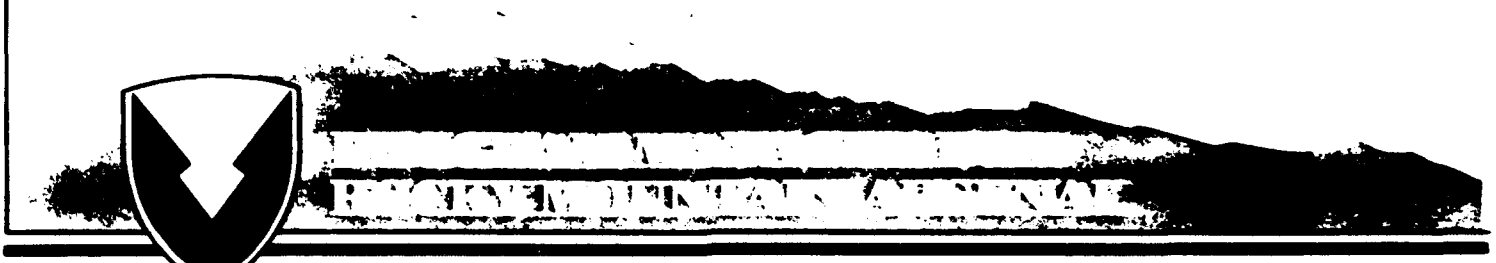
14. SUBJECT TERMS	15. NUMBER OF PAGES
SQI, IRA F	
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED			

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— COMMITTED TO PROTECTION OF THE ENVIRONMENT —

FINAL
HAZARD AND OPERABILITY STUDY
(HAZOP)
ROCKY MOUNTAIN ARSENAL
BASIN F LIQUID INCINERATOR

TASK IRA-2
JULY 1992

CONTRACT NO. DAAA15-88-D-0022/0001
VERSION 3.0

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HAZARD AND OPERABILITY STUDY
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VERSION 3.0

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Justification	
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Availability Codes	
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A-1	

Prepared by:
Woodward-Clyde Consultants

Prepared for:
U.S. Army Program Manager's Office
For Rocky Mountain Arsenal Contamination Cleanup

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- HAZOP Action Items Closeout dated July 28, 1992

EXECUTIVE SUMMARY

This document presents the results of the Hazard and Operability (HAZOP) study conducted in September 1991 on the Submerged Quench Incinerator (SQI) planned for installation at the Rocky Mountain Arsenal (RMA) to incinerate the Basin F liquids. This HAZOP was performed on the 90 percent design package from Weston. The results of the HAZOP study were submitted in October 1991 to the T-Thermal and Weston design team for their review and comment.

Prior to the HAZOP, a Preliminary Hazards Analysis (PHA) was performed by Woodward-Clyde on the SQI unit at the 30 percent design stage. This PHA identified a number of major issues that resulted in recommendations for design modifications to increase plant operability and safety. These recommendations were forwarded to Weston to be incorporated into the 90 percent design package. Since most of the major design issue/problems were identified in the PHA review, the HAZOP study did not identify any additional major issues which required Weston to redesign the SQI package.

The preliminary results of the HAZOP study were discussed in a meeting with Weston, T-Thermal, and RMA on November 5, 1991 in Denver. At that time, Weston presented a response to many of the action items/comments identified by the HAZOP. Additional responses and clarification, as discussed in the meeting, were prepared by Weston in February 1992. These responses have been incorporated into the HAZOP report.

Many of the HAZOP action items could not be resolved because the P&IDs were not finalized. Additionally, many of the items pertained to the Operation and Maintenance Manual, which was still being developed.

Based on a review of the Revised Draft Operation and Maintenance Manual dated May 1992 and the current P&IDs, it was concluded that all HAZOP Action Items have been or will be adequately addressed.

It should be noted that there are some plant systems that were not evaluated by the HAZOP team. These include boiler system, softener system, and brine loading. These

systems do not present major safety and operability problems to the SQI. Review of the O&M manual indicates that these systems are adequately addressed. Additionally, they will be included in the Pre-Startup Safety Review (PSSR) to be performed on the SQI project.

1.0
INTRODUCTION

Woodward-Clyde Consultants (Woodward-Clyde) has prepared this report to present the results of the Hazard and Operability (HAZOP) study which was conducted on the Submerged Quench Incinerator (SQI) planned for installation at Rocky Mountain Arsenal. The SQI will be used to incinerate the Basin F liquids at the site.

The HAZOP was conducted to comply with the System Safety Hazard Analysis Report (SSHAR) requirement under the Military Standard System Safety Program Requirements (MIL-STD-882B, July 1, 1987). The intent of the SSHAR is to identify hazards and assess the risk of the total system design. The HAZOP provided a means to perform a line-by-line analysis of the design of the SQI and associated transfer systems to determine whether hazardous situations could arise.

The HAZOP was conducted under the American Institute of Chemical Engineers' Center for Chemical Process Safety guidelines (Guidelines for Hazard Evaluation Procedures, Center for Chemical Process Safety, A.I.Ch.E., 1985). The HAZOP results provide insight into the cause and effect of hazardous situations and generate recommendations to reduce the risk associated with handling hazardous materials and/or hazardous operations.

1.1 BACKGROUND

The initial Military Standard System Safety Program Requirements call for a Preliminary Hazard Analysis (PHA) to be performed on a system during the design phase in order to obtain an initial risk assessment of a concept or system. The PHA was conducted on the 30 percent design package for the SQI, vapor treatment system, Basin F fluid transfer system, and brine/solids handling systems. The PHA was conducted in Denver on May 29-31, 1990, by a team consisting of design engineers from Woodward-Clyde and experienced HAZOP team members from Woodward-Clyde. The report which was generated following the PHA is presented in Appendix C. The report and recommendations arising from the PHA were presented to T-Thermal design engineers

in a meeting in Denver in July 1990. At that time design changes were recommended in the interest of safety and operability concerns. Key issues which arose from the PHA included the adequacy of FRP material, redundancy of controls and indicators, emissions from the incinerator, incinerator nozzle design, potential for disposing of brine rather than solids, and replacement of refractory material.

In October 1990 Woodward-Clyde turned over the design package, which was at 60 percent complete and incorporated some of the recommended design changes which resulted from the PHA, to Roy F. Weston (Weston) Engineers. Weston was to take the design package to 90 percent design, at which point Woodward-Clyde would perform a HAZOP study on the design package. Woodward-Clyde received the 90 percent design package from Weston in September 1991. The HAZOP study was conducted on this design package in September 1991. The HAZOP report, which included recommendations for design modifications to improve safety and reliability, is presented in this report. A meeting was held on November 5, 1991, to discuss the recommendations generated by the HAZOP. Weston responded to these recommendations in four separate submittals, dated November 5, 1991; February 2, 1992; and March 20, 1992, and May 15, 1992.

Additionally, review of the Revised Draft Operation and Maintenance Manual dated May 1992 and current P&IDs was required to verify that all recommendations had been responded to or incorporated.

2.0
HAZOP TEAM

The HAZOP team was composed of design engineers and experienced HAZOP team personnel from Woodward-Clyde Consultants, T-Thermal, Roy F. Weston Engineers, and Morrison-Knudsen (representing Shell Oil Company). The team was led by Mr. Vince Noble of Woodward-Clyde, with alternative leadership from Dr. Valorie Thompson of Woodward-Clyde. Both Mr. Noble and Dr. Thompson are experienced HAZOP team leaders.

Dr. Thompson and Mr. Louis Bulger served as HAZOP team scribes. The scribe is responsible for recording all information on a line-by-line basis into the computer database which is used to guide the study. Woodward-Clyde uses the CA-HAZOP software computer program which was developed by NUS Corporation to record the HAZOP study into a database.

HAZOP team members are as follows:

Vince Noble	Woodward-Clyde	HAZOP Team Leader
Valorie Thompson	Woodward-Clyde	Alternate Leader
		HAZOP Scribe
Louis Bulger	Woodward-Clyde	HAZOP Scribe
Elaine Puch	Woodward-Clyde	
Gene Irrgang	T-Thermal	
G. Don Bell	T-Thermal	
Guy Celenza	Roy F. Weston	
Amit Sarkar	Roy F. Weston	
Steve Luedders	Morrison-Knudsen (Representative for Shell)	

3.0
HAZOP STUDY CONDUCT

The SQI HAZOP was started on September 3, 1991 in the Woodward-Clyde office in San Diego. The study was divided into morning and afternoon sessions, about two to three hours per session. The SQI Package took two full weeks to complete utilizing the main body of the HAZOP Team outlined in the previous section. The first day that the team was assembled, September 3, Mr. Vince Noble had a HAZOP Orientation/Training Session for members of the Team. The purpose of this orientation was to insure that the group understood the basic rules of HAZOP, goals of the process and most importantly what was expected from each member. The Team consisted of five individuals who had HAZOP experience or knew the basics concepts and the other four who had no experience with the HAZOP process. Therefore, some training on guidewords, HAZOP software usage and other elementary parts of HAZOP was presented.

The HAZOP Team requested from Weston and T-Thermal the most recent and complete package of P&IDs available for the project. The following drawings were supplied by Weston/T-Thermal and now are the official set of design package drawings for the HAZOP study.

Weston P&ID Drawing	Date
01-04-001 - Rev. 1	4/26/91
02-04-002 - Rev. 1	4/26/91
03-04-001 - Rev. 0	7/31/91
03-04-009 - Rev. 0	7/31/91
03-04-015 - Rev. 0	7/31/91
03-04-010 - Rev. 0	7/31/91

T-Thermal P&ID Drawing	Date
32-03-713-D - Rev. 5 (Sheets 1 through 6)	7/23/91

Additional support drawings from the Weston bid package #3 set dated June 1991 were also used to supplement the P&ID's and HAZOP study review.

3.1 HAZARD AND OPERABILITY STUDY (HAZOP) - PROGRAM OVERVIEW

A Hazard and Operability (HAZOP) study employs a detailed, structured hazard identification methodology. The HAZOP provides for the systematic review of the plant design for possible hazardous conditions and operational problems that might be expected in the lifetime of the facility. The HAZOP process requires a series of meetings of a multi-disciplinary team comprised of a team leader, representatives from the design staff, additional technical specialists as required, and technical staff members trained in HAZOP techniques including a technical HAZOP recording secretary. The HAZOP team examines in the course of the study, detailed plant descriptions, such as P&IDs, process flow diagrams, and other operating procedures. The HAZOP process also draws considerable knowledge of the plant operation from the process engineering team members and other experts. This structured "brain-storming" technique is quite effective if applied properly.

Plant Piping and Instrumentation Drawings (P&IDs) are the focus of the HAZOP review process. P&IDs convey the details of the design with respect to the equipment,piping, and operational process control features. The P&IDs are the detailed design description of the plant unit operations. Additionally, these diagrams specify safety equipment and instrumentation for plant/personnel protection. The HAZOP review process is specifically keyed to a process "line-by-line" survey of the P&IDs for potential hazards and operability problems. Relevant plant operating experience is used whenever possible along with operating and maintenance procedures, to gain insights for the study.

A typical HAZOP begins by assembling a multi-disciplinary team comprised of a HAZOP team leader, a HAZOP secretary, representatives from the design and technical staff specialists as necessary. The team defines the scope of their line/equipment investigation from an examination of the P&IDs. The team then systematically identifies all hazard and operability problems within the line/equipment being studied.

The HAZOP methodology involves identifying parameters which describe the intended operation of a line, piece of equipment, or process; and identifying potential deviations from the intended design through the use of guideword-parameter combinations.

The HAZOP team leader defines a process parameter of interest for the line (e.g., flows, temperature, pressure, etc.) and then applies a designated guideword (e.g., no, low, high, etc.) to produce a deviation to the intention of the line/equipment. For example, for a line the team leader may examine the process parameter "flow" and apply the guideword "no" to arrive at the deviation possible causes of "no flows." For each cause, potential consequences were identified. Many of the consequences are trivial or non-existent. For those that are not, the team determines if effective plant countermeasures are installed or should be installed to mitigate the risk.

The design package that includes the Piping and Instrumentation Diagrams (P&IDs) was reviewed and subdivided into nodes. A node was defined as a line or vessel which had a single design intent or purpose. For example, the line through which Basin F liquid is transferred from the day tanks to the SQI injection nozzles was considered as one node; a day tank was considered as one node.

The SQI system was divided into study nodes as described above. To each node selected for review by the team, a pre-established set of guideword-parameter combinations is applied to the node to determine whether a deviation in design intent is identified. Following that the team also evaluated whether there were any possible causes of the deviation and potential consequences of the deviation were identified and recorded.

Guidewords were used in combination with the appropriate parameters in order to identify deviations from the design intent of each node. The guidewords which were used in the HAZOP study included the following:

No	Negation of design intent
More	Greater than design intent
Less	Less than design intent
As well as	In addition to design intent
Reverse	Reverse of design intent
Other than	Different from design intent
Low	Lower than design intent

The following matrix illustrates the guideword-parameter relationships that were applied to the SQI HAZOP study:

Guideword	Parameter
Flow	No
	More
	Less
	As well as
	Reverse
	Other than
Pressure	No
	More
	Less
Temperature	More
	Less
Composition	More
	Less
	As well as
	Other than
Startup/Shutdown	Other than
Emergency Shutdown	Other than
Maintenance	Other than
Level (vessels/tank only)	No
	More
	Low

As the HAZOP study progressed; the deviations, causes, consequences, likelihood, and recommendations discussed were recorded in the CA-HAZOP database. Four categories of consequence types were used as defined below:

Consequence Type	Description
A	Operational Problem. Not a safety concern.
B	Operability problem. Affects plant operations and may require plant shutdown. Not a safety problem, but likely of economic concern for plant operations.
C	Safety Problem. Plant damage effects and/or release of hazardous materials contained within the boundaries of the plant. No off-site consequences. Regulatory reporting likely.
D	Significant Safety/Environmental problem. Off-site consequences. Regulatory reporting likely.

Additionally, five levels of likelihood were used as defined below:

Likelihood	Description
1	High
2	Low
3	Very Low
4	Rare
5	Very Rare

Likelihood levels, when recorded, were based on judgement. No attempt was made to quantify this parameter.

As the HAZOP study progressed; the deviations, causes, consequences, and recommendations discussed were recorded in the CA-HAZOP database. The HAZOP scribe also recorded any unresolved issues or questions which arose during the HAZOP which were not answerable without referral back to Weston for comment. These issues became part of the study found in the Audit Trail or Comment sections of the study. These HAZOP issues were presented to Weston in meetings for resolutions. Weston has produced several responses (see Appendix D), which have been incorporated into the study database.

3.2 HAZOP STUDY SOFTWARE

The CA-HAZOP is a PC-based software program used to assist in the conduct of Computer-Aided HAZard and OPerability Studies (CA-HAZOP). This software is essentially a self-documenting database to aid the HAZOP team in the conduct of the study. The real value of this software package is found in the help it gives to the team secretary/scribe in recording the ideas and information discussed during the study. The program greatly speeds the report writing process, adds a structure to the data taking and promotes the consistency of the HAZOP.

The software consists of a menu driven database manager program that stores the HAZOP information, line definitions and any audit trail information required. The software greatly speeds the conduct of the HAZOP by providing pre-programmed team worksheets; pre-assembled lists of guidewords, process parameters and potential deviations; database maintenance features; the ability to rapidly generate reports summarizing the HAZOP study information for various levels of detail; and most importantly, a complete computerized audit trail of the conduct of the study. An liquid crystal display projection of the PC screen onto a large viewgraph projection screen was used for easy viewing of the HAZOP study by all team participants. The projected worksheets serve as a focus or basis for the teams deliberations and can prove to strengthen a systematic approach to the survey of each process unit for possible hazards and operability problems.

A series of reports are available to the user of the software. These reports allow the HAZOP team to access and summarize different portions of the database and to view the hazards in a number of different ways.

4.0
HAZOP STUDY RESULTS

The HAZOP study found no major design problems with the SQI system designed by T-Thermal and the support facilities designed by Woodward-Clyde and Weston. The detailed review performed during the HAZOP indicated that the recommendations resulting from the PHA on the 30% design package had been incorporated into the 90% design and no major redesign of the SQI package was required. The HAZOP study did find several minor areas which need attention, revision or possibly further discussion between Weston and RMA. This report includes a summary of the results of the study in Appendix B - HAZOP Detail Audit Trail Report.

In general, the issues resulting from the HAZOP study pertain to the safety, operation/maintenance and other areas such as plant reliability. The following are examples of issues found in the general areas of the study.

Safety Issues

- Potential release of hot liquids and hazardous gases inside the SQI building or work areas

- Safeguards for hot surfaces in work areas (These include releases of hot Basin F liquid and its associated vapors - possibly ammonia and ammonium compounds, release of natural gas with explosion potential)

Other recommendations include monitoring procedures, and health and safety plan contents.

Operability/Maintenance Issues

- Heat tracing problem with outside exposed pipelines

- Nozzle maintenance and operability

- Refractory life
- Number and type of control system interlocks - emergency shutdowns
- Line plugging and line flushing frequency

As in the safety area, these items found are generally minor in nature, however, if not addressed adequately can cause numerous shutdowns and delays in schedule.

Other Issues

- Three operating units were not evaluated during the HAZOP due to unavailability of P&IDs, or vendor drawings, or systems design not completed in time for the September HAZOP
- O/M procedures were not completed or available at the time of the HAZOP

5.0
RESOLUTION OF HAZOP ISSUES

The HAZOP study was finished, printed in October 1991 and was sent to each team member for review/comments. These comments or revisions were incorporated into the study. As a result of this process, Weston, RMA, Shell Oil Company and Woodward-Clyde held a meeting on November 5, 1991. The following personnel were present at the meeting:

Ed Berry	Rocky Mountain Arsenal
Ben Wachob	Rocky Mountain Arsenal
Dennis Heitmann	Army Corps of Engineers
Valorie Thompson	Woodward-Clyde - HAZOP Team
Louis Bulger	Woodward-Clyde - HAZOP Team
Elaine Puch	Woodward-Clyde - HAZOP Team
Colleen Parker	Weston/TTSI
Amit Sarkar	Weston
Jesse Clement	T-Thermal
Steve Luedders	Morrison-Knudsen (Shell Contractor)
Arnold Marsden	Shell Oil Company - Development
Larry Faith	Shell Oil Company - Development

During this meeting, Weston presented their first response to study comments (see Appendix D.1) dated November 5, 1991. The above personnel involved in the SQI design reviewed the study and Weston responses. The result of this meeting was that Weston needed to provide additional responses and clarification to the issues raised by the HAZOP.

Weston then issued two reports dated February 2, 1992 and March 20, 1992 which addressed many of the comments. These reports are included in Appendix D.

The above mentioned Weston reports did not fully respond to all of the comments. An Action Item Summary Report (see Appendix F) dated March 27, 1992 was prepared by

Woodward-Clyde that listed the items still needing a response from Weston. A response was submitted by their letter dated May 15, 1992 (see Appendix F).

Review of this letter indicated that while Weston had incorporated the HAZOP comments into the final plant design and O&M Manual, this could not be fully verified since the appropriate documents were not available. This included the latest version of the P&IDs and the O&M Manual. These remaining items are listed in Woodward-Clyde's letter dated June 4, 1992 (see Appendix F).

On June 10, 1992 a meeting was held at the Rocky Mountain Arsenal to discuss the remaining open HAZOP action items. At that meeting, the HAZOP team was given a copy of the Revised Draft O&M Manual - dated May 1992. Additionally, it was decided to send a HAZOP team member to Weston's office in West Chester, Pennsylvania to review the latest P&ID revisions. A review of the current P&ID was also made to verify that no significant changes, beyond those requested by the HAZOP, were made since the time of the original HAZOP.

Based on a review of the O&M Manual and current P&IDs, it was concluded that the items in the June 4, 1992 list have been adequately addressed. Additionally, no significant revisions have been made to the P&IDs that would affect the HAZOP. This review is discussed in detail in Woodward-Clyde's "HAZOP Action Items Closeout" letter dated July 29, 1992, which is included in Appendix F.

6.0
SUMMARY AND CONCLUSIONS

This document has presented a description of the HAZOP study performed for the Submerged Quench Incinerator system to be constructed at the Rocky Mountain Arsenal. The appendices to this report include the major interim reports and documentation pertaining to this project.

Appendix A provides the HAZOP Study Report, which describes in detail the evaluation performed by the HAZOP team. This is a computer generated record of the discussions held for each node (process pipeline/component) of the incinerator facility.

Appendix B provides the detailed Audit Trail Report. This appendix includes the Action Items and Memo Field Comments generated during the HAZOP evaluation. Weston's responses to these action items have also been added.

Appendix C includes the report prepared for the Preliminary Hazard Analysis (PHA). This document is dated July 11, 1990.

Appendix D includes the Weston responses to the HAZOP study. This appendix includes three documents from Weston; dated November 5, 1991 (D.1), February 5, 1992 (D.2), and March 20, 1992 (D.3). These responses were incorporated into the document included in Appendix B.

Appendix E provides copies of miscellaneous correspondence relative to the project. Included are:

- Weston Transmittal Form - September 4, 1991
- RMA HAZOP Study Review - September 24, 1991
- Shell Oil Company - Initial Comments on HAZOP - October 17, 1991
- RMA Hazard Analysis Status Report SQI Project - January 14, 1992
- Attendance List - November 5, 1991 Meeting

Appendix F includes the RMA HAZOP - Action Item Summary Report dated March 27, 1992; Weston's response to this report dated May 15, 1992; and a revised action item list dated June 4, 1992. The last document provides a punch list of the unresolved issues remaining to date.

As stated in this report, the HAZOP study included and completed an evaluation of the major portion of the process design where the majority of problems would be expected. No significant design problems were identified.

The HAZOP team was unable to verify the Weston responses on safety and operational/ maintenance related issues due to the unavailability of needed documents at the time of the HAZOP review. Additionally, review of the Weston O&M Manual and other documents was not included in the current project scope.

The HAZOP study was conducted on drawings provided by Weston and T-Thermal that were Revision Set 0 or 1. Currently both contractors are working on P&ID sets that are Revision 7 or 8. The team has not been supplied with a list of changes along with the reasons for the numerous revisions since that original HAZOP study set and is therefore not able to verify all changes/revisions that have been incorporated into the current SQI package.

Until all items in the study have been adequately addressed by RMA, Shell and Weston, the study will remain open. RMA, Shell Oil Company, and Weston may at a later date resolve the issues that will not be closed.

APPENDIX A

HAZOP
Study Report

HAZARD AND OPERABILITY STUDY - H A Z O P
SUMMARY REPORT
CA_HAZOP VER 1.3

ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
		HAZOP STUDY IDENTIFIER : BASIN F FLUID TRANSFER					
		LINE OR EQUIPMENT DESIGNATION : W0001					
		LINE DESCRIPTION : PUMP HOUSE NO. 1 - RETENTION POND / PUMP HOUSE NO. 2 - STORAGE TANK AREA					
		LINE/EQUIPMENT CONSIDERED : 2-WK-001-N-K, 2-WK-001-P-K, 2-WK-005-P-K, 2-WK-006-E-L, 2-WK-004-P-K,2-WK-002-P-K, 2-WK-01A-P-K, 2-WK-013-P-K, 2-WK-014-E-L, 2-WK-014-P-K,3-WK-014-E-K, P-101A&B, POND A, TK-101, TK-102, TK-103, 2-WK-015-E-K,3-WK-015-EK,3-WK-015-P-K,2-WK-017					
		DRAWING DESIGNATION(S) : 01-04-001 REV 1, 02-04-002 REV 1					
** PROCESS PARAMETER : FLOW							
1-1	NO	PLUGGED INTAKE SCREEN AND/OR PUMP SUCTION STRAINER	CAVITATE PUMP P-101A/B LOSS OF FLOW TO TANKS	A	1		(1) RECOMMEND O/M PROCEEDU FOR INTAKE SCREEN MAINTENA
1-2	NO	Inadvertant closure of any valve in the line (7 total).	Loss of flow to tank TK-101. Cavitate pump *P-101A or B (if on suction side)* or dead head pump (if on discharge side).	A	2	Instrumentation on discharge side shuts down pump on high pressure.	(1)Recommend operator trai address this potential problem.
1-3	NO	P-101A or B failure due to power loss.	No flow to TK-101.	A	A		Operator training required insure line is gravity dra to prevent plugging of lin due to settled solids.
1-4	NO	Pump P-101A/B shutdown due to instrument malfunction.	No flow to TK-101.	A	2		(1)Operator training shoul address maintenance of instruments.

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
1-5	NO	Pipe line broken.	No flow to TK101. Basin F fluid release outside of pumphouse containment.	C	2		
2-1	MORE	NOT APPLICABLE					
3-1	LESS	SOLIDS BUILD UP IN LINE OR IN STRAINER(SEE ITEM 1-1,),CHANGE IN COMPOSITION, PARTICALLY OPEN DRAIN VALVE(OFF STRINER)	SLOWER FILL RATE IN TANK 101,	A	1		ROUTINE O/M ON THE LINE, T INSURE LINE IS OPERATED SAFELY. SOLIDS BUILDUP INDICATES A MAINTENANCE PROBLEM.
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	SMALL LEAK IN FEED LINE INTO SECONDARY CONTAINMENT	BASIN F FLUID GRAVITY DRAINS TO TK-109	A	2		O&M MANUAL TO REQUIRE DAIL CHECK OF SIGHT GLASS IN 2-WK-030-P-K
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SAME AS 1-1,1-2,1-3,1-4,AND 1-5	SAME AS NO FLOW	A	2		
8-1	MORE	SAME AS 1-1 AND 1-2,	POTENTIAL LINE FAILURE DUE TO OVERPRESSURE	C	3	INSTRUMENTATION INCLUDEDE TO PREVENT OVERPRESSURE,(PS 101A/B)	

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9-1	LESS	LEAK IN LINE					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NO PROBLEM					
11-1	LESS	LOSS OF HEAT TRACING ON FEED IN TO TANK 101	FREEZING OF FEED LINE.	A	5	REQUIRES LOSS OF PUMP AND FLUID LEFT IN LINE	OPERATOR TO INSURE LINE FLUSHED AND DRAINED AFTER PUMP FAILURE.
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	UNANTICIPATED BEHAVIOR OF BASIN F FLUID	FAILURE TO PUMP BASIN F FLUID	B	2		CONTINGENCY PLAN SHOULD BE DEVELOPED.
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : EMGCY SHUTDOWN							
17-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	O&M MANUAL NOT PROPERLY IMPLEMENTED. INSUFFICIENT	INABILITY OF SYSTEM TO FUNCTION AS DESIGNED.	B	2		INSURE O&M MANUAL IS IMPLEMENTED AND OPERATORS ARE

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		TRAINING.					PROPERLY TRAINED.

HAZOP STUDY IDENTIFIER : PURGE WATER SYSTEM
LINE OR EQUIPMENT DESIGNATION : W0002
LINE DESCRIPTION : PUMP HOUSE RETENTION POND P&ID
LINE/EQUIPMENT CONSIDERED : 2-WU-001-N-D, 3-WU-004-P-D, 2-WU-006-P-D, 2-WU-005-P-B, 2-WU-007-P-B, 2-WU-008-P-B, TK-107, P-102
DRAWING DESIGNATION(S) : 01-04-001 REV 1

** PROCESS PARAMETER : FLOW

1-1	NO	INADVERTANT VALVE CLOSURE	INABILITY TO FLUSH MAIN TRANSFER LINE	A	3		VALVE OPERATION TO BE ADDRESSED IN O&M PROCEDURES
1-2	NO	LOSS OF CITY WATER SUPPLY	SAME AS 1-1	A	3		OPERATIONAL CONTINGENCY PLAN TO INCLUDE TRUCK DELIVERY OF PURGE WATER
1-3	NO	LOSS OF PUMP P-102	SAME AS 1-1	A	2		
2-1	MORE	NOT APPLICABLE					
3-1	LESS	NOT APPLICABLE					
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	IMPROPER VALVE POSITIONING AND CHECK VALVE FAILURE ON 2-WU-007-P-D	BASIN F FLUID INTO PURGE WATER SYSTEM	C	4		CONSIDER ADDING REVERSE FLOW INDICATION IN THE LINE

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	LOSS OF PUMP	SAME AS 1-1	A	2		
8-1	MORE	NOT APPLICABLE					
9-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	FAILURE OF IH-101A&B	REDUCED ABILITY TO PURGE LINE DURING EXTREME COLD WEATHER	A	3		O&M MANUAL TO INCLUDE LINE ITEM FOR OPERATOR TO CHECK OPERATION OF HEATER AND TEMPERATURE CONTROL LOOP.
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	NOT APPLICABLE					

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** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : EMGCY SHUTDOWN							
17-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
		HAZOP STUDY IDENTIFIER : EXISTING STORAGE TANK AREA					
		LINE OR EQUIPMENT DESIGNATION : W0003					
		LINE DESCRIPTION : SQI BUILDING DAY TANK : PUMP HOUSE NO 2 STORAGE TANK AREA					
		LINE/EQUIPMENT CONSIDERED : TK-103,2-WK-015-E-K,2-WK-019-P-K,2-WK-020-P-K,2-WK-021-P-K,2-WK-21A-P-K,2-WK-023-P-K,2-WK-024-P-K,2-WK-040-N-K,2-WK-042-N-K,P-103A&B,TK-105,TK-106					
		DRAWING DESIGNATION(S) : 02-04-002 REV 1, 03-04-001 (7/31/91)					
** PROCESS PARAMETER : FLOW							
1-1	NO	PLUGGED STRAINER OR PLUGGED LINE	LOSS OF FLOW TO DAY TANK	A	1		
1-2	NO	INADVERTANT VALVE CLOSURE	SAME AS 1-1	A	3		O&M MANUAL SHOULD INCLUDE CHECKLIST FOR VALVE POSITIONING
1-3	NO	PUMP FAILURE	SAME AS 1-1	A	2	INLINE INSTRUMENTATION WILL DETECT LOSS OF FLOW. PI-103A&B SHOULD BE SHOWN AS REMOTE INDICATORS IN THE MAIN CONTROL ROOM.	DRAWING 02-04-002 SHOULD BE CORRECTED.
1-4	NO	PIPELINE BREAK	RELEASE OF BASIN F FLUID OUTSIDE OF CONTAINMENT	C	2		(1)VERIFY PIPELINE ARRANGEMENTS TO DETERMINE LIKELY CAUSE AND CONSEQUENCE
1-5	NO	LINE PLUGGED DUE TO SOLIDS ACCUMULATION	NO FLOW TO TK_105 OR TK-106. HIGH PRESSURE IN FEED LINE WILL SHUT DOWN FEED PUMP (via PAH-103A&B)	A	2		ROUTINE LINE FLUSHING TO BE INCLUDED IN O&M PROGRAM.

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
2-1	MORE	FAILURE OF LIS-105 OR 106	OVERFLOW DAY TANK	C	2	SYSTEM DESIGNED TO HANDLE THIS PROBLEM	CONSIDER ADDING FLOW SWITCH AND ALARM IN DAY TANK OVERFL LINE 3-WK-051-N-K.
3-1	LESS	CRYSTAL ACCUMULATION IN LINE CAUSING PARTIAL PLUGGING	INCREASED PRESSURE	A	1		PERIODIC FLUSHING REQUIRED T REDUCE CONSEQUENCE
5-1	REVERSE	CHECK VALVES IN LINE 2-WU-013-P-D FAIL AND IMPROPER VALVE POSITIONING	BASIN F FLUID FLOWS INTO PURGE WATER TANK TK-108	A	3		CONSIDER ADDING FLOW SWITCH DETECT REVERSE FLOW
6-1	OTHER THAN	PIPE LEAK INTO SECONDARY CONTAINMENT	BASIN F FLUID ENTERS SECONDARY CONTAINMENT	C	2		OPERATING MANUAL TO REQUIRE DAILY CHECK OF SIGHT GLASSES AND TK-109
** PROCESS PARAMETER : PRESSURE							
7-1	NO	NOT APPLICABLE					
8-1	MORE	PLUGGED LINE OR INADVERTANT VALVE CLOSURE	OVERPRESSURE PIPELINE	C	3	ASSUME PIPING DESIGNED ACCORDING TO GOOD ENGINEERING PRACTICE	
9-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					

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11-1	LESS	LOSS OF HEAT TRACING	LOSS OF FLOW	A	2	REQUIRES LOSS OF PUMP AND FLUID LEFT IN LINE	OPERATOR TO INSURE LINE DRAINED AFTER PUMP FAILURE & INSURE HEAT TRACING SYSTEM OPERABLE.
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	UNANTICIPITATED BEHAVIOR OF BASIN F FLUID	EXCESSIVE LINE PLUGGING, REDUCED SYSTEM CAPACITY	B	2		CONTINGENCY PLAN SHOULD BE DEVELOPED
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : EMGCY SHUTDOWN							
17-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN					MAINTENANCE ISSUES FOR THIS LINE INCLUDE: PLUGGING, CHECKING SIGHT GLASSES FOR LEAKS, INSTRUMENTATION CALIBRATION, PUMPS MAINTENANCE, AND MONITORING	

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						FOR CORROSION.	

HAZOP STUDY IDENTIFIER : PURGE SYSTEM TO DAY TANKS
LINE OR EQUIPMENT DESIGNATION : W0004
LINE DESCRIPTION : PUMP HOUSE NO 2 STORAGE TANK AREA
LINE/EQUIPMENT CONSIDERED : TK-108,2-WU-012-E-D,2-WU-012-P-D,2-WU-011-P-D,2-WU-015-E-D,2-WU-016-E-D,2-WK-025-P-K,2-WK-026-P-K,3-WU-010-P-D,P-105, 2-WU-008-N-D,2-WU-005-N-D,3-WU-005-N-D
DRAWING DESIGNATION(S) : 02-04-002 REV 1

** PROCESS PARAMETER : FLOW						
1-1	NO	PUMP INOPERABLE DUE TO LOSS OF POWER OR PUMP FAILURE	INABILITY TO PURGE LINE	A	2	(2)OPTION TO CONNECT WITH FIRE (1)CONTINGENCY PLAN FOR LO WATER SYSTEM FOR BACKUP PURGE OF POWER SHOULD BE DEVELOP
2-1	MORE	NOT APPLICABLE				
3-1	LESS	LINE LEAK	INEFFECTIVE LINE PURGING	A		
4-1	AS WELL AS	NOT APPLICABLE				
5-1	REVERSE	NOT APPLICABLE - DOUBLE SYSTEM FAILURE REQUIRED				
6-1	OTHER THAN	NOT APPLICABLE				
** PROCESS PARAMETER : PRESSURE						
7-1	NO	SEE NO FLOW				

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
8-1	MORE	INADVERTANT VALVE CLOSURE OR FEED LINE BLOCKAGE	HIGH PRESSURE IN LINE	A	2		

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HAZOP STUDY IDENTIFIER :
LINE OR EQUIPMENT DESIGNATION : W0004
LINE DESCRIPTION :
LINE/EQUIPMENT CONSIDERED :
DRAWING DESIGNATION(S) :

** PROCESS PARAMETER : PRESSURE

9-1	LESS	SAME AS LESS FLOW					

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	HAZOP STUDY IDENTIFIER :	PURGE SYSTEM TO DAY TANKS					
	LINE OR EQUIPMENT DESIGNATION :	W0004					
	LINE DESCRIPTION :	PUMP HOUSE NO 2 STORAGE TANK AREA					
	LINE/EQUIPMENT CONSIDERED :	TK-108,2-WU-012-E-D,2-WU-012-P-D,2-WU-011-P-D,2-WU-015-E-D,2-WU-016-E-D,2-WK-025-P-K,2-WK-026-P-K,3-WU-010-P-D,P-105, 2-WU-008-N-D,2-WU-005-N-D,3-WU-005-N-D					
	DRAWING DESIGNATION(S) :	02-04-002 REV 1					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	HEATER CONTROL MALFUNCTION	OVERHEAT TANK CONTENTS	A	3		
11-1	LESS	FAILURE OF HEAT TRACING SYSTEM WITH WATER TRAPPED IN PIPE	POTENTIAL DAMAGE TO PIPING	A	3		OEM MANUAL TO ADDRESS STANDING WATER IN PURGE LINES OUTSIDE OF BUILDING
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE					

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** PROCESS PARAMETER : EMGCY SHUTDOWN							
17-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN						(1)RECOMMEND THAT FQI108 (FL TOTALIZER) BE INSTALLED ON INLET TO TANK TK-108

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		HAZOP STUDY IDENTIFIER : DRAINS AND SUMP					
		LINE OR EQUIPMENT DESIGNATION : W0005					
		LINE DESCRIPTION : PUMPHOUSE NO2 P&ID - STORAGE TANK AREA					
		LINE/EQUIPMENT CONSIDERED : SUMP TK-109, PUMP P-106, 2-WK-030-P-K, 2-WK-031-P-K, 2-WK-032-P-K,2-WK-033-P-K, 2-WK-028P-K, 2-WK-029-P-K, 1/2-WK-037-N-M, 1/2-WK-035-N-M, 2-WK-034-P-K, 2-WU-014-P-D					
		DRAWING DESIGNATION(S) : 02-04-002 REV 1 (4/26/91)					
** PROCESS PARAMETER : FLOW							
1-1	NO	LINE BLOCKAGE	INABILITY TO GRAVITY DRAIN AFFECTED PIPING OR INABILITY TO PUMP SUMP LIQUID BACK INTO STORAGE TANKS	A	3	DRAIN ONLY USED UNDER ABNORMAL TRANSFER OPERATIONS	
1-2	NO	FAILURE OF PUMP P-106	HIGH LEVEL IN SUMP	A	2		REQUIRES OPERATOR ATTENTIO
2-1	MORE	MAJOR LEAK OR PIPE BREAK	FLOODED SUMP AREA	A	4	SUMP PUMP IS SIZED TO HANDLE A FULL LINE BREAK	
3-1	LESS	LEAK IN DRAIN LINE	BASIN F FLUID SPILL IN BUILDING	A	2	ANY SPILL GRAVITY FLOWS INTO SUMP	
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					

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** PROCESS PARAMETER : PRESSURE							
7-1	NO	SAME AS NO FLOW				ALL INLET LINES ARE GRAVITY FEED	
8-1	MORE	BLOCKAGE IN PUMP DISCHARGE LINE	INABILITY TO EMPTY SUMP. DEAD HEAD THE PUMP. POSSIBLE SPILL.	A	3	HIGH LEVEL (LAH-109) ALARM PROVIDED FOR THE SUMP	RECOMMEND ROUTINE INSPECTIO OF SUMP AND ASSOCIATED EQUIPMENT
9-1	LESS	SAME AS LESS FLOW					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	SOLIDS ACCUMULATION AND PRECIPITATION	BUILD UP OF SOLIDS IN SUMP	A	2		ROUTINE INSPECTION OF SUMP REQUIRED
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE					

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
** PROCESS PARAMETER : EMGCY SHUTDOWN							
17-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE				PRIMARY MAINTENANCE ISSUES INCLUDE SUMP INSPECTION, PUMP OPERATION, AND LEVEL INSTRUMENTATION.	

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HAZOP STUDY IDENTIFIER : WASTEWATER TANK TO DAY TANK
LINE OR EQUIPMENT DESIGNATION : W0006
LINE DESCRIPTION : SQI BUILDING DAY TANK
LINE/EQUIPMENT CONSIDERED : TK-104,2-WK-002-E-K,2-WD-003-E-K,P-104A/B,2-WD-005-E-M,1-WD-004-E-M,1-WD-007-E-M,1-WD-004-E-M,1-WD-006-E-M
DRAWING DESIGNATION(S) : 03-04-001 REV 0 (7/31/91)

ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
** PROCESS PARAMETER : FLOW							
1-1	NO	INADVERTANT VALVE CLOSURE DUE TO HUMAN ERROR OR INSTRUMENT FAILURE	INABILITY TO EMPTY WASTEWATER TANK. POSSIBLE TANK OVERFLOW.	A	2	TANK IS SIZED TO ALLOW TIME FOR MAINTENANCE.	
1-2	NO	PUMP P-104A/B FAILURE	SAME AS 1-1	A	2	SAME 1-1	
1-3	NO	BREAK IN LINE	SPILL OF TANK CONTENTS (POTENTIALLY BASIN F FLUID)	C	2	CURRENT DESIGN INCORPORATES GRAVITY FLOW OF SPILLED FLUID INTO SUMP, THUS MINIMIZING POTENTIAL EMPLOYEE EXPOSURE.	
2-1	MORE	INSTRUMENTATION FAILURE (FCV-104 MALFUNCTION)	EXCESS WASTEWATER INTO TANK TK-105 OR TK-106.	B	2	INTERLOCK 1-70 STOPS P-104A&B ON HIGH LEVEL. EXCESS WASTEWATER WILL CHANGE COMPOSITION OF FEED TO INCINERATOR. PUMP P-104 IS LIMITED TO 10 GPM.	

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3-1	LESS	PIPELINE LEAK	BASIN F FLUID (POTENTIALLY) OUTSIDE OF DESIGNED CONTAINMENT.	C	2	SPILLED MATERIAL GRAVITY DRAINS TO SUMP, MINIMIZING POTENTIAL FOR EMPLOYEE EXPOSURE.	O&M MANUAL SHOULD ADDRESS LEA DETECTION AND PIPELINE MAINTENANCE.
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE					REQUIRES SIMULTANEOUS FAILURE OF PUMP AND TWO CHECK VALVES.	
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SAME AS NO FLOW					
8-1	MORE	LINE BLOCK ON PUMP P-104A/B DISCHARGE OR INADVERTANT VALVE CLOSURE.	DEAD HEAD PUMPS.	A	2		ROUTINE LINE MAINTENANCE REQUIRED.
9-1	LESS	SAME AS LESS FLOW					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	NOT APPLICABLE					

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE				REVIEW OF TANK TK-104 TO BE DONE AS A SEPARATE LINE ITEM	
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : EMGCY SHUTDOWN							
17-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN					SEE LINE W0005 18-1	

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
		HAZOP STUDY IDENTIFIER : DAY TANK VENTS TO COMBUSTION AIR BLOWER SUCTION					
		LINE OR EQUIPMENT DESIGNATION : W0007					
		LINE DESCRIPTION : SQI BUILDING DAY TANK P&ID; SUB X INCINERATOR P&ID					
		LINE/EQUIPMENT CONSIDERED : 2-VA-001-N-D,2-VA-002-N-D,2-VA-003-N-D,3-VA-001-N-D,4-AP-113-N-C					
		DRAWING DESIGNATION(S) : 03-04-001 REV 0 (7/31/91) 32-03-713 REV 5					
** PROCESS PARAMETER : FLOW							
1-1	NO	INADVERTANT VALVE CLOSURE	LOSS OF ABILITY TO VENT DAY TANKS	C	2	POTENTIAL EMPLOYEE SAFETY PROBLEM DUE TO UNHEALTHY INTERIOR ATMOSPHERE	SUPPLIED AIR SHOULD BE AVAILABLE IN THE AREA
1-2	NO	NO VACUUM IN LINE	INABILITY TO VENT TANKS				
1-3	NO	COMBUSTION AIR BLOWER DOWN	INABILITY TO VENT DAY TANKS	C			
2-1	MORE	BLOWER INLET FILTER/SILENCER PLUGGED	HIGH VACUUM IN VENT LINE	A	2	TANKS EQUIPPED WITH CONSERVATION VENTS FOR BACKUP PROTECTION	ROUTINE CHECKING OF BLOWER INLET FILTER/SILENCER AND CONSERVATION VENTS REQUIRED
3-1	LESS	SAME AS 1-1					
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					

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** PROCESS PARAMETER : PRESSURE							
7-1	NO	SAME AS NO FLOW					
8-1	MORE	NOT APPLICABLE					
9-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE				NEED BACKUP CARBON SYSTEM	
** PROCESS PARAMETER : EMGCY SHUTDOWN							
17-1	OTHER THAN	NOT APPLICABLE					

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** PROCESS PARAMETER : MAINTENANCE							
18-1						MAINTENANCE OF TANK CONSERVATION VENTS AND PUMP INLET FILTERS REQUIRED	

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	HAZOP STUDY IDENTIFIER : SOFTENED WATER TO PROCESS WATER STORAGE TANK AND DILUTION TANK						
	LINE OR EQUIPMENT DESIGNATION : W0008						
	LINE DESCRIPTION : PROCESS WATER AND STORAGE P&ID						
	LINE/EQUIPMENT CONSIDERED : 6-WS-001-E-D,4-WU-001-E-D,2-WT-001-N-D,4-WT-001-E-D,TK-203,3-WT-002-E-D,3-WT-003-N-D,2-WT-005-N-D,P-209 A&B,2-WT-007-E-D						
	DRAWING DESIGNATION(S) : 03-06-009 REV 0 (7/31/91)						
** PROCESS PARAMETER : FLOW							
1-1	NO	LOSS OF CITY WATER, TANK TK-203 EMPTY.	LOSS OF CAUSTIC DILUTION WATER	A	2		BACKUP CONTINGENCY PLAN TO INCLUDE TRUCKING IN WATER
1-2	NO	POWER FAILURE SHUTS DOWN PUMPS P-209A&B	LOSS OF CAUSTIC DILUTION WATER	A	2		
1-3	NO	LINE RUPTURE		A	3		
1-4	NO	INADVERTANT VALVE CLOSURE OR INSTRUMENT FAILURE (FIC-205)	LOSS OF DILUTION WATER	A	2		ROUTINE MAINTENANCE REQUIRED
2-1	MORE	CONTROL LOOP MALFUNCTION (FIC-205)	IMPROPER DILUTION OF CAUSTIC	B	2		OSM MANUAL SHOULD ADDRESS PROPER MAINTENANCE AND CALIBRATION OF CONTROL LOOP
3-1	LESS	PIPE LINE LEAK		A	2	DESIGN ALLOWS SUFFICIENT TIME TO REPAIR LEAKS WITHOUT AFFECTING INCINERATOR OPERATION.	

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4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SAME AS NO FLOW					
8-1	MORE	INADVERTANT VALVE CLOSURE OR CONTROL FAILURE	DEAD HEAD PUMP	A	2		
9-1	LESS	SAME AS LESS FLOW					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					

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15-1	OTHER THAN	WATER SOFTENER SYSTEM FAILURE	PRECIPITATION OF SOLIDS AND POTENTIAL PLUGGING PROBLEMS	A	2		O&M MANUAL MUST ADDRESS PROPER OPERATION AND MAINTENANCE OF SOFTENER SYSTEM
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : EMGCY SHUTDOWN							
17-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN					MAINTAINING ADEQUATE WATER LEVEL IN TK-203 IS CRITICAL TO PLANT OPERATION.	

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	HAZOP STUDY IDENTIFIER : PROCESS WATER TO SQI QUENCH TANK						
	LINE OR EQUIPMENT DESIGNATION : W0009						
	LINE DESCRIPTION : PROCESS WATER & CAUSTIC STORAGE P&ID: SUB X INCINERATOR						
	LINE/EQUIPMENT CONSIDERED : 3-WT-004-E-D, 3-WT-301-E-D,3-WT-301A-E-D,3-WT-301B-E-D,P-207A&B						
	DRAWING DESIGNATION(S) : 03-04-009 REV 0, 32-03-713-D REV 5						
** PROCESS PARAMETER : FLOW							
1-1	NO	LINE BREAK	LOSS OF FEED TO PUMP P-207A&B	B	2	RESULTS IN LOSS OF MAKEUP TO QUENCH TANK	
1-2	NO	INADVERTANT VALVE CLOSURE	LOSS OF FEED TO PUMP	A	2		(2)MANUAL SHOULD ADDRESS PROPER OPERATION OF THIS SYSTEM
2-1	MORE	NOT APPLICABLE					
3-1	LESS	PIPELINE LEAK	NONE				
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SAME AS NO FLOW					

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8-1	MORE	NOT APPLICABLE					
9-1	LESS	SAME AS LESS FLOW					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	FAILURE OF HEAT TRACING DURING COLD WEATHER	FREEZE PIPELINE, POTENTIAL PIPE DAMAGE	B	2		O&M MANUAL SHOULD REQUIRE ADEQUATE CHECKS OF HEAT TRACING SYSTEM
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : EMGCY SHUTDOWN							
17-1	OTHER THAN	NOT APPLICABLE					

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** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN						

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HAZOP STUDY IDENTIFIER :
LINE OR EQUIPMENT DESIGNATION :
LINE DESCRIPTION :
LINE/EQUIPMENT CONSIDERED :
DRAWING DESIGNATION(S) :

** PROCESS PARAMETER :

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		HAZOP STUDY IDENTIFIER : SUB-X INCINERATOR					
		LINE OR EQUIPMENT DESIGNATION : T0001					
		LINE DESCRIPTION : NATURAL GAS FEED TO LV-24 BURNER					
		LINE/EQUIPMENT CONSIDERED : 3"-NG-101-N-F, PCV-06, 2"-NG-101-N-F, FE-09, 2"-NG-102-N-F, LV-24 BURNER					
		DRAWING DESIGNATION(S) : 32-03-713-D SHEET 1 OF 6, REV 5, 7/23/91					
** PROCESS PARAMETER : FLOW							
1-1	NO	LOSS OF SUPPLY	LOW PRESSURE TRIP ON LINE, SHUTDOWN OF BURNER, SCANNER INDICATES BURNER SHUTDOWN. NO WASTE FEED, COMBUSTION AIR CONTINUES TO FLOW.	A		INTERLOCKS EXIST BETWEEN NATURAL GAS PRESSURE INDICATOR AND FLOW OF WASTE/AIR TO THE FEED NOZZLE. INTERLOCK INTO XV-26.	NO BACKUP SUPPLY. WHAT KIND OF NOTIFICATION PROCEDURE EXISTS FROM THE PUBLIC UTILI TO RMA TO DETERMINE WHEN MAINTENANCE OR OTHER SHUTDOW MAY OCCUR?
1-2	NO	LINE RUPTURE	RELEASE OF NATURAL GAS INTO AREA, BLOCK VALVES CLOSE, POTENTIAL RELEASE OF FLAMMABLE GAS.	C		MOST LIKELY AREA FOR RUPTURE WOULD BE AT FLEXIBLE CONNECTOR. MAY REQUIRE OPERATOR ACTION TO SHUT OFF GAS FLOW. BUILDING HAS CEILING VENTILATION WHICH SHOULD DISSIPATE NATURAL GAS BUILDUP.	(1) ARE COMBUSTIBLE GAS SENSORS LOCATED IN BUILDING?(2) SAFETY CONTINGENCY PLAN SHOULD INCLUDE PROVISION FOR ACTION
1-2	NO	LINE RUPTURE	RELEASE OF NATURAL GAS INTO AREA, BLOCK VALVES CLOSE, POTENTIAL RELEASE OF FLAMMABLE GAS.	C		MOST LIKELY AREA FOR RUPTURE WOULD BE AT FLEXIBLE CONNECTOR. MAY REQUIRE OPERATOR ACTION TO SHUT OFF	(1) ARE COMBUSTIBLE GAS SENSORS LOCATED IN BUILDING?(2) SAFETY CONTINGENCY PLAN SHOULD

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						GAS FLOW. BUILDING HAS CEILING VENTILATION WHICH SHOULD DISSIPATE NATURAL GAS BUILDUP.	INCLUDE PROVISION FOR ACTIO
1-3	NO	INADVERTENT VALVE CLOSURE, BLOCK VALVES STICKING, REGULATOR FAILURES, INSTRUMENTATION FAILURE.	FAILURE TO START OR SHUTDOWN OF SYSTEM.	B		VALVES FAIL IN SAFE POSITION. STARTUP/SHUTDOWN ISSUE.	(1) PROPER LOCKOUT/TAG OUT PROCEDURES SHOULD BE INCLUD IN TRAINING AND OEM MANUAL. LINES SHOULD BE COLOR CODED
1-4	NO	POWER FAILURE	SYSTEM SHUTDOWN.	B		TWO BACKUP POWER SYSTEMS - UPS COVERS CEM, CONTROLLER PACKAGE CRITICAL LOOPS DIESEL BACKUP COVERS EMERGENCY AIR BLOWER AND QUENCH RECYCLE PUMP.	
1-5	NO	SOFTWARE FAILURE - CONTROLLER	BACKUP SHOULD KICK IN, MANUAL BACKUP MAY BE REQUIRED	A			
2-1	MORE	GAS PRESSURE INCREASES FROM SUPPLY, PRESSURE REGULATOR PCV-06 FAILURE, FLOW CONTROLLER FAILURE.	HIGH PRESSURE SWITCH IS TRIPPED UPON TOO HIGH GAS PRESSURE. REGULATOR FAILURE COULD USE SHUTDOWN FROM CO MONITOR.		B	CO MONITOR SHUTDOWN SHUTS IN FEED, CASCADING EFFECT IN SHUTDOWN PROCEDURE.	
3-1	LESS	LINE LEAK OR PARTIAL LINE BLOCKAGE	LOW PRESSURE SWITCH MAY TRIP. RELEASE OF NATURAL GAS INTO BUILDING. ULTIMATE BURNER SHUTDOWN DUE TO LOW	C		OPERATING PRESSURE RANGE IS SET. BUILDING VENTILATION SHOULD BE ADEQUATE TO DISPERSE	INSTALL LOW FLOW ALARM OR DEVIATION ALARM IN LINE. COMBUSTIBLE GAS MONITORS

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			TEMPERATURE IN SQI.			NATURAL GAS.	MAY/MAY NOT BE NECESSARY. O OR SAFETY MANUAL SHOULD INCLUDE MONITORING LINE.
3-1	LESS	LINE LEAK OR PARTIAL LINE BLOCKAGE	LOW PRESSURE SWITCH MAY TRIP. RELEASE OF NATURAL GAS INTO BUILDING. ULTIMATE BURNER SHUTDOWN DUE TO LOW TEMPERATURE IN SQI.	C		OPERATING PRESSURE RANGE IS SET. BUILDING VENTILATION SHOULD BE ADEQUATE TO DISPERSE NATURAL GAS.	INSTALL LOW FLOW ALARM OR DEVIATION ALARM IN LINE. COMBUSTIBLE GAS MONITORS MAY/MAY NOT BE NECESSARY. O OR SAFETY MANUAL SHOULD INCLUDE MONITORING LINE.
3-2	LESS	LOSS OF UTILITY PRESSURE	OPERATIONAL PROBLEMS	A		SEE NO FLOW LOSS OF SUPPLY.	
4-1	AS WELL AS	SEE COMPOSITION.					
5-1	REVERSE	NOT APPLICABLE				INCINERATOR COMBUSTION AIR PRESSURE IS LESS THAN NATURAL GAS REGULATED PRESSURE.	
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SEE NO FLOW					
8-1	MORE	SEE MORE FLOW					
9-1	LESS	SEE LESS FLOW					(1) RMA TO PROVIDE MINIMUM O 18 PSIG NATURAL GAS PRESSURE

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							AT T-THERMAL PIPE SKID.(2) T-THERMAL WILL REGULATE TO 10 PSIG.
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	AS WELL AS	NOT APPLICABLE					
14-1	AS WELL AS	PROPANE ALSO IN THE GAS SUPPLY	UNSTABLE BURNER OPERATION, CO EMISSIONS AFFECTED, ERRATIC CONTROL OF TEMPERATURE IN INCINERATOR	B		MAY NOT BE A CREDIBLE DEVIATION.	(1) IN ADDITION TO SUPPLY SOURCE, DETERMINE WHETHER COMPOSITION MAY CHANGE IN SUPPLY FROM THE UTILITY.
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	VALVE POSITIONS NOT CORRECT OR NO GAS PRESSURE IN LINE DURING STARTUP.	NO STARTUP SEQUENCE. ALARM MESSAGE WILL BE DISPLAYED TO OPERATOR.	B			(1) PROCEDURES SHOULD BE INCLUDED IN OBN MANUAL AND TRAINING PROGRAM.
16-2	OTHER THAN	NORMAL SHUTDOWN - NORMAL SHUTDOWN PROCEDURES ARE NOT FOLLOWED -	POSSIBLE REDUCED REFRACTORY LIFE, IN THE EVENT GAS VALVES DO NOT CLOSE,	C			(1) SHUTDOWN PROCEDURES SHOU BE INCLUDED IN OBN MANUAL.(2

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		AUTOMATIC SHUTDOWN PROCEDURE IS NOT FOLLOWED DUE TO SOFTWARE OR OTHER FAILURE.	POTENTIAL FOR EXPLOSION DOWNSTREAM.				OPERATOR SHOULD BE ALERTED IN THE EVENT THAT VALVES DO NOT CLOSE PROPERLY.
** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN					ESD CAN BE TRIGGERED BY A NUMBER OF EVENTS INCLUDING HIGH TEMPERATURE, CO MONITOR, LOW LEVEL IN QUENCH TANK. BLOCK VALVES ON GAS LINE SHOULD CLOSE. ONE SHUTDOWN BUTTON AT BURNER, ONE IN CONTROL ROOM.	OPERATOR TRAINING AND O&M MANUAL.
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN						PERIODIC INSPECTION AND MAINTENANCE OF LINE SHOULD BE INCLUDED IN O&M MANUAL. PROPER WORK PERMIT PROCEDURE SHOULD ALSO BE INCLUDED.
18-2	OTHER THAN	OPERATION OF INCINERATOR THROUGH BYPASS ON VALVE FCV09 DURING MAINTENANCE.	LOSS OF CONTROL ON GAS LINE.	B		INCINERATOR SHOULD NOT BE OPERATED THROUGH BYPASS.	BYPASS AROUND NATURAL GAS CONTROL VALVE FCV09 BE QUESTIONED OR ELIMINATED.

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HAZOP STUDY IDENTIFIER : INLET TO SQI BURNER
LINE OR EQUIPMENT DESIGNATION : T0002
LINE DESCRIPTION : PILOT GAS LINE
LINE/EQUIPMENT CONSIDERED : 3/4"-NG-104-N-F, 1/2"-NG-101-N-F, 1"-NG-104-N-F, LV-24 GAS PILOT
DRAWING DESIGNATION(S) : 32-03-713-D SHEET 1 OF 6, REV 5, 7/23/91

** PROCESS PARAMETER : FLOW

1-1	NO					CAUSES AND CONSEQUENCES OF DEVIATIONS ARE IDENTICAL TO NATURAL GAS LINE T0001. NORMAL OPERATION IS NO FLOW, LINE USED ONLY DURING STARTUP.	
2-1	MORE	NOT APPLICABLE					
3-1	LESS	NOT APPLICABLE					
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					

** PROCESS PARAMETER : PRESSURE

7-1	NO	NOT APPLICABLE					

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8-1	MORE	NOT APPLICABLE					
9-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NO SHUTDOWN OF LINE UPON FAILURE OF PILOT TO IGNITE.	CONTINUED FEED OF NATURAL GAS TO INCINERATOR. CONSEQUENCES ARE MINOR BECAUSE AMOUNT OF GAS INTRODUCED IS SMALL COMPARED TO AMOUNT OF AIR.			10-15 SECOND TIME ALLOWED FOR PILOT TO LIGHT. AMOUNT OF GAS WOULD BE BELOW EXPLOSIVE LIMIT.	INCLUDE IN O&M MANUAL THAT OPERATOR CHECK PROBLEM IF PILOT DOES NOT IGNITE IN TWO OR THREE TRIES.
** PROCESS PARAMETER : ENCGY SHUTDOWN							
17-1	OTHER THAN	NOT APPLICABLE					

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** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	INCORRECT SETTING ON PILOT FOR FUEL-AIR MIXTURE	PILOT DOES NOT LIGHT PROPERLY.	A		SHOULD NOT REQUIRE EXCESSIVE ATTENTION. T-THERMAL DRAWING 1-03-194-B, REV. 1, 5/27/91 SHOWS FUEL/AIR MIXING IN PILOT.	
18-2	OTHER THAN	SPARK PLUG FAILS TO SPARK	REQUIRES MAINTENANCE AND POSSIBLE REPLACEMENT OF SPARK PLUG.	A			

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		HAZOP STUDY IDENTIFIER : SQI AIR INLET					
		LINE OR EQUIPMENT DESIGNATION : T0003					
		LINE DESCRIPTION : COMBUSTION AIR TO BURNER					
		LINE/EQUIPMENT CONSIDERED : 18"-AP-105-N-C, 14"-AP-105-N-C, LV-24 BURNER, B-201A BLOWER, 1/2"-AP-109-N-F, 1 1/2"-AP-110-N-C					
		DRAWING DESIGNATION(S) : 32-03-713-D, SHEET 1 OF 6, REV 5, 7/23/91					
** PROCESS PARAMETER : FLOW							
1-1	NO	BLOWER FAILURE	NO AIR TO BURNER, BURNER GOES OUT, SYSTEM SHUTDOWN, POSSIBLE BACKUP OF HEAT.	B		EMERGENCY BLOWER IS AVAILABLE TO PREVENT BURNUP OF INCINERATOR. COMPLETE SPARE BLOWER MAY BE AVAILABLE.	(1)ENSURE ROUTINE MAINTENANC ON BLOWER - CRITICAL ITEM, INCLUDING BEARING TEMPERATUR OTHER PREDICTIVE MAINTENANCE MONITORING.(2) CONSIDER VIBRATION MONITORIG
1-2	NO	LINE RUPTURE, BLOCKED INLET FILTER. FAILURE OF XV-17.	SHUTDOWN OF SYSTEM. POSSIBLE OVERHEATING OF BURNER PARTS, EMERGENCY BLOWER STARTUP.	B		SEE LESS FLOW ACTION ITEM FOR FAILURE OF XV-17.	(1) INLET FILTER SHOULD BE PROPERLY MAINTAINED.(2) RECOMMEND INSTALLATION OF PRESSURE GAUGE ON INLET.
2-1	MORE	FAILURE OF FLOW CONTROL VALVE FCV-16	EXCESS AIR IN INCINERATOR, POSSIBLE LOW TEMPERATURE SHUTDOWN			EXCESS AIR IN INCINERATOR IS PREFERRED SAFE CONDITION	
3-1	LESS	CLOGGED INLET FILTER, BLOWER MALFUNCTION, PIPELINE LEAK, IMPROPER VALVE POSITIONING	IMPROPER OPERATION OF INCINERATOR DUE TO RICH FUEL/AIR MIXTURE, LOW OXYGEN AND HIGH CO IN EXHAUST, POTENTIAL EXPLOSIVE MIXTURE FORMED IN INCINERATOR	C			(1) DEVIATION ALARM ON LOW A FLOW RATE SET POINT SHOULD B ADDED (FIT-16).(2) NEED SHUTDOWN INTERLOCK.

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE				BACKUP BLOWER IS UNDER SEPARATE POWER SOURCE	
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	BLOWER NOT OPERATING, CLOGGED INLET FILTER	SAME AS NO FLOW				
8-1	MORE	NOT APPLICABLE					
9-1	LESS	PLUGGED STRAINER	INCREASED VACUUM IN DAY TANK VENT LINES	A		DAY TANKS INCLUDE SEAL DRIP LEGS AND CONSERVATION VENTS TO PREVENT DAMAGE	DEVIATION ALARM FROM FIT-016 INTO DAY TANK SHUT OFF VALVE XV-17A SHOULD BE ADDED
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	HIGH AMBIENT TEMPERATURE	INSUFFICIENT OXYGEN TO INCINERATOR, HIGH CO IN EXHAUST	B			CONSIDER ADDING TEMPERATURE COMPENSATION INSTRUMENTATION TO CORRECT AIR FLOW RATE.
11-1	LESS	LOW AMBIENT TEMPERATURE					SAME AS MORE TEMPERATURE
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					

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13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	VAPORS FROM DAY TANKS					SAMPLING SHOULD BE DONE DURING INITIAL PLANT OPERATION TO DETERMINE AMOUNT OF OFF GASING FROM DAY TANKS
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	IMPROPER OPERATION OF EITHER XV-17 OR FCV-16	INSUFFICIENT COMBUSTION AIR FLOW	A			BACKUP POWER SYSTEM SHOULD BE PERIODICALLY CHECKED FOR OPERABILITY. SUGGEST THAT LOW-FIRE LIMIT SWITCH OF FCV-16 & 30 XV-17 BE PART OF PERMISSIVES.
** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN	FAILURE OF XV-17 TO MAKE SWITCHOVER	NO EMERGENCY AIR TO INCINERATOR, POSSIBLE OVERHEATING OF BURNER/EXPANSION JOINTS/WASTE INJECTORS.	A			(1) CONTINGENCY PLAN FOR STARTING EMERGENCY AIR BLOWER B-201B FROM NORMAL POWER SUPPLY ON OTHER THAN LOSS OF POWER CONDITION.(2)INCLUDE ALARM POSITION OF XV-17
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					

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		HAZOP STUDY IDENTIFIER : INTAKE AIR TO INCINERATOR					
		LINE OR EQUIPMENT DESIGNATION : T0004					
		LINE DESCRIPTION : EMERGENCY AIR BLOWER					
		LINE/EQUIPMENT CONSIDERED : 6"-AP-107-N-C, B-201B EMERGENCY AIR BLOWER					
		DRAWING DESIGNATION(S) : 32-03-713D SHEET 1 OF 6, REV 5, 7/23/91					
** PROCESS PARAMETER : FLOW							
1-1	NO	BLOWER MALFUNCTION OR DIESEL GENERATOR NOT IN OPERATION TO POWER BLOWER, CLOGGED INLET FILTER	NO COOLING OF INCINERATOR, POSSIBLE OVERHEATING OF MATERIALS	B		DOUBLE FAILURE	(1)TESTING OF GENERATOR AND BLOWER SHOULD BE PART OF O&M MANUAL.
1-2	NO	LINKAGE BETWEEN COMBUSTION AIR AND EMERGENCY AIR BLOWER LINE VALVES BROKEN (INADVERTENT VALVE XV-17 CLOSURE), OR LINE RUPTURE.	NO COOLING OF INCINERATOR WHEN DESIRED UNDER SHUTDOWN OR EMERGENCY SITUATIONS, POSSIBLE OVERHEATING OF BURNER/EXPANSION JOINT/WASTE NOZZLES	B			SEE ITEM 1-1.
2-1	MORE	NOT APPLICABLE.					
3-1	LESS	INLET FILTER CLOGGED, LINE LEAK, PARTIAL OPENING OF VALVE.	SEE NO FLOW CONSEQUENCES	B			
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	FAILURE OF VALVE XV-17 LINKAGE CAUSES BACKFLOW INTO LINE.	INSUFFICIENT COMBUSTION AIR INTO INCINERATOR, BACKFLOW FROM COMBUSTION AIR INTO EMERGENCY AIR LINE.			DEVIATION LOW FLOW INDICATOR SHOULD DETECT.	

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6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SEE NO FLOW					
8-1	MORE	NOT APPLICABLE					
9-1	LESS	SEE LESS FLOW					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE.					

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN	FAILURE TO START BLOWER, MOTOR FAILURE, FAILURE OF EMERGENCY ELECTRICAL SYSTEM, CLOGGED AIR FILTER, IMPROPER VALVE (XV-17) OPERATION	SEE NO FLOW	B		ENSURE THAT BLOWER CAN BE USED AT TIMES OTHER THAN STRICTLY FOR POWER FAILURES IN THE EVENT THAT MAIN BLOWER MALFUNCTIONS OTHER THAN POWER FAILURE.	CONSIDER SWITCH GEAR TO AVOI REQUIREMENT OF EMERGENCY POW SYSTEM TO START BLOWER.
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	SEE NO FLOW AND EMERGENCY SHUTDOWN.					

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	HAZOP STUDY IDENTIFIER : INLET TO SUB-X INCINERATOR						
	LINE OR EQUIPMENT DESIGNATION : T0005						
	LINE DESCRIPTION : COMBUSTION AIR TO NOZZLE						
	LINE/EQUIPMENT CONSIDERED : 10"-AP-107-N-C, 8"-AP-108-N-C, 8"-AP-107-N-C, WASTE COMBUSTION AIR BUSTLE						
	DRAWING DESIGNATION(S) : 32-03-713D SHEET 1 OF 6, REV 5, 7/23/91						
** PROCESS PARAMETER : FLOW							
1-1	NO	FAILURE OF COMBUSTION AIR BLOWER, LINE RUPTURE, CONTROL VALVE FAILURE	IMPROPER COMBUSTION OF WASTE, POSSIBLE HIGH CO/LOW STACK O2 AND SYSTEM SHUTDOWN.	B		TEMPERATURE IN INCINERATOR WILL DROP UNDER NO FLOW CONDITIONS, WASTE WILL STILL FLOW TO INCINERATOR.	RECOMMEND INSTALLATION OF DEVIATION ALARM ON LINE.
2-1	MORE	FAILURE OF CONTROL VALVE IN COMBUSTION AIR LINE TO BURNER	INCREASED AIR TO WASTE NOZZLES, DETECTION THROUGH FLOW TRANSMITTOR	A			
3-1	LESS	SEE NO FLOW					
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SEE NO FLOW					

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8-1	MORE	SEE MORE FLOW					
9-1	LESS	SEE LESS FLOW					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	SEE COMMENTS UNDER TEMPERATURE FOR LINE T0003					
11-1	LESS	SEE COMMENTS UNDER TEMPERATURE FOR LINE T0003					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	SEE COMMENTS UNDER BURNER COMBUSTION AIR LINE T0003 FOR STARTUP/SHUTDOWN					
** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN	SEE COMMENTS UNDER EMERGENCY SHUTDOWN FOR LINE T0003					

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** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	SEE COMMENTS UNDER MAINTENANCE FOR LINE T0003					

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		HAZOP STUDY IDENTIFIER : INLET TO INCINERATOR					
		LINE OR EQUIPMENT DESIGNATION : T0006					
		LINE DESCRIPTION : AQUEOUS FEED LINE TO WASTE FEED MANIFOLD					
		LINE/EQUIPMENT CONSIDERED : 2"-WK-201A-E-U, 2"-WK-201B-E-U, 2"-WK-201-E-U, 1 1/2"-WK-201-E-U, 1"-WK-201-N-U, 1 1/2"-WK-201-N-U, P-201A, P-201B					
		DRAWING DESIGNATION(S) : 32-03-713-D SHEET 2 (11/2/90) REV 5					
** PROCESS PARAMETER : FLOW							
1-1	NO	PUMP FAILURE	NO FLOW TO NOZZLES, STANDBY PUMP WILL START UP AUTOMATICALLY	A			RECOMMEND OPERATING INLET F BY ALTERNATING PUMPS TO KEE PUMPS IN OPERATING CONDITIO
1-2	NO	INADVERTENT VALVE CLOSURE, LOSS OF INSTRUMENT AIR TO MAIN BLOCK VALVE.	NO WASTE FEED TO NOZZLES	B			REQUIRES OPERATOR ACTION.
1-2	NO	INADVERTENT VALVE CLOSURE, LOSS OF INSTRUMENT AIR TO MAIN BLOCK VALVE.	NO WASTE FEED TO NOZZLES	B			REQUIRES OPERATOR ACTION.
1-3	NO	LINE PLUGGING DUE TO SOLIDIFICATION IN LINE OR IN PUMPS.	NO FLOW TO NOZZLES, SHUTDOWN OF SYSTEM	B			(1) PUMP LOOP SHOULD INCORPORATE FLUSHING CONNECTIONS AND BE DESIGNED FOR SERVICING.(2) INVESTIGA MOVING THREE-WAY VALVE AND PLATE BIBS TO SUCTION SIDE.
1-4	NO	LINE RUPTURE	RELEASE OF BASIN F FLUID INTO BUILDING/WORK AREA	C			(1)INSTALL A HIGH/LOW ALARM FI-04A, INCLUDING INTERLOCK

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							FOR SHUTDOWN.
2-1	MORE	NOT APPLICABLE				FLOW IS NOT CONTROLLED IN THIS NODE. FLOW IS CONTROLLED BY FCV-22A TO E.	
3-1	LESS	PARTIAL PLUGGING OF LINE OR PUMPS	LOW FLOW TO NOZZLES, REQUIRES FLUSHING OF LINE.	A			SEE NO FLOW.
3-2	LESS	VALVE PARTIAL CLOSURE OR PUMP WEAR	LOW FLOW TO NOZZLES.	A			PUMP WEAR-REQUIRES SWITCHING OF PUMP, VALVE CLOSURE REQUIRES OPERATOR ACTION.
3-3	LESS	LINE LEAK	RELEASE OF BASIN F LIQUID INTO WORK AREA AND LOSS OF FLOW TO NOZZLES	C			SAME AS LINE RUPTURE UNDER NO FLOW.
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	VALVE XV-26 FAILS OPEN.	AIR BLOWN INTO TANK TK-105/106, POSSIBLE OVERPRESSURE OF TANK, INABILITY TO ADEQUATELY PURGE WASTE NOZZLES.	C			EVALUATE LOCATION OF CHECK VALVE 324.
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SEE NO FLOW					

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8-1	MORE	PLUGGING OF LINE	DEADHEAD PUMP.	A			SEE NO FLOW
9-1	LESS	SEE LESS FLOW					
** PROCESS PARAMETER : TEMPERATURE							
10-2	MORE	NOT APPLICABLE					
11-3	LESS	FAILURE OF HEAT TRACING	COULD RESULT IN LOW OR NO FLOW IN LINE				(1) HOW DOES THE OPERATOR DETECT A FAILURE IN THE HEAT TRACING?(2) ARE THERMOCOUPLE LOCATED ON HEAT TRACING OR LINE?
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	STRATIFICATION OF FEED OF BASIN F LIQUID IN FEED TANKS	POSSIBLE VISCOSITY CHANGES, SOLIDS BUILDUP MORE LIKELY TO OCCUR	A			
13-2	LESS	DILUTION OR STRATIFICATION OF BASIN F LIQUID	LONGER TIME REQUIRED TO PROCESS BASIN F LIQUID.	A			
14-1	AS WELL AS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSTION							
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN					OPERATION OF VALVE XV-66 AND XV-26 ARE INTERRELATED AND	RECOMMEND ROUTINE LINE FLUSHING AS PART OF

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						SHOULD BE PROPERLY INTERLOCKED.	MAINTENANCE PROGRAM PRIOR T STARTUP/AFTER SHUTDOWN.
** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN	VALVE MALFUNCTION ON EMERGENCY SHUTDOWN	POSSIBLE REVERSE FLOW OF AIR, CONTINUED FLOW OF BASIN F LIQUID INTO INCINERATOR	B			CONTINGENCY PLAN SHOULD INCLUDE CHECK OF FLOW IN FIT-04A TO DETERMINE IF FLO HAS CEASED UPON EMERGENCY SHUTDOWN.
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	SEE NO/LESS FLOW FOR LINE FLUSHING RECOMMENDATION.					

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		HAZOP STUDY IDENTIFIER : FEED SYSTEM TO SQI					
		LINE OR EQUIPMENT DESIGNATION : T0007					
		LINE DESCRIPTION : FEED TANKS TO WASTE FEED PUMPS					
		LINE/EQUIPMENT CONSIDERED : 2-WK-046-E-K,2-WK-045-E-K,2-WK-201-E-K,2-WK-201A/B/E-K,TK-105,TK-106,P-201A&B,1 1/2-WK-043-E-K					
		DRAWING DESIGNATION(S) : 32-03-713-D SHEET 2 REV 5 (7/23/91) 32-73-04-001 REV 0 (7/31/91)					
** PROCESS PARAMETER : FLOW							
1-1	NO	PLUGGED LINE, PLUGGED STRAINER	LOSS OF FEED TO P-201A/B	A		SEE LINE T0006 FOR FLUSHING COMMENT AND ACTION.	OEM MANUAL SHOULD EMPHASIZE IMPORTANCE OF CLOSE MONITOR OF PUMP SUCTION STRAINERS
1-2	NO	INADVERTANT VALVE CLOSURE	LOSS OF FEED	A			
1-3	NO	AUTOMATIC VALVE CLOSURE DUE TO MECHANICAL FAILURE OR LOSS OF INSTRUMENT AIR	LOSS OF FEED	A		CAN VALVE COV-105C AND COV-106B BE OPERATED MANUALLY?	
1-4	NO	LINE RUPTURE	LOSS OF FEED, RELEASE OF BASIN F FLUID TO WORK AREA	C			IS PIPING LOCATED WITHIN BE AREA WITH SUMP
2-1	MORE	NOT APPLICABLE					
3-1	LESS	LINE LEAK	BASIN F RELEASE INTO CONTAINMENT, CAVITATION OF PUMPS	C			RECOMMEND TRENDING OF PUMP DISCHARGE PRESSURE (PIT-28
3-2	LESS	PLUGGING OF STRAINERS, LINE PLUGGING				SEE NO FLOW	

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4-1	AS WELL AS	INADVERTANT OPENING OF VALVE IN LINE 1 1/2-WK-043-E-K.	UNCONTROLLED WASTEWATER IN FEED, LOSS OF CAPACITY IN THE INCINERATOR	A			RECOMMEND VALVE LOCKOUT CAPABILITY BE INCLUDED ON DISCHARGE OF TANK TK-104.
5-1	REVERSE	NO CONSEQUENCES					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SAME AS NO FLOW					
8-1	MORE	NOT APPLICABLE					
9-1	LESS	SAME AS LESS FLOW					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS					SEE LINE T0006 FOR ACTION ON HEAT TRACING INTEGRETY	
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					

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14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	SEE COMMENTS ON FLOW					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : EMGCY SHUTDOWN							
17-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					

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		HAZOP STUDY IDENTIFIER : FEED SYSTEM TO SQI					
		LINE OR EQUIPMENT DESIGNATION : T0008					
		LINE DESCRIPTION : WASTE FEED MANIFOLD TO INDIVIDUAL INJECTORS					
		LINE/EQUIPMENT CONSIDERED : 1-WK-203A/E-N-U,1-WK-204A/E-N-U					
		DRAWING DESIGNATION(S) : 32-03-713-D SHEET 2 REV 5 (11/2/90)					
** PROCESS PARAMETER : FLOW							
1-1	NO	LINE PLUG IN INDIVIDUAL INJECTOR FEED LINE	REDUCED INCINERATOR CAPACITY	A		REMAINING INJECTORS CANNOT MAKE UP FOR LOSS OF A SINGLE INJECTOR	
1-2	NO	LINE RUPTURE	LOSS OF FLOW TO INDIVIDUAL INJECTOR, RELEASE OF BASIN F FLUID INTO WORK AREA	C		MOST LIKELY RUPTURE LOCATION AT FLEXIBLE HOSE NEAR INJECTOR	(1)PROPER MAINTENANCE AND CHECKS OF HOSE SHOULD BE EMPHASIZED.(2) RECOMMEND ADDING TRENDING CAPABILITY F PIT-27A/E AND PIT-18A/E AND PIT-45A/E.
1-3	NO	INADVERTANT VALVE CLOSURE OR (FV-22A/E) CLOSURE DUE MECHANICAL FAILURE OR LOSS OF INSTRUMENT AIR AND OPERATOR ERROR	LOSS OF FLOW TO AN INJECTOR(S)	A			
2-1	MORE	INSTRUMENT FAILURE OR OPERATOR ERROR OR OPEN BYPASS ON VALVE 322A/E	IMPROPER OPERATION OF INCINERATOR, LOW OXYGEN, HIGH CO, REDUCED COMBUSTION EFFICIENCY	B			(1) REC. ADDING HIGH FLOW ALARM ON INDIVIDUAL CONTROLLERS FIC-22A/E.(2) RE REEVALUATION OF LOCKOUT ON

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							BYPASS VALVES ASSOCIATED WIT THESE CONTROL VALVES
3-1	LESS	SAME AS NO FLOW					
4-1	AS WELL AS	FAILURE OF VALVE XV-22A/E	REDUCED BASIN F FLOW TO INDIVIDUAL INJECTOR(S)	A		LOSS OF COMBUSTION EFFICIENCY	
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	MANUAL AIR PURGE VALVE INADVERTANTLY LEFT OPEN	LOSS OF FLOW TO INJECTOR(S)	A		FIT-22A/E WOULD DETECT	O&M MANUAL SHOULD INCLUDE TROUBLESHOOTING CHECKLIST TO CHECK AIR PURGE VALVES IF FIT-22A/E OPERATING ERRATICALLY
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SAME AS NO FLOW					
8-1	MORE	NOT APPLICABLE					
9-1	LESS	SAME AS LESS FLOW					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	NOT APPLICABLE					

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** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSTION							
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	FAILURE OF XV-66 TO OPEN ON SHUTDOWN	POSSIBLE PLUGGING OF LINE AND NOZZLE	B		AIR PURGE SYSTEM AUTOMATICALLY OPERATES ON SHUTDOWN. VALVE LIMIT SWITCHES INDICATE POSITION.	
** PROCESS PARAMETER : EMGCY SHUTDOWN							
17-1	OTHER THAN						OEM MANUAL SHOULD STATE OPERATORS SHOULD CONFIRM THA NOZZLES ARE CLEAR BEFORE RESTART.
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					

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HAZOP STUDY IDENTIFIER : INLET TO SUB-X INCINERATOR
LINE OR EQUIPMENT DESIGNATION : T0009
LINE DESCRIPTION : ATOMIZING AIR TO NOZZLES
LINE/EQUIPMENT CONSIDERED : 3"-AU-205-N-C, 2"-AU-213-N-C, 3"-AU-206-N-C, 1"-AU-206A/E-N-C, 1"-AU-207A/E-N-U, C-201 ATOMIZING AIR COMPRESSOR
DRAWING DESIGNATION(S) : 32-03-713 SHEET 2 OF 6, REV. 5, 7/23/91

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** PROCESS PARAMETER : FLOW							
1-1	NO	COMPRESSOR MALFUNCTION, LOSS OF POWER, RUPTURE OF PIPE/RECEIVER, INADVERTENT VALVE CLOSURE, PLUGGED AIR INLET	NO ATOMIZATION, SHUTDOWN OF WASTE FEED			IN THE EVENT THAT THE COMPRESSOR FAILS AND IS OUT OF SERVICE FOR A LENGTH OF TIME,(2) RMA MUST CONTRACT TO BRING IN SPARE COMPRESSED AIR SYSTEM TO CONTINUE OPERATION.	(1)SEE COMBUSTION AIR RECOMMENDATION FOR AIR INLET SCREEN MAINTENANCE.
2-1	MORE	NOT APPLICABLE					
3-1	LESS	SEE NO FLOW	DEVIATION ALARM AND WASTE FEED SHUTDOWN.	B			
4-1	AS WELL AS	FAILURE OF XV-21A/E.	INTRODUCTION OF STEAM INTO ATOMIZING AIR IF STEAM LINE IS CHARGED. POSSIBLE RESULT IS POOR COMBUSTION EFFICIENCY.	A		SHOULD BE AN INDICATION OF THE DEVIATION ALARM ON THE AIR FLOW.	
5-1	REVERSE	NOT APPLICABLE					

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6-1	OTHER THAN	MALFUNCTION OF VALVE XV-66, MAIN AIR PURGE	COMPRESSED AIR ENTERS WASTE FEED LINE, AIR PRESSURE WILL CUT OFF WASTE FEED	B		FIT-22A/E SHOULD SHOW ERRATIC FLOW READINGS TO INDICATE WASTE FEED CUTOFF. DEVIATION ALARM ON FIT-15A/E.	
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SEE NO FLOW					
8-1	MORE	NOT APPLICABLE					
9-1	LESS	SEE LESS FLOW					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	NOT APPLICABLE					

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** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	SEE LINE T0008, T0006.				OPERATION OF VALVE XV-66 AND XV-26 ARE INTERRELATED AND SHOULD BE PROPERLY INTERLOCKED.	
** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN	POWER LOSS OR OPERATOR INITIATED SHUTDOWN	IF COMPRESSOR STOPS OPERATION, COOLING AIR DOES NOT FLOW TO NOZZLES, REDUCED LIFE OF EQUIPMENT.	B		COMPRESSOR IS ASSUMED TO CONTINUE TO RUN ON EMERGENCY SHUTDOWN.	DETERMINE THAT COMPRESSOR IS SET UP TO CONTINUE TO RUN UP SHUTDOWN
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					

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		HAZOP STUDY IDENTIFIER : WASTE FEED TO INCINERATOR					
		LINE OR EQUIPMENT DESIGNATION : T0010					
		LINE DESCRIPTION : HOT WATER FOR PURGING WASTE LINE					
		LINE/EQUIPMENT CONSIDERED : 1-WT-707-E-D,1-WT-707-H-D,2-WT-216-H-D,1-WT-217A/E-H-D,H-201,INDIVIDUAL WASTE FEED LINES,1-WT-708-E-D,P-212,TK-206					
		DRAWING DESIGNATION(S) : 03-04-009 REV 0 (9/14/90) 32-03-713-D SHEET 2 OF 6 (7/23/91)					
** PROCESS PARAMETER : FLOW							
1-1	NO	PUMP FAILURE, INADVERTANT VALVE CLOSURE	NOT ABLE TO PURGE WASTE LINE, POSSIBLE A LOSS OF WASTE FLOW			INDICATION OF PROBLEM WOULD BE LACK OF FLOW INDICATION ON FIT-22A/E DURING PURGE OPERATION	
1-2	NO	LINE RUPTURE	SAME AS 1-1 PLUS HOT WATER RELEASED TO A WORK AREA			SAME AS 1-1	RECOMMEND MANUAL ON/OFF CONTROL OF PUMP BE ADDED (LOCAL AND REMOTE)
2-1	MORE	NOT APPLICABLE					
3-1	LESS	SAME AS NO FLOW					
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					

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** PROCESS PARAMETER : PRESSURE							
7-1	NO	SAME AS NO FLOW					
8-1	MORE	NOT APPLICABLE					
9-1	LESS	SAME AS LESS FLOW					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	HEATER INADEQUATELY SIZED	REDUCED EFFICIENCY OF FLUSHING	A			REVIEW SIZING OF HEATER AND TEMPERATURE REQUIREMENTS
11-2	LESS	HEAT TRACING FAILURE	FREEZING IN LINE, INSUFFICIENT FLOW	A		SEE COMMENT ON LINE T0006 FOR HEAT TRACING	
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE					

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** PROCESS PARAMETER : EMGCY SHUTDOWN							
17-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					

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		HAZOP STUDY IDENTIFIER : WASTE FEED SYSTEM					
		LINE OR EQUIPMENT DESIGNATION : T0011					
		LINE DESCRIPTION : ATOMIZING STEAM LINE					
		LINE/EQUIPMENT CONSIDERED : 3-ST-208-H-E,3-ST-209-H-E,1-ST-209-A/E-H-E,1-ST-210A/E-H-E,1-ST-215A/E-H-E,1-CS-215B,					
		DRAWING DESIGNATION(S) : 32-03-713-D SHEET 2 OF 6 REV 5 (7/23/91); 03-04-014 (UNAVAILABLE AT HAZOP)					
** PROCESS PARAMETER : FLOW							
1-1	NO	BOILER NOT OPERATING, INADVERTANT VALVE CLOSURE,	LOSS OF ATOMIZATION - IF BEING USED LOSS OF PURGING	A		LOSS WOULD BE INDICATED BY PIT-45A/E OR FLOW FIT-76A/E	RECOMMEND DEVIATION ALARM TO FIT-76A
1-2	NO	LINE RUPTURE	SAME AS 1-1 PLUS RELEASE OF STEAM TO WORK AREA	C			SAME AS 1-1
2-1	MORE	NOT APPLICABLE					
3-1	LESS	SAME AS 1-1					
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SAME AS NO FLOW					

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8-1	MORE	BOILER CONTROL MALFUNCTION	UNKNOWN				NEED TO REVIEW BOILER SYSTEM AND ITS CONTROLS TO DETERMIN CONSEQUENCES - DRAWING 03-04-014
9-1	LESS	SAME AS LESS FLOW					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	SAME AS FLOW					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSTION							
13-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSITION							
14-1	AS WELL AS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSITION							
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE					

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** PROCESS PARAMETER : EMGCY SD							
17-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					

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		HAZOP STUDY IDENTIFIER : SQI WASTE FEED SYSTEM					
		LINE OR EQUIPMENT DESIGNATION : T0012					
		LINE DESCRIPTION : WASTE RECYCLE LINE					
		LINE/EQUIPMENT CONSIDERED : 2-WK-202-E-U,1 1/2-WK-202-E-U,2-WK-211-E-U,TK-105,TK-106					
		DRAWING DESIGNATION(S) : 32-03-713-D SHEET 2 OF 6 REV 5 (7/23/91); 03-04-001 REV 0 (7/31/91)					
** PROCESS PARAMETER : FLOW							
1-1	NO	LINE RUPTURE	RELEASE OF BASIN F FLUID INTO WORK AREA	C		(2)CONTROL VALVE (PCV-28) SHOULD BE AS CLOSE TO T-THERMAL PIPE RACK AS POSSIBLE.(3) NO INDICATION AVAILABLE IF RUPTURE IS DOWNSTREAM OF PCV-28.	(1)ADD HIGH/LOW FLOW ALARM T FI-048.
1-2	NO	INADVERTANT VALVE CLOSURE, LOSS OF AIR, LINE PLUGGING	LOSS OF PRESSURE CONTROL ON T0006	A		SAME AS 1-1	SAME AS 1-1
2-1	MORE	PLUGGING IN T0006	FLOW DIVERTED TO RECIRC LINE. INADEQUATE FEED TO INCINERATOR.	A			SAME AS 1-1
3-1	LESS	SAME AS NO FLOW					
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					

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6-1	OTHER THAN					REFER TO TANK TK-105 AND TK-106 OPERATION	
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SAME AS NO FLOW					
8-1	MORE	NOT APPLICABLE					
9-1	LESS	SAME AS LESS FLOW					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	REFER TO LINE T0006					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	SAME AS LINE T0006					
13-1	LESS	SAME AS LINE T0006					
14-1	AS WELL AS	SAME AS LINE T0006					
15-1	OTHER THAN	SAME AS LINE T0006					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN					REFER TO OPERATION OF TK-105 AND TK-106	

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** PROCESS PARAMETER : EMGCY SD							
17-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					

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		HAZOP STUDY IDENTIFIER : SUB X INCINERATOR					
		LINE OR EQUIPMENT DESIGNATION : T0013					
		LINE DESCRIPTION : BURNER					
		LINE/EQUIPMENT CONSIDERED : BURNER LV-24					
		DRAWING DESIGNATION(S) : 32-03-713-D REV 5 (7/23/91); 17-24-325D REV 1 (3/2/91); 6-02-3796-B					
** PROCESS PARAMETER : FLOW							
1-1	NO	LOSS OF COMBUSTION AIR OR NATURAL GAS FEED	INCINERATOR SHUT DOWN	B			
2-1	MORE	LOSS OF CONTROL OF COMBUSTION AIR AND/OR NATURAL GAS	INEFFICIENT OPERATION, POSSIBLE SHUT DOWN	B		SEE TO LINES T0001 AND T0003	
3-1	LESS	SEE 2-1					
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SAME AS NO FLOW					
8-1	MORE	LOSS OF CONTROL OF VENTURI HIGH WATER LEVEL IN QUENCH TANK PLUGGAGE IN SCRUBBER TOWER PACKING	POOR BURNER OPERATION, INEFFICIENT OPERATION OF INCINERATOR	B			

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		HIGH WATER LEVEL IN SCRUBBER					
9-1	LESS	LOSS OF VENTURI CONTROL LOW WATER LEVEL IN QUENCH	INEFFICIENT BURNER OPERATION, POSSIBLE SYSTEM SHUTDOWN	B			
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	SEE LINE T0003					
11-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	IMPROPER CONTROL OF NATURAL GAS OR COMBUSTION AIR	IMPROPER AIR/FUEL RATIO INEFFICIENT BURNER OPERATION POSSIBLE SYSTEM SHUTDOWN	B		OPERATOR TRAINING SHOULD PAY SPECIAL ATTENTION TO IMPORTANCE OF A/F RATIO	
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	REFER TO T0003 AND T0001					
** PROCESS PARAMETER : EMGCY SHUTDOWN							
17-1	OTHER THAN	SAME AS 16-1					

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** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					

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		HAZOP STUDY IDENTIFIER : SUB-X INCINERATOR					
		LINE OR EQUIPMENT DESIGNATION : T0014					
		LINE DESCRIPTION : INCINERATOR CHAMBER					
		LINE/EQUIPMENT CONSIDERED : INCINERATOR SHELL AND REFRACTORY IN-201					
		DRAWING DESIGNATION(S) : 32-03-713D SHEET 1 OF 6, REV 5, 7/23/91, 6-02-3793-D SHEET 1 AND 2 REV 2, 6-02-3794-D SHEETS 1 AND 2, 6-02-3795-D SHEETS 1, 2, AND 3					
** PROCESS PARAMETER : FLOW							
1-1	NO	NOT APPLICABLE					
2-1	MORE	EXCESSIVE FEED RATES, ALL FEED SYSTEMS	RESIDENCE TIME SPECIFICATION NOT MET, POSSIBLE EMISSIONS PROBLEM	B			
3-1	LESS	EXCEEDING DESIGN TURNDOWN CONDITIONS	IMPROPER OPERATION, SURGING OF COMBUSTION GASES, POOR COMBUSTION, POSSIBLE SYSTEM SHUTDOWN	B		DESIGN TURNDOWN IS 2:1 FOR THE INCINERATOR CHAMBER	
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	NOT APPLICABLE					

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8-1	MORE	LOSS OF VENTURI CONTROL, HIGH LEVEL OF QUENCH TANK, CLOGGED SCRUBBER PACKING, HIGH WATER LEVEL IN SCRUBBER	DESIGN CONDITIONS FOR RESIDENCE TIME NOT MET	A			
9-1	LESS	LOSS OF VENTURI CONTROL, LOW WATER LEVEL IN QUENCH TANK	DESIGN RESIDENCE TIME NOT MET	A			
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	IMPROPER OPERATION OF CONTROL SYSTEM	DECREASED REFRACTORY LIFE	B		SYSTEM SHUTDOWN WILL OCCUR UPON REACHING HIGH REFRACTORY TEMPERATURE LIMIT.	
11-2	LESS	LOSS OF CONTROL	SHUTDOWN OF WASTE FEED TO UNIT	B			
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NO CONSEQUENCE					

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** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN	EXCESSIVE NUMBER/FREQUENCY OF EMERGENCY SHUTDOWNS	DECREASED REFRACTORY LIFE	B		EXCESSIVE SHUTDOWNS WILL AFFECT REMEDIATION SCHEDULE DUE TO LOSS OF EFFICIENCY AND NECESSITY OF CHANGING OUT REFRACTORY. T-THERMAL RECOMMENDS SPARING ENTIRE REFRACTORY LINING.	
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	LEAKS FROM FLANGES, ETC DUE TO LOSS OF INTEGRITY OF SEALS.	FUGITIVE EMISSIONS	C		HEALTH AND SAFETY PLAN IS NOT AVAILABLE AT THIS TIME. SHOULD ADDRESS THE POSSIBILITY OF FUGITIVE EMISSIONS.	O&M MANUAL SHOULD ADDRESS TH ISSUE.
18-2	OTHER THAN	LOSS OF REFRACTORY	LOCALLY HIGH SHELL TEMPERATURES.	B			

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		HAZOP STUDY IDENTIFIER : SUB-X INCINERATOR					
		LINE OR EQUIPMENT DESIGNATION : T0015					
		LINE DESCRIPTION : WASTE INJECTORS					
		LINE/EQUIPMENT CONSIDERED : WASTE INJECTORS					
		DRAWING DESIGNATION(S) : 32-03-713D REV 5, SHEET 1 OF 6, 7/31/91, 6-02-3820-C REV 1, 3/22/91;					
** PROCESS PARAMETER : FLOW							
1-1	NO	NOZZLE PLUGGING	LOSS OF FEED TO INCINERATOR, INEFFICIENT OPERATION	B		PLANNED MAINTENANCE INCLUDES FLUSHING, PURGING, CHANGING NOZZLE TIPS. REPLACEMENT/MAINTENANCE ALTERNATIVES ARE PLANNED. CONTINGENCY PLAN FOR NOZZLE PLUGGING EXISTS	
2-1	MORE	LOSS OF NOZZLE TIP	INEFFICIENT OPERATION, HIGH EMISSION RATE FROM STACK	B		PLANNED INSPECTION AND MAINTENANCE. SEE NO FLOW COMMENTS.	
3-1	LESS	SEE NO FLOW.					
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					

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** PROCESS PARAMETER : PRESSURE							
7-1	NO	NOT APPLICABLE					
8-1	MORE	SEE NO OR LESS FLOW					
9-1	LESS	LOSS OF NOZZLE TIP OR LOW FLOW.	INEFFICIENT OPERATION			PLANNED MAINTENANCE SCHEDULE SHOULD AVERT PROBLEM.	
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	INSUFFICIENT COMBUSTION AIR OR ATOMIZING AIR/STEAM FLOW DURING SHUTDOWN	POTENTIAL NOZZLE DAMAGE.	A			
11-2	LESS	NO CONSEQUENCE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	STRATIFICATION OF BASIN F WASTE IN TANK	GREATER TENDENCY TOWARD PLUGGING	B			
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	IMPROPER RATIO OF WASTE TO ATOMIZING AIR OR COMBUSTION AIR.	INEFFICIENT COMBUSTION OF WASTE	A			

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** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	SEE TEMPERATURE					
** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN	SEE TEMPERATURE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	SEE COMMENTS UNDER FLOW/TEMPERATURE					

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		HAZOP STUDY IDENTIFIER : SUB-X INCINERATOR					
		LINE OR EQUIPMENT DESIGNATION : T0016					
		LINE DESCRIPTION : INCINERATOR QUENCH TANK					
		LINE/EQUIPMENT CONSIDERED : Q-201 INCINERATOR QUENCH TANK					
		DRAWING DESIGNATION(S) : 32-03-713D SHEET 3 OF 6 REV 5, 7/23/91, 6-02-3793-D REV 2, 15-02-526-D REV 0					
** PROCESS PARAMETER : FLOW							
1-1	NO	NOT APPLICABLE					
2-1	MORE	MORE FLOW OF COMBUSTION GAS DUE TO LOSS OF CONTROL OF FEED STREAMS	EXCESSIVE AGITATION IN QUENCH TANK, POTENTIAL DAMAGE TO EXPANSION JOINT BETWEEN INCINERATOR AND QUENCH TANK, INCREASED VIBRATION POSSIBLE	B			
3-1	LESS	NO CONSEQUENCE					
4-1	AS WELL AS	SEE MAINTENANCE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	NO CONSEQUENCE					
8-1	MORE	LOSS OF CONTROL OF VENTURI, HIGH WATER LEVEL IN TANK, PLUGGED	POSSIBLE FAILURE OF EXPANSION JOINT BETWEEN INCINERATOR AND QUENCH TANK	C			

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
		SCRUBBER PACKING					
9-1	LESS	NO CONSEQUENCE					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	LOSS OF QUENCH WATER OR INSUFFICIENT QUENCH WATER IN TANK	DAMAGE TO LINING OF TANK AND EXPANSION JOINT, POTENTIAL HAZARDOUS RELEASE OF HOT GASES	C		REDUNDANT LEVEL AND TEMPERATURE ALARMS ON SEPARATOR	
10-2	MORE	PLUGGING OF RETURN LINE FROM SEPARATOR TO QUENCH TANK OR SOLIDS ACCUMULATION IN QUENCH TANK	POTENTIAL DAMAGE TO QUENCH TANK AND EXPANSION JOINT WITH RELEASE OF HOT GASES	C		UNLIKELY TO OCCUR SEPARATOR ALARMS MAY NOT DETECT HIGH TEMPERATURE/LOW LEVEL IN QUENCH TANK UNDER THIS CONDITION	
11-1	LESS	NO CONSEQUENCE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14--	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	SOLIDS ACCUMULATION	SEE MORE TEMPERATURE	C			

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** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NO CONSEQUENCE					
** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN	SEE EMERGENCY SD FOR RECYCLE LINE FOR PUMPS P-202A/B					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	CORROSION OR IMPROPER INSTALLATION OF HEAT SHIELD ITEM 9 ON DWG 6-02-3793D SHEET 2 OF 2, REV 2.	SHORTENED LIFE OF EXPANSION JOINT				HEAT SHIELD SHOULD BE INSTALLED PROPERLY AND INSPECTED PERIODICALLY DURIN SCHEDULED OUTTAGE.
** PROCESS PARAMETER : LEVEL							
19-1	NO	NOT APPLICABLE					
20-1	MORE	LOSS OF CONTROL ON MAKEUP WATER OR SCRUBBER BLOWDOWN	HIGH AGITATION CAUSING POTENTIAL DAMAGE TO EXPANSION JOINT AND OTHER EQUIPMENT	C		SAFEGUARDS IN DESIGN ARE IN PLACE.	
21-1	LOW/NO	SEE MORE TEMPERATURE					
21-2	LOW	LEAK OR TANK RUPTURE	RELEASE OF HOT GASES AND HIGH TEMPERATURE LIQUIDS INTO ENVIRONMENT	C			DETERMINE WHETHER CONTAINMEN BERMS EXIST AND WHETHER TANK IS BELOW GRADE.

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	HAZOP STUDY IDENTIFIER : CAUSTIC FEED SYSTEM (20%)						
	LINE OR EQUIPMENT DESIGNATION : T0017						
	LINE DESCRIPTION : CAUSTIC SOLUTION TO FEED PUMPS (P-208A/B)						
	LINE/EQUIPMENT CONSIDERED : 3-XB-012-E-D,3-XB-306-E-R,3-XB-306A-E-R,3-XB-306-E-R,TK-205,P-208A/B						
	DRAWING DESIGNATION(S) : 03-04-009 REV 0 (7/31/91); 32-03-713-D SHEET 3 OF 6 REV 5 (7/23/91)						
** PROCESS PARAMETER : FLOW							
1-1	NO	INADVERTANT VALVE CLOSURE,	NO CAUSTIC FEED, LOW pH IN QUENCH, REDUCED SCRUBBING EFFICIENCY, CORROSION POTENTIAL DUE TO ACID	A			
1-2	NO	LINE BREAK	SAME AS 1-1 PLUS RELEASE OF CAUSTIC INTO CONTAINMENT AREA	C			
2-1	MORE	NOT APPLICABLE					
3-1	LESS	SAME AS NO FLOW					
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SAME AS NO FLOW					

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8-1	MORE	NOT APPLICABLE					
9-1	LESS	INADVERTANT VALVE POSITIONING, LINE LEAK, FREEZING IN LINE	CAVITATION OF PUMP, LOSS OF CAUSTIC FEED	B		RECOMMEND REVIEW OF PUMP NPSH CALCS	
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	LOSS OF HEAT TRACING	LOSS OF CAUSTIC FEED, POSSIBLE CAVITATION OF PUMP DUE TO INCREASE IN VISCOSITY	B		SEE T0006 RE COMMENTS ON HEAT TRACING	
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	INCREASE IN VISCOSITY DUE TO HIGHER CONCENTRATION	POSSIBLE PUMP CAVITATION LOSS OF CAUSTIC FLOW	B		SEE STUDY NODE FOR TK-205 FOR IMPROPER CAUSTIC CONCENTRATION	
13-1	LESS	NO CONSEQUENCE TO THIS LINE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : EMGCY SD							
17-1	OTHER THAN	NOT APPLICABLE					

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** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					

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		HAZOP STUDY IDENTIFIER : CAUSTIC FEED SYSTEM					
		LINE OR EQUIPMENT DESIGNATION : T0018					
		LINE DESCRIPTION : CAUSTIC FEED TO QUENCH TANK					
		LINE/EQUIPMENT CONSIDERED : 2-XB-306A-E-R,2-XB-306B-E-R,3-XB-306-E-R,2-XB-306-E-R,1-XB-306-N-R,1 1/2-XB-306-N-R,1-XB-309-N-R,1 1/2-XB-306-E-R,P-208A/B,TERMINATES AT 3-BR-501-N-K (SCRUBBER BLOWDOWN TO QUENCH TANK)					
		DRAWING DESIGNATION(S) : 32-03-713-D REV 5 SHEET 3 OF 6 (7/23/91)					
** PROCESS PARAMETER : FLOW							
1-1	NO	INADVERTANT VALVE CLOSURE, PUMP FAILURE, LOSS OF POWER, LOSS OF INSTRUMENT AIR	SAME AS T0017 FOR NO FLOW	B		pH INSTRUMENTATION (AIC-64) WOULD DETECT THIS PROBLEM	
1-2	NO	LINE RUPTURE	SAME AS T0017 - NO FLOW (1-1) PLUS RELEASE OF CAUSTIC SOLUTION INTO WORK AREA	C			RECOMMEND ADDING CHECK VALVE AND PRESSURE SWITCH AT TERMINAL POINT OF LINE
2-1	MORE	LOSS OF CONTROL OF ACV-64 LOSS OF FLOW IN LINE CAUSTIC RECYCLE LINE TO STORAGE TANK	HIGH pH IN QUENCH TANK AND BLOWDOWN POSSIBLE PRECIPITATION OF SOLIDS	A			
3-1	LESS	SAME AS LESS FLOW FOR T0017					
4-1	AS WELL AS						RECOMMEND ADDITION OF INTERLOCK 65 TO ACV-64 AND INTERLOCK TO LOSS OF PUMPS P-202A/B.

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5-1	REVERSE	NO CONSEQUENCE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SAME AS NO FLOW					
8-1	MORE	NOT APPLICABLE					
9-1	LESS	SAME AS LESS FLOW					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	SEE LINE T0017				PART OF PIPING IS INDOORS	
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	SAME AS T0017					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NON SEQUENCED POSITIONING OF VALVE XV-23 WITH ASSOCIATED PUMP	SAME AS NO FLOW			(1)PUMP P-208A/B SHOULD BE OPERATING AND FLOW PROVEN AT	(2)RECOMMEND EVALUATION OF ADDING INTERLOCK TO SHUT DOW

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		(P-208A/B)				FE-41 PRIOR TO INTRODUCTION OF WASTE.	INCINERATOR IF LOSE CAUSTIC FLOW (FISL-41).
** PROCESS PARAMETER : EMGCY SD							
17-1	OTHER THAN	FAILURE OF VALVE ACV-64 TO CLOSE PROPERLY.	UNCONRTOLLED RELEASE OF CAUSTIC INTO QUENCH TANK AND POSSIBLE RELEASE OF CAUSTIC THROUGH OVERFLOW OF QUENCH TANK.			(1)OPERATOR SHOULD VERIFY CLOSURE OF THIS VALVE AFTER BOTH EMERGENCY AND NORMAL SHUTDOWN. (THIS BELONGS TO T0018 ITEM 16-2)	(2)COMFIRM WHETHER HEAT TRACING IS ON EMERGENCY POW SUPPLY
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					

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	HAZOP STUDY IDENTIFIER : CAUSTIC FEED SYSTEM						
	LINE OR EQUIPMENT DESIGNATION : T0019						
	LINE DESCRIPTION : CAUSTIC RECYCLE						
	LINE/EQUIPMENT CONSIDERED : 2-XB-307-E-R,1-XB-307-E-R,1-XB-319-E-R BEGIN AT 2-XB-306-E-R AND TERMINATE AT TANK TK-205						
	DRAWING DESIGNATION(S) : 32-03-713-D REV 5 SHEET 3 OF 6 (7/23/91); 03-04-009 REV 0 (7/31/91)						
** PROCESS PARAMETER : FLOW							
1-1	NO	SAME AS NO FLOW FOR LINE T0018	INEFFICIENT MIXING IN TANK TK-205 POSSIBLE pH CONTROL PROBLEMS	A			
1-2	NO	LINE RUPTURE	SAME AS T0018				
2-1	MORE	NO CONSEQUENCE					
3-1	LESS	SAME AS NO FLOW					
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SAME AS T0018 - NO PRESSURE					
8-1	MORE	SAME AS T0018					

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9-1	LESS	SAME AS T0018					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	SEE LINE T0018					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	SEE T0018					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : EMGCY SD							
17-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					

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		HAZOP STUDY IDENTIFIER : SCRUBBER RECYCLE LOOP					
		LINE OR EQUIPMENT DESIGNATION : T0020					
		LINE DESCRIPTION : SCRUBBER BLEED					
		LINE/EQUIPMENT CONSIDERED : 3-BR-501-H-K,2-BR-501-H-K,2-BR-502-H-K,3-BR-501-H-K,3-BR-501-N-K, BEGINS AT 6-BR-501-H-K AND ENDS AT TERMINUS OF CAUSTIC FEED LINE 1 1/2-XB-306-N-R					
		DRAWING DESIGNATION(S) : 32-03-713-D REV 5 SHEET 3 AND 5 OF 6 (7/23/91)					
** PROCESS PARAMETER : FLOW							
1-1	NO	INADVERTANT VALVE CLOSURE, INSTRUMENT AIR FAILURE PUMP FAILURE (P-203A/B)	HIGH LEVEL IN SCRUBBER	A			
1-2	NO	LINE RUPTURE UPSTREAM OF CONTROL VALVE	LOSS OF WATER TO SCRUBBER AND VENTURI RELEASE OFHOT SCRUBBER BLOWDOWN TO WORK AREA	C			
1-3	NO	LINE RUPTURE DOWNSTREAM OF CONTROL VALVE	LOSS OF FLOW TO QUENCH TANK	A		ALTERNATE MAKEUP WATER SUPPLY TO QUENCH TANK AVAILABLE	
1-4	NO	LINE RUPTURE DOWNSTREAM OF CONTROL VALVE	SPILL OF HOT (190F) SCRUBBER BLOWDOWN INTO WORK AREA	C			EVALUATE NEED FOR PRESSURE SWITCH TO INDICATE CONDITION
2-1	MORE	LOSS OF CONTROL OF FCV-62	INCREASED BLOWDOWN TO BRINE HOLDING TANKS	A			
3-1	LESS	LOSS OF CONTROL VALVE OPERATION, INADVERTANT VALVE POSITIONING	LOSS OF LEVEL CONTROL IN SCRUBBER	A			

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3-2	LESS	LINE LEAK	SAME AS LINE RUPTURE	C			
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SAME AS NO FLOW					
8-1	MORE	NOT APPLICABLE					
9-1	LESS	LOSS OF PUMP P-203A/B LOSS OF CONTROL ON FIC-60 AND/OR FIC-65	SAME AS LESS FLOW	A			
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	NO CONSEQUENCE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					

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14-1	AS WELL AS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSTION							
15-1	OTHER THAN	NO CONSEQUENCE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	VALVE FCV-62 FAILS TO CLOSE (FAIL SAFE POSITION) UPON INCINERATOR SHUTDOWN.	EMPTY BRINE FROM T-201 AND T-202 AND ASSOCIATED PIPING INTO QUENCH TANK CAUSING POSSIBLE OVERFLOW OF HOT BRINE INTO SUMP.	A		OPERATOR SHOULD CONFIRM PROPER CLOSURE OF THIS VALVE AFTER SHUTDOWN.	
** PROCESS PARAMETER : EMGCY SD							
17-1	OTHER THAN	SEE NORMAL SHUTDOWN.					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE				ALL HOT SERVICE LINES SHOULD BE ADEQUATELY PROTECTED AND IDENTIFIED	

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		HAZOP STUDY IDENTIFIER : SOFT WATER FEED SYSTEM					
		LINE OR EQUIPMENT DESIGNATION : T0021					
		LINE DESCRIPTION : SOFTENED DOMESTIC WATER TO QUENCH TANK					
		LINE/EQUIPMENT CONSIDERED : 2-WT-301A-E-D,2-WT-301B-E-D,2-WT-301-E-D,2-WT-301-N-D,1 1/2-WT-301-N-D,1 1/2 WT-303-N-D,2-WT-301-N-D,P-207A/B,QUENCH TANK Q-201					
		DRAWING DESIGNATION(S) : 32-03-713-D REV 5 SHEET 3 OF 6 (7/23/91)					
** PROCESS PARAMETER : FLOW							
1-1	NO	LOSS OF PUMP, INADVERTANT VALVE CLOSURE, LOSS OF INSTRUMENT AIR	LOSS OF WATER FEED TO QUENCH TANK SYSTEM SHUTDOWN	B			
1-2	NO	LINE RUPTURE	SAME AS 1-1 PLUS RELEASE OF SOFT WATER	B		IF UPSTREAM OF FIT-39 - GET ALARM AND SYSTEM SHUTDOWN IF DOWNSTREAM OF FIT-39 - NO INDICATION AVAILABLE	(1) INVESTIGATE NEED FOR PRESSURE SWITCH FOR LOSS OF FLOW INDICATION.(2) LOCATIO WOULD BE BETWEEN WPR-7 AND QUENCH TANK
2-1	MORE	LOSS OF CONTROL OF FCV-39	DECREASED FLOW FROM SCRUBBER BLEED LOSS OF CONTROL OF SCRUBBER LEVEL INCREASED BLOWDOWN TO BRINE HOLDING TANKS	A			
3-1	LESS	INADVERTANT VALVE POSITIONING	SEE NO FLOW	B		IF FLOW FALLS BELOW SETPOINT OF FSLL-39 SYSTEM WILL SHUTDOWN	

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4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SAME AS NO FLOW					
8-1	MORE	SAME AS MORE FLOW					
9-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	LOSS OF HEAT TRACING	FROZEN PIPE AND LOSS OF WATER FEED	B			
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	WATER SOFTENER FAILURE	PRECIPITATION OF SOLIDS, PLUGGING OF LINES	A			

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** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	SEQUENCING OF VALVE (XV-37) WITH ASSOCIATED PUMP INCORRECT.	SAME AS NO FLOW	A		ADEQUATE WATER PRESSURE IS A STARTUP PERMISSIVE	
** PROCESS PARAMETER : EMGCY SD							
17-1	OTHER THAN	FAILURE OF XV-40 TO CLOSE ON SHUTDOWN.	OVERFLOW OF QUENCH TANK Q-201 INTO SUMP.	A		LIMIT SWITCH ON VALVE CLOSURE SHOULD BE PROVEN UPON SHUTDOWN. ADD 16-2 FOR LINE T0021 AND REFER TO 17-1.	
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					

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		HAZOP STUDY IDENTIFIER : SCRUBBER RECYCLE AND CAUSTIC MAKEUP					
		LINE OR EQUIPMENT DESIGNATION : T0022					
		LINE DESCRIPTION : CAUSTIC AND SCRUBBER BLEED TO QUENCH TANK					
		LINE/EQUIPMENT CONSIDERED : 2-BR-501-N-K BEGINS AT INTERSECTION O 1 1/2-XB-306-N-R AND 3-BR-501-N-K, AND TERMINATES AT QUENCH TANK Q-201					
		DRAWING DESIGNATION(S) : 32-03-713-D REV 5 SHEET 3 OF 6 (7/23/91)					
** PROCESS PARAMETER : FLOW							
1-1	NO	LOSS OF FLOW FROM SCRUBBER RECYCLE AND/OR CAUSTIC SYSTEM	SAME AS T0018 AND/OR T0020				
1-2	NO	LINE RUPTURE	RELEASE OF HOT (>150F) CAUSTIC INTO WORK AREA	C			REVIEW PIPING RUN FOR SAFETY
2-1	MORE	SAME AS T0020 OR T0018					
3-1	LESS	SAME AS T0020 OR T0018					
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SAME AS T0020 OR T0018					

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8-1	MORE	NOT APPLICABLE					
9-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	SAME AS T0018 OR T0020					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	SAME AS T0018 OR T0020					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : EMGCY SD							
17-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					

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		HAZOP STUDY IDENTIFIER : SOFTENED WATER SUPPLY					
		LINE OR EQUIPMENT DESIGNATION : T0023					
		LINE DESCRIPTION : SOFTENED MAKEUP WATER TO SCRUBBER RECYCLE LINE					
		LINE/EQUIPMENT CONSIDERED : 2-WT-302-N-D,1-WT-305-N-D FROM 2-WT-301-N-D; TERMINATES AT 4-BR-503-H-K					
		DRAWING DESIGNATION(S) : 32-03-713-D REV 5 SHEETS 3 AND 5 OF 6 (7/23/91)					
** PROCESS PARAMETER : FLOW							
1-1	NO	INADVERTANT VALVE CLOSURE, LOSS OF INSTRUMENT AIR, PUMP P-207A/B FAILURE, LOSS OF CONTROL VALVE FCV-48	LOW WATER LEVEL IN SCRUBBER, SYSTEM SHUTDOWN	B			
1-2	NO	LINE RUPTURE	RELEASE OF SOFTENED WATER TO WORK AREA	B		NO INDICATION IF RUPTURE DOWNSTREAM OF FE-48	
2-1	MORE	LOSS OF CONTROL VALVE FCV-48	HIGH LEVEL IN SCRUBBER, INCREASED BLOWDOWN TO QUENCH TANK, AND INCREASED BLOWDOWN TO BRINE TANKS	A			
3-1	LESS	IMPROPER VALVE POSITIONING, PUMP MALFUNCTION	LOWER LEVEL IN SCRUBBER AND SYSTEM SHUTDOWN	B		LESS FLOW EXPECTED DURING STARTUP. DEVIATION ONLY OCCURS DURING NORMAL OPERATION	
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					

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6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SAME AS NO FLOW					
8-1	MORE	NOT APPLICABLE					
9-1	LESS	SAME AS LESS FLOW					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	NOT APPLICABLE					

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HAZOP STUDY IDENTIFIER : SOFTENED WATER SUPPLY
LINE OR EQUIPMENT DESIGNATION : T0024
LINE DESCRIPTION : SCRUBBER TOWER DEMISTER FLUSH
LINE/EQUIPMENT CONSIDERED : 2"-wt-304-n-d, 1"-WT-304-N-D,
DRAWING DESIGNATION(S) : 32-03-713D SHEETS 3 AND 5 OF 6, REV 5, 7/23/91

** PROCESS PARAMETER : COMPOSITION

12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					

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HAZOP STUDY IDENTIFIER : SOFTENED WATER SUPPLY
LINE OR EQUIPMENT DESIGNATION : T0023
LINE DESCRIPTION : SOFTENED MAKEUP WATER TO SCRUBBER RECYCLE LINE
LINE/EQUIPMENT CONSIDERED : 2-WT-302-N-D,1-WT-305-N-D FROM 2-WT-301-N-D; TERMINATES AT 4-BR-503-H-K
DRAWING DESIGNATION(S) : 32-03-713-D REV 5 SHEETS 3 AND 5 OF 6 (7/23/91)

** PROCESS PARAMETER : COMPOSITION

15-1	OTHER THAN	SEE T0021					

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		HAZOP STUDY IDENTIFIER :					
		LINE OR EQUIPMENT DESIGNATION : T0023					
		LINE DESCRIPTION :					
		LINE/EQUIPMENT CONSIDERED :					
		DRAWING DESIGNATION(S) :					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	FCV-48 FAILS OPEN	UNCONTROLLED WATER INTO SCRUBBER CAUSING OVERFLOW TO SUMP.	A		THIS LINE WILL NOT HAVE FLOW DURING STARTUP	CHANGE FAIL POSITION TO FAIL CLOSED ON VALVE FCV-48.

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HAZOP STUDY IDENTIFIER : SOFTENED WATER SUPPLY
LINE OR EQUIPMENT DESIGNATION : T0023
LINE DESCRIPTION : SOFTENED MAKEUP WATER TO SCRUBBER RECYCLE LINE
LINE/EQUIPMENT CONSIDERED : 2-WT-302-N-D,1-WT-305-N-D FROM 2-WT-301-N-D; TERMINATES AT 4-BR-503-H-K
DRAWING DESIGNATION(S) : 32-03-713-D REV 5 SHEETS 3 AND 5 OF 6 (7/23/91)

** PROCESS PARAMETER : EMGCY SD

17-1	OTHER THAN	SEE ITEM 16-1					

** PROCESS PARAMETER : MAINTENANCE

18-1	OTHER THAN	NOT APPLICABLE					

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		HAZOP STUDY IDENTIFIER : SOFTENED WATER SUPPLY					
		LINE OR EQUIPMENT DESIGNATION : T0024					
		LINE DESCRIPTION : SCRUBBER TOWER DEMISTER FLUSH					
		LINE/EQUIPMENT CONSIDERED : 2"-wt-304-n-d, 1"-WT-304-N-D,					
		DRAWING DESIGNATION(S) : 32-03-713D SHEETS 3 AND 5 OF 6, REV 5, 7/23/91					
** PROCESS PARAMETER : FLOW							
1-1	NO	INADVERTENT VALVE CLOSURE, LOSS OF INSTRUMENT AIR, PUMP FAILURE P-206A/B	PLUGGING OF SCRUBBER DEMISTER WITH SOLIDS OVER TIME	A		INTERMITTENT FLOW IS DESIGN OPERATION. CYCLES TO BE ADJUSTED DURING STARTUP.	
1-2	NO	LINE RUPTURE	SEE 1-1 AND RELEASE OF SOFT WATER TO WORK AREA, SYSTEM SHUTDOWN	B			
2-1	MORE	TIMER MALFUNCTION	INCREASED WATER USAGE	A			
3-1	LESS	SEE NO FLOW					
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SEE NO FLOW					

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8-1	MORE	NOT APPLICABLE					
9-1	LESS	SEE LESS FLOW					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	NO CONSEQUENCE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	SAME AS T0021					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	XV-54 OPENS	UNCONTROLLED WATER INTO SCRUBBER CAUSING OVERFLOW TO SUMP.	A			XV-54 SHOULD FAIL CLOSED
** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN	SEE ITEM 17-1					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					

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	HAZOP STUDY IDENTIFIER : SOFTENED WATER SUPPLY						
	LINE OR EQUIPMENT DESIGNATION : T0025						
	LINE DESCRIPTION : pH FLUSH PROBE						
	LINE/EQUIPMENT CONSIDERED : 1 1/2"-WT-317-E-D, 1 1/2"-WT-318-E-D, 1 1/2"-BR-501-H-K, 1"-BR-501-H-K, 1 1/2"-BR-416-H-K, 1"-BR-416A-H-K, 1"-BR-416B-H-K,						
	DRAWING DESIGNATION(S) : 32-03-713D SHEET 3, 4 AND 5 OF 6, REV 5, 7/23/91						
** PROCESS PARAMETER : FLOW							
1-1	NO	PUMP MALFUNCTION P-207A/B	POTENTIAL FOR ERRONEOUS pH READING WHICH MAY RESULT IN LOSS OF pH CONTROL IN QUENCH TANK AND/OR SCRUBBER SYSTEM	A		SYSTEM IS MANUALLY OPERATED	
1-2	NO	LINE RUPTURE	SEE T0024 1-2			NORMAL OPERATION IS INTERMITTENT	
2-1	MORE	NOT APPLICABLE					
3-1	LESS	NOT APPLICABLE					
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICALBE					

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** PROCESS PARAMETER : PRESSURE							
7-1	NO	SEE NO FLOW					
8-1	MORE	NOT APPLICABLE					
9-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN	NOT APPLICABLE					

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** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICALBE					

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		HAZOP STUDY IDENTIFIER : QUENCH TANK SOLIDS REMOVAL					
		LINE OR EQUIPMENT DESIGNATION : T0026					
		LINE DESCRIPTION : QUENCH TANK RECIRCULATION					
		LINE/EQUIPMENT CONSIDERED : 6"-BR-316-H-K, 6"-BR-316A-H-K, 6"-BR-316B-H-K, Q-201 QUENCH TANK, P-205A/B QUENCH TANK RECIRCULATE PUMPS					
		DRAWING DESIGNATION(S) : 32-03-713D SHEET 3 OF 6, REV 5, 7/23/91					
** PROCESS PARAMETER : FLOW							
1-1	NO	CLOGGED FILTER OR CLOGGED LINE, INADVERTANT VALVE CLOSURE	SOLIDS BUILDUP IN QUENCH TANK AND SEPARATOR, CAVITATION OF PUMPS P-205A/B	A		FREQUENCY OF USE WILL DICTATE SOLIDS ACCUMULATION IN QUENCH TANK	
1-2	NO	LINE RUPTURE	RELEASE OF HOT WATER (190 F) TO WORK AREA, RELEASE OF HOT GASES TO WORK ENVIRONMENT AND DOWNSTREAM FRP EQUIPMENT, SYSTEM SHUTDOWN	C			
2-1	MORE	NO CONSEQUENCE					
3-1	LESS	PARTIAL LINE PLUGGING, CLOGGED STRAINER, INADVERTANT VALVE POSITIONING	INEFFICIENT REMOVAL OF SOLIDS, PUMP CAVITATION, SHUTDOWN OF SOLIDS REMOVAL.	A		OPERATIONAL EXPERIENCE WILL DICTATE WHEN AND HOW THE SOLIDS REMOVAL SYSTEM IS USED.	
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					

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6-1	OTHER THAN	NOT APPICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	NOT APPLICABLE					
8-1	MORE	NOT APPLICABLE					
9-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE					

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN					SYSTEM USAGE IS MAINTENANCE-RELATED.	

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		HAZOP STUDY IDENTIFIER : SOLIDS REMOVAL					
		LINE OR EQUIPMENT DESIGNATION : T0027					
		LINE DESCRIPTION : REMOVAL OF SOLIDS FROM QUENCH TANK					
		LINE/EQUIPMENT CONSIDERED : 6"-BR-316A-H-K, 6"-BR-316B-H-K, 6"-BR-315-H-K, 6"-BR-316-N-K, 4"-BR-316-H-K, 6"-BR-322-N-K, P-205A/B, Q-201					
		DRAWING DESIGNATION(S) : 32-03-713D SHEET 3 OF 6, REV 5, 7/23/91					
** PROCESS PARAMETER : FLOW							
1-1	NO	PUMP FAILURE, INADVERTANT VALVE CLOSURE, PLUGGING OF LINE	SEE NO FLOW FOR LINE T0026	A			
1-2	NO	LINE RUPTURE	SAME AS T0026 LINE RUPTURE	C			
2-1	MORE	NOT APPLICABLE					
3-1	LESS	PUMP MALFUNCTION, CLOGGED LINE, INADVERTANT VALVE POSITIONING	INEFFICIENT SOLIDS REMOVAL.	A			
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	PUMP LOSS, INADVERTENT VALVE POSITIONING, INSTRUMENT AIR	SEE NO FLOW	A			

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		FAILURE, LINE PLUGGING					
8-1	MORE	NOT APPLICABLE					
9-1	LESS	SEE LESS FLOW					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	MORE SOLIDS IN SYSTEM	INCREASED PUMP WEAR	A			MAINTENANCE ITEM
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN	NOT APPLICABLE					

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** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	SEE COMPOSITION.					

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		HAZOP STUDY IDENTIFIER : SOLIDS REMOVAL					
		LINE OR EQUIPMENT DESIGNATION : T0028					
		LINE DESCRIPTION : KREBS VORTEX SEPARATOR					
		LINE/EQUIPMENT CONSIDERED : VORTEX SEPARATOR					
		DRAWING DESIGNATION(S) : 32-03-713D SHEET 3 OF 6, REV 5, 7/23/91					
** PROCESS PARAMETER : FLOW							
1-1	NO	PUMP LOSS, PLUGGED EQUIPMENT	SOLIDS BUILDUP IN QUENCH TANK, MAINTENANCE REQUIRED TO CLEAN OUT SEPARATOR	A		CAN BYPASS VORTEX SEPARATOR IF NECESSARY.	
2-1	MORE	NOT APPLICABLE					
3-1	LESS	SEE NO FLOW	SEE NO FLOW				

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		HAZOP STUDY IDENTIFIER : SUB-X INCINERATOR					
		LINE OR EQUIPMENT DESIGNATION : T0029					
		LINE DESCRIPTION : DOWNCOMER					
		LINE/EQUIPMENT CONSIDERED : DOWNCOMER INTO QUENCH TANK					
		DRAWING DESIGNATION(S) : 32-03-713D SHEET 3 OF 6, REV. 5, 7/23/91					
** PROCESS PARAMETER : *FLOW*							
1-1	NO	PLUGGED DOWNCOMER PORTS	SURGING OF QUENCH TANK AND EVENTUAL SYSTEM SHUTDOWN	B		SITUATION PRECEDED BY LESS FLOW CONDITIONS - NOT EXPECTED TO PROGRESS TO A NO FLOW SITUATION.	
2-1	MORE	UNCONTROLLED FEED TO INCINERATOR	IMPROPER QUENCH OPERATION, SURGING OF COMBUSTION GASES, RISK OF DAMAGING *EXPANSION JOINT, VIBRATION*	C			
3-1	LESS	PLUGGED DOWNCOMER PORTS	POSSIBLE COMBUSTION GAS SURGING WITH POTENTIAL DAMAGE TO EXPANSION JOINT, VIBRATION	C			RECOMMEND SEMI-ANNUAL MAINTENANCE PROGRAM INCLUDE INSPECTION OF PORTS
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPICABLE					
6-1	OTHER THAN	NOT APPLICABLE					

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** PROCESS PARAMETER : PRESSURE							
7-1	NO	NOT APPLICABLE					
8-1	MORE	PLUGGING OF DOWNCOMER PORTS	HIGHER THAN NORMAL PRESSURE IN *INCINERATOR*			PRESSURE DIFFERENCE WOULD BE MINOR AND WOULD NOT BE DETECTED. SURGING AND VIBRATION WOULD BE BETTER INDICATORS OF PLUGGED PORTS. PLUGGED PORTS COULD CAUSE PUMP CAVITATION.	
9-1	LESS	NOT APPLICABLE					
** *PROCESS PARAMETER : TEMPERATURE*							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	NO CONSEQUENCES					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	LOSS OF NEUTRALIZATION	ACCELERATED CORROSION OF DOWNCOMER.	A			

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** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NO CONSEQUENCES					
** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN	NOT APPLICALBE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	SEE NO FLOW AND COMPOSITION					
** PROCESS PARAMETER : LEVEL							
19-1	NO	NOT APPLICABLE					
20-1	MORE/LESS	SEE LEVEL ISSUES UNDER QUENCH TANK					
21-1	LOW	NOT APPLICABLE					

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		HAZOP STUDY IDENTIFIER : CAUSTIC SUPPLY SYSTEM					
		LINE OR EQUIPMENT DESIGNATION : T0030					
		LINE DESCRIPTION : CAUSTIC MAKEUP TO SCRUBBER					
		LINE/EQUIPMENT CONSIDERED : 1 1/2-XB-320-E-R, 1-XV-321-H-R STARTS AT 1 1/2-XB-306-E-R AND TERMINATES AT 4-BR-503-H-K, 1 1/2-XB-320-H-R ,					
		DRAWING DESIGNATION(S) : 32-03-713-D REV 5 SHEETS 3 AND 5 OF 6 (7/23/91)					
** PROCESS PARAMETER : FLOW							
1-1	NO	INADVERTANT VALVE CLOSURE, INSTRUMENT AIR FAILURE, PUMP FAILURE (P-208A/B)	LOSS OF pH CONTROL IN SCRUBBER, HIGH EMISSIONS IN STACK	A		RECOMMEND TRENDING ON AIC-56	
1-2	NO	LINE RUPTURE	LOSS OF pH CONTROL IN SCRUBBER, HIGH EMISSIONS IN STACK, RELEASE OF CAUSTIC TO WORK AREA	C			CONSIDER LOOKING AT SAFETY CONSIDERATIONS ASSOCIATED WI LACK OF RUPTURE (FLOW OR PRESSURE) INDICATION ON LINE
2-1	MORE	LOSS OF CONTROL ON VALVE FCV-56	HIGH pH IN SCRUBBER LOOP, POSSIBLE PRECIPITATION OF METAL HYDROXIDES	A		LOSS OF CONTROL INDICATED BY CHANGE IN pH ONLY.	
3-1	LESS	INADVERTANT VALVE POSITIONING, LOSS OF INSTRUMENT AIR, LOSS OF CONTROL TO CONTROL VALVE FCV-56, LOSS OF SUPPLY PUMPS,	LOW pH IN SCRUBBER LOOP, HIGH EMISSIONS IN STACK	B			
3-2	LESS	LINE LEAK	SEE LINE RUPTURE	C			

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4-1	AS WELL AS						
5-1	REVERSE	NOT APPLICABLE - DOUBLE FAILURE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SEE NO FLOW					
8-1	MORE	NOT APPLICABLE					
9-1	LESS	SEE LESS FLOW					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	LOSS OF HEAT TRACING	SEE LESS FLOW	A			REVIEW HEAT TRACING CONTROL AND MONITORING
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	SEE LINE T0018, CAUSTIC TO QUENCH TANK					

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** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	FAILURE OF FCV-56 TO FAIL CLOSED	INTRODUCTION OF CAUSTIC INTO SCRUBBER, SEE MORE FLOW.	C			OPERATOR SHOULD CONFIRM CLOSURE OF FCV-56 ON SHUTDOW
** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN	SEE ITEM 16-1					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
	HAZOP STUDY IDENTIFIER : QUENCH TANK RECYCLE						
	LINE OR EQUIPMENT DESIGNATION : T0031						
	LINE DESCRIPTION : QUENCH RECYCLE SUCTION						
	LINE/EQUIPMENT CONSIDERED : 4"-BR-416-H-K, 4"-BR-416A-H-K, 4"-BR-416B-H-K, S-201 SEPARATOR, P-202A/B PUMPS						
	DRAWING DESIGNATION(S) : 32-03-713D SHEET 4 OF 6, REV 5, 7/23/91						
** PROCESS PARAMETER : FLOW							
1-1	NO	INADVERTANT VALVE CLOSURE, STRAINER PLUGGING, LINE PLUGGING	LOSS OF RECYCLE TO DOWNCOMER, PUMP CAVITATION, SYSTEM SHUTDOWN, POSSIBLE OVERHEATING OF DOWNCOMER, LOSS OF BLOWDOWN	B		PUMPS ARE PART OF EMERGENCY DIESEL GENERATOR SYSTEM. DP INDICATOR ACROSS STRAINERS SHOULD INDICATE A PROBLEM BEFORE COMPLETE PLUGGING.	
1-2	NO	LINE RUPTURE	SEE LINE RUPTURE FOR T0026, QUENCH TANK RECIRCULATION	C			
2-1	MORE	NOT APPLICABLE					
3-1	LESS	SEE NO FLOW	SEE NO FLOW				
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
** PROCESS PARAMETER : PRESSURE							
7-1	NO	NOT APPLICABLE					
8-1	MORE	NOT APPLICABLE					
9-1	LESS	PLUGGING OF LINE, SOLIDS BUILDUP, PLUGGING OF STRAINER, FAILURE OF DP INDICATOR	PUMP CAVITATION P-202A/B,				EVALUATE TRENDING POINT FOR INDICATOR
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE						
11-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE				ENSURE THAT UTILITIES SUCH AS CAUSTIC PUMPS SHUT OFF DURING SHUTDOWN.	

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** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
		HAZOP STUDY IDENTIFIER : QUENCH TANK RECYCLE					
		LINE OR EQUIPMENT DESIGNATION : T0032					
		LINE DESCRIPTION : QUENCH RECYCLE PRESSURE SIDE					
		LINE/EQUIPMENT CONSIDERED : 2"-BR-313-H-K, 4"-BR-313-H-K, 2"-BR-313A-H-K, 4"-BR-313A-H-K, 4"-BR-416B-H-K, 4"-BR-416A-H-K, 4"-BR-416-H-K,, PUMPS P-202A/B, TO Q-201 QUENCH TANK					
		DRAWING DESIGNATION(S) : 32-03-713D SHEET 3 AND 4 OF 6, REV 5, 7/23/91					
** PROCESS PARAMETER : FLOW							
1-1	NO	PUMP FAILURE, INADVERTANT VALVE CLOSURE, LOSS OF INSTRUMENT AIR, LINE PLUGGING	SYSTEM SHUTDOWN, SEE T0031.	B			
1-2	NO	LINE RUPTURE	SEE T0031	C			
2-1	MORE	UNBALANCE PRESSURE BETWEEN BLOWDOWN AND RECYCLE	NO BLOWDOWN	A			ADD A RESTRICTING ORIFICE (VALVE) INCLUDING PRESSURE INDICATOR TO BALANCE PRESSUR BETWEEN RECYCLE AND BLOWDOWN LINES.
3-1	LESS	PUMP DETERIORATION, LINE PLUGGING, INADVERTANT VALVE POSITIONING	SEE LINE T0031	A			
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SEE NO FLOW					
8-1	MORE	NOT APPLICABLE					
9-1	LESS	PUMP WEAR, INADVERTANT VALVE POSITIONING, LINE PLUGGING	SEE LESS FLOW FOR LINE T0031	A			
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE				SEE TEMPERATURE COMMENTS ON LINE T0031	
11-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	MALFUNCTION OF DENSITY METERS AE-59A/B	BLOWDOWN TOO CONCENTRATED, GREATER TENDENCY TOWARD DEPOSITION OF SOLIDS IN QUENCH TANK AND SEPARATOR, INCREASED SOLIDS DEPOSITION IN RECIRC/SOLIDS REMOVAL	C		EVENTUAL BUILDUP OF SOLIDS IN QUENCH TANK CAN RESULT IN SURGING, VIBRATION, LOSS OF EXPANSION JOINTS, CATASTROPHIC FAILURE. DENSITY METERS ARE REDUNDANT.	(1)PROVIDE MIN FLOW LIMIT SWITCH INTERLOCKED TO WASTE FEED VALVE TO ENSURE MINIMUM BLOWDOWN DURING WASTE INCINERATION OPERATION.(2) RECOMMEND DEN. TREND.
13-1	LESS	FAILURE OF DENSITY METERS AE-59A/B	DILUTE BLOWDOWN RESULTS IN CONSEQUENCE DOWNSTREAM INTO BRINE HOLDING TANKS.				SEE COMPOSITION-MORE.

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14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	IMPROPER SEQUENCING OF VALVES XV-78A/B WITH PUMPS P-202A/B.	SEE NO FLOW.			FISL-57 IS A FLOW PERMISSIVE FOR STARTUP. SYSTEM IS DESIGNED NOT TO START UNLESS MINIMUM FLOW IS ESTABLISHED.	
** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN					PUMPS P-202A/B ARE OPERATED UNDER EMERGENCY SHUTDOWN THROUGH THE EMERGENCY DIESEL GENERATOR.	CONFIRM WHETHER EMERGENCY DIESEL GENERATOR IS AUTOMATICALLY STARTED UPON EMERGENCY SHUTDOWN. IS EMERGENCY GENERATOR AUTOMATICALLY STARTED?
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					

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HAZOP STUDY IDENTIFIER : BRINE HANDLING SYSTEM
LINE OR EQUIPMENT DESIGNATION : T0033
LINE DESCRIPTION : BLOWDOWN TO BRINE TANKS
LINE/EQUIPMENT CONSIDERED : 2"-BR-313-H-K, 1 1/2"-BR-313-H-K, 2-WP-500-E-K, 1 1/2-BR-417-H-K, BEGINS AT 4-BR-416-H-K AND ENDS AT TANK TK-201 AND TK-202.
DRAWING DESIGNATION(S) : 32-03-713-D REV 5 SHEET 4 OF 6 (7/23/91) ; 03-04-015 REV 0 (7/31/91)

ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
** PROCESS PARAMETER : FLOW							
1-1	NO	INADVERTANT VALVE CLOSURE, LINE PLUGGING, CONTROL FAILURE ON FCV-58, INSTRUMENT AIR FAILURE, FAILURE OF P-202A/B PUMPS	BUILDUP OF SOLIDS IN SYSTEM, LOSS OF CONTROL ON QUENCH TANK LEVEL HIGH, SYSTEM SHUTDOWN.	B			INSTALL ALARM ON FI-83A LINK TO DENSITY READING ON AIC-59
1-2	NO	LINE RUPTURE	RELEASE OF HOT LIQUID (190 F) IN WORK AREA AND OUT IN CONTAINMENT AREA.	C		A RUPTURE UPSTREAM OF THE CONTROL VALVE FCV-58 WILL EMPTY THE QUENCH TANK AND CAUSE SYSTEM SHUTDOWN.	REVIEW LACK OF RUPTURE/LEAK INDICATION (FLOW OR PRESSURE INDICATOR) DOWNSTREAM OF FCV-58.
2-1	MORE	FAILURE OF CONTROL ON FCV-58	BLOWDOWN OF DILUTE BRINE TO BRINE HOLDING TANKS AFFECTING STORAGE CAPACITY.	A		PROBLEMS IN BRINE DISPOSAL LOGISTICS.	
3-1	LESS	PUMP WEAR ON P-202A/B, INADVERTANT VALVE POSITIONING, LOSS OF CONTROL ON CV-58, LINE PLUGGING	LESS BRINE FLOW TO BRINE TANKS, REFER TO CONCENTRATION DEVIATION FOR LINE T0032	A			

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4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	LOSS OF PUMPS P-202A/B WHILE SCRUBBER PUMPS CONTINUE TO RUN AND LINE 2"-BR-313A-H-K IS OPEN BRINGING SCRUBBER BLOWDOWN TO TK-101, TK-102	FLOW BACKUP, POSSIBLE OVERFLOW OF QUENCH SYSTEM	A		NO CHECK VALVE TO PREVENT BACKFLOW.	PIPING DRAWINGS SHOW CH VALVES IN LINES SHOW CHECK VALVES IN L P&ID.
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SEE NO FLOW					
8-1	MORE	NOT APPLICABLE					
9-1	LESS	SEE LESS FLOW					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	REFER TO SAFETY CONSIDERATIONS ON HOT LINES (T0032,T0031,T0018)					
11-1	LESS	NO CONSEQUENCE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	SEE MORE FLOW					

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN						(1)RECOMMEND INSTALLATION OF MIN FLOW LIMIT SWITCH INTERLOCKED WITH WASTE FEED BLOCK VALVE.(2) RECOMMEND FLUSHING OF QUENCH TANK RECYCLE ON SHUTDOWN.
16-2	OTHER THAN	VALVE FCV-58 FAILS OPEN UPON SHUTDOWN	QUENCH TANK EMPTIES	C			REPLACE FAIL OPEN VALVE FCV-58 WITH FAIL CLOSED VALVE.
** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN	SEE STARTUP/SHUTDOWN 16-2					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN						LINE DESIGNATIONS ON P&ID ARE INCORRECT AND SHOULD BE REVISED TO SHOW/NOT SHOW HEAT TRACING.

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
		HAZOP STUDY IDENTIFIER : QUENCH RECYCLE SYSTEM					
		LINE OR EQUIPMENT DESIGNATION : T0034					
		LINE DESCRIPTION : pH LOOP IN QUENCH RECYCLE					
		LINE/EQUIPMENT CONSIDERED : 2-BR-416-H-K, 1-BR-416-H-K, 1-BR-416A-H-K, 1-BR-416B-H-K, BEGINS AT 4-BR-416-H-K, ENDS AT S-201 QUENCH SEPARATOR					
		DRAWING DESIGNATION(S) : 32-03-713-D REV 5, SHEET 4 OF 6, 7/23/91					
** PROCESS PARAMETER : FLOW							
1-1	NO	INADVERTANT VALVE CLOSURE, LOSS OF PUMPS P-202A/B, LINE PLUGGAGE	LOSS OF pH CONTROL IN QUENCH TANK, INCREASED USE OF CAUSTIC IN SCRUBBER LOOP, POSSIBLE HIGH EMISSIONS IN STACK, SYSTEM SHUTDOWN	B			
1-2	NO	LINE RUPTURE	SEE LINE T0032 FOR NO FLOW LINE RUPTURE	C		NO INDICATION OF LINE RUPTURE	RECOMMEND EVALUATION OF SAFE HAZARD FROM RELEASE OF HOT BRINE
2-1	MORE	PLUGGAGE IN LINE T0032 DOWNSTREAM OF INTERSECTION	POTENTIAL pH PROBE DAMAGE	A		FLOW WOULD BE DIVERTED TO LINE T0034 REDUCING QUENCH RECYCLE FLOW TO DOWNCOMER	RECOMMEND EVALUATION OF PROBE DESIGN TO MINIMIZE POSSIBILITY OF DAMAGE DUE TO HIGH FLOW
3-1	LESS	INADVERTANT VALVE POSITIONING, LOSS OF PUMPS(P-202), LINE PLUGGAGE	ERRONEOUS pH READINGS IN QUENCH TANK, INCREASED CAUSTIC USAGE IN SCRUBBER, POSSIBLE HIGH STACK EMISSIONS CAUSING SHUTDOWN	B			

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
4-1	AS WELL AS	INADVERTANT VALVE POSITION WITH DOMESTIC WATER LINE LEFT OPEN	ERRONEOUS pH READINGS FROM DILUTION OF RECYCLE LIQUID WITH DOMESTIC SOFTENED WATER	A			RECOMMEND EVALUATION OF ADDIN TRENDING POINT TO CAUSTIC CONTROL LOOPS - AIC-56 AND AIC-64
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SAME AS NO FLOW					
8-1	MORE	NO CONSEQUENCE					
9-1	LESS	SAME AS LESS FLOW					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NO CONSEQUENCE					
11-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	INCREASED SOLIDS ACCUMULATION IN RECYCLE LINE	GREATER TENDANCY TO COAT pH PROBE - REQUIRING MORE FREQUENT CLEANING AND FLUSHING	A			
13-1	LESS	INADVERTANT VALVE POSITION ON SOFTENED WATER FLUSH LINE	SEE AS WELL AS - FLOW	A			

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN					LINE T0034 SHOULD BE FLUSHED ONCE PUMPS (P-202A/B) HAVE BEEN SHUT DOWN	
** PROCESS PARAMETER : EMGCY SD							
17-1	OTHER THAN	NO SPECIAL CONSIDERATIONS					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT FOLLOWING PROPER PROBE REMOVAL PROCEEDURE FROM LINE	RELEASE OF HOT BRINE INTO WORK AREA	C			(1) RECOMMEND THAT ALL HOT LINES BE IDENTIFIED.(2) RECOMMEND SPLASH SHIELDS O GUARDS INCLUDED AT PROBES
18-2	OTHER THAN	INFREQUENT FLUSHING OF pH PROBES	ERRONEOUS pH READINGS CAUSED BY BUILDUP OF SCALE ON PROBE	A		FREQUENCY OF FLUSHING TO BE ESTABLISHED BASED ON OPERATING EXPERIENCE, HOWEVER INITIAL FREQUENCY MAY CONSERVATIVE.	RECOMMEND EVALUATION OF TRENDING OF pH CONTROLLER AIC-64

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	HAZOP STUDY IDENTIFIER :	SCRUBBER/VENTURI RECYCLE SYSTEM					
	LINE OR EQUIPMENT DESIGNATION :	T0035					
	LINE DESCRIPTION :	VENTURI RECYCLE					
	LINE/EQUIPMENT CONSIDERED :	4-BR-505-H-K,3-BR-413-H-K,3-BR-505-H-K,2-BR-505-H-K,2-BR-411-H-K, BEGINS AT 6-BR-501-H-K AND TERMINATES AT VENTURI					
	DRAWING DESIGNATION(S) :	32-03-713-D SHEETS 4 & 5 OF 6 - REV 5 (7/23/91)					
** PROCESS PARAMETER : FLOW							
1-1	NO	INADVERTANT VALVE CLOSURE, LINE PLUGGING, LOSS OF INSTRUMENT AIR, LOSS OF CONTROL OF FCV-60, LOSS OF PUMPS P-203A/B, LOSS OF CONTROL OF FCV-62 AND FCV-65	LOW VENTURE PRESSURE DROP, DECREASED PARTICULATE REMOVAL, DECREASED PRESSURE IN INCINERATOR, SYSTEM SHUTDOWN	B			RECOMMEND ADDITION OF FSLL-60 WASTE FEED INTERLOCK TO INTERLOCK MATRIX
1-2	NO	LINE RUPTURE	RELEASE OF HOT BRINE INTO WORK AREA, ALSO SEE 1-1	C		NO INDICATION OF SPILL IF LOCATION IS DOWNSTREAM OF FE-60	RECOMMEND EVALUATION OF HAZARD BY SAFETY COMMITTEE
2-1	MORE	NOT APPLICABLE					
3-1	LESS	SEE NO FLOW					
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SAME AS NO FLOW					
8-1	MORE	NOT APPLICABLE					
9-1	LESS	SAME AS LESS FLOW					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN						RECOMMEND CONSIDERATION OF WHETHER STARTUP PERMISSIVE SHOULD INCLUDE FLOW OF WATER TO VENTURI

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** PROCESS PARAMETER : EMGCY SD							
17-1	OTHER THAN						RECOMMEND EVALUATION OF VALV (FCV-60) FAIL POSITION
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN					SEE COMMENTS CONCERNING SAFETY OF HOT LINE T0034	

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		HAZOP STUDY IDENTIFIER : QUENCH RECYCLE SYSTEM					
		LINE OR EQUIPMENT DESIGNATION : T0036					
		LINE DESCRIPTION : QUENCH SEPARATOR					
		LINE/EQUIPMENT CONSIDERED : S-201 QUENCH SEPARATOR - INCLUDES INTERCONNECTING DUCTS, EXPANSION JOINTS, AND QUENCH TANK					
		DRAWING DESIGNATION(S) : 32-03-713-D SHEET 4 OF 6 REV 5 (7/23/91); 6-02-3851-D REV 1 (3/27/91)					
** PROCESS PARAMETER : FLOW							
1-1	NO	SOLIDS ACCUMULATION AND PLUGGAGE OF LOWER EQUALIZATION DUCTS	IMPROPER QUENCH OPERATION, LOSS OF BRINE IN QUENCH TANK, AND SYSTEM SHUTDOWN	C		SOLIDS CONTROL IS A CRITICAL ISSUE FOR THIS DEVIATION	
2-1	MORE	NOT APPLICABLE					
3-1	LESS	NOT APPLICABLE					
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	NOT APPLICABLE					
8-1	MORE	NOT APPLICABLE					

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9-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	LOSS OF BRINE IN QUENCH TANK AND BYPASS OF HOT GAS INTO VESSEL	DAMAGE TO VESSEL LINING	A		REDUNDANT TEMPERATURE SWITCHES LOCATED IN CROSSOVER DUCT BETWEEN SEPARATOR AND VENTURI	
11-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE	SEE NO FLOW				
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN					TANK LEVEL IS A PERMISSIVE FOR STARTUP	
** PROCESS PARAMETER : EMGCY SD							
17-1	OTHER THAN	SEE MORE TEMPERATURE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	IMPROPER MAINTENANCE , WELDING ON VESSEL	DAMAGE TO LINING	C		(1) THIS IS A LINED VESSEL - NO WELDING SHOULD BE ALLOWED	(2) RECOMMEND THIS VESSEL BE INSPECTED ON A ROUTINE BASIS

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							FOR LINING INTEGRETY AND SOLIDS BUILDUP
** PROCESS PARAMETER : LEVEL							
19-1	NO	RUPTURE OF INTERCONNECTING DUCTS OR RECIRCULATION PIPING OR VESSEL WALL. GASKET FAILURE. FAILURE OF EXPANSION JOINTS. LOSS OF LEVEL CONTROL.	SYSTEM SHUTDOWN. RELEASE OF 190F BRINE INTO WORK AREA. RELEASE OF HOT GASES INTO WORK AREA.	C		LEVEL ALARMS FOR DETECTION.	SEE MAINTENANCE
20-1	MORE	LOSS OF LEVEL CONTROL. PLUGGAGE OF LOWER RETURN DUCTS.	IMPROPER QUENCH OPERATION, VIBRATION OF VESSEL, LOSS OF EXPANSION JOINTS. SYSTEM SHUTDOWN. POSSIBLE RELEASE OF 190F BRINE AND GASES INTO WORK AREA.	C		SEE NO FLOW	
21-1	LESS	SEE NO LEVEL					

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	HAZOP STUDY IDENTIFIER : FLUE GAS SYSTEM						
	LINE OR EQUIPMENT DESIGNATION : T0037						
	LINE DESCRIPTION : VENTURI						
	LINE/EQUIPMENT CONSIDERED : VENTURI						
	DRAWING DESIGNATION(S) : 32-03-713-D SHEET 4 OF 6 REV 5 (7/23/91); 6-05-129-D REV 2						
** PROCESS PARAMETER : FLOW							
1-1	NO	NOT POSSIBLE					
2-1	MORE	LOSS OF CONTROL OF VENTURI	INEFFICIENT PARTICULATE REMOVAL AND WASTE SHUTDOWN	B			RECOMMEND ADDING CLOSURE OF VALVE XV-25 TO INTERLOCK POSLL-53
3-1	LESS	SAME AS MORE FLOW	SYSTEM SHUTDOWN	B			
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	NOT APPLICABLE					
8-1	MORE	LOSS OF CONTROL, HIGH COMBUSTION GAS FLOW RATE FROM INCINERATOR, MECHANICAL FAILURE OF DAMPERS	IMPROPER COMBUSTION AND QUENCHING. SYSTEM SHUTDOWN	B			

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
9-1	LESS	SAME AS LESS FLOW					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NO CONSEQUENCES					
11-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE'					
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	*OTHER THAN*	*NOT APPLICABLE*					
** PROCESS PARAMETER : EMGCY SD							
17-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					

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	HAZOP STUDY IDENTIFIER : FLUE GAS SYSTEM						
	LINE OR EQUIPMENT DESIGNATION : T0038						
	LINE DESCRIPTION : INTERCONNECTING DUCT FROM QUENCH SEPARATOR S-201 TO VENTURI						
	LINE/EQUIPMENT CONSIDERED : CROSSOVER DUCT - QUENCH SEPARATOR TO VENTURI						
	DRAWING DESIGNATION(S) : 6-07-209-B REV 1 (12/28/90); 32-03-713-D REV 5 SHEET 4 OF 6 (7/23/91)						
** PROCESS PARAMETER : FLOW							
1-1	NO	RUPTURE	RELEASE OF HOT GASES INTO WORK AREA WASTE FEED SHUTDOWN	C		NO DIRECT INDICATION AVAILABLE, HOWEVER SEVERAL INDIRECT MONITORS WILL DETECT	(1) RECOMMEND SAFETY ASPECTS OF THIS DEVIATION BE EVALUATED.(2) RECOMMEND THE ADDITION OF BURNER SHUTDOWN PDSLL-53 INTERLOCK.
2-1	MORE	NOT APPLICABLE					
3-1	LESS	SAME AS NO, PLUS LEAKAGE.	RELEASE OF HOT GAS WITHIN WORK AREA.	C		NO INDICATION AVAILABLE	RECOMMEND REVIEW OF CONSEQUENCES OF NO DETECTION
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	NOT APPLICABLE					

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8-1	MORE	NOT APPLICABLE					
9-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	LOSS OF WATER IN QUENCH TANK.	DAMAGE TO DUCT. POSSIBLE FIRE HAZARD.	C		DESIGN INCLUDES USE OF FIRE RESISTANT FRP.	
11-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : EMGCY SD							
17-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					

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	HAZOP STUDY IDENTIFIER : FLUE GAS SYSTEM						
	LINE OR EQUIPMENT DESIGNATION : T0039						
	LINE DESCRIPTION : VENTURI SUMP						
	LINE/EQUIPMENT CONSIDERED : VENTURI SUMP						
	DRAWING DESIGNATION(S) : 32-03-713-D SHEET 4 OF 6 REV 5 (7/31/91); 6-05-125-D REV 3 (8/19/91)						
** PROCESS PARAMETER : FLOW							
1-1	NO	LINE OR VESSEL RUPTURE	RELEASE OF FLUE GAS OR HOT (190F) BRINE INTO WORK AREA.	C			(1)RECOMMEND EVALUATION OF SAFETY CONCERNS FOR RUPTURED VESSEL.(2) VESSEL IS 13 FEET ABOVE WORKING FLOOR.
2-1	MORE	NOT APPLICABLE					
3-1	LESS	NOT APPLICABLE					
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	NOT APPLICABLE					
8-1	MORE	NOT APPLICABLE					

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9-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	SEE LINE T0038					
11-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN					LEVEL LIT-62 IS PERMISSIVE FOR STARTUP	
** PROCESS PARAMETER : EMGCY SD							
17-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					

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** PROCESS PARAMETER : LEVEL							
19-1	NO	SAME AS NO FLOW					
19-2	NO	LOSS OF LEVEL CONTROL IN T-201. LOSS OF CONTROL OF FCV-62.	LOSS OF RECYCLE TO SCRUBBER. INCREASED STACK EMISSIONS. SYSTEM SHUTDOWN.	B			
20-1	MORE	LOSS OF LEVEL CONTROL (FCV-62). LOSS OF PUMPS P-203A/B.	REDUCED FLUE GAS FLOW AND SYSTEM SHUTDOWN.	B			
21-1	LESS	SAME AS NO LEVEL	CAVITATION OF PUMP P-203A/B. LOSS OF SCRUBBER EFFICIENCY. INCREASED EMISSIONS. POSSIBLE SYSTEM SHUTDOWN.	B		THIS VESSEL (S-202 - VENTURI SUMP) AND T-201 (SCRUBBER) ARE DIRECTLY CONNECTED AND ACT IN CONSERT.	

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		HAZOP STUDY IDENTIFIER : SCRUBBER/VENTURI RECYCLE SYSTEM					
		LINE OR EQUIPMENT DESIGNATION : T0040					
		LINE DESCRIPTION : SCRUBBER RECYCLE PUMP SUCTION					
		LINE/EQUIPMENT CONSIDERED : 8-BR-501-H-K, 8-BR-501A-H-K, 8-BR-501B-H-K, BEGINS AT T-201 SCRUBBER, ENDS AT P-203A/B RECYCLE PUMPS					
		DRAWING DESIGNATION(S) : 32-03-713-D REV 5 SHEET 5 OF 6 (7/23/91)					
** PROCESS PARAMETER : FLOW							
1-1	NO	INADVERTANT VALVE CLOSURE, LINE PLUGGING	CAVITATION OF PUMP P-203A/B, LOSS OF FLOW TO SCRUBBER AND VENTURI, SHUTDOWN OF WASTE	B			
1-2	NO	LINE RUPTURE	RELEASE OF HOT (190F) BRINE INTO WORK AREA, LOSS OF RECYCLE TO VENTURI AND SCRUBBER, LOW LEVELS IN S-202 SUMP AND T-201 (SCRUBBER)	C			RECOMMEND SAFETY EVALUATION RELEASE OF HOT BRINE
2-1	MORE	NOT APPLICABLE					
3-1	LESS	SEE NO FLOW					
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					

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** PROCESS PARAMETER : PRESSURE							
7-1	NO	NOT APPLICABLE					
8-1	MORE	NOT APPLICABLE					
9-1	LESS	SAME AS LESS FLOW					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					RECOMMEND SAFETY REVIEW OF HOT LINE
11-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	BUILDUP OF SOLIDS	CAVITATION OF PUMPS, LOSS OF FLOW TO VENTURI AND SCRUBBER, HIGH STACK EMISSIONS, SYSTEN SHUTDOWN	B		SOLUBILITY OF SOLIDS WILL BE DEPENDENT ON pH. IF pH CONTROL IS LOST, THE pHCONTROL WILL BE LOST AND WILL RISES ABOVE 10.0 CAUSING PRECIPITATION.	
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	NOT APPLICABLE					

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** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : EMGCY SD							
17-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					

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	HAZOP STUDY IDENTIFIER :	SCRUBBER/VENTURI RECYCLE SYSTEM					
	LINE OR EQUIPMENT DESIGNATION :	T0041					
	LINE DESCRIPTION :	SCRUBBER RECYCLE PRESSURE SIDE					
	LINE/EQUIPMENT CONSIDERED :	6-BR-501A-H-K, 6-BR-501B-H-K, 6-BR-501-H-K, 4-BR-503-H-K, 3-WP-503-L-XXXX, 3-BR-504-H-K, P-203A/B, ENDS AT T-201 SCRUBBER					
	DRAWING DESIGNATION(S) :	32-03-713-D REV 5, SHEET 5 OF 6 (7/23/91)					
** PROCESS PARAMETER : FLOW							
1-1	NO	LOSS OF PUMPS P203A/B, LINE PLUGGING, INADVERTANT VALVE CLOSURE, LOSS OF INSTRUMENT AIR, LOSS OF CONTROL OF FCV-65, PLUGGING OF SCRUBBER SPARGER NOZZLE	INSUFFICIENT SCRUBBING IN T-201, HIGH STACK EMISSIONS, SYSTEM SHUTDOWN	B			RECOMMEND INVESTIGATION OF EMERGENCY FAIL POSITION OF VALVE FCV-65.
1-2	NO	LINE RUPTURE	RELEASE OF HOT BRINE (190 F) INTO WORK AREA, LOSS OF SCRUBBING, HIGH STACK EMISSIONS, SYSTEM SHUTDOWN	C			INVESTIGATE SAFETY ASPECTS OF LACK OF RUPTURE DETECTION. NO INDICATION OF RUPTURE DOWNSTREAM OF FE-65
2-1	MORE	NOT APPLICABLE					
3-1	LESS	LOSS OF PUMPS 203A/B, PARTIAL LINE PLUGGING, INADVERTANT VALVE POSITIONING, LOSS OF CONTROL OF FCV-65, LOSS OF CONTROL OF FCV-62 AND/OR FCV-60	SAME AS NO FLOW.	B		TRENDING OF FIC-65 WOULD INDICATE NOZZLE PLUGGING OR NOZZLE FAILURE.	

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3-2	LESS	LINE LEAK	SEE LINE RUPTURE	C		TRENDING FIC-65 WOULD INDICATE PLUGGING OF NOZZLE OR NOZZLE FAILURE.	
4-1	AS WELL AS	CAUSTIC FLOW INTO LINE WHEN NOT INTENDED	HIGH pH IN SCRUBBER, POSSIBLE HAZARD DURING MAINTENANCE BECAUSE CAUSTIC IS STILL FLOWING UNEXPECTEDLY.	C		LOW FLOW IS INDICATED ON FSLL-65.	INSTALL INTERLOCK TO FCV- SHUT CAUSTIC FLOW IN THE OF INSUFFICIENT FLOW AT F
5-1	REVERSE	LOSS OF PUMPS P-203A/B	CAUSTIC MAY BE INTRODUCED IN REVERSE FLOW ON 4"-BR-503-H-K TO 6"-BR-501-H-K, CAUSTIC IN LINE WHERE NOT EXPECTED.	C			INVESTIGATE ADDITION OF C VALVE AT INTERSECTION OF CAUSTIC LINE WITH 4"-BR-503-H-K, SEE RECOMMENDATION FOR INTERL UNDER AS WELL AS FLOW.
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SEE NO FLOW					
8-1	MORE	NOT APPLICABLE					
9-1	LESS	SEE LESS FLOW, NOZZLE FAILURE					INCLUDE INSPECTION OF NOZ ON A REGULAR BASIS.
9A-1	AS WELL AS	SEE AS WELL AS FLOW					

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** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	SEE SAFETY CONSIDERATIONS RECOMMENDED UNDER ALL HOT LINES.					
11-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	UNCONTROLLED ADDITION OF CAUSTIC	HIGH pH IN SCRUBBER, PRECIPITATION OF METAL HYDROXIDES	A			
13-1	LESS	ADDITION OF LESS CAUSTIC THAN INTENDED	LOW pH IN SCRUBBER, INEFFICIENT SCRUBBER OPERATION, HIGH EMISSIONS, SYSTEM SHUTDOWN.	B			
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	HIGH CAUSTIC IN SCRUBBER PIPELINES	POSSIBLE PLUGGED LINES, PLUGGED NOZZLE AND PACKING, SAFETY CONSIDERATION DURING MAINTENANCE	C		ADD ITEM 16-2 - IMPROPER SEQUENCING OF PUMPS P-203A/B WITH VALVES XV-79A/B, CONSEQUENCE: SEE NO FLOW.	(1) RECOMMEND SHUTDOWN OF CAUSTIC PUMPS PRIOR TO SHUTDOWN OF RECIRCULATION I SHUTDOWN SEQUENCE,(2) RECOMMEND FSLL-65 BE INCLUI AS BURNER STARTUP PERMISSI\

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** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	PUMP WEAR AND/OR CORROSION	INEFFICIENT OPERATION OF PUMP				RECOMMEND ALTERNATING US[redacted] SPARE PUMP FOR ALL LINES

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		HAZOP STUDY IDENTIFIER : SCRUBBER/VENTURI RECYCLE SYSTEM					
		LINE OR EQUIPMENT DESIGNATION : T0042					
		LINE DESCRIPTION : pH CONTROL LOOP FOR SCRUBBER RECYCLE					
		LINE/EQUIPMENT CONSIDERED : 2-BR-501-H-K, 1-BR-501-H-K BEGINS AT 6-BR-501-H-K AND TERMINATES AT 1-201 (SCRUBBER)					
		DRAWING DESIGNATION(S) : 32-03-713-D SHEET 5 OF 6 REV 5 (7/23/91)					
** PROCESS PARAMETER : FLOW							
1-1	NO	INADVERTANT VALVE CLOSURE, LINE PLUGGING, LOSS OF PUMP P-203A/B	LOSS OF CAUSTIC FEED TO SCRUBBER, INCREASED EMISSIONS TO STACK, SYSTEM SHUTDOWN.	B			
1-2	NO	LINE RUPTURE	SEE LINE T0041	C			
2-1	MORE	NO CONSEQUENCES					
3-1	LESS	INADVERTANT VALVE POSITIONING, PARTIAL LINE PLUGGING, DEGRADATION OF PUMPS	ERRONEOUS pH INDICATION, POSSIBLE INCREASED EMISSIONS TO STACK, POSSIBLE SHUTDOWN	B			
3-2	LESS	LINE LEAKS	RELEASE OF HOT BRINE, POSSIBLE HIGH EMISSIONS, POSSIBLE SHUTDOWN	C		INABILITY TO DETECT LINE LEAKS.	
4-1	AS WELL AS	INADVERTANT VALVE OPEN ON DOMESTIC SOFTENED WATER SUPPLY.	INTRODUCTION OF SOFTENED WATER IN LINE, ERRONEOUS pH READING, POSSIBLE HIGHER EMISSIONS, POSSIBLE SYSTEM SHUTDOWN.	B			

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5-1	REVERSE	NOT APPLICABLE					

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HAZOP STUDY IDENTIFIER :
LINE OR EQUIPMENT DESIGNATION : T0042
LINE DESCRIPTION :
LINE/EQUIPMENT CONSIDERED :
DRAWING DESIGNATION(S) :

** PROCESS PARAMETER : FLOW

6-1	OTHER THAN	VALVE MISALIGNMENT	FLOW OF DOMESTIC WATER INSTEAD OF RECYCLE, HIGH EMISSIONS, POSSIBLE SYSTEM SHUTDOWN.	B			

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		HAZOP STUDY IDENTIFIER : SCRUBBER/VENTURI RECYCLE SYSTEM					
		LINE OR EQUIPMENT DESIGNATION : T0042					
		LINE DESCRIPTION : pH CONTROL LOOP FOR SCRUBBER RECYCLE					
		LINE/EQUIPMENT CONSIDERED : 2-BR-501-H-K, 1-BR-501-H-K BEGINS AT 6-BR-501-H-K AND TERMINATES AT T-201 (SCRUBBER)					
		DRAWING DESIGNATION(S) : 32-03-713-D SHEET 5 OF 6 REV 5 (7/23/91)					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	NOT APPLICABLE					
8-1	MORE	NOT APPLICABLE					
9-1	LESS	SEE LESS FLOW					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE					SEE COMMENTS/ACTION ITEMS UNDER ALL HOT LINES.	
11-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	LOSS OF CONTROL ON FCV-56	HIGH pH IN LOOP CAUSING PRECIPITATION OF METAL HYDROXIDES AND FOULING OF pH PROBES AND POSSIBLE PLUGGING OF LINES.	A			
13-1	LESS	SEE AS WELL AS FLOW.					

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14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	CAUSTIC REMAINS IN LINE AFTER SHUTDOWN	POSSIBLE BUILDUP OF CAUSTIC/SOLID DEPOSITION	A			RECOMMEND FLUSHING OF LINES AFTER SHUTDOWN OF P-203A/B.
** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	SOLIDS BUILDUP ON pH PROBES	ERRONEOUS pH READINGS	A		(1) FREQUENCY OF FLUSHING TO BE DETERMINED UPON OPERATING EXPERIENCE.(2) FREQUENCY WILL BE CONSERVATIVE ON STARTUP.	(3)RECOMMEND TRE[illegible]NG OF CAUSTIC CONTROL VALVE FCV-56
18-2	OTHER THAN	IMPROPER MAINTENANCE PROCEDURE ON REMOVING pH PROBE.	LEAK OF CAUSTIC INTO WORKPLACE	C			RECOMMEND INSTALLATION OF SPLASH SHIELDS OR GUARDS ON PROBES.

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		HAZOP STUDY IDENTIFIER : SCRUBBER/VENTURI RECYCLE SYSTEM					
		LINE OR EQUIPMENT DESIGNATION : T0043					
		LINE DESCRIPTION : ALTERNATE BLOWDOWN TO BRINE TANK FROM SCRUBBER					
		LINE/EQUIPMENT CONSIDERED : 2"-BR-313A-H-K, 2"-BR-313B-H-K, BEGINS AT 3"-BR-501-H-K, ENDS AT 2"-WP-500-B-K AND 2"-BR-313-H-K					
		DRAWING DESIGNATION(S) : 32-03-713D SHEET 5 OF 6, REV 5, 7/23/91; 03-04-015 REV 0, 7/31/91					
** PROCESS PARAMETER : FLOW							
1-1	NO	INADVERTANT VALVE CLOSURE, LINE PLUGGING, LOSS OF INSTRUMENT AIR, LOSS OF PUMPS P-203A/B, LOSS OF CONTROL ON FCV-62	INABILITY TO REMOVE EXCESS BRINE FROM SCRUBBER RECYCLE SYSTEM	A		THIS LINE IS NORMALLY NOT IN USE- IS AN ALTERNATIVE TO NORMAL OPERATION AND IS ACTIVATED MANUALLY BY OPERATOR.	
1-2	NO	LINE RUPTURE	RELEASE OF HOT BRINE TO WORK AREA, UNABLE TO TRANSFER BRINE TO TANKS	C		NO INDICATION OF LINE RUPTURE	CONSIDER SAFETY RAMIFICATIO OF LACK OF LINE RUPTURE INDICATION.
2-1	MORE	INADVERTANT VALVE POSITIONING	LOSS OF STORAGE CAPACITY, BRINE DISPOSAL PROBLEMS, INCREASED MAKEUP WATER FLOW TO QUENCH TANK				
3-1	LESS	LINE PLUGGING, INADVERTANT VALVE POSITIONING, DETERIORATION OF PUMPS P-203A/B	INABILITY TO TRANSFER BRINE AT REQUIRED RATE.	A			
3-2	LESS	SEE LINE RUPTURE					

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4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SEE NO FLOW					
8-1	MORE	NOT APPLICABLE					
9-1	LESS	SEE LESS FLOW					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	FREEZING OF FLUID IN LINE	INABILITY TO OPERATE LINE WHEN NECESSARY	A			INVESTIGATE WHETHER LINE IS PROPERLY SLOPED TO DRAIN WHE NOT IN USE.
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					

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15-1	OTHER THAN	HIGH SOLIDS IN LINE	LINE PLUGGING, SEE NO/LOW FLOW	A			
** PROCESS PARAMETER : STARTUP/SHUTDOWN							
16-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN	LOSS OF LINE (LINE PLUGGING, ETC) WHEN INTENDED FOR USE FOR FLUSH WATER SUBSEQUENT TO EMERGENCY SHUTDOWN	INABILITY TO DISPOSE OF FLUSH WATER INTO BRINE TANKS	A		MAY BE NECESSARY TO EMPTY LINES AND SCRUBBER TO DRAIN.	
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					

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		HAZOP STUDY IDENTIFIER : SCRUBBER/VENTURI SYSTEM					
		LINE OR EQUIPMENT DESIGNATION : T0044					
		LINE DESCRIPTION : SCRUBBER					
		LINE/EQUIPMENT CONSIDERED : SCRUBBER T-201					
		DRAWING DESIGNATION(S) : 32-03-713D SHEET 5 OF 6, REV 5, 7/23/91, 6-05-125D REV 3, 8/19/91					
** PROCESS PARAMETER : FLOW							
1-1	NO	PLUGGED PACKING AND/OR DEMISTER, LOSS OF LEVEL CONTROL	LOSS OF FLOW THROUGH SCRUBBER, SYSTEM SHUTDOWN	B			
1-2	NO	VESSEL RUPTURE	RELEASE OF HOT GASES AND HOT SCRUBBER LIQUID TO WORK AREA	C			
2-1	MORE	NOT APPLICABLE					
3-1	LESS	LEAKING MANWAY	RELEASE OF HOT GASES TO WORK AREA	C			
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	NOT APPLICABLE					

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8-1	MORE	SEE NO FLOW					
9-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	SEE LINE T0038 FOR MORE TEMPERATURE					
11-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	LOSS OF pH CONTROL OR FAILURE OF FCV-56	MORE CAUSTIC - GREATER TENDENCIES TO DEPOSIT SOLIDS ON PACKING CAUSING BLOCKAGE, IMPROPER SCRUBBING DUE TO CHANNELING.	A			
13-1	LESS	LESS CAUSTIC - SEE ITEM 16-1	HIGH EMISSIONS OUT OF STACK, SYSTEM SHUTDOWN	B			
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE					PROVIDE PERMISSIVE FOR STA ON LSLI-62.

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** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	MATERIAL FAILURE	LOSS OF SCRUBBER			NORMAL MAINTENANCE IS VISUAL INSPECTION FOR CRACKS. SCRUBBER IS FRP MATERIAL	INSURE THAT O&M CONTAINS PROPER MAINTENANCE PROCEDUER FOR INSPECTION OF FRP
** PROCESS PARAMETER : LEVEL							
19-1	NO	SCRUBBER RUPTURE	RELEASE OF HOT GASES AND BRINE TO WORK AREA	C			INVESTIGATE CONTAINMENT FOR SPILLAGE CAPACITY
19-2	NO	FAILURE OF LEVEL INDICATOR/CONTROL SYSTEM	CAVITATION OF PUMPS, LOSS OF RECIRCULATION TO SCRUBBER AND VENTURI, HIGH EMISSIONS IN STACK, SYSTEM SHUTDOWN.	B			
20-1	MORE	LOSS OF LEVEL CONTROL, PLUGGING OF PUMP SUCTION	RESTRICTION OF GAS FLOW, IMPROPER SYSTEM OPERATION, POSSIBLE SYSTEM SHUTDOWN	B			
21-1	LOW	LOSS OF LEVEL CONTROL, INADEQUATE SCRUBBER WATER FEED	CAVITATION OF PUMPS P-203A/B, LOSS OF FLOW TO SCRUBBER AND VENTURI, LOSS OF SCRUBBING EFFICIENCY, HIGH EMISSIONS, POSSIBLE SYSTEM SHUTDOWN.	B			
21-2	LOW	VESSEL/MANWAY LEAK	RELEASE OF HOT (190 F) SCRUBBING LIQUID TO WORK AREA, SEE 21-1, 19-1	C			SEE ACTION ITEM UNDER 19-1.

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		HAZOP STUDY IDENTIFIER : FLUE GAS SYSTEM					
		LINE OR EQUIPMENT DESIGNATION : T0045					
		LINE DESCRIPTION : STACK					
		LINE/EQUIPMENT CONSIDERED : DUCT FROM SCRUBBER TO STACK AND STACK					
		DRAWING DESIGNATION(S) : 32-03-713D SHEET 5 OF 6, REV 5, 7/23/91					
** PROCESS PARAMETER : FLOW							
1-1	NO	NO FLOW FROM SCRUBBER	SEE NO FLOW FOR LINE T0044	B			
1-2	NO	RUPTURE	RELEASE OF HOT GASES INSIDE/OUTSIDE BUILDING IN WORK AREA, CEM SYSTEM WILL NOT MONITOR SAMPLE RESULTING IN ERRONEOUS READINGS AND SYSTEM SHUTDOWN.	C		NO INDICATION OF RUPTURE BESIDE HIGH OXYGEN READING.	RECOMMEND EVALUATION OF NEE FOR INDICATOR ON STACK FOR RUPTURE.
2-1	MORE	NOT APPLICABLE					
3-1	LESS	BUILDUP OF CONDENSED WATER IN DUCT AND/OR STACK OR EXCESSIVE CARRYOVER OF WATER FROM SCRUBBER DEMISTER.	IMPROPER SYSTEM OPERATION AND EVENTUAL SHUTDOWN	B		(2) DRAIN IS LOCATED ON STACK, DUCT HAS NO DRAIN, UNKNOWN WHETHER DUCT IS SLOPED OR NOT.	(1) RECOMMEND INVESTIGATIN NECESSITY FOR INSTALLATION BIRD SCREEN
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					

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6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	NOT APPLICABLE					
8-1	MORE	NOT APPLICABLE					
9-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE					

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** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN					(1) NOT ENOUGH INFORMATION EXISTS AT THIS POINT TO FULLY EVALUATE CEM.(2) CEM HAS THE ABILITY TO SHUT THE SYSTEM DOWN ON MALFUNCTION.	(3)RECOMMEND ASSESSMENT OF CEM UPON AVAILABILITY OF COMPLETE INFORMATION.

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HAZOP STUDY IDENTIFIER : SQI, WASTEWATER, BRINE, AND CAUSTIC DRAINS AND SUMPS
LINE OR EQUIPMENT DESIGNATION : T0046
LINE DESCRIPTION : DRAINS AND SUMPS
LINE/EQUIPMENT CONSIDERED : 1"-WD-003A-E-N, 1 1/2"-WD-004A-E-N, 3"-WD-015-E-K, 4"-WD-015-E-K, BEGIN AT SUMP TK-402A, END AT WASTEWATER TANK TK-104. SUMP TK-402A REPRESENTS REPRESENTATIVE SUMP FOR HAZOP
DRAWING DESIGNATION(S) : 03-04-010 REV 0, 7/31/91, 03-04-001 REV 0, 7/31/91

ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
** PROCESS PARAMETER : FLOW							
1-1	NO	PLUGGED INTAKE LINE, INADVERTANT VALVE CLOSURE, FAILURE OF LEVEL CONTROL VALVE, PLUGGED DISCHARGE LINE, PUMP FAILURE	POSSIBLE OVERFLOW OF SUMP, LOSS OF FEED TO WASTEWATER TANK, RELEASE OF HOT BRINE, CAUSTIC, AND/OR BASIN F LIQUID TO WORK AREA.	C		(2)WESTON AND T-THERMAL DRAWINGS HAVE NOT BEEN COORDINATED. UNCERTAIN WHETHER PIPING CONNECTS DRAINS TO SUMPS OR WHERE SUMPS ARE LOCATED. QUESTION DESIGN OF SUMP CAPACITY AND PUMP CAPACITY.	(1)P&IDS SHOULD DESIGNATE FL PATH FROM DRAIN LINES TO SUMPS.(4) RECOMMEND ROUTINE INSPECTION OF SUMPS.(5) *RECOMMEND REVIEW OF SUMP* SIZING AND PUMP CAPACITY.
1-2	NO	LINE RUPTURE	RELEASE OF BRINE, CAUSTIC, AND/OR BASIN F LIQUID	C		SUMP LOCATION/PIPING IS UNCLEAR.	RECOMMEND INVESTIGATION OF NECESSITY OF LINE RUPTURE *INDICATION ON SUMPS.*
2-1	MORE	NOT APPLICABLE					
3-1	LESS	QUANTITY PUMPED FROM SUMP LESS THAN INFLOW.	POSSIBLE SUMP OVERFLOW, SEE NO FLOW, REDUCED WATER TO WASTEWATER TANK.	C		(2)LOCATIONS AND ELEVATION OF SUMPS IS UNCLEAR FROM P&IDS AND SCHEMATIC DRAWINGS.	(1)RECOMMEND ROUTINE FLUSHIN OF SUMP DISCHARGE

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3-2	LESS	SEE NO FLOW					
3-3	LESS	LINE LEAKS	SEE LINE RUPTURE	C			
4-1	AS WELL AS	NO CONSEQUENCE					
5-1	REVERSE	FAILURE OF CHECK VALVE.				ELEVATION OF SUMP IS NOT CLEAR FROM DRAWINGS.	
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SEE NO FLOW					
8-1	MORE	SAME AS NO FLOW					
9-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	FAILURE OF HEAT TRACING	POSSIBLE FREEZING OF LINE	B		SEE COMMENTS/ACTION ITEMS UNDER LOSS OF HEAT TRACING FOR HEAT TRACING LINES.	
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					

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3-1	LESS	NOT APPLICABLE					
4-1	AS WELL AS	NOT APPLICABLE					
5-1	OTHER THAN	NOT APPLICABLE					
* PROCESS PARAMETER : STARTUP/SHUTDWN							
6-1	OTHER THAN	NOT APPLICABLE				INTERMITTENT USE.	
* PROCESS PARAMETER : EMERGENCY SD							
7-1	OTHER THAN	FEED OF FLUID TO SUMP GREATER THAN SUMP CAPACITY	SUMP OVERFLOW	C			RECOMMEND REVIEW OF SUMP SIZING.
* PROCESS PARAMETER : MAINTENANCE							
8-1	OTHER THAN	FAILURE OF LEVEL CONTROLLER	LOSS OF LEVEL CONTROL, OVERFLOW OF SUMP	B			ENSURE LEVEL CONTROLLERS ARE INSPECTED ROUTINELY FOR PROPER OPRATION DUE TO SUMP CAPACITIES.
* PROCESS PARAMETER : LEVEL							
9-1	NO	NOT APPLICABLE					
0-1	MORE	FAILURE OF LEVEL CONTROL, FLOW TO SUMP EXCEEDS SUMP CAPACITY	SEE MORE FLOW	C			SEE MAINTENANCE, ITEM 18-1
1-1	LESS	NOT APPLICABLE					

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		HAZOP STUDY IDENTIFIER : DRAINS AND SUMPS					
		LINE OR EQUIPMENT DESIGNATION : T0047					
		LINE DESCRIPTION : DRAINS FROM TANKS TK-201, 202					
		LINE/EQUIPMENT CONSIDERED : 6" DRAIN LINES FROM TANKS TK-202, TK-201					
		DRAWING DESIGNATION(S) : 03-04-015, REV 0, 7/31/91					
** PROCESS PARAMETER : FLOW							
1-1	NO	LINE/DRAIN PLUGGING	NO FLOW TO SUMP, POSSIBLE RELEASE OF FLUID TO WORK AREA	C			(1)INVESTIGATE POSSIBLE DRAI FLOW TO SUMP AND ADEQUACY OF SUMP TO HANDLE FLOW.(2) REEVALUATE BOTTOM DRAIN LINE SIZING TO SUMP.
2-1	MORE	SEE NO FLOW, INADVERTANT VALVE POSITIONING.	POSSIBLE OVERFLOW OF LIQUID IN SUMP	C			SEE ACTION ITEM UNDER NO FLO 1-1.
3-1	LESS	NOT APPLICABLE					
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	NOT APPLICABLE					

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8-1	MORE	NOT APPLICABLE					
9-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : EMGCY SHUTDOWN							
17-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					

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		HAZOP STUDY IDENTIFIER : BRINE DISPOSAL					
		LINE OR EQUIPMENT DESIGNATION : T0048					
		LINE DESCRIPTION : SUCTION SIDE OF BRINE TRANSFER TO TANK CAR					
		LINE/EQUIPMENT CONSIDERED : 6"-BR-503-P-K, 6"-BR-504-P-K, 4"-BR-503A-P-K, 4"-BR-503B-P-K BEGINS AT TK-201/TK-202, TERMINATES AT P-206A/B					
		DRAWING DESIGNATION(S) : 03-04-015 REV 0 7/31/91					
** PROCESS PARAMETER : FLOW							
1-1	NO	INADVERTANT VALVE CLOSURE, SOLIDS ACCUMULATION, PUMP FAILURE P-206A/B	NO BRINE TRANSFER TO TRUCKS, DECREASE PLANT CAPACITY, POSSIBLE EVENTUAL SYSTEM SHUTDOWN	B		ON OPERATOR DEMAND.	
1-2	NO	LINE RUPTURE	BRINE SPILLAGE TO GROUND, BRINE STORAGE TANK EMPTIES, DRAINS TO SUMPS.	C			SEE RECOMMENDATION UNDER SU FOR SUMP SIZING CONCERNS.
2-1	MORE	INADVERTANT VALVE POSITIONING, OPEN WHEN NOT INTENDED	FLOW WHEN TANK CAR NOT IN POSITION	C		HAZOP TEAM DOES NOT HAVE ADEQUATE LOADING PROCEDURES TO EVALUATE WHETHER MORE FLOW DEVIATION CAN OCCUR.	
3-1	LESS	LINE LEAK	LEAKING OF BRINE INTO SUMP. SEE NO FLOW	C			
3-2	LESS	INADVERTANT VALVE POSITIONING	INEFFICIENT LOADING OPERATION	A			
4-1	AS WELL AS	NOT APPLICABLE					

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5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SEE NO FLOW					
8-1	MORE	NOT APPLICBLE					
9-1	LESS	SEE LESS FLOW					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE					SEE ACTION AND COMMENTS FOR ALL HOT LINES	
11-1	LESS	FREEZING IN LINE	NO FLOW IN LINE	B		UNLIKELY TO OCCUR AS FLOW RECIRCULATES, BRINE IS EXPECTED TO BE WARM/HOT HOWEVER, THERE IS NO HEAT TRACING ON THE LINE.	
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	FAILURE OF TANK TK-201/202 MIXER RESULTING IN BUILDUP OF SOLIDS ON BOTTOM OF TANK.	EXCESSIVE SOLIDS IN TANK, INEFFICIENT BRINE REMOVAL, POSSIBLE LINE BLOCKAGE, EXCESSIVE PUMP WEAR			(1)HOW DOES OPERATOR DETECT MIXER OPERATION?(2) DETECTION OF MORE SOLIDS IN LINE IS UNCLEAR.	

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13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE				LOADING/UNLOADING PROCEDURES ARE UNAVAILABLE TO EVALUATE - UNABLE TO DETERMINE DEVIATIONS IN OPERATING PROCEDURES	
** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					

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		HAZOP STUDY IDENTIFIER : BRINE DISPOSAL					
		LINE OR EQUIPMENT DESIGNATION : T0049					
		LINE DESCRIPTION : DISCHARGE OF PUMPS P-206A/B TO LOADING OF TRUCK/TANK CARS					
		LINE/EQUIPMENT CONSIDERED : P-206A/B PUMPS, 3"-BR-503A/B-P-K, 4"-BR-503A/B-P-K, 4"-BR-503A/B-P-H, 4"-BR-401-P-H, 4"-BR-401A-P-H, 6"-BR-401-E-K, 6"-BR-401A-E-K, TANK CAR LOADING ARMS A AND B, BEGINS AT PUMP P-206A/B, ENDS AT TANK CAR LOADING ARMS OR TK-201/202					
		DRAWING DESIGNATION(S) : 03-04-015 REV 0, 7/31/91					
** PROCESS PARAMETER : FLOW							
1-1	NO	PUMP FAILURE, LINE BLOCKAGE, INADVERTANT VALVE CLOSURE, LOSS OF INSTRUMENT AIR	NO LOADING OF TANK CARS/TRUCKS WHEN DESIRED	B		SEE COMMENT FOR LINE T0048(FLOW-MORE) ON STANDARD LOADING/UNLOADING PROCEDURES.	
1-2	NO	LINE RUPTURE	RELEASE OF BRINE TO GROUND/FLOOR. SEE NO FLOW ON LINE T0048	C		(Q)WHAT IS POSITION OF VALVES ON FAILURE?	
2-1	MORE	SEE MORE FLOW FOR LINE T0048					
3-1	LESS	INADVERTANT VALVE POSITIONING, PUMP WEAR	INEFFICIENT TANK CAR/TRUCK LOADING	A		SYSTEM IS PARALLEL WITH EITHER PUMP ABLE TO SERVICE EITHER TANK AND TANK CAR.	
3-2	LESS	LINE LEAKS	SEE NO FLOW	C			
4-1	AS WELL AS	UTILITY WATER VALVE INADVERTANTLY OPEN	INEFFICIENT BRINE HANDLING AND DISPOSAL, DESIGNED BRINE STORAGE CAPACITY MAY BE EXCEEDED DUE TO	B			

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			INTRODUCTION INTO TANK OR REPLACEMENT OF BRINE IN TANK CAR/TRUCK				
5-1	REVERSE	NOT APPLICABLE					

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HAZOP STUDY IDENTIFIER :
LINE OR EQUIPMENT DESIGNATION : T0049
LINE DESCRIPTION :
LINE/EQUIPMENT CONSIDERED :
DRAWING DESIGNATION(S) :

** PROCESS PARAMETER : FLOW

6-1	OTHER THAN	NOT APPLICABLE					

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HAZOP STUDY IDENTIFIER : BRINE DISPOSAL
LINE OR EQUIPMENT DESIGNATION : T0049
LINE DESCRIPTION : DISCHARGE OF PUMPS P-206A/B TO LOADING OF TRUCK/TANK CARS
LINE/EQUIPMENT CONSIDERED : P-206A/B PUMPS, 3"-BR-503A/B-P-K, 4"-BR-503A/B-P-K, 4"-BR-503A/B-P-H, 4"-BR-401-P-H, 4"-BR-401A-P-H, 6"-BR-401-E-K, 6"-BR-401A-E-K, TANK CAR LOADING ARMS A AND B, BEGINS AT PUMP P-206A/B, ENDS AT TANK CAR LOADING ARMS OR TK-201/202
DRAWING DESIGNATION(S) : 03-04-015 REV 0, 7/31/91

** PROCESS PARAMETER : PRESSURE

7-1	NO	SEE NO FLOW					
8-1	MORE	NOT APPLICABLE					
9-1	LESS	SEE LESS FLOW					

** PROCESS PARAMETER : TEMPERATURE

10-1	MORE	SEE LINE T0048					
11-1	LESS	SEE LINE T0048					

** PROCESS PARAMETER : COMPOSITION

12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED

HAZOP STUDY IDENTIFIER :
LINE OR EQUIPMENT DESIGNATION : T0049
LINE DESCRIPTION :
LINE/EQUIPMENT CONSIDERED :
DRAWING DESIGNATION(S) :

** PROCESS PARAMETER : COMPOSITION

15-1	OTHER THAN	SEE LINE T0048					

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HAZOP STUDY IDENTIFIER : BRINE DISPOSAL
LINE OR EQUIPMENT DESIGNATION : T0049
LINE DESCRIPTION : DISCHARGE OF PUMPS P-206A/B TO LOADING OF TRUCK/TANK CARS
LINE/EQUIPMENT CONSIDERED : P-206A/B PUMPS, 3"-BR-503A/B-P-K, 4"-BR-503A/B-P-K, 4"-BR-503A/B-P-H, 4"-BR-401-P-H, 4"-BR-401A-P-H, 6"-BR-401-E-K, 6"-BR-401A-E-K, TANK CAR LOADING ARMS A AND B, BEGINS AT PUMP P-206A/B, ENDS AT TANK CAR LOADING ARMS OR TK-201/202
DRAWING DESIGNATION(S) : 03-04-015 REV 0, 7/31/91

** PROCESS PARAMETER : STARTUP/SHUTDWN

16-1	OTHER THAN	NOT APPLICABLE					

** PROCESS PARAMETER : EMERGENCY SD

17-1	OTHER THAN	NOT APPLICABLE					

** PROCESS PARAMETER : MAINTENANCE

18-1	OTHER THAN	NOT APPLICABLE					

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	HAZOP STUDY IDENTIFIER : BRINE HANDLING						
	LINE OR EQUIPMENT DESIGNATION : W0050						
	LINE DESCRIPTION : BRINE STORAGE TANKS						
	LINE/EQUIPMENT CONSIDERED : TK-201/TK-202						
	DRAWING DESIGNATION(S) : 03-04-015 REV 0, 7/31/91						
** PROCESS PARAMETER : FLOW							
1-1	NO	SEE LINE W0033 AND W0043.					
2-1	MORE	TANK RUPTURE	RELEASE OF HOT BRINE (190 F) TO WORK AREA, LOSS OF STORAGE CAPACITY, SYSTEM SHUTDOWN.	C			
3-1	LESS	SEE LINE W0048.					
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	PUMPOUT WITHOUT VENT	POSSIBLE TANK COLLAPSE, RELEASE OF HOT BRINE TO WORK AREA	C			EVALUATE TANK SAFETY AND REVISE P&ID WHERE APPROPRIAT NO VENTS SHOWN ON P&IDs

[redacted] No. [redacted]

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8-1	MORE	FAILURE OF HIGH LEVEL ALARM(LAH 84A/B) WITH CONTINUED PUMPING OF FLUID	POSSIBLE OVERPRESSURE OF TANK, POSSIBLE TANK RUPTURE	C		NO INTERLOCKS SHOWN ON DRAWING, NO VENT ON TANK, NO TANK OVERFLOW, NO TANK SAFETY FEATURES SHOWN ON P&ID.	EVALUATE TANK SAFETY AND REVISE P&ID WHERE APPROPRIAT
9-1	LESS	PUMPOUT WITHOUT TANK VENT	POSSIBLE TANK COLLAPSE, RELEASE OF HOT BRINE TO WORK AREA	C		(1)LOADING PROCEDURES ARE UNCLEAR.(2) UNCLEAR WHETHER LEVEL IS INDICATED LOCALLY AS WELL AS REMOTELY.	
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS					IN THE EVENT THAT BRINE MUST BE STORED FOR A PERIOD OF TIME, COOLING CAN OCCUR. HOWEVER, BRINE MIXING IN THE TANK, RECIRCULATION OF BRINE, AND FEED OF HOT BRINE TO THE TANK SHOULD PRECLUDE FREEZING.	
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					

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15-1	OTHER THAN	FAILURE OF BRINE TANK MIXER M-204/M-205	SOLIDS ACCUMULATION IN DISCHARGE WITH POSSIBLE PLUGGING OF LINE	A			EVALUATE NEED FOR MIXER MOTO TRIP INDICATION.
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	BOTH TANKS FULL OF BRINE ON STARTUP	UNABLE TO STORE PRODUCED BRINE	B		INADEQUATE INFORMATION TO EVALUATE CONSEQUENCE	RECOMMEND EVALUATION OF NEED FOR INTERLOCK OR OPERATING PROCEDURES TO CHECK LEVEL ON BOTH TANKS ON STARTUP/SHUTDO WHEN BOTH TANKS ARE FULL.
** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN	EMERGENCY BLOWDOWN TO TANKS DURING EMERGENCY SHUTDOWN	INADEQUATE BRINE CAPACITY	B			EVALUATE NEED TO MAINTAIN RESERVE CAPACITY IN TANK FOR EMERGENCY SHUTDOWN.
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	SEE COMPOSITION FOR LOSS OF MIXER	EXCESSIVE SOLIDS ACCUMULATION REQUIRING TANK SHUTIN AND CLEANOUT.	B			
** PROCESS PARAMETER : LEVEL							
19-1	NO	NOT APPLICABLE					
20-1	MORE	SEE MORE PRESSURE					
21-1	LESS	SEE MORE FLOW, LESS PRESSURE					

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	HAZOP STUDY IDENTIFIER : 50% CAUSTIC INJECTION						
	LINE OR EQUIPMENT DESIGNATION : W0051						
	LINE DESCRIPTION : CAUSTIC DELIVERY						
	LINE/EQUIPMENT CONSIDERED : 4"-XC-004-E-R, 3"-XC-004-E-R BEGINS AT CAUSTIC DELIVERY POINT, TERMINUS AT TK-204, CAUSTIC STORAGE TANK						
	DRAWING DESIGNATION(S) : 03-04-009 REV Q, 7/31/91						
** PROCESS PARAMETER : FLOW							
1-1	NO	LINE RUPTURE, LINE PLUGEDGE	RELEASE OF CAUSTIC TO WORK AREA	C		CAUSTIC DELIVERY AND UNLOADING PROCEDURES ARE UNAVAILABLE. ASSUME THAT UNLOADING OPERATOR OBSERVES RUPTURE AND INITIATES EMERGENCY PROCEDURES.	
2-1	MORE	NOT APPLICABLE					
3-1	LESS	LOSS OF HEAT TRACING	SOLIDIFICATION OF CAUSTIC, PARTIAL BLOCKAGE OF LINE, INEFFICIENT DELIVERY	A			
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	IMPROPER DELIVERED MATERIAL	CONTAMINATION OF TANK TK-204 WITH IMPROPER MATERIAL	B			UNLOADING PROCEDURES SHOULD INCLUDE A PROVISION FOR VERIFYING CONTENTS OF DELI

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** PROCESS PARAMETER : PRESSURE							
7-1	NO	PUMP FAILURE ON DELIVERY TRUCK	INEFFICIENT PUMPING				
8-1	MORE	NOT APPLICABLE					
9-1	LESS	LINE LEAK	RELEASE OF CAUSTIC TO WORK AREA	C			
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	LOSS OF HEAT TRACING	RESTRICTION OF LOADING LINE DUE TO SOLIDIFICATION, INABILITY TO OFFLOAD TANK TRUCK.	B		IS CAUSTIC LEFT IN LINE AFTER LOADING OPERATION?	EVALUATE DETECTION OF LOSS O HEAT TRACING.
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	SEE OTHER THAN FLOW					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE					

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** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	FAILURE OF HEAT TRACING/ FAILURE OF LINE AT FLEX/FIXED JUNCTURE	POSSIBLE FAILURE AND RELEASE OF CAUSTIC	C			RECOMMEND INVESTIGATION OF FLEX/FIXED JUNCTURE ON LIN

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		HAZOP STUDY IDENTIFIER : CAUSTIC DELIVERY SYSTEM					
		LINE OR EQUIPMENT DESIGNATION : W0052					
		LINE DESCRIPTION : CAUSTIC STORAGE TANK					
		LINE/EQUIPMENT CONSIDERED : CAUSTIC TANK TK-204					
		DRAWING DESIGNATION(S) : 03-04-009 REV 0, 7/31/91					
** PROCESS PARAMETER : FLOW							
1-1	NO	NOT APPLICABLE					
2-1	MORE	SEE MORE LEVEL					
3-1	LESS	NOT APPLICABLE					
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	NOT APPLICABLE					
8-1	MORE	NOT APPLICABLE				OVERFLOW AND VENT ON TANK	
9-1	LESS	NOT APPLICABLE				SEE MORE PRESSURE	

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** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	RUNAWAY HEATER	OVERHEATING OF CAUSTIC	A		HOW SELF-REGULATING IS THE HEATER? NO HIGH TEMPERATURE ALARM	
11-1	LESS	LOSS OF HEATER	POTENTIAL SOLIDIFICATION OF CAUSTIC, LOSS OF CAUSTIC TO SYSTEM, SYSTEM SHUTDOWN.	B			
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	SEE ITEM 16-1 ON LINE W0051 FOR COMPOSITION.					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					

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** PROCESS PARAMETER : LEVEL							
19-1	NO	NOT APPLICABLE					
20-1	MORE	FAILURE OF LEVEL INDICATOR LSH-204 INTERLOCKED WITH PUMP P-211A/B	OVERFLOW TO TANK TK-402, CAUSTIC SUMP	A			
21-1	LESS	FAILURE OF LEVEL INDICATOR LSL-204 INTERLOCKED WITH PUMP P-211A/B.	LOSS OF CAUSTIC TO SYSTEM, PUMP CAVITATION, POTENTIAL SHUTDOWN OF SYSTEM	B			

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		HAZOP STUDY IDENTIFIER : CAUSTIC DELIVERY SYSTEM					
		LINE OR EQUIPMENT DESIGNATION : W0053					
		LINE DESCRIPTION : SUCTION SIDE OF P-211A/B, DISCHARGE FROM TANK TK-204					
		LINE/EQUIPMENT CONSIDERED : 2"-XC-006-E-R, 2"-XC-007-E-R, BEGINS AT TK-204, TERMINUS AT PUMPS P-211A/B.					
		DRAWING DESIGNATION(S) : 03-04-009 REV 0, 7/31/91					
** PROCESS PARAMETER : FLOW							
1-1	NO	INADVERTANT VALVE CLOSURE, PUMP FAILURE P-211A/B, LINE PLUGGING	LOSS OF CAUSTIC FEED TO PUMPS 211A/B, EVENTUAL SYSTEM SHUTDOWN	B			
1-2	NO	LINE RUPTURE	RELEASE OF CAUSTIC TO WORK AREA	C			EVALUATE DETECTION FOR LINE RUPTURE.
2-1	MORE	NOT APPLICABLE					
3-1	LESS	PARTIAL LINE PLUGGING, INADVERTANT VALVE POSITIONING, PUMP WEAR	LOW FLOW TO CAUSTIC DILUTION TANK	A			
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SEE LINE RUPTURE					

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8-1	MORE	NOT APPLICABLE					
9-1	LESS	SEE LESS FLOW					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE					SEE GENERAL COMMENTS FOR ALL HEAT TRACED LINES ON HEAT TRACING CONTROL	
11-1	LESS	LOSS OF HEAT TRACING	POTENTIAL LINE BLOCKAGE, LOSS OF FLOW	A		SEE COMMENTS UNDER HEAT TRACING FOR ALL HEAT TRACED LINES	
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	SEE ITEM 15-1 UNDER LINE W0051.					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN	LINE PLUGGING ON STARTUP AFTER EMERGENCY SHUTDOWN	NO FLOW TO CAUSTIC DILUTION TANK	A		(1)HEAT TRACING AND TANK HEATER ARE NOT ON EMERGENCY	(3)INCLUDE PROVISION IN OPERATOR/TRAINING MANUAL FOR

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						POWER SYSTEMS.(2) HOW DOES OPERATOR DETERMINE WHETHER CAUSTIC IS FLOWING IN THIS LINE DURING RESTART AFTER EMERGENCY SHUTDOWN	DETERMINING WHETHER CAUSTIC FLOWING ON RESTART AFTER EMERGENCY SHUTDOWN.

** PROCESS PARAMETER : MAINTENANCE

18-1	OTHER THAN	NOT APPLICABLE					

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		HAZOP STUDY IDENTIFIER : CAUSTIC DELIVERY SYSTEM					
		LINE OR EQUIPMENT DESIGNATION : W0054					
		LINE DESCRIPTION : DISCHARGE FROM PUMPS F-211A/B					
		LINE/EQUIPMENT CONSIDERED : PUMPS P-211A/B, 1 1/2"-XC-008-E-R, 1 1/2"-XC-009-E-R, 1/2"-XC-010-E-R BEGINS AT PUMP DISCHARGE P-211A/B, TERMINUS AT TANK TK-205					
		DRAWING DESIGNATION(S) : 03-04-009 REV 0, 7/31/91					
** PROCESS PARAMETER : FLOW							
1-1	NO	LOSS OF PUMPS P-211A/B, LINE PLUGGING, INADVERTANT VALVE CLOSURE, LOSS OF INSTRUMENT AIR	LOSS OF FEED TO CAUSTIC DILUTION TANK	A		(1)INTERLOCKED WITH WATER LINE THROUGH FLOW METER FIC-205. (2)FAIL POSITION ON VALVE FCV-211 AND FCV-209 ON LINE W0008 IS UNCLEAR.	
1-2	NO	LINE RUPTURE	RELEASE OF CAUSTIC TO WORK AREA	C			
2-1	MORE	FAILURE OF FLOW CONTROLLER FCV-211.	MORE FLOW OF CAUSTIC TO CAUSTIC DILUTION TANK RESULTING IN MORE CONCENTRATED CAUSTIC SOLUTION TO SCRUBBER AND QUENCH TANK.	A			
3-1	LESS	FAILURE OF FCV-211, INADVERTANT VALVE POSITIONING, PUMP WEAR, PARTIAL PLUGGING OF LINE	LESS CAUSTIC TO DILUTION TANK THAN DESIGNED POTENTIAL EVENTUAL SHUTDOWN DUE TO HIGH EMISSIONS FROM STACK	B			

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3-2	LESS	LINE LEAKS	RELEASE OF CAUSTIC TO WORK AREA, SEE ITEM 3-1.	C			
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SEE NO FLOW					
8-1	MORE	NOT APPLICABLE					
9-1	LESS	SEE LESS FLOW					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	LOSS OF HEAT TRACING	POSSIBLE LINE PLUGGING, NO FLOW TO CAUSTIC DILUTION TANK, POSSIBLE EVENTUAL SHUTDOWN OF SYSTEM	B			
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					

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14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	SEE ITEM 15-1 ON LINE W0051					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN	SEE LINE W0053					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					

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		HAZOP STUDY IDENTIFIER : CAUSTIC DELIVERY					
		LINE OR EQUIPMENT DESIGNATION : W0055					
		LINE DESCRIPTION : CAUSTIC DILUTION TANK					
		LINE/EQUIPMENT CONSIDERED : 3"-XB-001-P-R, CAUSTIC DILUTION TANK TK-205					
		DRAWING DESIGNATION(S) : 03-04-009 REV 0, 7/31/91					
** PROCESS PARAMETER : FLOW							
1-1	NO	NOT APPLICABLE					
2-1	MORE	RUPTURE OF TANK	FLOW OF DILUTE CAUSTIC TO WORK AREA	C			
3-1	LESS	NOT APPLICABLE					
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	SEE TANK RUPTURE (MORE FLOW)					
8-1	MORE	NOT APPLICABLE					
9-1	LESS	NOT APPLICABLE					

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** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	LOSS OF DILUTION WATER	HEATING OF LIQUID IN CAUSTIC DILUTION TANK DUE TO EXOTHERMIC HEAT OF SOLUTION.	A		(2)CAN EXOTHERMIC REACTION GREATER THAN DESIGN?	
11-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	LOSS OF FLOW CONTROLLERS FCV-211 AND FCV-209	GREATER CAUSTIC CONCENTRATION IN TANK THAN INTENDED.	A		SEE MORE TEMPERATURE	
13-1	LESS	LOSS OF FLOW CONTROLLER FCV-211 AND FCV-209	HIGH WATER CONCENTRATION AND LESS CONCENTRATION CAUSTIC IN TANK	A			
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	LOSS OF TANK MIXER	IMPROPER MIXING, POSSIBLE FLUID STRATIFICATION, LOSS OF pH CONTROL IN QUENCH TANK AND SCRUBBER, POSSIBLE EVENTUAL SYSTEM SHUTDOWN	B			
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : EMERGENCY SD							
17-1	OTHER THAN	NOT APPLICABLE					

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** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					

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HAZOP STUDY IDENTIFIER :
LINE OR EQUIPMENT DESIGNATION :W0056
LINE DESCRIPTION :
LINE/EQUIPMENT CONSIDERED :
DRAWING DESIGNATION(S) :

** PROCESS PARAMETER : FLOW

1-1	NO	NOT APPLICABLE					
2-1	MORE	NOT APPLICABLE					

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		HAZOP STUDY IDENTIFIER : PROCESS WATER SYSTEM					
		LINE OR EQUIPMENT DESIGNATION : W0056					
		LINE DESCRIPTION : PROCESS WATER TANK					
		LINE/EQUIPMENT CONSIDERED : TANK TK-203 - PROCESS WATER STORAGE TANK					
		DRAWING DESIGNATION(S) : 03-04-009 REV 0 (7/31/91)					
** PROCESS PARAMETER : FLOW							
3-1	LESS	NOT APPLICABLE					
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	TANK RUPTURE	LOSS OF PROCESS WATER TO PLANT	B			
8-1	MORE	NOT APPLICABLE					
9-1	LESS	SEE LINE W0008					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	LOSS OF HEATER HP-203, FAILURE OF TEMPERATURE CONTROLLER	POSSIBLE LOSS OF WATER SUPPLY DUE TO FREEZING	B			

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** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	FAILURE OF WATER SOFTENER	POTENTIAL PRECIPITATION AND SCALING	A		SEE LINE W0008	

HAZARD AND OPERABILITY STUDY - H A Z O P
SUMMARY REPORT
CA_HAZOP VER 1.3

ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
		HAZOP STUDY IDENTIFIER :					
		LINE OR EQUIPMENT DESIGNATION :W0056					
		LINE DESCRIPTION :					
		LINE/EQUIPMENT CONSIDERED :					
		DRAWING DESIGNATION(S) :					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	LACK OF PROCESS WATER	UNABLE TO STARTUP INCINERATOR DUE TO LACK OF WATER.	B			
** PROCESS PARAMETER : EMGCY SHUTDOWN							
17-1	OTHER THAN	NOT APPLICABLE					

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
		HAZOP STUDY IDENTIFIER : PROCESS WATER SYSTEM					
		LINE OR EQUIPMENT DESIGNATION : W0056					
		LINE DESCRIPTION : PROCESS WATER TANK					
		LINE/EQUIPMENT CONSIDERED : TANK TK-203 - PROCESS WATER STORAGE TANK					
		DRAWING DESIGNATION(S) : 03-04-009 REV 0 (7/31/91)					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : LEVEL							
19-1	NO	INSTRUMENTATION FAILURE(LIT-203), LOSS OF WATER SUPPLY	LOSS OF WATER IN TK-203 NO CAUSTIC/WATER MIX	B		CHECK INSTRUMENTATION IDENTIFICATION LCS-205 FOR TANK TK-203 CONTROLLERS.	
20-1	MORE	INSTRUMENTATION FAILURE CAUSING LCV-203 TO MAINTAIN FLOW INTO TANK WHEN ALREADY FULL.	OVERFLOW TANK TO SUMP T-402	A			
21-1	LESS	SAME AS LESS PRESSURE					

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
		HAZOP STUDY IDENTIFIER : WASTEWATER HANDLING SYSTEM					
		LINE OR EQUIPMENT DESIGNATION : W0057					
		LINE DESCRIPTION : SQI DAY TANK AND WASTEWATER TANK AREA					
		LINE/EQUIPMENT CONSIDERED : TK-104 (WASTEWATER TANK),					
		DRAWING DESIGNATION(S) : 03-04-001 REV 0 (7/31/91)					
** PROCESS PARAMETER : FLOW							
1-1	NO	NOT APPLICABLE					
2-1	MORE	NOT APPLICABLE					
3-1	LESS	NOT APPLICABLE					
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	TANK RUPTURE	RELEASE OF WASTEWATER INTO WORK AREA	B			
8-1	MORE	NOT APPLICABLE					
9-1	LESS	NOT APPLICABLE				TANK INCLUDES ADAQUETE VENTS	

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	LOSS OF HEATER	POTENTIAL TANK DAMAGE FROM FREEZING.	A			
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	LOSS OF AGITATOR	POSSIBLE SOLIDS ACCUMULATION AND BLOCKING OF LINE W0006.	A			RECOMMEND EVALUATION OF NEED TO INDICATE MIXER MOTOR TRIP ON MAIN AND/OR LOCAL CONTROL PANEL.
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : EMGCY SHUTDOWN							
17-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : MAINTANANCE							
18-1	OTHER THAN	WASTEWATER TANK OUT OF SERVICE	INABILITY TO FLUSH BASIN F FEED LINES. POTENTIAL PLUGGING OF FEED LINES DUE TO SOLIDS LEFT IN PIPING.	A			

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
** PROCESS PARAMETER : LEVEL							
19-1	NO	LOSS OF LEVEL CONTROL	PUMPS P-104A/B CONTINUE OPERATION WITH NO WATER SUPPLY AND CAVITATE	A			
20-1	MORE	LOSS OF LEVEL CONTROL LIT-105	OVERFLOW OF TANK. NO CAPACITY TO RECEIVE WATER FROM SUMPS OR FLUSH WATER.	A			
21-1	LESS	NOT APPLICABLE					

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HAZOP STUDY IDENTIFIER : WASTE FEED SYSTEM
LINE OR EQUIPMENT DESIGNATION : W0058
LINE DESCRIPTION : SQI INCINERATOR DAY TANKS
LINE/EQUIPMENT CONSIDERED : TK-105 AND TK-106
DRAWING DESIGNATION(S) : (3-04-001 REV 0 (7/31/91)

ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
** PROCESS PARAMETER : FLOW							
1-1	NO	NOT APPLICABLE					
2-1	MORE	NOT APPLICABLE					
3-1	LESS	NOT APPLICABLE					
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	TANK RUPTURE	RELEASE OF BASIN F FLUID INTO WORK AREA	C			
8-1	MORE	HIGH VAPOR PRESSURE IN TANK	VAPORS RELEASED THROUGH LIQUID SEAL	C		RELEASE OF VAPORS INTO WORK AREA	RECOMMEND PERIODIC INSPECTIO OF LIQUID SEALS

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
9-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	LOSS OF HEATER	PRECIPITATION OF SOLIDS AND POTENTIAL PLUGGING OF DISCHARGE	B			
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSTION							
15-1	OTHER THAN	FAILURE OF MIXER	SETTLING OF SOLIDS. STRATIFICATION OF TANK CONTENTS. POTENTIAL PLUGGING OF WASTE FEED TO P-201.	B			
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NO BASIN F FLUID IN TANK	NO WASTE FEED TO INCINERATOR	B			
** PROCESS PARAMETER : EMGCY SHUTDOWN							
17-1	OTHER THAN	NOT APPLICABLE					

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : LEVEL							
19-1	NO	LOSS OF LEVEL CONTROL	NO BASIN F FLUID IN DAY TANKS. NO FEED TO PUMPS P-201A/B.	B		SQI WASTE FEED SYSTEM INCLUDES DUAL TANKS.	REVIEW DESIGNATIONS OF LEVEL INSTRUMENTATION SHOWN ON P&I
20-1	LOW	LOSS OF LEVEL CONTROL	PUMP CONTINUES TO OPERATE WITH NO WASTE FEED. POTENTIAL FOR PUMP CAVITATION.	B			
21-1	MORE	LOSS OF LEVEL CONTROL	OVERFLOW OF TANKS	C			

[redacted] No. [redacted]

05/13/92

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
		HAZOP STUDY IDENTIFIER : BASIN F STORAGE					
		LINE OR EQUIPMENT DESIGNATION : W0059					
		LINE DESCRIPTION : EXISTING BASIN F FLUID STORAGE TANKS					
		LINE/EQUIPMENT CONSIDERED : TK-101,102,103					
		DRAWING DESIGNATION(S) : 02-04-002 REV 1 (4/26/91)					
** PROCESS PARAMETER : FLOW							
1-1	NO	NOT APPLICABLE					
2-1	MORE	TANK RUPTURE	RELEASE OF BASIN F FLUID	C			
3-1	LESS	NOT APPLICABLE					
4-1	AS WELL AS	NOT APPLICABLE					
5-1	REVERSE	NOT APPLICABLE					
6-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : PRESSURE							
7-1	NO	NOT APPLICABLE					
8-1	MORE	NOT APPLICABLE					
9-1	LESS	NOT APPLICABLE					

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARIFICATION	A-ACTION RECOMMENDED
** PROCESS PARAMETER : TEMPERATURE							
10-1	MORE	NOT APPLICABLE					
11-1	LESS	NOT APPLICABLE					
** PROCESS PARAMETER : COMPOSITION							
12-1	MORE	NOT APPLICABLE					
13-1	LESS	NOT APPLICABLE					
14-1	AS WELL AS	NOT APPLICABLE					
15-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : STARTUP/SHUTDWN							
16-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : EMGCY SHUTDOWN							
17-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : MAINTENANCE							
18-1	OTHER THAN	NOT APPLICABLE					
** PROCESS PARAMETER : LEVEL							
19-1	NO	TANK RUPTURE	RELEASE OF BASIN F FLUID	C			
20-1	MORE	LOSS OF LEVEL CONTROL WHILE FILLING TANK FROM POND	OVERFLOW AND RELEASE OF BASIN F FLUID	C		THIS DEVIATION IS HIGHLY UNLIKELY.	

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ITEM	DEVIATION GUIDE WRDS	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ. TYPE	LIKELI-HOOD	C-COMMENTS Q-QUESTION/CLARI	N	A-ACTION RECOMMENDED
21-1	LESS	NOT APPLICABLE						

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HAZOP STUDY IDENTIFIER : BASIN F FLUID TRANSFER
LINE OR EQUIPMENT DESIGNATION : W0001
LINE DESCRIPTION : PUMP HOUSE NO. 1 - RETENTION POND / PUMP HOUSE NO. 2 - STORAGE TANK AREA
LINE/EQUIPMENT CONSIDERED : 2-WK-001-N-K, 2-WK-001-P-K, 2-WK-005-P-K, 2-WK-006-E-L, 2-WK-004-P-K,2-WK-002-P-K, 2-WK-01A-P-K, 2-WK-013-P-K, 2-WK-014-E-L, 2-WK-014-P-K,3-WK-014-E-K, P-101A&B, POND A, TK-101, TK-102, TK-103, 2-WK-015-E-K,3-WK-015-EK,3-WK-015-P-K,2-WK-017
DRAWING DESIGNATION(S) : 01-04-001 REV 1, 02-04-002 REV 1

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0001-1-1	FLOW-NO	PLUGGED INTAKE SCREEN AND/OR PUMP SUCTION STRAINER	CAVITATE PUMP P-101A/B; LOSS OF FLOW TO TANKS	A1

COMMENTS:

ACTION: (1) RECOMMEND O/M PROCEEDURES FOR INTAKE SCREEN MAINTENANCE

AUDIT NOTES: (2) Q: WILL A PROCEDURE BE WRITTEN FOR ROUTINE CLEANING OF THE INTAKE SCREEN IN POND A? INSURE THAT THE CLEANING OF THE SCREEN IS ADDED TO THE ROUTINE MAINTENANCE CHECKLIST/SCHEDULE AND THAT CLEANING IS PART OF THE OPERATOR RESPONSIBILITIES.

HAZOP TEAM: MEETING 11/91 NOTES, AFTER EVERY TYRANSFER, SYSTEM IS TO BE FLUSHED, CONNECTIONS REMOVED AND FLUSHED. QUESTION ON PUMP DESIGN? RMA IS CONSIDERING USING ONLY ONE STORAGE TANK.
RESPONSE: WESTON 2/21/92 RERPORT, (1)THERE HAS REPORTABLY BEEN TWO SUPPLY INTERRUPTIONS IN APPROXIMATELY 5 YEARS(2) EVEN THOUGH THE SUPPLY WILL REPORTABLY BE INTERRUPTABLE, THERE IS TO BE A BACKUP SUPPLY AGREEMENT WHERIN THE CARRIER AGEES TO PROVIDE GAS SHOULD THE SUPPLIER INTERRUPT THE SUPPLY. THE INTERRUPTABLE SUPPLY PROVIDES FOR 4 HOUR NOTICE, ALTHOUGH 1 HOUR NOTICE IS POSSIBLE.
RESPONSE; WESTON 2/21/92 REPORT, (1) AGREED, SCREEN AND STRIANER MAINTENANCE PROCEDURES WILL BE INCLUDED IN THE O&M(2) AGREED, INTAKE SCREEN CLEANING PROCEDURS WILL BE INCLUDED IN THE O&M

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
001-1-2	FLOW-NO	Inadvertant closure of any valve in the line (7 total).	Loss of flow to tank TK-101. Cavitate pump P-101A or B (if on suction side) or dead head pump (if on discharge side).	A2

COMMENTS: Instrumentation on discharge side shuts down pump on high pressure.

ACTION: (1)Recommend operator training address this potential problem.

DIT NOTES: (2)Q: Will the safety training manual address safe operation of feed line to TK-101?

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HAZOP TEAM: MEETING 11/91 NOTES, O&M TO ADDRESS, WESTON WILL FURNISH DRAFT O&M MANUAL AND SUBMIT TO RMA SHORTY ALSO THE H&S MANUAL.
RESPONSE: WESTON 2/5/92 REPORT, (1) AGREED, THE O&M WILL ADDRESS PROPER VALVE POSITING. (2) YES, SAFETY MANUAL WILL ADDRESS THE TRANSFER OF FEED TO TK-101.
RESPONSE 2/21/92 REPORT, SAME AS ABOVE

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0001-1-3	FLOW-NO	P-101A or B failure due to power loss.	No flow to TK-101.	AA

COMMENTS:

ACTION: Operator training required to insure line is gravity drained to prevent plugging of line due to settled solids.

AUDIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
ACTION ITEM: RECOMMEND PUMPS BE ALTERNATED TO MONITOR OPERATING CONDITION OF STANDBY.
HAZOP TEAM: MEETING 11/91 NOTES, COMBINATION OF MANUAL AND CONTROL ROOM OPERATOR SEQUENCE, FLUSHING IS INCLUDED.
RESPONSE; WESTON 2/21/92 REPORT,LINE FLUSHING PROCEDURES WILL BE INCLUEDE IN THE O&M

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0001-1-4	FLOW-NO	Pump P-101A/B shutdown due to instrument malfunction.	No flow to TK-101.	A2

COMMENTS:

ACTION: (1)Operator training should address maintenance of instruments.

AUDIT NOTES: (2)Q: Does Operation and Maintenance manual address maintenance of instrumentation?
RESPONSE: WESTON 11/5/91 REPORT: (1) AGREED (2) YES
RESPONSE: 2/21/92 WESTON, (1)TRAINING WILL REVIEW MALFUNCTION SHOOTING RESPONSES,(2) MAINTENANCE OF INSTRUMENTATION WILL BE INCLUDED IN THE O&M

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0001-1-5	FLOW-NO	Pipe line broken.	No flow to TK101. Basin F fluid release outside of pumphouse containment.	C2

COMMENTS:

ACTION:

AUDIT NOTES: (1)Q: Field run piping layout should address safety of feedline to TK-101.(2) Current P&I's do not show whether piping is pre-engineered or field run. Please verify.

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NOVEMBER 3, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
AUDIT TRAIL NOTES: IS MOISTURE SENSOR PROVIDED IN SECONDARY CONTAINMENT OF TRANSFER LINE?

RESPONSE: WESTON 11/5/91 REPORT,(1) THE DESIGN OF THE PIPE INCLUDES DOUBLE WALL CONSTRUCTION AND INTERSTITIAL LEAK DETECTION TO SAFELY CONTAIN AND DETECT RELEASES.(2) OUTSIDE THE PUMPHOUSE, THE POTENIAL FOR RELEASES IS CONTROLLED BY THE SPECIFIED DOUBLE WALL CONSTRUCTION.
2/21/92 WESTON SAME AS ABOVE

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0001-2-1	FLOW-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0001-3-1	FLOW-LESS	SOLIDS BUILD UP IN LINE OR IN STRAINER(SEE ITEM 1-1,),CHANGE IN COMPOSITION, PARTICALLY OPEN DRAIN VALVE(OFF STRINER)	SLOWER FILL RATE IN TANK 101,	A1

COMMENTS: ACTION: ROUTINE O/M ON THE LINE, TO INSURE LINE IS OPERATED SAFELY. SOLIDS BUILDUP INDICATES A MAINTENANCE PROBLEM.

AUDIT NOTES: HAZOP TEAM: MEETIN 11/91 NOTES, FLUSHING OPS BETWEEN EACH TRANSFER.
RESPONSE: WESTON 11/5/91 REPORT, AGREED.
2/21/92 WESTON RESPONSE, O&M TO INCLUDE ROUTINE LINE FLUSHING PROCEDURES.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0001-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0001-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0001-6-1	FLOW-OTHER THAN	SMALL LEAK IN FEED LINE INTO SECONDARY CONTAINMENT	BASIN F FLUID GRAVITY DRAINS TO TK-109	A2

COMMENTS: ACTION: O&M MANUAL TO REQUIRE DAILY CHECK OF SIGHT GLASS IN 2-WK-030-P-K

AUDIT NOTES: Q. WILL O&M MANUAL REQUIRE DAILY CHECK OF SIGHT GLASS?

HAZOP TEAM: MEETING 11/91 NOTES, FIELD TECH. TO CHECK SIGHT GLASS AND LINE.

RESPONSE: WESTON 11/5/91 REPORT, AGREED
2/21/92 WESTON REPORT,O&M COVERS DAILY PIPELINE INSPECTIONS.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0001-7-1	PRESSURE-NO	SAME AS 1-1,1-2,1-3,1-4,AND 1-5	SAME AS NO FLOW	A2

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0001-8-1	PRESSURE-MORE	SAME AS 1-1 AND 1-2,	POTENTIAL LINE FAILURE DUE TO OVERPRESSURE	C3

COMMENTS: INSTRUMENTATION INCLUDEDE TO PREVENT OVERPRESSURE,(PS 101A/B) ACTION:

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT, HIGH PRESSURE ALARMS ARE PROVIDED ON P-101A/B DISCHARGE. LOCAL PI-101C IS PROVIDED ON SUCTION SIDE.
2/21/92 WESTON SAME AS ABOVE

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0001-9-1	PRESSURE-LESS	LEAK IN LINE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0001-10-1	TEMPERATURE-MORE	NO PROBLEM		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0001-11-1	TEMPERATURE-LESS	LOSS OF HEAT TRACING ON FEED IN TO TANK 101	FREEZING OF FEED LINE.	A5

COMMENTS: REQUIRES LOSS OF PUMP AND FLUID LEFT IN LINE ACTION: OPERATOR TO INSURE LINE FLUSHED AND DRAINED AFTER PUMP FAILURE.

AUDIT NOTES: Q: IS LINE FLUSH AND DRAIN PROCEDURE INCLUDED IN O&M MANUAL?

RESPONSE:WESTON 11/5/91 REPORT, O&M MANUAL PROVIDES FLUSHING OF LINES AFTER TRANSFER OPERATIONS ONLY. OTHER FLUSHING WILL BE DETERMINED BY THE OPERATOR ON A AS REQUIRED BASIS.
2/21/92 WESTON REPORT SAME AS ABOVE.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
001-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0001-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0001-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0001-15-1	COMPOSITION-OTHER THAN	UNANTICIPATED BEHAVIOR OF BASIN F FLUID	FAILURE TO PUMP BASIN F FLUID	B2

COMMENTS: ACTION: CONTINGENCY PLAN SHOULD BE DEVELOPED.

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0001-16-1	STARTUP/SHUTDWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0001-17-1	EMGCY SHUTDOWN-OTHER THAN	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0001-18-1	MAINTENANCE-OTHER THAN	O&M MANUAL NOT PROPERLY IMPLEMENTED. INSUFFICIENT TRAINING.	INABILITY OF SYSTEM TO FUNCTION AS DESIGNED.	B2

COMMENTS:

ACTION: INSURE O&M MANUAL IS IMPLEMENTED AND OPERATORS ARE PROPERLY TRAINED.

AUDIT NOTES: (1)Q: DOES O&M MANUAL ADDRESS PROPER MAINTENANCE OF THE SYSTEM AS DESIGNED?(2) Q: WILL OPERATORS BE PROPERLY TRAINED?
RESPONSE: WESTON 11/5/91 REPORT, (1) AGREED (2) AGREED
2/21/92 WESTON REPORT, (1) O&M WILL INCLUDE MAINTENANCE PROCEDURES (2) QA PLAN WILL INCLUDE QUALITY REVIEW OF PROCEDURES.

HAZOP STUDY IDENTIFIER : PURGE WATER SYSTEM
LINE OR EQUIPMENT DESIGNATION : W0002
LINE DESCRIPTION : PUMP HOUSE RETENTION POND P&ID
LINE/EQUIPMENT CONSIDERED : 2-WU-001-N-D, 3-WU-004-P-D, 2-WU-006-P-D, 2-WU-005-P-B, 2-WU-007-P-B, 2-WU-008-P-B, TK-107, P-102
DRAWING DESIGNATION(S) : 01-04-001 REV 1

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0002-1-1	FLOW-NO	INADVERTANT VALVE CLOSURE	INABILITY TO FLUSH MAIN TRANSFER LINE	A3

COMMENTS:

ACTION: VALVE OPERATION TO BE ADDRESSED IN O&M PROCEDURES

AUDIT NOTES: HAZOP TEAM: MEETING 11/5/91 NOTES, PURGE SAME AS FLUSH, MANUAL OPERATION BY FIELD TECH.
RESPONSE:2/21/92 REPORT, AGREED, THE O&M INCLUDES VALVE POSITIONING INSTRUCTIONS.

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0002-1-2	FLOW-NO	LOSS OF CITY WATER SUPPLY	SAME AS 1-1	A3

COMMENTS:

ACTION: OPERATIONAL CONTINGENCY PLAN TO INCLUDE TRUCK DELIVERY OF PURGE WATER

AUDIT NOTES: HAZOP TEAM: MEETING 11/91 NOTES, PURGE WATER TANK TO SUPPLY TO FLUSH LINE. COULD BE FIRE WATER ALSO. REMENBER TO FILL TANK AFTER FLUSH. HOW LONG CAN WATER BE OFF?(RMA)
RESPONSE: WESTON 11/5/91 REPORT, NO WATER NO OPS.
2/21/92 WESTON REPORT,AS AGREED THE OPERATORS ARE TO BE NOTIFED IF NO WATER IS AVAILABLE, NO WATER-NO OPS.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0002-1-3	FLOW-NO	LOSS OF PUMP P-102	SAME AS 1-1	A2

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0002-2-1	FLOW-MORE	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0002-3-1	FLOW-LESS	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0002-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0002-5-1	FLOW-REVERSE	IMPROPER VALVE POSITIONING AND CHECK VALVE FAILURE ON 2-WU-007-P-D	BASIN F FLUID INTO PURGE WATER SYSTEM	C4

COMMENTS:

ACTION: CONSIDER ADDING REVERSE FLOW INDICATION IN THE LINE

AUDIT NOTES: HAZOP TEAM NOTES:(1) REVERSE FLOW CONDITION COULD EXIST.(2)MAY WANT TO RECOMMEND ADDITION OF A HIGH PRESSURE ALARM OR REVERSE FLOW INDICATOR.
TEAM: MEETIN 11/91 NOTES, DUAL CHECK VALVE(S) AND AIR BREAK NEED TO BE CLEANED UP.

RESPONSE: WESTON 11/5/91 REPORT; (1) NOT NECESSARY, THERE ARE CHECK VALVES IN THE LINE. (2) NO, FIELD TECH. SHALL BE PRESENT FOR ALL TRANSFER AND PURGE OPS. IF A REVERSE SITUATION OCCURS HE WILL BE IN A POSITION TO NOTIFY THE OPERATOR AND STOP THE PURGE OR TRANSFER.
2/21/92 WESTON REPORT SAME AS ABOVE.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0002-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0002-7-1	PRESSURE-NO	LOSS OF PUMP	SAME AS 1-1	A2

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0002-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES: HAZOP TEAM NOTES:

REVERSE FLOW CONDITION COULD EXIST. MAY WANT TO RECOMMEND ADDITION OF A HIGH PRESSURE ALARM OR REVERSE FLOW INDICATOR.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0002-9-1	PRESSURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0002-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0002-11-1	TEMPERATURE-LESS	FAILURE OF IH-101A&B	REDUCED ABILITY TO PURGE LINE DURING EXTREME COLD WEATHER	A3

COMMENTS: ACTION: O&M MANUAL TO INCLUDE LINE ITEM FOR OPERATOR TO CHECK OPERATION OF HEATER AND TEMPERATURE CONTROL LOOP.

AUDIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
ACTION ITEMS: ADD LOW TEMPERATURE ALARM TO TI 107
RESPONSE: WESTON 11/5/91 REPORT, AGREED
2/21/92 WESTON REPORT, O&M WILL INCLUDE HEATER AND TEMPERATURE CONTROL MAINTENANCE PROCEDURES.

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0002-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES: Q: WILL O&M MANUAL REQUIRE DAILY CHECK OF SIGHT GLASS?

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0002-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0002-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

UDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0002-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

UDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0002-16-1	STARTUP/SHUTDWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0002-17-1	EMGCY SHUTDOWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0002-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : EXISTING STORAGE TANK AREA
LINE OR EQUIPMENT DESIGNATION : W0003
LINE DESCRIPTION : SQI BUILDING DAY TANK : PUMP HOUSE NO 2 STORAGE TANK AREA
LINE/EQUIPMENT CONSIDERED : TK-103,2-WK-015-E-K,2-WK-019-P-K,2-WK-020-P-K,2-WK-021-P-K,2-WK-21A-P-K,2-WK-023 -P-K,2-WK-024-P-K,2-WK-040-N-K,2-WK-042-N-K,P-103A&B,TK-105,TK-106
DRAWING DESIGNATION(S) : 02-04-002 REV 1, 03-04-001 (7/31/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0003-1-1	FLOW-NO	PLUGGED STRAINER OR PLUGGED LINE	LOSS OF FLOW TO DAY TANK	A1

COMMENTS: ACTION:

AUDIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
ACTION ITEMS: O&M MANUAL TO PROVIDE ROUTINE MAINTENANCE OF STRAINERS.

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0003-1-2	FLOW-NO	INADVERTANT VALVE CLOSURE	SAME AS 1-1	A3

COMMENTS:

ACTION: O&M MANUAL SHOULD INCLUDE CHECKLIST FOR VALVE POSITIONING

AUDIT NOTES: TEAM: MEETING 11/91 NOTES, COVERED IN NORMAL TRANSFER

RESPONSE: WESTON 11/5/91 REPORT; AGREED
2/21/92 WESTON REPORT,O&M INCLUDES VALVE POSITIONING

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0003-1-3	FLOW-NO	PUMP FAILURE	SAME AS 1-1	A2

COMMENTS: INLINE INSTRUMENTATION WILL DETECT LOSS OF FLOW. PI-103A&B SHOULD BE SHOWN AS REMOTE INDICATORS IN THE MAIN CONTROL ROOM.

ACTION: DRAWING 02-04-002 SHOULD BE CORRECTED.

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT, AGREED, 02-04-002 REV. 2
2/21/92 WESTON REPORT SAME AS ABOVE.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0003-1-4	FLOW-NO	PIPELINE BREAK	RELEASE OF BASIN F FLUID OUTSIDE OF CONTAINMENT	C2

COMMENTS:

ACTION: (1)VERIFY PIPELINE ARRANGEMENTS TO DETERMINE LIKELY CAUSE AND CONSEQUENCE.

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0003-1-5	FLOW-NO	LINE PLUGGED DUE TO SOLIDS ACCUMULATION	NO FLOW TO TK_105 OR TK-106. HIGH PRESSURE IN FEED LINE WILL SHUT DOWN FEED PUMP (via PAH-103A&B)	A2

COMMENTS:

ACTION: ROUTINE LINE FLUSHING TO BE INCLUDED IN O&M PROGRAM.

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT, AGREED

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RESPONSE;WESTON 2/21/92 REPORT, AGREED, ROUTINE PIPELINE FLUSHING IS INCLUDE IN O&M

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0003-2-1	FLOW-MORE	FAILURE OF LIS-105 OR 106	OVERFLOW DAY TANK	C2

COMMENTS: SYSTEM DESIGNED TO HANDLE THIS PROBLEM

ACTION: CONSIDER ADDING FLOW SWITCH AND ALARM IN DAY TANK OVERFLOW LINE 3-WK-051-N-K.

AUDIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
ACTION ITEMS: CONSIDER SEPARATE HI-HI LEVEL SWITCH AS BACKUP TO LIT 105 AND 106.
HAZOP TEAM: MEETIN 11/91 NOTES, CONTROL ROOM INDICATORS.

RESPONSE: WESTON 11/5/91 REPORT, HIGH LEVEL ALARMS LAH-106 ALREADY EXIST TO ALARM HIGH LEVEL IN THE TANKS. A FAILURE OF LIS-105 OR LIS 106 WOULD BE DETECTED BY THE CONTOLL ROOM OPERATOR AND CAN BE INVESTIGATED AND REPAIRED AS REQUIRED.
RESPONSE; WESTON 2/21/92 REPORT; SAME AS ABOVE

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0003-3-1	FLOW-LESS	CRYSTAL ACCUMULATION IN LINE CAUSING PARTIAL PLUGGING	INCREASED PRESSURE	A1

COMMENTS:

ACTION: PERIODIC FLUSHING REQUIRED TO REDUCE CONSEQUENCE

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT, AGREED
WESTON 2/21/92 REPORT,O&M TO INCLUDE PROCEDURES FOR FLUSHING.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0003-5-1	FLOW-REVERSE	CHECK VALVES IN LINE 2-WU-013-P-D FAIL AND IMPROPER VALVE POSITIONING	BASIN F FLUID FLOWS INTO PURGE WATER TANK TK-108	A3

COMMENTS:

ACTION: CONSIDER ADDING FLOW SWITCH TO DETECT REVERSE FLOW

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT, NO, AFIELD TECH. WILL BE PRESENT FOR ALL PURGE/TRANSFER OPERATIONS. IF SUCH A CONDITION DOESOCCUR, HE WILL BE PRESENT TO NOTIFY THE OPERATOR AND STOP PURGE/TRANSFER OPS.
2/21/92 WESTON REPORT SAME AS ABOVE

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
003-6-1	FLOW-OTHER THAN	PIPE LEAK INTO SECONDARY CONTAINMENT	BASIN F FLUID ENTERS SECONDARY CONTAINMENT	C2

COMMENTS:

ACTION: OPERATING MANUAL TO REQUIRE DAILY CHECK OF SIGHT GLASSES AND TK-109

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT, AGREED
RESPONSE; WESTON 2/21/92 REPORT, PROCEDURES IN THE O&M MANUAL WILL DESCRIBE DAILY PIPE INSPECTIONS.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0003-7-1	PRESSURE-NO	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
003-8-1	PRESSURE-MORE	PLUGGED LINE OR INADVERTANT VALVE CLOSURE	OVERPRESSURE PIPELINE	C3

COMMENTS: ASSUME PIPING DESIGNED ACCORDING TO GOOD ENGINEERING PRACTICE

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0003-9-1	PRESSURE-LESS	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0003-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0003-11-1	TEMPERATURE-LESS	LOSS OF HEAT TRACING	LOSS OF FLOW	A2

COMMENTS: REQUIRES LOSS OF PUMP AND FLUID LEFT IN LINE

ACTION: OPERATOR TO INSURE LINE DRAINED AFTER PUMP FAILURE AND INSURE HEAT TRACING SYSTEM OPERABLE.

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT, AGREED
2/21/92 WESTON REPORT, PROCEDURES IN THE O&M WILL DESCRIBE THE DRAIN INSPECTION

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0003-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0003-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0003-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0003-15-1	COMPOSITION-OTHER THAN	UNANTICIPITATED BEHAVIOR OF BASIN F FLUID	EXCESSIVE LINE PLUGGING, REDUCED SYSTEM CAPACITY	B2

COMMENTS: ACTION: CONTINGENCY PLAN SHOULD BE DEVELOPED

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT, THE COMPOSITION OF BASIN F LIQUID HAS BEEN DETERMINED PREVIOUSLY. HEAT TRACING AND FLUSHING PROVISIONS HAVE BEEN INCLUDED AS CONTINGENCY MEASURES.
2/21/92 WESTON SAME AS ABOVE.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0003-16-1	STARTUP/SHUTDOWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0003-17-1	EMGCY SHUTDOWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0003-18-1	MAINTENANCE-OTHER THAN			

COMMENTS: MAINTENANCE ISSUES FOR THIS LINE INCLUDE: PLUGGING, CHECKING SIGHT GLASSES FOR LEAKS, INSTRUMENTATION CALIBRATION, PUMPS MAINTENANCE, AND MONITORING FOR CORROSION.

ACTION:

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT, AGREED
2/21/92 WESTON REPORT, INSPECTION PROCEDURES WILL BE INCLUDED IN THE O&M

HAZOP STUDY IDENTIFIER : PURGE SYSTEM TO DAY TANKS
LINE OR EQUIPMENT DESIGNATION : W0004
LINE DESCRIPTION : PUMP HOUSE NO 2 STORAGE TANK AREA
LINE/EQUIPMENT CONSIDERED : TK-108,2-WU-012-E-D,2-WU-012-P-D,2-WU-011-P-D,2-WU-015-E-D,2-WU-016-E-D,2-WK-025 -P-K,2-WK-026-P-K,3-WU-010-P-D,P-105, 2-WU-008-N-D,2-WU-005-N-D,3-WU-005-N-D
DRAWING DESIGNATION(S) : 02-04-002 REV 1

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0004-1-1	FLOW-NO	PUMP INOPERABLE DUE TO LOSS OF POWER OR PUMP FAILURE	INABILITY TO PURGE LINE	A2

COMMENTS: (2)OPTION TO CONNECT WITH FIRE WATER SYSTEM FOR BACKUP PURGE

ACTION: (1)CONTINGENCY PLAN FOR LOSS OF POWER SHOULD BE DEVELOPED

AUDIT NOTES: HAZOP TEAM: MEETING 11/91 NOTES, EMERGENCY POWER DOES NOT INCLUDE PURGE OF PUMPS.
RESPONSE: WESTON 11/5/91 REPORT (1) IF A POWER OUTAGE OCCURS ONLY THE MOST CRITICAL SYSTEMS WILL BE OPERATIONAL. IF THE POWER FAILURE IS A LOCAL PROBLEM,THE SITUATION WILL BE REPAIRED AND THE PURGE OPERATION WILL COMMENCE.(2) NO
2/21/92 WESTON SAME AS ABOVE, (2) NOT REQUIRED AS DISCUSSED

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0004-2-1	FLOW-MORE	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0004-3-1	FLOW-LESS	LINE LEAK	INEFFECTIVE LINE PURGING	A

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0004-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0004-5-1	FLOW-REVERSE	NOT APPLICABLE - DOUBLE SYSTEM FAILURE REQUIRED		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0004-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0004-7-1	PRESSURE-NO	SEE NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0004-8-1	PRESSURE-MORE	INADVERTANT VALVE CLOSURE OR FEED LINE BLOCKAGE	HIGH PRESSURE IN LINE	A2

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER :
LINE OR EQUIPMENT DESIGNATION : W0004
LINE DESCRIPTION :
LINE/EQUIPMENT CONSIDERED :
DRAWING DESIGNATION(S) :

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0004-9-1	PRESSURE-LESS	SAME AS LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
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HAZOP STUDY IDENTIFIER : PURGE SYSTEM TO DAY TANKS
LINE OR EQUIPMENT DESIGNATION : W0004
LINE DESCRIPTION : PUMP HOUSE NO 2 STORAGE TANK AREA
LINE/EQUIPMENT CONSIDERED : TK-108,2-WU-012-E-D,2-WU-012-P-D,2-WU-011-P-D,2-WU-015-E-D,2-WU-016-E-D,2-WK-025 -P-K,2-WK-026-P-K,3-WU-010-P-D,P-105, 2-WU-008-N-D,2-WU-005-N-D,3-WU-005-N-D
DRAWING DESIGNATION(S) : 02-04-002 REV 1

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0004-10-1	TEMPERATURE-MORE	HEATER CONTROL MALFUNCTION	OVERHEAT TANK CONTENTS	A3

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0004-11-1	TEMPERATURE-LESS	FAILURE OF HEAT TRACING SYSTEM WITH WATER TRAPPED IN PIPE	POTENTIAL DAMAGE TO PIPING	A3

COMMENTS:

ACTION: O&M MANUAL TO ADDRESS STANDING WATER IN PURGE LINES OUTSIDE OF BUILDING

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT, IF HEAT TRACING FAILS, TEMP. HEATS WILL BE USED AS REQUIRED.
2/21/92 WESTON REPORT SAME AS ABOVE

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0004-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0004-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0004-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0004-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0004-16-1	STARTUP/SHUTDWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0004-17-1	EMGCY SHUTDOWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0004-18-1	MAINTENANCE-OTHER THAN			

COMMENTS:

ACTION: (1)RECOMMEND THAT FQI108 (FLOW TOTALIZER) BE INSTALLED ON INLET TO TANK TK-108

AUDIT NOTES: (2)Q: PLEASE EXPLAIN FUNCTION AND LOCATION OF FQI108 WHICH IS ON THE DISCHARGE LINE OF P-108.

(1)Q: SHOULD A FLOW INDICATOR BE ADDED TO THIS LINE?
HAZOP TEAM: MEETING 11/91 NOTES, OPERABILITY ISSUE, FQI ON THE OUTLET, TOTALIZER IN THE WASTE WATER OUTLET.
RESPONSE: WESTON 11/5/91 REPORT, (1) why?(REQUIRES FUTHER DISCUSSION) (2) FLOW INDICATING TOTALIZER FQI-108 IS PROVIDED ON OUTLET.
RESPONSE;2/21/92 WESTON REPORT, (1) AS DISCUSSED 11/91 MEETING, THIS IS NOT REQUIRED (2) SAME

HAZOP STUDY IDENTIFIER : DRAINS AND SUMP
LINE OR EQUIPMENT DESIGNATION : W0005
LINE DESCRIPTION : PUMPHOUSE NO2 P&ID - STORAGE TANK AREA
LINE/EQUIPMENT CONSIDERED : SUMP TK-109, PUMP P-106, 2-WK-030-P-K, 2-WK-031-P-K, 2-WK-032-P-K,2-WK-033-P-K, 2-WK-028P-K, 2-WK-029-P-K, 1/2-WK-037-N-M, 1/2-WK-035-N-M, 2-WK-034-P-K, 2-WU-014-P-D
DRAWING DESIGNATION(S) : 02-04-002 REV 1 (4/26/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0005-1-1	FLOW-NO	LINE BLOCKAGE	INABILITY TO GRAVITY DRAIN AFFECTED PIPING OR INABILITY TO PUMP SUMP LIQUID BACK INTO STORAGE TANKS	A3

COMMENTS: DRAIN ONLY USED UNDER ABNORMAL TRANSFER OPERATIONS

ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0005-1-2	FLOW-NO	FAILURE OF PUMP P-106	HIGH LEVEL IN SUMP	A2

COMMENTS: ACTION: REQUIRES OPERATOR ATTENTION

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0005-2-1	FLOW-MORE	MAJOR LEAK OR PIPE BREAK	FLOODED SUMP AREA	A4

COMMENTS: SUMP PUMP IS SIZED TO HANDLE A FULL LINE BREAK ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0005-3-1	FLOW-LESS	LEAK IN DRAIN LINE	BASIN F FLUID SPILL IN BUILDING	A2

COMMENTS: ANY SPILL GRAVITY FLOWS INTO SUMP ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0005-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0005-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0005-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0005-7-1	PRESSURE-NO	SAME AS NO FLOW		

COMMENTS: ALL INLET LINES ARE GRAVITY FEED ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0005-8-1	PRESSURE-MORE	BLOCKAGE IN PUMP DISCHARGE LINE	INABILITY TO EMPTY SUMP. DEAD HEAD THE PUMP. POSSIBLE SPILL.	A3

COMMENTS: HIGH LEVEL (LAH-109) ALARM PROVIDED FOR THE SUMP ACTION: RECOMMEND ROUTINE INSPECTION OF SUMP AND ASSOCIATED EQUIPMENT

AUDIT NOTES: RERSPONSE: WESTON 11/5/91 REPORT, AGREED
2/21/92 WESTON, O&M CONTAINS PROCEDURES FOR ROUTINE INSPECTION OF SUMPS.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0005-9-1	PRESSURE-LESS	SAME AS LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0005-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0005-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0005-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0005-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0005-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0005-15-1	COMPOSITION-OTHER THAN	SOLIDS ACCUMULATION AND PRECIPITATION	BUILD UP OF SOLIDS IN SUMP	A2

COMMENTS: ACTION: ROUTINE INSPECTION OF SUMP REQUIRED

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT, AGREED
2/21/92 WESTON REPORT, O&M CONTAINS PROCEDURES FOR ROUTINE INSPECTION OF SUMPS

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0005-16-1	STARTUP/SHUTDWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0005-17-1	EMGCY SHUTDOWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0005-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: PRIMARY MAINTENANCE ISSUES INCLUDE SUMP INSPECTION, PUMP OPERATION, AND LEVEL INSTRUMENTATION. ACTION:

AUDIT NOTES: RESPONSE; 2/21/92 WESTON REPORT, AGREED, O&M CONTAINS PUMP AND INSTRUMENT MAINTENANCE INFORMATION.

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

HAZOP STUDY IDENTIFIER : WASTEWATER TANK TO DAY TANK
LINE OR EQUIPMENT DESIGNATION : W0006
LINE DESCRIPTION : SQI BUILDING DAY TANK
LINE/EQUIPMENT CONSIDERED : TK-104,2-WK-002-E-K,2-WD-003-E-K,P-104A/B,2-WD-005-E-M,1-WD-004-E-M,1-WD-007-E-M ,1-WD-004-E-M,1-WD-006-E-M
DRAWING DESIGNATION(S) : 03-04-001 REV 0 (7/31/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0006-1-1	FLOW-NO	INADVERTANT VALVE CLOSURE DUE TO HUMAN ERROR OR INSTRUMENT FAILURE	INABILITY TO EMPTY WASTEWATER TANK. POSSIBLE TANK OVERFLOW.	A2

COMMENTS: TANK IS SIZED TO ALLOW TIME FOR MAINTENANCE. ACTION:

AUDIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
ACTION ITEMS: O&M PROCEDURES TO ADDRESS PROPER VALVE POSITIONING.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0006-1-2	FLOW-NO	PUMP P-104A/B FAILURE	SAME AS 1-1	A2

COMMENTS: SAME 1-1 ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0006-1-3	FLOW-NO	BREAK IN LINE	SPILL OF TANK CONTENTS (POTENTIALLY BASIN F FLUID)	C2

COMMENTS: CURRENT DESIGN INCORPORATES GRAVITY FLOW OF SPILLED FLUID INTO SUMP, THUS MINIMIZING POTENTIAL EMPLOYEE EXPOSURE. ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0006-2-1	FLOW-MORE	INSTRUMENTATION FAILURE (FCV-104 MALFUNCTION)	EXCESS WASTEWATER INTO TANK TK-105 OR TK-106.	B2

COMMENTS: INTERLOCK I-70 STOPS P-104A&B ON HIGH LEVEL. EXCESS WASTEWATER WILL CHANGE COMPOSITION OF FEED TO INCINERATOR. PUMP P-104 IS LIMITED TO 10 GPM.

ACTION:

AUDIT NOTES: Q: EXPLAIN MEANING OF "COV" LABEL FOR VALVE 105B&C, AND 106B&C etc., and HOW THESE VALVES OPERATE.
RESPONSE; WESTON 2/21/92 REPORT, COV INDICATES" CYLINDER OPERATED VALVE", THESE VALVES ARE PNEUMATIOC OPERATED AND WORK THE SAME WAY AN ELECTRICALLY OPERATED VALVE WORKS EXCEPT THEY USE PLANT AIR.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0006-3-1	FLOW-LESS	PIPELINE LEAK	BASIN F FLUID (POTENTIALLY) OUTSIDE OF DESIGNED CONTAINMENT.	C2

COMMENTS: SPILLED MATERIAL GRAVITY DRAINS TO SUMP, MINIMIZING POTENTIAL FOR EMPLOYEE EXPOSURE.

ACTION: O&M MANUAL SHOULD ADDRESS LEAK DETECTION AND PIPELINE MAINTENANCE.

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT, AGREED
2/21/92 WESTON REPORT, O&M CONTAINS PROCEDURES TO INSPECT LEAK DETECTION SYSTEM.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0006-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0006-5-1	FLOW-REVERSE			

COMMENTS: REQUIRES SIMULTANEOUS FAILURE OF PUMP AND TWO CHECK VALVES.

ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0006-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0006-7-1	PRESSURE-NO	SAME AS NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0006-8-1	PRESSURE-MORE	LINE BLOCK ON PUMP P-104A/B DISCHARGE OR INADVERTANT VALVE CLOSURE.	DEAD HEAD PUMPS.	A2

COMMENTS: ACTION: ROUTINE LINE MAINTENANCE REQUIRED.

AUDIT NOTES: HAZOP TEAM: MEETING 11/91 NOTES, LONG TERM POWER OUTAGE WHILE TRANSFERING BASIN F NEED FLUSHING CAPACITY TO BE ON EMERGENCY POWER- WESTON TO REVIEW.

RESPONSE: WESTON 11/5/91 REPORT, LINE MAINTENANCE WILL BE PROVIDED AS REQUIRED. ALL LINES WILL BE CHECKED DAILY FOR LEAKS AND OBVIOUS STRUCTURAL DAMAGE.
WESTON 2/21/92 REPORT SAME AS ABOVE.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0006-9-1	PRESSURE-LESS	SAME AS LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0006-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0006-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0006-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0006-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0006-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: REVIEW OF TANK TK-104 TO BE DONE AS A SEPARATE LINE ITEM ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0006-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0006-16-1	STARTUP/SHUTDWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0006-17-1	EMGCY SHUTDOWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0006-18-1	MAINTENANCE-OTHER THAN			

COMMENTS: SEE LINE W0005 18-1 ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

HAZOP STUDY IDENTIFIER : DAY TANK VENTS TO COMBUSTION AIR BLOWER SUCTION
LINE OR EQUIPMENT DESIGNATION : W0007
LINE DESCRIPTION : SQI BUILDING DAY TANK P&ID; SUB X INCINERATOR P&ID
LINE/EQUIPMENT CONSIDERED : 2-VA-001-N-D,2-VA-002-N-D,2-VA-003-N-D,3-VA-001-N-D,4-AP-113-N-C
DRAWING DESIGNATION(S) : 03-04-001 REV 0 (7/31/91) 32-03-713 REV 5

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0007-1-1	FLOW-NO	INADVERTANT VALVE CLOSURE	LOSS OF ABILITY TO VENT DAY TANKS	C2

COMMENTS: POTENTIAL EMPLOYEE SAFETY PROBLEM DUE TO UNHEALTHY INTERIOR ATMOSPHERE

ACTION: SUPPLIED AIR SHOULD BE AVAILABLE IN THE AREA

AUDIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
AUDIT NOTES: WILL P-TRAP ALLOW AIR FLOW INTO TANK PRIOR TO COLLAPSE WHEN EMPTYING?

RESPONSE: WESTON 11/5/91 REPORT, PERSONNEL AIR IS AVAILABLE IN THE SQI BUILDING.
2/21/92 WESTON REPORT, SAME AS ABOVE

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0007-1-2	FLOW-NO	NO VACUUM IN LINE	INABILITY TO VENT TANKS	

COMMENTS:

ACTION:

AUDIT NOTES: Q: NEED CLARIFICATION OF OPERATION AND CONTROL OF VENTING SYSTEM

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0007-1-3	FLOW-NO	COMBUSTION AIR BLOWER DOWN	INABILITY TO VENT DAY TANKS	C

COMMENTS:

ACTION:

AUDIT NOTES: Q: DOES SYSTEM DESIGN INCLUDE CABABILITY TO VENT TANKS THROUGH CARBON WHEN INCINERATOR IS DOWN AS A STANDBY CONDITION?

RESPONSE: WESTON 11/5/91 REPORT, NO
RESPONSE; WESTON 2/21/92 REPORT, NO, VENT GASES WILL BE SCREENED WITH AN OVA AND Hnu DURING STARTUP.

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0007-2-1	FLOW-MORE	BLOWER INLET FILTER/SILENCER PLUGGED	HIGH VACUUM IN VENT LINE	A2

COMMENTS: TANKS EQUIPPED WITH CONSERVATION VENTS FOR BACKUP PROTECTION

ACTION: ROUTINE CHECKING OF BLOWER INLET FILTER/SILENCER AND CONSERVATION VENTS REQUIRED

AUDIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
AUDIT TRAIL NOTES: DO CONSERVATION VENTS HAVE VACUUM RELIEF CAPABILITY?

RESPONSE 11/5/91 REPORT, AGREED
2/21/92 WESTON REPORT, O&M WILL INCLUDE INSPECTION OF BLOWER INLET FILTER AND SILENCER

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0007-3-1	FLOW-LESS	SAME AS 1-1		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0007-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0007-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0007-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0007-7-1	PRESSURE-NO	SAME AS NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0007-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0007-9-1	PRESSURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0007-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0007-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0007-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0007-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0007-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0007-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0007-16-1	STARTUP/SHUTDWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: NEED BACKUP CARBON SYSTEM ACTION:

AUDIT NOTES: HAZOP TEAM: MEETIN 11/91 NOTES, VAPORS ARE MOSTLY AMMONIA, SMALL AMOUNT OF VENTING OCCURS.

RESPONSE: WESTON 11/5/91 REPORT, CARBON SYSTEM IS NOT EFFECTIVE ON AMMONIA VAPORS.
2/21/92 WESTON RESPONSE,TANKS ARE NOW OUTSIDE ABD VENTING IS EXPECTED ONLY DURING TRANSFER.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0007-17-1	EMGCY SHUTDOWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0007-18-1	MAINTENANCE-			

COMMENTS: MAINTENANCE OF TANK CONSERVATION VENTS AND PUMP INLET FILTERS REQUIRED ACTION:

AUDIT NOTES: HAZOP TEAM: MEETIN 11/91 NOTES, NOT SURE HOW OFTEN THIS WILL BE DONE, AGREE TO BE MAINTENANCE ITEM.

RESPONSE: WESTON 11/5/91 REPORT, AGREED O&M, SCHEDULE ITEM.
RESPONSE,WESTON 2/21/92 REPORT, SAME AS ABOVE

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HAZOP STUDY IDENTIFIER : SOFTENED WATER TO PROCESS WATER STORAGE TANK AND DILUTION TANK
LINE OR EQUIPMENT DESIGNATION : W0008
LINE DESCRIPTION : PROCESS WATER AND STORAGE P&ID
LINE/EQUIPMENT CONSIDERED : 6-WS-001-E-D,4-WU-001-E-D,2-WT-001-N-D,4-WT-001-E-D,TK-203,3-WT-002-E-D,3-WT-003-N-D,2-WT-005-N-D,P-209A&B,2-WT-007-E-D
DRAWING DESIGNATION(S) : 03-04-009 REV 0 (7/31/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0008-1-1	FLOW-NO	LOSS OF CITY WATER, TANK TK-203 EMPTY.	LOSS OF CAUSTIC DILUTION WATER	A2

COMMENTS:

ACTION: BACKUP CONTINGENCY PLAN TO INCLUDE TRUCKING IN WATER

AUDIT NOTES: HAZOP TEAM: MEETIN 11/91 NOTES, NO WATER CAUSES SHUTDOWN, PROCEDURES NEED TO BE INSTITUTED WITH RMA. NEED TO COORDINATE TO PREVENT LOSS OF WATER-SHUTDOWN; FIREWATER TANK? CONTINGENCY PLAN? RMA TO SUPPLY DATA ON SUPPLY AND DISTRIBUTION OF UTILITIES ON BASE.

RESPONSE: WESTON 11/5/91 REPORT, NO WATER-NO OPS
RESPONSE: WESTON 2/21/92 REPORT, AS AGREED, THE OPERATORS ARE TO BE NOTIFIED IF CITY WATER SUPPLY IS GOING TO BE INTERRUPTED, BUT IF THERE IS NO WATER THERE WILL BE NO SQI OPERATION.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0008-1-2	FLOW-NO	POWER FAILURE SHUTS DOWN PUMPS P-209A&B	LOSS OF CAUSTIC DILUTION WATER	A2

COMMENTS:

ACTION:

AUDIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
ACTION ITEMS: O&M ACTION REQUIRED

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0008-1-3	FLOW-NO	LINE RUPTURE		A3

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0008-1-4	FLOW-NO	INADVERTANT VALVE CLOSURE OR INSTRUMENT FAILURE (FIC-205)	LOSS OF DILUTION WATER	A2

COMMENTS: ACTION: ROUTINE MAINTENANCE REQUIRED

AUDIT NOTES: HAZOP TEAM: MEETIN 11/91 NOTES, O&M MANUAL TO INCLUDE THIS ITEM.

RESPONSE: WESTON 11/5/91 REPORT, AND 2/5/92 REPORT, AGREED
2/21/92 WESTON SAME AS ABOVE, MAINTENANCE PROCDURES FOR THE VALVE AND
INSTRUMENTS WILL BE INCLUDED IN THE O&M MANUAL.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0008-2-1	FLOW-MORE	CONTROL LOOP MALFUNCTION (FIC-205)	IMPROPER DILUTION OF CAUSTIC	B2

COMMENTS: ACTION: O&M MANUAL SHOULD ADDRESS PROPER MAINTENANCE AND CALIBRATION OF CONTROL LOOP

AUDIT NOTES: HAZOP TEAM: MEETING 11/91 NOTES, O&M MANUAL TO INCLUDE THIS ITEM.

RESPONSE: WESTON 11/5/91 AND 2/5/92 REPORTS, AGREED
2/21/92 WESTON REPORT, MAINTENANCE AND CALIBRATION PROCEDURES WILL BE INCLUDED
IN THE O&M.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0008-3-1	FLOW-LESS	PIPE LINE LEAK		A2

COMMENTS: DESIGN ALLOWS SUFFICIENT TIME TO REPAIR LEAKS WITHOUT AFFECTING INCINERATOR OPERATION. ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0008-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0008-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0008-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0008-7-1	PRESSURE-NO	SAME AS NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0008-8-1	PRESSURE-MORE	INADVERTANT VALVE CLOSURE OR CONTROL FAILURE	DEAD HEAD PUMP	A2

COMMENTS: ACTION:

AUDIT NOTES: Q: EXPLAIN OPERATION AND FUNCTION OF KIC-209A& AND KIC-211A&B.
HAZOP TEAM: MEETING 11/91 NOTES, CONSIDER TRANSFER IN SEQUENCE AND HAVE OPERATOR CONTROL. CONSIDER TOTALIZER AS A CHECK ON TRANSFER OPS. O&M PLAN TO DISCUSS THAT OPERATOR SHOULD CHECK LEVEL IN TANK AFTER OPS.
RESPONSE: WESTON 11/5/91 AND 2/5/92 REPORTS, REPORT INDICATED TO SEE ATTACHED, NO ATTACHMENMT WAS INCLUDED IN SUBMITTAL.
SAME 2/221/92 WESTON RESPONSE, NO ATTACHMENT SENT WITH REPORT.

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0008-9-1	PRESSURE-LESS	SAME AS LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0008-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0008-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0008-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0008-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0008-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES: Q: EXPLAIN PURPOSE OF HEATER E-203 IN TANK TK-203.
RESPONSE; WESTON 2/21/92 REPORT; FREEZE PROTECTION

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0008-15-1	COMPOSITION-OTHER THAN	WATER SOFTENER SYSTEM FAILURE	PRECIPITATION OF SOLIDS AND POTENTIAL PLUGGING PROBLEMS	A2

COMMENTS:

ACTION: O&M MANUAL MUST ADDRESS PROPER OPERATION AND MAINTENANCE OF SOFTENER SYSTEM

AUDIT NOTES: HAZOP TEAM; MEETIN 11/91 NOTES, WATER SOFTENER SYSTEM HAS BEEN ORDERED BY WESTON.
RESPONSE: WESTON 11/5/91 REPORT, AGREED
2/21/92 WESTON REPORT, THE OPERATION AND MAINTENANCE OF THE SOFTENER WILL BE DISCUSSED IN THE O&M

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0008-16-1	STARTUP/SHUTDOWN-OTHER THAN	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0008-17-1	EMGCY SHUTDOWN-OTHER THAN	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0008-18-1	MAINTENANCE-OTHER THAN			

COMMENTS: MAINTAINING ADEQUATE WATER LEVEL IN TK-203 IS CRITICAL TO PLANT OPERATION. ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : PROCESS WATER TO SQI QUENCH TANK
LINE OR EQUIPMENT DESIGNATION : W0009
LINE DESCRIPTION : PROCESS WATER & CAUSTIC STORAGE P&ID: SUB X INCINERATOR
LINE/EQUIPMENT CONSIDERED : 3-WT-004-E-D, 3-WT-301-E-D,3-WT-301A-E-D,3-WT-301B-E-D,P-207A&B
DRAWING DESIGNATION(S) : 03-04-009 REV 0, 32-03-713-D REV 5

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0009-1-1	FLOW-NO	LINE BREAK	LOSS OF FEED TO PUMP P-207A&B	B2

COMMENTS: RESULTS IN LOSS OF MAKEUP TO QUENCH TANK ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0009-1-2	FLOW-NO	INADVERTANT VALVE CLOSURE	LOSS OF FEED TO PUMP	A2

COMMENTS: ACTION: (2)MANUAL SHOULD ADDRESS PROPER OPERATION OF THIS SYSTEM

AUDIT NOTES: (1)Q: WHY IS VALVE IN LINE 3-WT-004-E-D SHOWN NORMALLY CLOSED?
RESPONSE: WESTON 11/5/91 REPORT, (1) THE VALVES ON 3-WT-004-E-D SHOULD BE NORMALLY OPEN (2) AGREED
RESPONSE: WESTON 2/21/92 REPORT,(1) THE VALVE ON 3-WT-004-E-D SHOULD NORMALLY(BE) OPEN.(2) AGREED, THE OPERATION OF THE WATER SYSTEM WILL BE INCLUDED IN THE O&M

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0009-2-1	FLOW-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0009-3-1	FLOW-LESS	PIPELINE LEAK	NONE	

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0009-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0009-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0009-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0009-7-1	PRESSURE-NO	SAME AS NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0009-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0009-9-1	PRESSURE-LESS	SAME AS LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0009-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0009-11-1	TEMPERATURE-LESS	FAILURE OF HEAT TRACING DURING COLD WEATHER	FREEZE PIPELINE, POTENTIAL PIPE DAMAGE	B2

COMMENTS: ACTION: O&M MANUAL SHOULD REQUIRE ADEQUATE CHECKS OF HEAT TRACING SYSTEM

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AUDIT NOTES: RESPONSE: WESTON 2/21/92 REPORT; AGREED PERIODIC INSPECTIONS OF THE HEAT TRACING WIL BE PROVIDED IN THE O&M.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0009-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0009-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0009-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0009-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0009-16-1	STARTUP/SHUTDWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0009-17-1	EMGCY SHUTDOWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

UDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0009-18-1	MAINTENANCE-OTHER THAN			

COMMENTS: ACTION:

UDIT NOTES:

HAZOP STUDY IDENTIFIER :
LINE OR EQUIPMENT DESIGNATION :
LINE DESCRIPTION :
LINE/EQUIPMENT CONSIDERED :
DRAWING DESIGNATION(S) :

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
-	-			

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
-	-			

COMMENTS: ACTION:

AUDIT NOTES:

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HAZOP STUDY IDENTIFIER : SUB-X INCINERATOR
LINE OR EQUIPMENT DESIGNATION : T0001
LINE DESCRIPTION : NATURAL GAS FEED TO LV-24 BURNER
LINE/EQUIPMENT CONSIDERED : 3"-NG-101-N-F, PCV-06, 2"-NG-101-N-F, FE-09, 2"-NG-102-N-F, LV-24 BURNER
DRAWING DESIGNATION(S) : 32-03-713-D SHEET 1 OF 6, REV 5, 7/23/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0001-1-1	FLOW-NO	LOSS OF SUPPLY	LOW PRESSURE TRIP ON LINE, SHUTDOWN OF BURNER, SCANNER INDICATES BURNER SHUTDOWN. NO WASTE FEED, COMBUSTION AIR CONTINUES TO FLOW.	A

COMMENTS: INTERLOCKS EXIST BETWEEN NATURAL GAS PRESSURE INDICATOR AND FLOW OF WASTE/AIR TO THE FEED NOZZLE. INTERLOCK INTO XV-26.

ACTION: NO BACKUP SUPPLY. WHAT KIND OF NOTIFICATION PROCEDURE EXISTS FROM THE PUBLIC UTILITY TO RMA TO DETERMINE WHEN MAINTENANCE OR OTHER SHUTDOWNS MAY OCCUR?

AUDIT NOTES: Q. QUESTION HAS COME UP IN THE PAST AS TO WHAT SORT OF HISTORY DO WE HAVE AT RMA RELATING TO UTILITIES. 1) ARE THE UTILITY SUPPLIES RELIABLE? 2) WHAT SORT OF NOTIFICATION PROCEDURES EXIST FOR UTILITY SHUTDOWN?

NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
ACTION ITEMS: OPERATING PROCEDURES SHOULD INCLUDE UTILITY NOTIFICATION PROCEDURES, IF APPLICABLE, FOR APPROPRIATE RESPONSE BY PLANT PERSONNEL.

A. WESTON HAZOP SUMMARY 2/21/92 REPORT; (1) THERE HAS BEEN TWO SUPPLY INTERRUPTIONS IN APPROXIMATELY 5 YEARS. (2) EVEN THOUGH THE SUPPLY WILL REPORTEDLY BE "INTERRUPTABLE" THERE IS A BACKUP SUPPLY AGREEMENT WHEREIN THE CARRIER AGREES TO PROVIDE GAS SHOULD THE SUPPLIER INTERRUPT THE SUPPLY. AN "INTERRUPTABLE" SUPPLY PROVIDES FOR FOUR HOUR NOTICE, ALTHOUGH ONE HOUR NOTICE IS POSSIBLE.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0001-1-2	FLOW-NO	LINE RUPTURE	RELEASE OF NATURAL GAS INTO AREA, BLOCK VALVES CLOSE, POTENTIAL RELEASE OF FLAMMABLE GAS.	C

COMMENTS: MOST LIKELY AREA FOR RUPTURE WOULD BE AT FLEXIBLE CONNECTOR. MAY REQUIRE OPERATOR ACTION TO SHUT OFF GAS FLOW. BUILDING HAS CEILING VENTILATION WHICH SHOULD DISSIPATE NATURAL GAS BUILDUP.

ACTION: (1) ARE COMBUSTIBLE GAS SENSORS LOCATED IN BUILDING?(2) SAFETY CONTINGENCY PLAN SHOULD INCLUDE PROVISION FOR ACTION.

AUDIT NOTES: COORDINATION OF CONTRACTORS IS NECESSARY. RMA SHOULD BE RESPONSIBLE FOR AS-BUILTS REFLECTING THE CHANGES THROUGH BASE FACILITY DRAWINGS.

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NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
REVISE AUDIT TRAIL NOTES: COORDINATION OF UNDERGROUND INSTALLATIONS IS NECESSARY. RMA SHOULD BE RESPONSIBLE FOR MAINTAINING BASE FACILITY DRAWING AS-BUILTS REFLECTING CHANGES IN UNDERGROUND UTILITIES TO MINIMIZE LINE RUPTURE POTENTIAL.

NOTE: HAZOP TEAM, BASED UPON THE NOV.'91 REVIEW MEETING, WESTON WAS TO CLARIFY SEVERAL ISSUES FOR THIS LINE ITEM. THE FEB.'92 REPORT DID NOT ADDRESS ANY ISSUES DISCUSSED IN THE NOV.'91 MEETING.(EXAMPLE-NUMBER AND LOCATIONS OF SENSORS NOT IDENTIFIED)

WESTON HAZOP SUMMARY 2/21/92 REPORT (1)YES, AN AREA SENSOR FOR TOTAL HYDROCARBON AND AMMONIA IS TO BE INSTALLED IN THE SQI (2) AGREED, A CONTINGENCY PLAN WILL BE INCLUDED IN THE HEALTH AND SAFETY PLAN.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0001-1-2	FLOW-NO	LINE RUPTURE	RELEASE OF NATURAL GAS INTO AREA, BLOCK VALVES CLOSE, POTENTIAL RELEASE OF FLAMMABLE GAS.	C

COMMENTS: MOST LIKELY AREA FOR RUPTURE WOULD BE AT FLEXIBLE CONNECTOR. MAY REQUIRE OPERATOR ACTION TO SHUT OFF GAS FLOW. BUILDING HAS CEILING VENTILATION WHICH SHOULD DISSIPATE NATURAL GAS BUILDUP.

ACTION: (1) ARE COMBUSTIBLE GAS SENSORS LOCATED IN BUILDING?(2) SAFETY CONTINGENCY PLAN SHOULD INCLUDE PROVISION FOR ACTION.

AUDIT NOTES: NOTE: HAZOP TEAM; NOT ABLE TO VERIFY P&ID 00-02-104 REV. 2 CHANGE, NOT AVAILABLE TO HAZOP TEAM.

WESTON HAZOP SUMMARY 2/21/92 REPORT; (1) RMA TO PROVIDE MINIMUM 22 PSIG AT INTERFACE SHOWN ON DRAWING 00-02-104 REV 2 (2) T-THERMAL TO REGULATE TO 10 PSIG.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0001-1-3	FLOW-NO	INADVERTENT VALVE CLOSURE, BLOCK VALVES STICKING, REGULATOR FAILURES, INSTRUMENTATION FAILURE.	FAILURE TO START OR SHUTDOWN OF SYSTEM.	B

COMMENTS: VALVES FAIL IN SAFE POSITION. STARTUP/SHUTDOWN ISSUE.

ACTION: (1) PROPER LOCKOUT/TAG OUT PROCEDURES SHOULD BE INCLUDED IN TRAINING AND O&M MANUAL.(2) LINES SHOULD BE COLOR CODED.

AUDIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
EDIT ACTION ITEMS: PROPER WORK PERMIT PROCEDURES SHOULD BE INCLUDED IN TRAINING AND O&M MANUAL. LINES SHOULD BE COLOR CODED.

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WESTON HAZOP SUMMARY 2/21/92 REPORT: (1) AGREED, THE HEALTH AND SAFETY PLAN WILL INCLUDE A DESCRIPTION OF PROPER LOCKOUT AND TAGOUT PROCEDURES.(2) AGREED, WESTON WILL COLOR CODE THE NATURAL GAS LINE.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0001-1-4	FLOW-NO	POWER FAILURE	SYSTEM SHUTDOWN.	B

COMMENTS: TWO BACKUP POWER SYSTEMS - UPS COVERS CEM, CONTROLLER PACKAGE CRITICAL LOOPS; DIESEL BACKUP COVERS EMERGENCY AIR BLOWER AND QUENCH RECYCLE PUMP.

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0001-1-5	FLOW-NO	SOFTWARE FAILURE - CONTROLLER	BACKUP SHOULD KICK IN, MANUAL BACKUP MAY BE REQUIRED	A

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0001-2-1	FLOW-MORE	GAS PRESSURE INCREASES FROM SUPPLY, PRESSURE REGULATOR PCV-06 FAILURE, FLOW CONTROLLER FAILURE.	HIGH PRESSURE SWITCH IS TRIPPED UPON TOO HIGH GAS PRESSURE. REGULATOR FAILURE COULD USE SHUTDOWN FROM CO MONITOR.	B

COMMENTS: CO MONITOR SHUTDOWN SHUTS IN FEED, CASCADING EFFECT IN SHUTDOWN PROCEDURE.

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0001-3-1	FLOW-LESS	LINE LEAK OR PARTIAL LINE BLOCKAGE	LOW PRESSURE SWITCH MAY TRIP. RELEASE OF NATURAL GAS INTO BUILDING. ULTIMATE BURNER SHUTDOWN DUE TO LOW TEMPERATURE IN SQI.	C

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0001-3-1	FLOW-LESS	LINE LEAK OR PARTIAL LINE BLOCKAGE	LOW PRESSURE SWITCH MAY TRIP. RELEASE OF NATURAL GAS INTO BUILDING. ULTIMATE BURNER SHUTDOWN DUE TO LOW TEMPERATURE IN SQI.	C

COMMENTS: OPERATING PRESSURE RANGE IS SET. BUILDING VENTILATION SHOULD BE ADEQUATE TO DISPERSE NATURAL GAS.

ACTION: INSTALL LOW FLOW ALARM OR DEVIATION ALARM IN LINE. COMBUSTIBLE GAS MONITORS MAY/MAY NOT BE NECESSARY. O&M OR SAFETY MANUAL SHOULD INCLUDE MONITORING LINE.

AUDIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
EDIT ACTION ITEMS: O&M OR SAFETY MANUAL SHOULD INCLUDE PERIODIC MONITERING OF LINE FOR COMBUSTIBLE GAS LEAKS.
2/21/92 WESTON REPORT, PALL-08 IS INCLUDED

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0001-3-1	FLOW-LESS	LINE LEAK OR PARTIAL LINE BLOCKAGE	LOW PRESSURE SWITCH MAY TRIP. RELEASE OF NATURAL GAS INTO BUILDING. ULTIMATE BURNER SHUTDOWN DUE TO LOW TEMPERATURE IN SQI.	C

COMMENTS: OPERATING PRESSURE RANGE IS SET. BUILDING VENTILATION SHOULD BE ADEQUATE TO DISPERSE NATURAL GAS.

ACTION: INSTALL LOW FLOW ALARM OR DEVIATION ALARM IN LINE. COMBUSTIBLE GAS MONITORS MAY/MAY NOT BE NECESSARY. O&M OR SAFETY MANUAL SHOULD INCLUDE MONITORING LINE.

AUDIT NOTES: QUESTION AS TO THE SCOPE OF THE OPERATOR TRAINING, TIMING BEFORE OPERATION COMMENCES OF OPERATOR FAMILIARIZATION WITH SOFTWARE PACKAGES AND OTHER CONTROL OPERATIONS IN ADVANCE OF OPERATING THE INCINERATOR, AND WHETHER IT IS BEING COORDINATED AT THIS POINT BETWEEN WESTON, T-THERMAL, AND RMA. TRAINING MAY BE DICTATED BY CONTRACT AWARD TIMING WITH THE ARMY.
WESTON 2/21/92 REPORT, O&M MANUAL WILL ADDRESS EMERGENCY SHUTDOWNS AND OPERATOR TRAINING WILL BE PROVIDED

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0001-3-2	FLOW-LESS	LOSS OF UTILITY PRESSURE	OPERATIONAL PROBLEMS	A

COMMENTS: SEE NO FLOW LOSS OF SUPPLY.

ACTION:

AUDIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
ACTION ITEMS: PROPER PROCEDURES SHOULD BE DEVELOPED TO IDENTIFY SOURCE TO NOTIFY FOR UTILITY PROBLEMS AND ACTIONS REQUIRED TO RESOLVE PROBLEMS IN A TIMELY MANNER.

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0001-4-1	FLOW-AS WELL AS	SEE COMPOSITION.		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0001-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: INCINERATOR COMBUSTION AIR PRESSURE IS LESS THAN NATURAL GAS REGULATED PRESSURE. ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0001-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0001-7-1	PRESSURE-NO	SEE NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0001-8-1	PRESSURE-MORE	SEE MORE FLOW		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0001-9-1	PRESSURE-LESS	SEE LESS FLOW		

COMMENTS:

ACTION: (1) RMA TO PROVIDE MINIMUM OF 18 PSIG NATURAL GAS PRESSURE AT T-THERMAL PIPE SKID.(2) T-THERMAL WILL REGULATE TO 10 PSIG.

AUDIT NOTES: NOTE: HAZOP TEAM; NOT ABLE TO VERIFY P&ID 00-02-104 REV. 2 CHANGE, NOT AVAILABLE TO HAZOP TEAM.

WESTON HAZOP SUMMARY 2/21/92 REPORT; (1) RMA TO PROVIDE MINIMUM 22 PSIG AT INTERFACE SHOWN ON DRAWING 00-02-104 REV 2 (2) T-THERMAL TO REGULATE TO 10 PSIG.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0001-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0001-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0001-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0001-13-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0001-14-1	COMPOSITION-AS WELL AS	PROPANE ALSO IN THE GAS SUPPLY	UNSTABLE BURNER OPERATION, CO EMISSIONS AFFECTED, ERRATIC CONTROL OF TEMPERATURE IN INCINERATOR	B

COMMENTS: MAY NOT BE A CREDIBLE DEVIATION. ACTION: (1) IN ADDITION TO SUPPLY SOURCE, DETERMINE WHETHER COMPOSITION MAY CHANGE IN SUPPLY FROM THE UTILITY.

AUDIT NOTES: WESTON HAZOP SUMMARY 2/21/92 REPORT;(1) THE QUALITY OF THE NATURAL GAS SUPPLY IS SUBJECTED TO SPECIFICAIONS WHICH WILL BE INCLUDED IN THE SUPPLY AGREEMENT UNDER H.11 QUALITY

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0001-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0001-16-1	STARTUP/SHUTDWN-OTHER THAN	VALVE POSITIONS NOT CORRECT OR NO GAS PRESSURE IN LINE DURING STARTUP.	NO STARTUP SEQUENCE. ALARM MESSAGE WILL BE DISPLAYED TO OPERATOR.	B

COMMENTS:

ACTION: (1) PROCEDURES SHOULD BE INCLUDED IN O&M MANUAL AND TRAINING PROGRAM.

AUDIT NOTES: NOTE: HAZOP TEAM; WESTON WAS TO PROVIDE ADDITIONAL DETAIL ON GAS PRESSURE AND START UP PROCEDURES IN THE O&M MANUAL. WESTON RESPONSES DON'T INDICATE DETAILS FOR MANUAL.

WESTON HAZOP SUMMARY 2/21/92 REPORT;(1) AGREED, INCLUDED IN THE O&M MANUAL.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0001-16-2	STARTUP/SHUTDWN-OTHER THAN	NORMAL SHUTDOWN - NORMAL SHUTDOWN PROCEDURES ARE NOT FOLLOWED - AUTOMATIC SHUTDOWN PROCEDURE IS NOT FOLLOWED DUE TO SOFTWARE OR OTHER FAILURE.	POSSIBLE REDUCED REFRACTORY LIFE, IN THE EVENT GAS VALVES DO NOT CLOSE, POTENTIAL FOR EXPLOSION DOWNSTREAM.	C

COMMENTS:

ACTION: (1) SHUTDOWN PROCEDURES SHOULD BE INCLUDED IN O&M MANUAL.(2) OPERATOR SHOULD BE ALERTED IN THE EVENT THAT VALVES DO NOT CLOSE PROPERLY.

AUDIT NOTES: ACTION; MAY REQUIRE OPERATOR ACTION TO MANUALLY CLOSE VALVES.

NOTE: HAZOP TEAM; WESTON RESPONSE SHOULD DISCUSS REFRACTORY "CURE",PLUS MORE ON SHUTDOWN PROCEDURES IN THE O&M MANUAL.

WESTON HAZOP SUMMARY 2/21/92 REPORT; (1) AGREED, THE O&M MANUAL WILL INCLUDE PROCEDURES IN THE EVENT OF IMPROPER VALVE OPENINGS.(2) AGREED, O&M MANUAL WILL INCLUDE MANUAL ACTIONS TO ADDRESS IMPROPER OPENINGS

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0001-17-1	EMERGENCY SD-OTHER THAN			

COMMENTS: ESD CAN BE TRIGGERED BY A NUMBER OF EVENTS INCLUDING HIGH TEMPERATURE, CO MONITOR, LOW LEVEL IN QUENCH TANK. BLOCK VALVES ON GAS LINE SHOULD CLOSE. ONE SHUTDOWN BUTTON AT BURNER, ONE IN CONTROL ROOM.

ACTION: OPERATOR TRAINING AND O&M MANUAL.

AUDIT NOTES: QUESTION AS TO THE SCOPE OF THE OPERATOR TRAINING, TIMING BEFORE OPERATION

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COMMENCES OF OPERATOR FAMILIARIZATION WITH SOFTWARE PACKAGES AND OTHER CONTROL OPERATIONS IN ADVANCE OF OPERATING THE INCINERATOR, AND WHETHER IT IS being COORDINATED AT THIS POINT BETWEEN WESTON, T-THERMAL, AND RMA. TRAINING MAY BE DICTATED BY CONTRACT AWARD TIMING WITH THE ARMY.
WESTON 2/21/92 REPORT, O&M MANUAL WILL ADDRESS EMERGENCY SHUTDOWNS AND OPERATOR TRAINING WILL BE PROVIDED

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0001-18-1	MAINTENANCE-OTHER THAN			

COMMENTS:

ACTION: PERIODIC INSPECTION AND MAINTENANCE OF LINE SHOULD BE INCLUDED IN O&M MANUAL. PROPER WORK PERMIT PROCEDURES SHOULD ALSO BE INCLUDED.

AUDIT NOTES: IS THERE A PROCEDURE FOR CHECKING AUTOMATIC SHUTDOWN AND SAFETY INTERLOCKS ON A PERIODIC BASIS?

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0001-18-2	MAINTENANCE-OTHER THAN	OPERATION OF INCINERATOR THROUGH BYPASS ON VALVE FCV09 DURING MAINTENANCE.	LOSS OF CONTROL ON GAS LINE.	B

COMMENTS: INCINERATOR SHOULD NOT BE OPERATED THROUGH BYPASS.

ACTION: BYPASS AROUND NATURAL GAS CONTROL VALVE FCV09 BE QUESTIONED OR ELIMINATED.

AUDIT NOTES: WESTON 2/21/92 REPORT, BY PASS REMAINS BUT WILL BE LOCKED OUT PER THE O&M MANUAL

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HAZOP STUDY IDENTIFIER : INLET TO SQI BURNER
LINE OR EQUIPMENT DESIGNATION : T0002
LINE DESCRIPTION : PILOT GAS LINE
LINE/EQUIPMENT CONSIDERED : 3/4"-NG-104-N-F, 1/2"-NG-101-N-F, 1"-NG-104-N-F, LV-24 GAS PILOT
DRAWING DESIGNATION(S) : 32-03-713-D SHEET 1 OF 6, REV 5, 7/23/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0002-1-1	FLOW-NO			

COMMENTS: CAUSES AND CONSEQUENCES OF DEVIATIONS ARE IDENTICAL TO NATURAL GAS LINE T0001. NORMAL OPERATION IS NO FLOW, LINE USED ONLY DURING STARTUP.

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0002-2-1	FLOW-MORE	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0002-3-1	FLOW-LESS	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0002-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0002-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0002-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0002-7-1	PRESSURE-NO	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0002-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0002-9-1	PRESSURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0002-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0002-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0002-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0002-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0002-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0002-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0002-16-1	STARTUP/SHUTDWN-OTHER THAN	NO SHUTDOWN OF LINE UPON FAILURE OF PILOT TO IGNITE.	CONTINUED FEED OF NATURAL GAS TO INCINERATOR. CONSEQUENCES ARE MINOR BECAUSE AMOUNT OF GAS INTRODUCED IS SMALL COMPARED TO AMOUNT OF AIR.	

COMMENTS: 10-15 SECOND TIME ALLOWED FOR PILOT TO LIGHT. AMOUNT OF GAS WOULD BE BELOW EXPLOSIVE LIMIT.

ACTION: INCLUDE IN O&M MANUAL THAT OPERATOR CHECK PROBLEM IF PILOT DOES NOT IGNITE IN TWO OR THREE TRIES.

AUDIT NOTES: WESTON HAZOP SUMMARY 2/21/92 REPORT; AGREED, BUT THE O&M MANUAL WILL DIRECT THAT AN INSPECTION OCCUR AFTER TWO FAILED ATTEMPTS.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0002-17-1	EMCGY SHUTDOWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0002-18-1	MAINTENANCE-OTHER THAN	INCORRECT SETTING ON PILOT FOR FUEL-AIR MIXTURE	PILOT DOES NOT LIGHT PROPERLY.	A

COMMENTS: SHOULD NOT REQUIRE EXCESSIVE ATTENTION. T-THERMAL DRAWING 1-03-194-B, REV. 1, 5/27/91 SHOWS FUEL/AIR MIXING IN PILOT.

ACTION:

AUDIT NOTES: RESPONSE; WESTON 11/5/91 REPORT; AGREED THAT O&M MANUAL TO INCLUDE INSTRUCTIONS ON PILOT LIGHTING.
NOTE; NOT VERIFIED BY HAZOP TEAM

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0002-18-2	MAINTENANCE-OTHER THAN	SPARK PLUG FAILS TO SPARK	REQUIRES MAINTENANCE AND POSSIBLE REPLACEMENT OF SPARK PLUG.	A

COMMENTS:

ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : SQI AIR INLET
LINE OR EQUIPMENT DESIGNATION : T0003
LINE DESCRIPTION : COMBUSTION AIR TO BURNER
LINE/EQUIPMENT CONSIDERED : 18"-AP-105-N-C, 14"-AP-105-N-C, LV-24 BURNER, B-201A BLOWER, 1/2"-AP-109-N-F, 1 1/2"-AP-110-N-C
DRAWING DESIGNATION(S) : 32-03-713-D, SHEET 1 OF 6, REV 5, 7/23/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0003-1-1	FLOW-NO	BLOWER FAILURE	NO AIR TO BURNER, BURNER GOES OUT, SYSTEM SHUTDOWN, POSSIBLE BACKUP OF HEAT.	B

COMMENTS: EMERGENCY BLOWER IS AVAILABLE TO PREVENT BURNUP OF INCINERATOR. COMPLETE SPARE BLOWER MAY BE AVAILABLE.

ACTION: (1)ENSURE ROUTINE MAINTENANCE ON BLOWER - CRITICAL ITEM, INCLUDING BEARING TEMPERATURE, OTHER PREDICTIVE MAINTENANCE MONITORING.(2) CONSIDER VIBRATION MONITORIG

AUDIT NOTES: NOTE: HAZOP TEAM, ACCORDING TO NOV.'91 MEETING, WESTON WAS TO REVIEW NEED FOR SPARE PARTS AND DELIVERY TIME. ADDITIONALLY, BLOWER MOTOR IS SUPPLIED WITH TEMPERATURE SENSOR, T-THERMAL BLOWER BEARINGS ARE NOT TEMPERATURE MONITORED, WESTON TO FOLLOWUP BASED UPON NOV.'91 MEETING.

WESTON HAZOP SUMMARY 11/5/91 REPORT; BEARING TEMPERATURE AND BLOWER VIBRATIONS WILL BE MONITORED.

RESPONSE: WESTON 2/21/92 REPORT, (1)AGREED, ROUTINE MAINTENANCE WILL BE INCLUDED IN THE O&M MANUAL(2) MONITORING BEARING TEMPERATURE AND BLOWER VIBRATION WILL BE ADDRESSED LATER.

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
10003-1-2	FLOW-NO	LINE RUPTURE, BLOCKED INLET FILTER. FAILURE OF XV-17.	SHUTDOWN OF SYSTEM. POSSIBLE OVERHEATING OF BURNER PARTS, EMERGENCY BLOWER STARTUP.	B

COMMENTS: SEE LESS FLOW ACTION ITEM FOR FAILURE OF XV-17.

ACTION: (1) INLET FILTER SHOULD BE PROPERLY MAINTAINED.(2) RECOMMEND INSTALLATION OF PRESSURE GAUGE ON INLET.

AUDIT NOTES: NOTE: HAZOP TEAM; (1) INLET FILTER IS CHECKED DAILY PER O&M PLAN.(2) NOV.'91 MEETING NOTES, VALVE WILL CLOSE AUTOMATICALLY WHEN SQI GOES DOWN.

RESPONSE: WESTON 11/5/91 REPORT, (1) COVERED IN O&M PLAN (2) NO
RESPONSE: WESTON 2/21/92 REPORT, (1) AGREED, FILTER INSPECTION WILL BE INCLUDED IN THE O&M MANUAL (2) AS AGREED, THE EXISTING EQUIPMENT WILL PROVIDE ADEQUATE WARNING.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
10003-2-1	FLOW-MORE	FAILURE OF FLOW CONTROL VALVE FCV-16	EXCESS AIR IN INCINERATOR, POSSIBLE LOW TEMPERATURE SHUTDOWN	

COMMENTS: EXCESS AIR IN INCINERATOR IS PREFERRED SAFE CONDITION

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
10003-3-1	FLOW-LESS	CLOGGED INLET FILTER, BLOWER MALFUNCTION, PIPELINE LEAK, IMPROPER VALVE POSITIONING	IMPROPER OPERATION OF INCINERATOR DUE TO RICH FUEL/AIR MIXTURE, LOW OXYGEN AND HIGH CO IN EXHAUST, POTENTIAL EXPLOSIVE MIXTURE FORMED IN INCINERATOR	C

COMMENTS:

ACTION: (1) DEVIATION ALARM ON LOW AIR FLOW RATE SET POINT SHOULD BE ADDED (FIT-16).(2) NEED SHUTDOWN INTERLOCK.

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT, (1) INTERLOCK CHANGE INCORPORATED (2) AGREED
RESPONSE: WESTON 2/21/92 REPORT, (1) INCORPORATED AS FSD-16 ON REV. 7 OF THE P&ID (2) AGREED, INTERLOCK 67 HAS BEEN PROVIDED ON REV 7 OF THRE P&ID.

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0003-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0003-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: BACKUP BLOWER IS UNDER SEPARATE POWER SOURCE ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0003-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0003-7-1	PRESSURE-NO	BLOWER NOT OPERATING, CLOGGED INLET FILTER	SAME AS NO FLOW	

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0003-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0003-9-1	PRESSURE-LESS	PLUGGED STRAINER	INCREASED VACUUM IN DAY TANK VENT LINES	A

COMMENTS: DAY TANKS INCLUDE SEAL DRIP LEGS AND CONSERVATION VENTS TO PREVENT DAMAGE

ACTION: DEVIATION ALARM FROM FIT-016 INTO DAY TANK SHUT OFF VALVE XV-17A SHOULD BE ADDED

AUDIT NOTES: NOTE: HAZOP TEAM, POTENTIAL CONFLICT, SUCTION SIDE OF BLOWER USED TO VENT DAY TANK. TANKS HAVE A VACUUM BLEEDER. MEETING NOTES, 11/5/91, PLUGGING OF 17A PLUS BLOCK VALVE CLOSED IS A DOUBLE FAILURE, NOT PART OF HAZOP STUDY.

RESPONSE:WESTON 11/5/91 REPORT,DEVIATION ALARM WILL NOT SOLVE THIS PROBLEM.
RESPONSE: WESTON 2/21/92 REPORT, THE TANK IS DESIGNED WITH A VACUUM BREAK.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0003-10-1	TEMPERATURE-MORE	HIGH AMBIENT TEMPERATURE	INSUFFICIENT OXYGEN TO INCINERATOR, HIGH CO IN EXHAUST	B

COMMENTS:

ACTION: CONSIDER ADDING TEMPERATURE COMPENSATION INSTRUMENTATION TO CORRECT AIR FLOW RATE.

AUDIT NOTES: HAZOP TEAM: MEETINGS NOTES FROM NOV.'91 MEETING, COMPENSATED BY 02 TREND IN INCINERATOR.

RESPONSE: WESTON 11/5/91 REPORT; NO, CORRECTION IS BUILT INTO THE INCINERATOR SYSTEM DESIGN (AIC-30).
2/21/92 REPORT STATES SAME REPONSE.

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0003-11-1	TEMPERATURE-LESS	LOW AMBIENT TEMPERATURE		

COMMENTS: ACTION: SAME AS MORE TEMPERATURE

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0003-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0003-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0003-14-1	COMPOSITION-AS WELL AS	VAPORS FROM DAY TANKS		

COMMENTS: ACTION: SAMPLING SHOULD BE DONE DURING INITIAL PLANT OPERATION TO DETERMINE AMOUNT OF OFF GASING FROM DAY TANKS

AUDIT NOTES: NOTE: HAZOP TEAM MEETING NOTES (11/91) DURING INITIAL PHASE, MONITORING OF VAPOR QUALITY AND AMOUNT OF OFF-GASING SHOULD BE CONSIDERED.

RESPONSE: WESTON 11/5/91 REPORT, AGREED
RESPONSE: WESTON 2/21/92 REPORT, TANKS NOW OUTSIDE, BUT WE AGREE THAT QUALITY AND QUANTITY OF VAPORS WILL BE SCREENED AT START-UP WITH AN Hnu AND OVA MONITOR. IF READINGS INDICATE DETECTABLE EMISSIONS OF ORGANICS THE FUTHER ANALYSIS WILL BE PERFORMED.

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0003-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0003-16-1	STARTUP/SHUTDWN-OTHER THAN	IMPROPER OPERATION OF EITHER XV-17 OR FCV-16	INSUFFICIENT COMBUSTION AIR FLOW	A

COMMENTS:

ACTION: BACKUP POWER SYSTEM SHOULD BE PERIODICALLY CHECKED FOR OPERABILITY. SUGGEST THAT LOW-FIRE LIMIT SWITCH OF FCV-16 & 30 XV-17 BE PART OF PERMISSIVES.

AUDIT NOTES: T-THERMAL TO ADVISE MAXIMUM TIME FOR BACKUP BLOWER TO SUPPLY BACKUP AIR TO INCINERATOR.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0003-17-1	EMERGENCY SD-OTHER THAN	FAILURE OF XV-17 TO MAKE SWITCHOVER	NO EMERGENCY AIR TO INCINERATOR, POSSIBLE OVERHEATING OF BURNER/EXPANSION JOINTS/WASTE INJECTORS.	A

COMMENTS:

ACTION: (1) CONTINGENCY PLAN FOR STARTING EMERGENCY AIR BLOWER B-2018 FROM NORMAL POWER SUPPLY ON OTHER THAN LOSS OF POWER CONDITION.(2)INCLUDE ALARM POSITION OF XV-17

AUDIT NOTES: NOTE: HAZOP TEAM; INCORPORATED INTO DESIGN (CONTINGENCY PLAN) DRAWINGS BEING REVISED

RESPONSE: WESTON 11/5/91 REPORT (1) YES (2) ALARM HAS BEEM INCLUDED.
RESPONSE: WESTON 2/21/922 REPORT, (1)AGREED A CONTINGENCY PLAN FOR OPERATING EMERGENCY BLOWER.(2) ALARM HAS BEEN INCLUDED IN REV.8 OF THE P&ID.

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0003-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : INTAKE AIR TO INCINERATOR
LINE OR EQUIPMENT DESIGNATION : T0004
LINE DESCRIPTION : EMERGENCY AIR BLOWER
LINE/EQUIPMENT CONSIDERED : 6"-AP-107-N-C, B-201B EMERGENCY AIR BLOWER
DRAWING DESIGNATION(S) : 32-03-713D SHEET 1 OF 6, REV 5, 7/23/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0004-1-1	FLOW-NO	BLOWER MALFUNCTION OR DIESEL GENERATOR NOT IN OPERATION TO POWER BLOWER, CLOGGED INLET FILTER	NO COOLING OF INCINERATOR, POSSIBLE OVERHEATING OF MATERIALS	B

COMMENTS: DOUBLE FAILURE ACTION: (1)TESTING OF GENERATOR AND BLOWER SHOULD BE PART OF O&M MANUAL.

AUDIT NOTES: RESPONSE: WESTON 2/21/92 REPORT; AGREED, ONCE WEEK ROUTINE IS SPECIFIED IN THE O&M MANUAL.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0004-1-2	FLOW-NO	LINKAGE BETWEEN COMBUSTION AIR AND EMERGENCY AIR BLOWER LINE VALVES BROKEN (INADVERTENT VALVE XV-17 CLOSURE), OR LINE RUPTURE.	NO COOLING OF INCINERATOR WHEN DESIRED UNDER SHUTDOWN OR EMERGENCY SITUATIONS, POSSIBLE OVERHEATING OF BURNER/EXPANSION JOINT/WASTE NOZZLES	B

COMMENTS: ACTION: SEE ITEM 1-1.

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0004-2-1	FLOW-MORE	NOT APPLICABLE.		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0004-3-1	FLOW-LESS	INLET FILTER CLOGGED, LINE LEAK, PARTIAL OPENING OF VALVE.	SEE NO FLOW CONSEQUENCES	B

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0004-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0004-5-1	FLOW-REVERSE	FAILURE OF VALVE XV-17 LINKAGE CAUSES BACKFLOW INTO LINE.	INSUFFICIENT COMBUSTION AIR INTO INCINERATOR, BACKFLOW FROM COMBUSTION AIR INTO EMERGENCY AIR LINE.	

COMMENTS: DEVIATION LOW FLOW INDICATOR SHOULD DETECT. ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0004-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0004-7-1	PRESSURE-NO	SEE NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0004-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0004-9-1	PRESSURE-LESS	SEE LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0004-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0004-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0004-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0004-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0004-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0004-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0004-16-1	STARTUP/SHUTDWN-OTHER THAN	NOT APPLICABLE.		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0004-17-1	EMERGENCY SD-OTHER THAN	FAILURE TO START BLOWER, MOTOR FAILURE, FAILURE OF EMERGENCY ELECTRICAL SYSTEM, CLOGGED AIR FILTER, IMPROPER VALVE (XV-17) OPERATION	SEE NO FLOW	B

COMMENTS: ENSURE THAT BLOWER CAN BE USED AT TIMES OTHER THAN STRICTLY FOR POWER FAILURES IN THE EVENT THAT MAIN BLOWER MALFUNCTIONS OTHER THAN POWER FAILURE.

ACTION: CONSIDER SWITCH GEAR TO AVOID REQUIREMENT OF EMERGENCY POWER SYSTEM TO START BLOWER.

AUDIT NOTES: NOTE: ENSURE THAT BLOWER CAN BE USED AT TIMES OTHER THAN STRICKLY FOR POWER FAILURES IN THE EVENT THAT MAIN BLOWER MALFUNCTIONS OTHER THAN POWER FAILURE.

HAZOP TEAM: MEETING NOTES 11/91, INCORPORATED INTO THE DESIGN, PUT INTO OTHER POWER SYSTEMS OR FEEDS. WILL HAVE A M.O.A TO SWITCH

RESPONSE: WESTON 11/5/91 REPORT; AGREED.
RESPONSE; WESTON 2/21/92 REPORT, AGREED ON/OFF AUTO SWITCHES ON EACH MOTOR WILL ALLOW THIS TYPE OF TEST.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0004-18-1	MAINTENANCE-OTHER THAN	SEE NO FLOW AND EMERGENCY SHUTDOWN.		

COMMENTS: ACTION:

AUDIT NOTES:

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HAZOP STUDY IDENTIFIER : INLET TO SUB-X INCINERATOR
LINE OR EQUIPMENT DESIGNATION : T0005
LINE DESCRIPTION : COMBUSTION AIR TO NOZZLE
LINE/EQUIPMENT CONSIDERED : 10"-AP-107-N-C, 8"-AP-108-N-C, 8"-AP-107-N-C, WASTE COMBUSTION AIR BUSTLE
DRAWING DESIGNATION(S) : 32-03-713D SHEET 1 OF 6, REV 5, 7/23/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0005-1-1	FLOW-NO	FAILURE OF COMBUSTION AIR BLOWER, LINE RUPTURE, CONTROL VALVE FAILURE	IMPROPER COMBUSTION OF WASTE, POSSIBLE HIGH CO/LOW STACK O2 AND SYSTEM SHUTDOWN.	B

COMMENTS: TEMPERATURE IN INCINERATOR WILL DROP UNDER NO FLOW CONDITIONS, WASTE WILL STILL FLOW TO INCINERATOR.

ACTION: RECOMMEND INSTALLATION OF DEVIATION ALARM ON LINE.

AUDIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
ACTION ITEMS: AIR FLOW INSTRUMENT FIT 30.

RESPONSE: WESTON 11/5/91 REPORT, ALARM HAS BEEN INCLUDED.
RESPONSE: WESTON 2/21/92 REPORT, ALARM INCLUDED AS FSD-16 AND INTERLOCK 67 ON REV. 7 OF THE P&ID

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0005-2-1	FLOW-MORE	FAILURE OF CONTROL VALVE IN COMBUSTION AIR LINE TO BURNER	INCREASED AIR TO WASTE NOZZLES, DETECTION THROUGH FLOW TRANSMITTOR	A

COMMENTS:

ACTION:

AUDIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
ACTION ITEMS: SEE T0005-1-1

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0005-3-1	FLOW-LESS	SEE NO FLOW		

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0005-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0005-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0005-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0005-7-1	PRESSURE-NO	SEE NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0005-8-1	PRESSURE-MORE	SEE MORE FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0005-9-1	PRESSURE-LESS	SEE LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0005-10-1	TEMPERATURE-MORE	SEE COMMENTS UNDER TEMPERATURE FOR LINE T0003		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0005-11-1	TEMPERATURE-LESS	SEE COMMENTS UNDER TEMPERATURE FOR LINE T0003		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0005-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0005-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0005-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0005-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0005-16-1	STARTUP/SHUTDWN-OTHER THAN	SEE COMMENTS UNDER BURNER COMBUSTION AIR LINE T0003 FOR STARTUP/SHUTDOWN		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0005-17-1	EMERGENCY SD-OTHER THAN	SEE COMMENTS UNDER EMERGENCY SHUTDOWN FOR LINE T0003		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0005-18-1	MAINTENANCE-OTHER THAN	SEE COMMENTS UNDER MAINTENANCE FOR LINE T0003		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : INLET TO INCINERATOR
LINE OR EQUIPMENT DESIGNATION : T0006
LINE DESCRIPTION : AQUEOUS FEED LINE TO WASTE FEED MANIFOLD
LINE/EQUIPMENT CONSIDERED : 2"-WK-201A-E-U, 2"-WK-201B-E-U, 2"-WK-201-E-U, 1 1/2"-WK-201-E-U, 1"-WK-201-N-U, 1 1/2"-WK-201-N-U, P-201A, P-201B
DRAWING DESIGNATION(S) : 32-03-713-D SHEET 2 (11/2/90) REV 5

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0006-1-1	FLOW-NO	PUMP FAILURE	NO FLOW TO NOZZLES, STANDBY PUMP WILL START UP AUTOMATICALLY	A

COMMENTS: ACTION: RECOMMEND OPERATING INLET FEED BY ALTERNATING PUMPS TO KEEP PUMPS IN OPERATING CONDITION.

AUDIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
REVISE ACTION ITEM: RECOMMEND ALTERNATING PUMPS TO MONITOR/VERIFY OPERATING CONDITION.

HAZOP TEAM: MEETING NOTES 11/91, WESTON NEEDS TO PROVIDE BETTER CLARIFICATION ON ACTION ITEM.

RESPONSE:WESTON 11/5/91 REPORT; AGREED
RESPONSE: WESTON 2/21/92 REPORT, AGREED, THE O&M MANUAL PROVIDES A DISCUSSION

ON IN-LINE SPARES WHICH WILL OPERATE AS FOLLOWS: ONCE/WEEK FOR 6HRS, B ON; A ON OTHERWISE.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0006-1-2	FLOW-NO	INADVERTENT VALVE CLOSURE, LOSS OF INSTRUMENT AIR TO MAIN BLOCK VALVE.	NO WASTE FEED TO NOZZLES	B

COMMENTS: ACTION: REQUIRES OPERATOR ACTION.

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0006-1-2	FLOW-NO	INADVERTENT VALVE CLOSURE, LOSS OF INSTRUMENT AIR TO MAIN BLOCK VALVE.	NO WASTE FEED TO NOZZLES	B

COMMENTS: ACTION: REQUIRES OPERATOR ACTION.

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0006-1-3	FLOW-NO	LINE PLUGGING DUE TO SOLIDIFICATION IN LINE OR IN PUMPS.	NO FLOW TO NOZZLES, SHUTDOWN OF SYSTEM	B

COMMENTS: ACTION: (1) PUMP LOOP SHOULD INCORPORATE FLUSHING CONNECTIONS AND BE DESIGNED FOR SERVICING.(2) INVESTIGATE MOVING THREE-WAY VALVE AND PLATE BIBS TO SUCTION SIDE.

AUDIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
REVISE ACTION ITEM: INVESTIGATE MOVING THREE-WAY VALVE AND PURGE HOSE BIBS TO SUCTION SIDE.

NOTE: HAZOP TEAM MEETING NOTES 11/91, FLUSH NOT NEEDED ON SUCTION LINE.

RESPONSE:WESTON 11/5/91 REPORT, (1) AGREED (2) NO

RESPONSE: WESTON 2/21/92 REPORT; (1) AGREED, WESTON WILL INSTEALL FLUSH CONNECTIONS AT APPORPRIATE LOCATIONS (2) AS AGREED, THERE IS NO BENEFIT TO MOVING THE THREE WAY VALVE.

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0006-1-4	FLOW-NO	LINE RUPTURE	RELEASE OF BASIN F FLUID INTO BUILDING/WORK AREA	C

COMMENTS:

ACTION: (1)INSTALL A HIGH/LOW ALARM ON FI-04A, INCLUDING INTERLOCK FOR SHUTDOWN.

AUDIT NOTES: (2)Q. IS THERE A SUMP OR COLLECTION DIKE BENATH THE SKIDS?
11/5/91 MEETING, NO RESPONSE FROM WESTON ON Q.

HAZOP TEAM: MEETING NOTES 11/91, DRIP PANS WILL BE REQUIRED PER WESTON.

RESPONSE: WESTON 11/5/91 REPORT, AGREED
RESPONSE: WESTON 2/21/92 REPORT, (1) AGREED, INTERLOCK 68 AND ALARMS INCLUDING INTERLOCK ON REV. 7 TO THE P&ID (2) YES, UNDER SKIDS AND NOZZLES, BUT NOT UNDER PIPING WHICH IS INSIDE AND OVER CONTAINMENT SERVICED BY SUMP.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0006-2-1	FLOW-MORE	NOT APPLICABLE		

COMMENTS: FLOW IS NOT CONTROLLED IN THIS NODE. FLOW IS CONTROLLED BY FCV-22A TO E.

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0006-3-1	FLOW-LESS	PARTIAL PLUGGING OF LINE OR PUMPS	LOW FLOW TO NOZZLES, REQUIRES FLUSHING OF LINE.	A

COMMENTS:

ACTION: SEE NO FLOW.

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0006-3-2	FLOW-LESS	VALVE PARTIAL CLOSURE OR PUMP WEAR	LOW FLOW TO NOZZLES.	A

COMMENTS: ACTION: PUMP WEAR-REQUIRES SWITCHING OF PUMP, VALVE CLOSURE REQUIRES OPERATOR ACTION.

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0006-3-3	FLOW-LESS	LINE LEAK	RELEASE OF BASIN F LIQUID INTO WORK AREA AND LOSS OF FLOW TO NOZZLES	C

COMMENTS: ACTION: SAME AS LINE RUPTURE UNDER NO FLOW.

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0006-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0006-5-1	FLOW-REVERSE	VALVE XV-26 FAILS OPEN.	AIR BLOWN INTO TANK TK-105/106, POSSIBLE OVERPRESSURE OF TANK, INABILITY TO ADEQUATELY PURGE WASTE NOZZLES.	C

COMMENTS: ACTION: EVALUATE LOCATION OF CHECK VALVE 324.

AUDIT NOTES: RESPONSE: WESTON 11/5/91 SUMMARY REPORT; VALVE 324 MOVED TO ELIMATE POSSIBILITY OF REVERSE FLOW, SEE REV. 7,SHEET 2 OF 32-03-713-D
2/21/92 REPORT STATES SAME REPONSE

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0006-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0006-7-1	PRESSURE-NO	SEE NO FLOW		

COMMENTS: ACTION:

DIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
006-8-1	PRESSURE-MORE	PLUGGING OF LINE	DEADHEAD PUMP.	A

COMMENTS: ACTION: SEE NO FLOW

DIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0006-9-1	PRESSURE-LESS	SEE LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0006-10-2	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

DIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0006-11-3	TEMPERATURE-LESS	FAILURE OF HEAT TRACING	COULD RESULT IN LOW OR NO FLOW IN LINE	

COMMENTS:

ACTION: (1) HOW DOES THE OPERATOR DETECT A FAILURE IN THE HEAT TRACING?(2) ARE THERMOCOUPLES LOCATED ON HEAT TRACING OR LINE?

AUDIT NOTES: HAZOP TEAM: MEETING NOTES 11/91, WESTON WAS TO ADDRESS LOSS OF HEAT TRACING. OPERATION PROCEDURES INCLUDE ROUTINE CHECK OF CIRCUT BREAKERS, ADDITIONALLY WESTON WAS TO ADDRESS HOW TO THAW FROZEN FLOW LINES DUE TO LOSS OF HEAT TRACING. RMA VIEWS HEAT TRACING FAILURE AS A PROBLEM TO BE ADDRESS.

RESPONSE: WESTON SUMMARY 11/5/91 REPORT; (1) NO MONITORING SYSTEM IN PLCE TO MONITOR HEAT TRACING (2) REFERENCE WESTON DRG. 00-03-009

RESPONSE:2/21/92 REPORT, SAME REPONSE AS ABOVE(1) O&M MANUAL REQUIRES PERIODIC SURVEILANCE,

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0006-12-1	COMPOSITION-MORE	STRATIFICATION OF FEED OF BASIN F LIQUID IN FEED TANKS	POSSIBLE VISCOSITY CHANGES, SOLIDS BUILDUP MORE LIKELY TO OCCUR	A

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0006-13-2	COMPOSITION-LESS	DILUTION OR STRATIFICATION OF BASIN F LIQUID	LONGER TIME REQUIRED TO PROCESS BASIN F LIQUID.	A

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0006-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
006-15-1	COMPOSTION-OTHER THAN	NOT APPLICABLE		

COMMENTS:

ACTION:

DIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
006-16-1	STARTUP/SHUTDWN-OTHER THAN			

COMMENTS: OPERATION OF VALVE XV-66 AND XV-26 ARE INTERRELATED AND SHOULD BE PROPERLY INTERLOCKED.

ACTION: RECOMMEND ROUTINE LINE FLUSHING AS PART OF MAINTENANCE PROGRAM PRIOR TO STARTUP/AFTER SHUTDOWN.

DIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
REVISE ACTION ITEM: RECOMMEND ROUTINE LINE FLUSHING AS PART OF MAINTENANCE PROGRAM AFTER SHUTDOWN.
2/21/92 WESTON REPORT, LINE FLUSHING WILL BE SPECIFIED IN THE O&M MANUAL

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
06-17-1	EMERGENCY SD-OTHER THAN	VALVE MALFUNCTION ON EMERGENCY SHUTDOWN	POSSIBLE REVERSE FLOW OF AIR, CONTINUED FLOW OF BASIN F LIQUID INTO INCINERATOR	B

MMENTS:

ACTION: CONTINGENCY PLAN SHOULD INCLUDE CHECK OF FLOW IN FIT-04A TO DETERMINE IF FLOW HAS CEASED UPON EMERGENCY SHUTDOWN.

IT NOTES: RESPONSE: WESTON 11/5/91 REPORT; CHECKS ARE INCORPORATED INTO THE SOFTWARE.
2/21/92 REPONSE SAME AS 11/5/92
RESPONSE 2/21/92 ADDITIONAL RESPONSE, THE OPERATING INTERLOCKS WILL INCLUDE PROVISIONS TO CHECK ON FLOW IN TIF-04A VIA A HIGH FLOW ALARM COORDINATED ON THE WASTE FEED BEING SHUT OFF.

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0006-18-1	MAINTENANCE-OTHER THAN	SEE NO/LESS FLOW FOR LINE FLUSHING RECOMMENDATION.		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : FEED SYSTEM TO SQI
LINE OR EQUIPMENT DESIGNATION : T0007
LINE DESCRIPTION : FEED TANKS TO WASTE FEED PUMPS
LINE/EQUIPMENT CONSIDERED : 2-WK-046-E-K,2-WK-045-E-K,2-WK-201-E-K,2-WK-201A/B/E-K,TK-105,TK-106,P-201A&B,1 1/2-WK-043-E-K
DRAWING DESIGNATION(S) : 32-03-713-D SHEET 2 REV 5 (7/23/91) 32-73-04-001 REV 0 (7/31/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0007-1-1	FLOW-NO	PLUGGED LINE, PLUGGED STRAINER	LOSS OF FEED TO P-201A/B	A

COMMENTS: SEE LINE T0006 FOR FLUSHING COMMENT AND ACTION. ACTION: O&M MANUAL SHOULD EMPHASIZE IMPORTANCE OF CLOSE MONITORING OF PUMP SUCTION STRAINERS

AUDIT NOTES: HAZOP TEAM: MEETING 11/91 NOTES, ALL WESTON CONTROL VALVES CAN BE MANUALLY OPREATED.

RESPONSE: WESTON SUMMARY 11/5/91 REPORT, AGREED
RESPONSE: WESTON 2/21/92 REPORT, AGREED, PDIT WILL BE ALARMED.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0007-1-2	FLOW-NO	INADVERTANT VALVE CLOSURE	LOSS OF FEED	A

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0007-1-3	FLOW-NO	AUTOMATIC VALVE CLOSURE DUE TO MECHANICAL FAILURE OR LOSS OF INSTRUMENT AIR	LOSS OF FEED	A

COMMENTS: CAN VALVE COV-105C AND COV-106B BE OPERATED MANUALLY? ACTION:

AUDIT NOTES: RESPONSE TO COMMENT: WESTON 11/5/91 REPORT; YES
RESPONSE: WESTON 2/21/92 REPORT; ALL VALVES CAN BE OPERATED MANUALLY IN THE FIELD

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0007-1-4	FLOW-NO	LINE RUPTURE	LOSS OF FEED, RELEASE OF BASIN F FLUID TO WORK AREA	C

COMMENTS: ACTION: IS PIPING LOCATED WITHIN DIKED AREA WITH SUMP

AUDIT NOTES: HAZOP TEAM; MEETING 11/91 NOTES; TRANSFER LINE IS IT DOUBLE WAALED PIPE?
WESTON MEETING RESPONSE, IT IS IN DIKED AREA.

RESPONSE: WESTON SUMMARY REPORT(S) 11/5/91 AND 2/5/92, YES
2/21/92 SAME REPONSE

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0007-2-1	FLOW-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0007-3-1	FLOW-LESS	LINE LEAK	BASIN F RELEASE INTO CONTAINMENT, CAVITATION OF PUMPS	C

COMMENTS: ACTION: RECOMMEND TRENDING OF PUMP DISCHARGE PRESSURE (PIT-28)

AUDIT NOTES: HAZOP TEAM: MEETING 11/91 NOTES, WALKING LINES REGULARLY, FREQUNCEY TO BE DETERMINED LATER, MONITORING LINE PRESSURE(ONCE PER SHIFT)

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RESPONSE: WESTON SUMMARY 2/5/92 REPORT, NO- REGULAR LINE INSPECTIONS SHALL BE PERFORMED BY FIELD TECH AT A MINIUM OF ONE PER SHIFT.
RESPONSE: WESTON 2/21/92 REPORT, CONTINUOUS TRENDING OF THE PRESSURE IS NOT PROVIDED. TRENDING CAN BE PROVIDED ON AN AS NEEDED BASIS BY THE CONROL SOFTWARE. REGULAR LINE INSPECTIONS SHALL BE PERFORMED BY THE FIELD TECH. A MINIMUN OF ONCE PER SHIFT.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0007-3-2	FLOW-LESS	PLUGGING OF STRAINERS, LINE PLUGGING		

COMMENTS: SEE NO FLOW

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0007-4-1	FLOW-AS WELL AS	INADVERTANT OPENING OF VALVE IN LINE 1 1/2-WK-043-E-K.	UNCONTROLLED WASTEWATER IN FEED, LOSS OF CAPACITY IN THE INCINERATOR	A

COMMENTS:

ACTION: RECOMMEND VALVE LOCKOUT CAPABILITY BE INCLUDED ON DISCHARGE OF TANK TK-104.

AUDIT NOTES: RESPONSE: WESTON 2/21/92 REPORT, NOT REQUIRED, FIC-104 CONTROLS THE FLOW OF WASTEWATER INTO TK-104. IF THINGS GET OUT OF CONTROL THE OPERATOR CAN TURN OFF THE TRANSFER PUMP AND CLOSE THE COV FROM THE CONTROL ROOM OR THE FIELD TECH. CAN STOP THE TRANSFER PUMP AND MANUALLY CLOSE COV FROM THE FIELD.
WESTON 2/21/92 ADDITIONAL RESPONSE, AGREED TO THE ORGINAL ACTION ITEM.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0007-5-1	FLOW-REVERSE	NO CONSEQUENCES		

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0007-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0007-7-1	PRESSURE-NO	SAME AS NO FLOW		

COMMENTS: ACTION:

UDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0007-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0007-9-1	PRESSURE-LESS	SAME AS LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0007-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

UDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0007-11-1	TEMPERATURE-LESS			

COMMENTS: SEE LINE T0006 FOR ACTION ON HEAT TRACING INTEGRETY ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0007-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0007-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0007-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0007-15-1	COMPOSITION-OTHER THAN	SEE COMMENTS ON FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0007-16-1	STARTUP/SHUTDOWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0007-17-1	EMGCY SHUTDOWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0007-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : FEED SYSTEM TO SQI
LINE OR EQUIPMENT DESIGNATION : T0008
LINE DESCRIPTION : WASTE FEED MANIFOLD TO INDIVIDUAL INJECTORS
LINE/EQUIPMENT CONSIDERED : 1-WK-203A/E-N-U,1-WK-204A/E-N-U
DRAWING DESIGNATION(S) : 32-03-713-D SHEET 2 REV 5 (11/2/90)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0008-1-1	FLOW-NO	LINE PLUG IN INDIVIDUAL INJECTOR FEED LINE	REDUCED INCINERATOR CAPACITY	A

COMMENTS: REMAINING INJECTORS CANNOT MAKE UP FOR LOSS OF A SINGLE INJECTOR ACTION:

AUDIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:

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ACTION ITEM: DEVIATION ALARM SHOULD PROVIDE INDICATION OF ABNORMAL FLOW CONDITION.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0008-1-2	FLOW-NO	LINE RUPTURE	LOSS OF FLOW TO INDIVIDUAL INJECTOR, RELEASE OF BASIN F FLUID INTO WORK AREA	C

COMMENTS: MOST LIKELY RUPTURE LOCATION AT FLEXIBLE HOSE NEAR INJECTOR

ACTION: (1)PROPER MAINTENANCE AND CHECKS OF HOSE SHOULD BE EMPHASIZED.(2) RECOMMEND ADDING TRENDING CAPABILITY FOR PIT-27A/E AND PIT-18A/E AND PIT-45A/E.

AUDIT NOTES: RESPONSE: WESTON 22/21/92 REPORT, (1) AGREED, O&M MAUNAL WILL INCLUDE INSPECTION PROCEDURES.(2) TRENDING CAN BE PROVIDED BUT NOT REQUIRED. HIGH AND LOW ALARMS AND ACTUAL FEED RATE IS BEING MONITORED FOR ALL INJECTORS. REV 7 OF THER P&ID INCLUDES DEVIATION ALARMS.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0008-1-3	FLOW-NO	INADVERTANT VALVE CLOSURE OR (FV-22A/E) CLOSURE DUE MECHANICAL FAILURE OR LOSS OF INSTRUMENT AIR AND OPERATOR ERROR	LOSS OF FLOW TO AN INJECTOR(S)	A

COMMENTS:

ACTION:

AUDIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
ACTION ITEM: O&M MANUAL SHOULD PROVIDE VALVE POSITIONING PROCEDURES.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0008-2-1	FLOW-MORE	INSTRUMENT FAILURE OR OPERATOR ERROR OR OPEN BYPASS ON VALVE 322A/E	IMPROPER OPERATION OF INCINERATOR, LOW OXYGEN, HIGH CO, REDUCED COMBUSTION EFFICIENCY	B

COMMENTS:

ACTION: (1) REC. ADDING HIGH FLOW ALARM ON INDIVIDUAL CONTROLLERS FIC-22A/E.(2) REC. REEVALUATION OF LOCKOUT ON BYPASS VALVES ASSOCIATED WITH THESE CONTROL VALVES

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT: (1) ALARMS HAVE BEEN ADDED (2) AGREED, A LOCK OUT MECHANISM WILL BE PROVIDED.
RESPONSE: WESTON 2/21/92 REPORT, ALARMS ADDED ON REV.7 OF THE P&ID AS FAH-22A/E.(2) AGREED A LOCK OUT MECHANISM WILL BE PROVIDED ON THE CONTROL

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VALVE BYPASSES.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0008-3-1	FLOW-LESS	SAME AS NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0008-4-1	FLOW-AS WELL AS	FAILURE OF VALVE XV-22A/E	REDUCED BASIN F FLOW TO INDIVIDUAL INJECTOR(S)	A

COMMENTS: LOSS OF COMBUSTION EFFICIENCY ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0008-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0008-6-1	FLOW-OTHER THAN	MANUAL AIR PURGE VALVE INADVERTANTLY LEFT OPEN	LOSS OF FLOW TO INJECTOR(S)	A

COMMENTS: FIT-22A/E WOULD DETECT ACTION: O&M MANUAL SHOULD INCLUDE TROUBLESHOOTING CHECKLIST TO CHECK AIR PURGE VALVES IF FIT-22A/E OPERATING ERRATICALLY

AUDIT NOTES: HAZOP TEAM: MEETING 11/91 NOTES, O&M MANUAL INCLUDE A TROUBLE SHOOTING MECHANISM.

RESPONSE: WESTON 11/5/91 REPORT, AGREED
RESPONSE: WESTON 2/21/92 REPORT, AGREED, THE O&M MANUAL WILL INCLUDE TROUBLE SHOOTING CHECKLIST.

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0008-7-1	PRESSURE-NO	SAME AS NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0008-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0008-9-1	PRESSURE-LESS	SAME AS LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0008-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0008-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0008-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0008-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0008-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0008-15-1	COMPOSTION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0008-16-1	STARTUP/SHUTDOWN-OTHER THAN	FAILURE OF XV-66 TO OPEN ON SHUTDOWN	POSSIBLE PLUGGING OF LINE AND NOZZLE	B

COMMENTS: AIR PURGE SYSTEM AUTOMATICALLY OPERATES ON SHUTDOWN. VALVE LIMIT SWITCHES INDICATE POSITION. ACTION:

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AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0008-17-1	EMGCY SHUTDOWN-OTHER THAN			

COMMENTS:

ACTION: O&M MANUAL SHOULD STATE OPERATORS SHOULD CONFIRM THAT NOZZLES ARE CLEAR BEFORE RESTART.

AUDIT NOTES: HAZOP TEAM; MEETING 11/91 NOTES, (1) PULL OUT NOZZLES AND MANUALLY CHECK/INSPECT (2) FLOW WATER THRU, NEED ROUTINE CLEANING PROCEDURE FOR REMOVING NOZZLES DURING OPS (3) VIEW PORTS SHOULD BE INSTALLED.

RESPONSE: WESTON 11/5/91 REPORT; AGREED
2/21/92 REPORT STATES THE SAME REPONSE, IN O&M MANUAL.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0008-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : INLET TO SUB-X INCINERATOR
LINE OR EQUIPMENT DESIGNATION : T0009
LINE DESCRIPTION : ATOMIZING AIR TO NOZZLES
LINE/EQUIPMENT CONSIDERED : 3"-AU-205-N-C, 2"-AU-213-N-C, 3"-AU-206-N-C, 1"-AU-206A/E-N-C, 1"-AU-207A/E-N-U, C-201 ATOMIZING AIR COMPRESSOR
DRAWING DESIGNATION(S) : 32-03-713 SHEET 2 OF 6, REV. 5, 7/23/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0009-1-1	FLOW-NO	COMPRESSOR MALFUNCTION, LOSS OF POWER, RUPTURE OF PIPE/RECEIVER, INADVERTENT VALVE CLOSURE, PLUGGED AIR INLET	NO ATOMIZATION, SHUTDOWN OF WASTE FEED	

COMMENTS: IN THE EVENT THAT THE COMPRESSOR FAILS AND IS OUT OF SERVICE FOR A LENGTH OF TIME,(2) RMA MUST CONTRACT TO BRING IN SPARE COMPRESSED AIR SYSTEM TO CONTINUE OPERATION.

ACTION: (1)SEE COMBUSTION AIR RECOMMENDATION FOR AIR INLET SCREEN MAINTENANCE.

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DIT NOTES: RESPONSE TO COMMENT: WESTON 11/5/91 REPORT;(1) AGREED(2) AGREED
RESPONSE:WESTON 2/21/92 REPORT: (1) AGREED, THE O&M MANUAL WILL INCLUDE INLET SCREEN MAINTENANCE PROCEDURES (2) AGREED, DESIGN INCLUDES CONNECTIONS FOR RENTED COMPRESSOR.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
009-2-1	FLOW-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

DIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
009-3-1	FLOW-LESS	SEE NO FLOW	DEVIATION ALARM AND WASTE FEED SHUTDOWN.	B

OMMENTS: ACTION:

AUDIT NOTES:

NE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
009-4-1	FLOW-AS WELL AS	FAILURE OF XV-21A/E.	INTRODUCTION OF STEAM INTO ATOMIZING AIR IF STEAM LINE IS CHARGED. POSSIBLE RESULT IS POOR COMBUSTION EFFICIENCY.	A

OMMENTS: SHOULD BE AN INDICATION OF THE DEVIATION ALARM ON THE AIR FLOW. ACTION:

DIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0009-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0009-6-1	FLOW-OTHER THAN	MALFUNCTION OF VALVE XV-66, MAIN AIR PURGE	COMPRESSED AIR ENTERS WASTE FEED LINE, AIR PRESSURE WILL CUT OFF WASTE FEED	B

COMMENTS: FIT-22A/E SHOULD SHOW ERRATIC FLOW READINGS TO INDICATE WASTE FEED CUTOFF. DEVIATION ALARM ON FIT-15A/E. ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0009-7-1	PRESSURE-NO	SEE NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0009-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0009-9-1	PRESSURE-LESS	SEE LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0009-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0009-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0009-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0009-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0009-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0009-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0009-16-1	STARTUP/SHUTDWN-OTHER THAN	SEE LINE T0008, T0006.		

COMMENTS: OPERATION OF VALVE XV-66 AND XV-26 ARE INTERRELATED AND SHOULD BE PROPERLY INTERLOCKED. ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0009-17-1	EMERGENCY SD-OTHER THAN	POWER LOSS OR OPERATOR INITIATED SHUTDOWN	IF COMPRESSOR STOPS OPERATION, COOLING AIR DOES NOT FLOW TO NOZZLES, REDUCED LIFE OF EQUIPMENT.	B

COMMENTS: COMPRESSOR IS ASSUMED TO CONTINUE TO RUN ON EMERGENCY SHUTDOWN. ACTION: DETERMINE THAT COMPRESSOR IS SET UP TO CONTINUE TO RUN UPON SHUTDOWN

AUDIT NOTES: RESPONSE:WESTON 2/21/92 REPORT: THERE IS NO FLYWHEEL EFFECT ON THIS TYPE OF COMPRESSOR, HOWEVER, THE RECEIVER TANK WILL PROVIDE ENOUGH BACKUP AIR TO COOL THE NOZZLES.

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0009-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : WASTE FEED TO INCINERATOR
LINE OR EQUIPMENT DESIGNATION : T0010
LINE DESCRIPTION : HOT WATER FOR PURGING WASTE LINE
LINE/EQUIPMENT CONSIDERED : 1-WT-707-E-D,1-WT-707-H-D,2-WT-216-H-D,1-WT-217A/E-H-D,H-201,INDIVIDUAL WASTE FEED LINES,1-WT-708-E-D,P-212,TK-206
DRAWING DESIGNATION(S) : 03-04-009 REV 0 (9/14/90) 32-03-713-D SHEET 2 OF 6 (7/23/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0010-1-1	FLOW-NO	PUMP FAILURE, INADVERTANT VALVE CLOSURE	NOT ABLE TO PURGE WASTE LINE, POSSIBLE LOSS OF WASTE FLOW	A

COMMENTS: INDICATION OF PROBLEM WOULD BE LACK OF FLOW INDICATION ON FIT-22A/E DURING PURGE OPERATION ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0010-1-2	FLOW-NO	LINE RUPTURE	SAME AS 1-1 PLUS HOT WATER RELEASED TO WORK AREA	A

COMMENTS: SAME AS 1-1 ACTION: RECOMMEND MANUAL ON/OFF CONTROL OF PUMP BE ADDED (LOCAL AND REMOTE)

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; ALL PUMPS HAVE LOCAL AND REMOTE CAPABILITY.
2/21/92 REPORT STATES SAME REPONSE.

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0010-2-1	FLOW-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0010-3-1	FLOW-LESS	SAME AS NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0010-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0010-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0010-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0010-7-1	PRESSURE-NO	SAME AS NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0010-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0010-9-1	PRESSURE-LESS	SAME AS LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0010-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0010-11-1	TEMPERATURE-LESS	HEATER INADEQUATELY SIZED	REDUCED EFFICIENCY OF FLUSHING	A

COMMENTS: ACTION: REVIEW SIZING OF HEATER AND TEMPERATURE REQUIREMENTS

AUDIT NOTES: HAZOP TEAM: MEETING 11/91 NOTES; WESTON IS WORKING ON THE PROBLEM

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RESPONSE: WESTON 11/5/91 REPORT; HEATER MUST BE CAPABLE OF SUPPLING 175 DEGREE F WATER TO NOZZLES FOR FLUSHING.
2/21/92 REPONSE SAME AS ABOVE

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0010-11-2	TEMPERATURE-LESS	HEAT TRACING FAILURE	FREEZING IN LINE, INSUFFICIENT FLOW	A

COMMENTS: SEE COMMENT ON LINE T0006 FOR HEAT TRACING ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0010-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0010-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0010-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0010-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0010-16-1	STARTUP/SHUTDWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0010-17-1	EMGCY SHUTDOWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0010-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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HAZOP STUDY IDENTIFIER : WASTE FEED SYSTEM
LINE OR EQUIPMENT DESIGNATION : T0011
LINE DESCRIPTION : ATOMIZING STEAM LINE
LINE/EQUIPMENT CONSIDERED : 3-ST-208-H-E,3-ST-209-H-E,1-ST-209-A/E-H-E,1-ST-210A/E-H-E,1-ST-215A/E-H-E,1-CS-215B,
DRAWING DESIGNATION(S) : 32-03-713-D SHEET 2 OF 6 REV 5 (7/23/91); 03-04-014 (UNAVAILABLE AT HAZOP)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0011-1-1	FLOW-NO	BOILER NOT OPERATING, INADVERTANT VALVE CLOSURE,	LOSS OF ATOMIZATION - IF BEING USED; LOSS OF PURGING	A

COMMENTS: LOSS WOULD BE INDICATED BY PIT-45A/E OR FLOW FIT-76A/E ACTION: RECOMMEND DEVIATION ALARM TO FIT-76A

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; AGREED, DEVIATION ALARM HAS BEEN PROVIDED.
RESPONSE: 2/21/92, ALARM PROVIDED ON REV.7 OF THE P&ID AS FSD-76A/E.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0011-1-2	FLOW-NO	LINE RUPTURE	SAME AS 1-1 PLUS RELEASE OF STEAM TO WORK AREA	C

COMMENTS: ACTION: SAME AS 1-1

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; SAME LINE 1-1

WESTON 2/21/92 STATES SAME AS LINE 1-1

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0011-2-1	FLOW-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0011-3-1	FLOW-LESS	SAME AS 1-1		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0011-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0011-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0011-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0011-7-1	PRESSURE-NO	SAME AS NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0011-8-1	PRESSURE-MORE	BOILER CONTROL MALFUNCTION	UNKNOWN	

COMMENTS: ACTION: NEED TO REVIEW BOILER SYSTEM AND ITS CONTROLS TO DETERMINE CONSEQUENCES - DRAWING 03-04-014

AUDIT NOTES: HAZOP TEAM: MEETING 11/91 NOTES; SYSTEM HAS BEEN ORDER, WESTON HAS NOT SEEN DRGS., STEAM IS NOT CRITICAL CONTROL.
HAZOP TEAM STILL NEEDS TO COMPLETE REVIEW DRGS. WHEN AVAILABLE.

RESPONSE: WESTON 2/5/92 SUMMARY REPORT; P&IDS STILL NOT AVAILABLE
WESTON 2/21/92 REPORT STATES SAME

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0011-9-1	PRESSURE-LESS	SAME AS LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0011-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0011-11-1	TEMPERATURE-LESS	SAME AS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0011-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0011-13-1	COMPOSTION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0011-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0011-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0011-16-1	STARTUP/SHUTDWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0011-17-1	EMGCY SD-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0011-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : SQI WASTE FEED SYSTEM
LINE OR EQUIPMENT DESIGNATION : T0012
LINE DESCRIPTION : WASTE RECYCLE LINE
LINE/EQUIPMENT CONSIDERED : 2-WK-202-E-U,1 1/2-WK-202-E-U,2-WK-211-E-U,TK-105,TK-106
DRAWING DESIGNATION(S) : 32-03-713-D SHEET 2 OF 6 REV 5 (7/23/91); 03-04-001 REV 0 (7/31/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0012-1-1	FLOW-NO	LINE RUPTURE	RELEASE OF BASIN F FLUID INTO WORK AREA	C

COMMENTS: (2)CONTROL VALVE (PCV-28) SHOULD BE AS CLOSE TO T-THERMAL PIPE RACK AS POSSIBLE.(3) NO INDICATION AVAILABLE IF RUPTURE IS DOWNSTREAM OF PCV-28.

ACTION: (1)ADD HIGH/LOW FLOW ALARM TO FI-04B.

AUDIT NOTES: RESPONSE: WESTON 2/21/92 REPORT: AGREED, HIGH/LOW FLOW ALARM WAS ADDED ON REV.7 OF THE P&ID AS FAH-04B AND FAL-04B. (2) PVC-28 IS DESIGNED TO BE AS CLOSE ACCESS AND AISLE SPACE REQUIREMENTS PERMIT.(3) ROUTINE LINE INSPECTIONS WILL BE PERFORMED DAILY.

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0012-1-2	FLOW-NO	INADVERTANT VALVE CLOSURE, LOSS OF AIR, LINE PLUGGING	LOSS OF PRESSURE CONTROL ON T0006;	A

COMMENTS: SAME AS 1-1 ACTION: SAME AS 1-1

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0012-2-1	FLOW-MORE	PLUGGING IN T0006	FLOW DIVERTED TO RECIRC LINE. INADEQUATE FEED TO INCINERATOR.	A

COMMENTS: ACTION: SAME AS 1-1

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0012-3-1	FLOW-LESS	SAME AS NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0012-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0012-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0012-6-1	FLOW-OTHER THAN			

COMMENTS: REFER TO TANK TK-105 AND TK-106 OPERATION ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0012-7-1	PRESSURE-NO	SAME AS NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0012-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0012-9-1	PRESSURE-LESS	SAME AS LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0012-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0012-11-1	TEMPERATURE-LESS	REFER TO LINE T0006		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0012-12-1	COMPOSITION-MORE	SAME AS LINE T0006		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0012-13-1	COMPOSITION-LESS	SAME AS LINE T0006		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0012-14-1	COMPOSITION-AS WELL AS	SAME AS LINE T0006		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0012-15-1	COMPOSITION-OTHER THAN	SAME AS LINE T0006		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0012-16-1	STARTUP/SHUTDWN-OTHER THAN			

COMMENTS: REFER TO OPERATION OF TK-105 AND TK-106 ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0012-17-1	EMGCY SD-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0012-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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HAZOP STUDY IDENTIFIER : SUB X INCINERATOR
LINE OR EQUIPMENT DESIGNATION : T0013
LINE DESCRIPTION : BURNER
LINE/EQUIPMENT CONSIDERED : BURNER LV-24
DRAWING DESIGNATION(S) : 32-03-713-D REV 5 (7/23/91); 17-24-325D REV 1 (3/2/91); 6-02-3796-B

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0013-1-1	FLOW-NO	LOSS OF COMBUSTION AIR OR NATURAL GAS FEED	INCINERATOR SHUT DOWN	B

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0013-2-1	FLOW-MORE	LOSS OF CONTROL OF COMBUSTION AIR AND/OR NATURAL GAS	INEFFICIENT OPERATION, POSSIBLE SHUT DOWN	B

COMMENTS: SEE TO LINES T0001 AND T0003 ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0013-3-1	FLOW-LESS	SEE 2-1		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0013-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0013-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0013-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0013-7-1	PRESSURE-NO	SAME AS NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0013-8-1	PRESSURE-MORE	LOSS OF CONTROL OF VENTURI; HIGH WATER LEVEL IN QUENCH TANK; PLUGGAGE IN SCRUBBER TOWER PACKING; HIGH WATER LEVEL IN SCRUBBER	POOR BURNER OPERATION, INEFFICIENT OPERATION OF INCINERATOR	.8

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0013-9-1	PRESSURE-LESS	LOSS OF VENTURI CONTROL; LOW WATER LEVEL IN QUENCH	INEFFICIENT BURNER OPERATION, POSSIBLE SYSTEM SHUTDOWN	B

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0013-10-1	TEMPERATURE-MORE	SEE LINE T0003		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0013-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0013-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0013-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0013-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0013-15-1	COMPOSITION-OTHER THAN	IMPROPER CONTROL OF NATURAL GAS OR COMBUSTION AIR	IMPROPER AIR/FUEL RATIO; INEFFICIENT BURNER OPERATION; POSSIBLE SYSTEM SHUTDOWN	B

COMMENTS: OPERATOR TRAINING SHOULD PAY SPECIAL ATTENTION TO IMPORTANCE OF A/F RATIO
ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0013-16-1	STARTUP/SHUTDWN-OTHER THAN	REFER TO T0003 AND T0001		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0013-17-1	EMGCY SHUTDOWN-OTHER THAN	SAME AS 16-1		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0013-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : SUB-X INCINERATOR
LINE OR EQUIPMENT DESIGNATION : T0014
LINE DESCRIPTION : INCINERATOR CHAMBER
LINE/EQUIPMENT CONSIDERED : INCINERATOR SHELL AND REFRACTORY IN-201
DRAWING DESIGNATION(S) : 32-03-713D SHEET 1 OF 6, REV 5, 7/23/91, 6-02-3793-D SHEET 1 AND 2 REV 2, 6-02-3794-D SHEETS 1 AND 2, 6-02-3795-D SHEETS 1, 2, AND 3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0014-1-1	FLOW-NO	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0014-2-1	FLOW-MORE	EXCESSIVE FEED RATES, ALL FEED SYSTEMS	RESIDENCE TIME SPECIFICATION NOT MET, POSSIBLE EMISSIONS PROBLEM	B

COMMENTS: ACTION:

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AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0014-3-1	FLOW-LESS	EXCEEDING DESIGN TURNDOWN CONDITIONS	IMPROPER OPERATION, SURGING OF COMBUSTION GASES, POOR COMBUSTION, POSSIBLE SYSTEM SHUTDOWN	B

COMMENTS: DESIGN TURNDOWN IS 2:1 FOR THE INCINERATOR CHAMBER ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0014-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0014-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0014-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0014-7-1	PRESSURE-NO	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0014-8-1	PRESSURE-MORE	LOSS OF VENTURI CONTROL, HIGH LEVEL OF QUENCH TANK, CLOGGED SCRUBBER PACKING, HIGH WATER LEVEL IN SCRUBBER	DESIGN CONDITIONS FOR RESIDENCE TIME NOT MET	A

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0014-9-1	PRESSURE-LESS	LOSS OF VENTURI CONTROL, LOW WATER LEVEL IN QUENCH TANK	DESIGN RESIDENCE TIME NOT MET	A

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0014-10-1	TEMPERATURE-MORE	IMPROPER OPERATION OF CONTROL SYSTEM	DECREASED REFRACTORY LIFE	B

COMMENTS: SYSTEM SHUTDOWN WILL OCCUR UPON REACHING HIGH REFRACTORY TEMPERATURE LIMIT. ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0014-11-2	TEMPERATURE-LESS	LOSS OF CONTROL	SHUTDOWN OF WASTE FEED TO UNIT	B

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0014-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0014-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0014-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0014-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0014-16-1	STARTUP/SHUTDWN-OTHER THAN	NO CONSEQUENCE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0014-17-1	EMERGENCY SD-OTHER THAN	EXCESSIVE NUMBER/FREQUENCY OF EMERGENCY SHUTDOWNS	DECREASED REFRACTORY LIFE	B

COMMENTS: EXCESSIVE SHUTDOWNS WILL AFFECT REMEDIATION SCHEDULE DUE TO LOSS OF EFFICIENCY AND NECESSITY OF CHANGING OUT REFRACTORY. T-THERMAL RECOMMENDS SPARING ENTIRE REFRACTORY LINING. ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0014-18-1	MAINTENANCE-OTHER THAN	LEAKS FROM FLANGES, ETC DUE TO LOSS OF INTEGRITY OF SEALS.	FUGITIVE EMISSIONS	C

COMMENTS: HEALTH AND SAFETY PLAN IS NOT AVAILABLE AT THIS TIME. SHOULD ADDRESS THE POSSIBILITY OF FUGITIVE EMISSIONS. ACTION: O&M MANUAL SHOULD ADDRESS THIS ISSUE.

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; AGREED
WESTON 2/21/92 REPORT,O&M MANUAL CONTAINS ROUTINE INSPECTIONS PROCEDURES.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0014-18-2	MAINTENANCE-OTHER THAN	LOSS OF REFRACTORY	LOCALLY HIGH SHELL TEMPERATURES.	B

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
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CA_HAZOP VER 1.3

HAZOP STUDY IDENTIFIER : SUB-X INCINERATOR
LINE OR EQUIPMENT DESIGNATION : T0015
LINE DESCRIPTION : WASTE INJECTORS
LINE/EQUIPMENT CONSIDERED : WASTE INJECTORS
DRAWING DESIGNATION(S) : 32-03-713D REV 5, SHEET 1 OF 6, 7/31/91, 6-02-3820-C REV 1, 3/22/91;

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0015-1-1	FLOW-NO	NOZZLE PLUGGING	LOSS OF FEED TO INCINERATOR, INEFFICIENT OPERATION	B

COMMENTS: PLANNED MAINTENANCE INCLUDES FLUSHING, PURGING, CHANGING NOZZLE TIPS. REPLACEMENT/MAINTENANCE ALTERNATIVES ARE PLANNED. CONTINGENCY PLAN FOR NOZZLE PLUGGING EXISTS

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0015-2-1	FLOW-MORE	LOSS OF NOZZLE TIP	INEFFICIENT OPERATION, HIGH EMISSION RATE FROM STACK	B

COMMENTS: PLANNED INSPECTION AND MAINTENANCE. SEE NO FLOW COMMENTS.

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0015-3-1	FLOW-LESS	SEE NO FLOW.		

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0015-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0015-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0015-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0015-7-1	PRESSURE-NO	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0015-8-1	PRESSURE-MORE	SEE NO OR LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0015-9-1	PRESSURE-LESS	LOSS OF NOZZLE TIP OR LOW FLOW.	INEFFICIENT OPERATION	

COMMENTS: PLANNED MAINTENANCE SCHEDULE SHOULD AVERT PROBLEM. ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0015-10-1	TEMPERATURE-MORE	INSUFFICIENT COMBUSTION AIR OR ATOMIZING AIR/STEAM FLOW DURING SHUTDOWN	POTENTIAL NOZZLE DAMAGE.	A

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0015-11-2	TEMPERATURE-LESS	NO CONSEQUENCE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0015-12-1	COMPOSITION-MORE	STRATIFICATION OF BASIN F WASTE IN TANK	GREATER TENDENCY TOWARD PLUGGING	B

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0015-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0015-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0015-15-1	COMPOSITION-OTHER THAN	IMPROPER RATIO OF WASTE TO ATOMIZING AIR OR COMBUSTION AIR.	INEFFICIENT COMBUSTION OF WASTE	A

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0015-16-1	STARTUP/SHUTDWN-OTHER THAN	SEE TEMPERATURE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0015-17-1	EMERGENCY SD-OTHER THAN	SEE TEMPERATURE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0015-18-1	MAINTENANCE-OTHER THAN	SEE COMMENTS UNDER FLOW/TEMPERATURE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : SUB-X INCINERATOR
LINE OR EQUIPMENT DESIGNATION : T0016
LINE DESCRIPTION : INCINERATOR QUENCH TANK
LINE/EQUIPMENT CONSIDERED : Q-201 INCINERATOR QUENCH TANK
DRAWING DESIGNATION(S) : 32-03-713D SHEET 3 OF 6 REV 5, 7/23/91, 6-02-3793-D REV 2, 15-02-526-D REV 0

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0016-1-1	FLOW-NO	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0016-2-1	FLOW-MORE	MORE FLOW OF COMBUSTION GAS DUE TO LOSS OF CONTROL OF FEED STREAMS	EXCESSIVE AGITATION IN QUENCH TANK, POTENTIAL DAMAGE TO EXPANSION JOINT BETWEEN INCINERATOR AND QUENCH TANK, INCREASED VIBRATION POSSIBLE	B

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COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0016-3-1	FLOW-LESS	NO CONSEQUENCE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0016-4-1	FLOW-AS WELL AS	SEE MAINTENANCE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0016-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0016-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0016-7-1	PRESSURE-NO	NO CONSEQUENCE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0016-8-1	PRESSURE-MORE	LOSS OF CONTROL OF VENTURI, HIGH WATER LEVEL IN TANK, PLUGGED SCRUBBER PACKING	POSSIBLE FAILURE OF EXPANSION JOINT BETWEEN INCINERATOR AND QUENCH TANK	C

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0016-9-1	PRESSURE-LESS	NO CONSEQUENCE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0016-10-1	TEMPERATURE-MORE	LOSS OF QUENCH WATER OR INSUFFICIENT QUENCH WATER IN TANK	DAMAGE TO LINING OF TANK AND EXPANSION JOINT, POTENTIAL HAZARDOUS RELEASE OF HOT GASES	C

COMMENTS: REDUNDANT LEVEL AND TEMPERATURE ALARMS ON SEPARATOR ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0016-10-2	TEMPERATURE-MORE	PLUGGING OF RETURN LINE FROM SEPARATOR TO QUENCH TANK OR SOLIDS ACCUMULATION IN QUENCH TANK	POTENTIAL DAMAGE TO QUENCH TANK AND EXPANSION JOINT WITH RELEASE OF HOT GASES	C

COMMENTS: UNLIKELY TO OCCUR; SEPARATOR ALARMS MAY NOT DETECT HIGH TEMPERATURE/LOW LEVEL IN QUENCH TANK UNDER THIS CONDITION

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0016-11-1	TEMPERATURE-LESS	NO CONSEQUENCE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0016-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0016-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0016-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0016-15-1	COMPOSITION-OTHER THAN	SOLIDS ACCUMULATION	SEE MORE TEMPERATURE	C

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0016-16-1	STARTUP/SHUTDWN-OTHER THAN	NO CONSEQUENCE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0016-17-1	EMERGENCY SD-OTHER THAN	SEE EMERGENCY SD FOR RECYCLE LINE FOR PUMPS P-202A/B		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0016-18-1	MAINTENANCE-OTHER THAN	CORROSION OR IMPROPER INSTALLATION OF HEAT SHIELD ITEM 9 ON DWG 6-02-3793D SHEET 2 OF 2, REV 2.	SHORTENED LIFE OF EXPANSION JOINT	

COMMENTS: ACTION: HEAT SHIELD SHOULD BE INSTALLED PROPERLY AND INSPECTED PERIODICALLY DURING SCHEDULED OUTTAGE.

AUDIT NOTES: HAZOP TEAM: MEETING 11/91 NOTES, INSPECTIONS DURING SCHEDULED MAJOR SHUTDOWNS

RESPONSE: WESTON 11/5/91 REPORT; AGREED
WESTON 2/21/92 REPORT, O&M MANUAL WILL INCLUDE

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0016-19-1	LEVEL-NO	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0016-20-1	LEVEL-MORE	LOSS OF CONTROL ON MAKEUP WATER OR SCRUBBER BLOWDOWN	HIGH AGITATION CAUSING POTENTIAL DAMAGE TO EXPANSION JOINT AND OTHER EQUIPMENT	C

COMMENTS: SAFEGUARDS IN DESIGN ARE IN PLACE. ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0016-21-1	LEVEL-LOW/NO	SEE MORE TEMPERATURE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0016-21-2	LEVEL-LOW	LEAK OR TANK RUPTURE	RELEASE OF HOT GASES AND HIGH TEMPERATURE LIQUIDS INTO ENVIRONMENT	C

COMMENTS:

ACTION: DETERMINE WHETHER CONTAINMENT BERMS EXIST AND WHETHER TANK IS BELOW GRADE.

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; CONTAINMENT BERNS DO NOT EXIST, HOWEVER TANKS ARE BELOW GRADE
WESTON 2/21/92 REPORT STATES SAME

HAZOP STUDY IDENTIFIER : CAUSTIC FEED SYSTEM (20%)
LINE OR EQUIPMENT DESIGNATION : T0017
LINE DESCRIPTION : CAUSTIC SOLUTION TO FEED PUMPS (P-208A/B)
LINE/EQUIPMENT CONSIDERED : 3-XB-012-E-D,3-XB-306-E-R,3-XB-306A-E-R,3-XB-306-E-R,TK-205,P-208A/B
DRAWING DESIGNATION(S) : 03-04-009 REV 0 (7/31/91); 32-03-713-D SHEET 3 OF 6 REV 5 (7/23/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0017-1-1	FLOW-NO	INADVERTANT VALVE CLOSURE,	NO CAUSTIC FEED, LOW pH IN QUENCH, REDUCED SCRUBBING EFFICIENCY, CORROSION POTENTIAL DUE TO ACID	A

COMMENTS:

ACTION:

AUDIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
ACTION ITEM: O&M MANUALS SHOULD INCLUDE PROPER VALVE POSITIONING

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0017-1-2	FLOW-NO	LINE BREAK	SAME AS 1-1 PLUS RELEASE OF CAUSTIC INTO CONTAINMENT AREA	C

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0017-2-1	FLOW-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0017-3-1	FLOW-LESS	SAME AS NO FLOW		

COMMENTS: ACTION:

UDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0017-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

UDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0017-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0017-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

UDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0017-7-1	PRESSURE-NO	SAME AS NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0017-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0017-9-1	PRESSURE-LESS	INADVERTANT VALVE POSITIONING, LINE LEAK, FREEZING IN LINE	CAVITATION OF PUMP, LOSS OF CAUSTIC FEED	B

COMMENTS: RECOMMEND REVIEW OF PUMP NPSH CALCS ACTION:

AUDIT NOTES: RESPONSE TO COMMENT: WESTON 11/5/91 REPORT; P-208 REQUIRES 4 FEET; A MINIMUM OF 30 FEET IS AVAILABLE
WESTON 2/21/92 REPORT SAME AS 11/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0017-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0017-11-1	TEMPERATURE-LESS	LOSS OF HEAT TRACING	LOSS OF CAUSTIC FEED, POSSIBLE CAVITATION OF PUMP DUE TO INCREASE IN VISCOSITY	B

COMMENTS: SEE T0006 RE COMMENTS ON HEAT TRACING ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0017-12-1	COMPOSITION-MORE	INCREASE IN VISCOSITY DUE TO HIGHER CONCENTRATION	POSSIBLE PUMP CAVITATION; LOSS OF CAUSTIC FLOW	B

COMMENTS: SEE STUDY NODE FOR TK-205 FOR IMPROPER CAUSTIC CONCENTRATION ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0017-13-1	COMPOSITION-LESS	NO CONSEQUENCE TO THIS LINE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0017-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0017-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0017-16-1	STARTUP/SHUTDWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0017-17-1	EMGCY SD-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0017-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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AUDIT TRAIL SUMMARY REPORT
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HAZOP STUDY IDENTIFIER : CAUSTIC FEED SYSTEM
LINE OR EQUIPMENT DESIGNATION : T0018
LINE DESCRIPTION : CAUSTIC FEED TO QUENCH TANK
LINE/EQUIPMENT CONSIDERED : 2-XB-306A-E-R,2-XB-306B-E-R,3-XB-306-E-R,2-XB-306-E-R,1-XB-306-N-R,1 1/2-XB-306-N-R,1-XB-309-N-R,1 1/2-XB-306-E-R,P-208A/B,TERMINATES AT 3-BR-501-N-K (SCRUBBER BLOWDOWN TO QUENCH TANK)
DRAWING DESIGNATION(S) : 32-03-713-D REV 5 SHEET 3 OF 6 (7/23/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0018-1-1	FLOW-NO	INADVERTANT VALVE CLOSURE, PUMP FAILURE, LOSS OF POWER, LOSS OF INSTRUMENT AIR	SAME AS T0017 FOR NO FLOW	B

COMMENTS: pH INSTRUMENTATION (AIC-64) WOULD DETECT THIS PROBLEM ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0018-1-2	FLOW-NO	LINE RUPTURE	SAME AS T0017 - NO FLOW (1-1) PLUS RELEASE OF CAUSTIC SOLUTION INTO WORK AREA	C

COMMENTS: ACTION: RECOMMEND ADDING CHECK VALVE AND PRESSURE SWITCH AT TERMINAL POINT OF LINE

AUDIT NOTES: HAZOP TEAM: MEETING 11/91 NOTES; WESTON DOES NOT FEEL A CHECK VALVE WOULD HELP.

RESPONSE: WESTON 11/5/91 REPORT; NO, ROUTINE CHECKS ARE PERFORMED DAILY TO CHECK FOR LINE RUPTURE AND UNPLANNED RELEAES.
RESPONSE:WESTON 2/21/92, ALSO A CHECK VALVE CAN BE ADDED.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0018-2-1	FLOW-MORE	LOSS OF CONTROL OF ACV-64; LOSS OF FLOW IN LINE CAUSTIC RECYCLE LINE TO STORAGE TANK	HIGH pH IN QUENCH TANK AND BLOWDOWN; POSSIBLE PRECIPITATION OF SOLIDS	A

COMMENTS: ACTION:

DIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0018-3-1	FLOW-LESS	SAME AS LESS FLOW FOR T0017		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0018-4-1	FLOW-AS WELL AS			

COMMENTS: ACTION: RECOMMEND ADDITION OF INTERLOCK 65 TO ACV-64 AND INTERLOCK TO LOSS OF PUMPS P-202A/B.

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; AGREED, INTERLOCK 65 HAS BEEN ADDED.
RESPONSE: WESTON 2/21/92 REPORT, ALSO FSHH-41 HAVE BEEN ADDED.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0018-5-1	FLOW-REVERSE	NO CONSEQUENCE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0018-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0018-7-1	PRESSURE-NO	SAME AS NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0018-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0018-9-1	PRESSURE-LESS	SAME AS LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0018-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0018-11-1	TEMPERATURE-LESS	SEE LINE T0017		

COMMENTS: PART OF PIPING IS INDOORS ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0018-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0018-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0018-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0018-15-1	COMPOSITION-OTHER THAN	SAME AS T0017		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0018-16-1	STARTUP/SHUTDWN-OTHER THAN	NON SEQUENCED POSITIONING OF VALVE XV-23 WITH ASSOCIATED PUMP (P-208A/B)	SAME AS NO FLOW	

COMMENTS: (1)PUMP P-208A/B SHOULD BE OPERATING AND FLOW PROVEN AT FE-41 PRIOR TO INTRODUCTION OF WASTE.

ACTION: (2)RECOMMEND EVALUATION OF ADDING INTERLOCK TO SHUT DOWN INCINERATOR IF LOSE CAUSTIC FLOW

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(FISL-41).

AUDIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
ACTION ITEMS: INCINERATOR WILL TERMINATE WASTE FEED IF SCRUBBING pH IS NOT WITHIN PERMIT LIMITS.
RESPONSE: WESTON 2/21/92 REPORT, (1)THIS HAS BEEN PROVIDED FOR IN THE CONTROL LOGIC. REFERENCE INTERLOCK 66 ON THE INTERLOCK MATRIX (2) FISLL-41 HAS BEEM ADDED TO THE INTERLOCKS

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0018-17-1	EMGCY SD-OTHER THAN	FAILURE OF VALVE ACV-64 TO CLOSE PROPERLY.	UNCONRTOLLED RELEASE OF CAUSTIC INTO QUENCH TANK AND POSSIBLE RELEASE OF CAUSTIC THROUGH OVERFLOW OF QUENCH TANK.	

COMMENTS: (1)OPERATOR SHOULD VERIFY CLOSURE OF THIS VALVE AFTER BOTH EMERGENCY AND NORMAL SHUTDOWN. (THIS BELONGS TO T0018 ITEM 16-2)

ACTION: (2)COMFIRM WHETHER HEAT TRACING IS ON EMERGENCY POWER SUPPLY

AUDIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
NOTE TO ACTION ITEM: 20% CAUSTIC SODA DOES NOT REQUIRE HEAT TRACING.
RESPONSE:WESTON 2/21/92 REPORT, (1)PROOF OF CLOSURE LIMIT SWITCHES ARE INCLUDED ON ALL CRITICAL VALVES (2) ALL HEAT TRACING IS INCLUDED ON THE EMERGENCY POWER SUPPLY.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0018-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

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HAZOP STUDY IDENTIFIER : CAUSTIC FEED SYSTEM
LINE OR EQUIPMENT DESIGNATION : T0019
LINE DESCRIPTION : CAUSTIC RECYCLE
LINE/EQUIPMENT CONSIDERED : 2-XB-307-E-R,1-XB-307-E-R,1-XB-319-E-R BEGIN AT 2-XB-306-E-R AND TERMINATE AT TANK TK-205
DRAWING DESIGNATION(S) : 32-03-713-D REV 5 SHEET 3 OF 6 (7/23/91); 03-04-009 REV 0 (7/31/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0019-1-1	FLOW-NO	SAME AS NO FLOW FOR LINE T0018	INEFFICIENT MIXING IN TANK TK-205; POSSIBLE pH CONTROL PROBLEMS	A

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0019-1-2	FLOW-NO	LINE RUPTURE	SAME AS T0018	

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0019-2-1	FLOW-MORE	NO CONSEQUENCE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0019-3-1	FLOW-LESS	SAME AS NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0019-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0019-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0019-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0019-7-1	PRESSURE-NO	SAME AS T0018 - NO PRESSURE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0019-8-1	PRESSURE-MORE	SAME AS T0018		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0019-9-1	PRESSURE-LESS	SAME AS T0018		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0019-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0019-11-1	TEMPERATURE-LESS	SEE LINE T0018		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0019-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0019-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0019-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0019-15-1	COMPOSITION-OTHER THAN	SEE T0018		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0019-16-1	STARTUP/SHUTDWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0019-17-1	EMGCY SD-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0019-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : SCRUBBER RECYCLE LOOP
LINE OR EQUIPMENT DESIGNATION : T0020
LINE DESCRIPTION : SCRUBBER BLEED
LINE/EQUIPMENT CONSIDERED : 3-BR-501-H-K,2-BR-501-H-K,2-BR-502-H-K,3-BR-501-H-K,3-BR-501-N-K, BEGINS AT 6-BR-501-H-K AND ENDS AT TERMINUS OF CAUSTIC FEED LINE 1 1/2-XB-306-N-R
DRAWING DESIGNATION(S) : 32-03-713-D REV 5 SHEET 3 AND 5 OF 6 (7/23/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0020-1-1	FLOW-NO	INADVERTANT VALVE CLOSURE, INSTRUMENT AIR FAILURE; PUMP FAILURE (P-203A/B)	HIGH LEVEL IN SCRUBBER	A

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0020-1-2	FLOW-NO	LINE RUPTURE UPSTREAM OF CONTROL VALVE	LOSS OF WATER TO SCRUBBER AND VENTURI; RELEASE OFHOT SCRUBBER BLOWDOWN TO WORK AREA;	C

COMMENTS: ACTION:

AUDIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
ACTIN ITEM: LOW SCRUBBER FLOW WILL ALARM.

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0020-1-3	FLOW-NO	LINE RUPTURE DOWNSTREAM OF CONTROL VALVE	LOSS OF FLOW TO QUENCH TANK	A

COMMENTS: ALTERNATE MAKEUP WATER SUPPLY TO QUENCH TANK AVAILABLE ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0020-1-4	FLOW-NO	LINE RUPTURE DOWNSTREAM OF CONTROL VALVE	SPILL OF HOT (190F) SCRUBBER BLOWDOWN INTO WORK AREA	C

COMMENTS: ACTION: EVALUATE NEED FOR PRESSURE SWITCH TO INDICATE CONDITION

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; NO, ROUTINE LINE INSPECTIONS WILL NOTE SPILLS OF THIS TYPE.
WESTON 2/21/92 REPONSE IS THE SAME AS 11/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0020-2-1	FLOW-MORE	LOSS OF CONTROL OF FCV-62	INCREASED BLOWDOWN TO BRINE HOLDING TANKS	A

COMMENTS: ACTION:

AUDIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
ACTION ITEMS: CONSIDER FLOW INDICATOR IN LINE TO BRINE HOLDING TANKS (FLOW INDICATOR PROVIDED FOR QUENCH RECYCLE BLOWDOWN)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0020-3-1	FLOW-LESS	LOSS OF CONTROL VALVE OPERATION, INADVERTANT VALVE POSITIONING	LOSS OF LEVEL CONTROL IN SCRUBBER	A

COMMENTS: ACTION:

AUDIT NOTES:

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E/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
20-3-2	FLOW-LESS	LINE LEAK	SAME AS LINE RUPTURE	C

MMENTS:

ACTION:

IT NOTES:

E/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
20-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

MMENTS:

ACTION:

IT NOTES:

E/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
20-5-1	FLOW-REVERSE	NOT APPLICABLE		

MMENTS:

ACTION:

IT NOTES:

I/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

MENTS:

ACTION:

T NOTES:

/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0-7-1	PRESSURE-NO	SAME AS NO FLOW		

ENTS:

ACTION:

T NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0020-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0020-9-1	PRESSURE-LESS	LOSS OF PUMP P-203A/B; LOSS OF CONTROL ON FIC-60 AND/OR FIC-65	SAME AS LESS FLOW	A

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0020-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0020-11-1	TEMPERATURE-LESS	NO CONSEQUENCE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0020-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0020-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0020-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0020-15-1	COMPOSITION-OTHER THAN	NO CONSEQUENCE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0020-16-1	STARTUP/SHUTDOWN-OTHER THAN	VALVE FCV-62 FAILS TO CLOSE (FAIL SAFE POSITION) UPON INCINERATOR SHUTDOWN.	EMPTY BRINE FROM T-201 AND T-202 AND ASSOCIATED PIPING INTO QUENCH TANK CAUSING POSSIBLE OVERFLOW OF HOT BRINE INTO SUMP.	A

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COMMENTS: OPERATOR SHOULD CONFIRM PROPER CLOSURE OF THIS VALVE AFTER SHUTDOWN. ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0020-17-1	EMGCY SD-OTHER THAN	SEE NORMAL SHUTDOWN.		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0020-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ALL HOT SERVICE LINES SHOULD BE ADEQUATELY PROTECTED AND IDENTIFIED ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : SOFT WATER FEED SYSTEM
LINE OR EQUIPMENT DESIGNATION : T0021
LINE DESCRIPTION : SOFTENED DOMESTIC WATER TO QUENCH TANK
LINE/EQUIPMENT CONSIDERED : 2-WT-301A-E-D,2-WT-301B-E-D,2-WT-301-E-D,2-WT-301-H-D,1 1/2-WT-301-H-D,1 1/2 WT-303-H-D,2-WT-301-H-D,P-207A/B,QUENCH TANK D-201
DRAWING DESIGNATION(S) : 32-03-713-D REV 5 SHEET 3 OF 6 (7/23/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0021-1-1	FLOW-NO	LOSS OF PUMP, INADVERTANT VALVE CLOSURE, LOSS OF INSTRUMENT AIR	LOSS OF WATER FEED TO QUENCH TANK; SYSTEM SHUTDOWN	B

COMMENTS: ACTION:

AUDIT NOTES:

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NE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
021-1-2	FLOW-NO	LINE RUPTURE	SAME AS 1-1 PLUS RELEASE OF SOFT WATER	B

OMMENTS: IF UPSTREAM OF FIT-39 - GET ALARM AND SYSTEM SHUTDOWN; IF DOWNSTREAM OF FIT-39 - NO INDICATION AVAILABLE

ACTION: (1) INVESTIGATE NEED FOR PRESSURE SWITCH FOR LOSS OF FLOW INDICATION.(2) LOCATION WOULD BE BETWEEN UPR-7 AND QUENCH TANK

DIT NOTES: HAZOP TEAM: MEETING 11/91 NOTES; (2) WESTON DOES NOT AGREE ON MOVING LOCATION.

RESPONSE: WESTON 11/5/91 REPORT; (1) THE CURRENT MONITORING SYSTEM IS ADEQUATE. (2) NO WESTON RESPONSE.
WESTON 2/21/92 RESPONSE, (2) THERE IS NO NEED FOR A PRESSURE SWITCH.

NE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
021-2-1	FLOW-MORE	LOSS OF CONTROL OF FCV-39	DECREASED FLOW FROM SCRUBBER BLEED; LOSS OF CONTROL OF SCRUBBER LEVEL; INCREASED BLOWDOWN TO BRINE HOLDING TANKS	A

OMMENTS:

ACTION:

DIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
ACTION ITEMS: CONSIDER FLOW DEVIATION ALARM ON FIC-39.

NE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
021-3-1	FLOW-LESS	INADVERTANT VALVE POSITIONING	SEE NO FLOW	B

OMMENTS: IF FLOW FALLS BELOW SETPOINT OF FSLL-39 SYSTEM WILL SHUTDOWN

ACTION:

IT NOTES:

E/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
21-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

MENTS:

ACTION:

IT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0021-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0021-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0021-7-1	PRESSURE-NO	SAME AS NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0021-8-1	PRESSURE-MORE	SAME AS MORE FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0021-9-1	PRESSURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
1-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

MENTS: ACTION:

T NOTES:

/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
1-11-1	TEMPERATURE-LESS	LOSS OF HEAT TRACING	FROZEN PIPE AND LOSS OF WATER FEED	B

MENTS: ACTION:

T NOTES:

/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
1-12-1	COMPOSITION-MORE	NOT APPLICABLE		

MENTS: ACTION:

T NOTES:

/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
1-13-1	COMPOSITION-LESS	NOT APPLICABLE		

MENTS: ACTION:

T NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0021-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0021-15-1	COMPOSITION-OTHER THAN	WATER SOFTENER FAILURE	PRECIPITATION OF SOLIDS, PLUGGING OF LINES	A

COMMENTS: ACTION:

AUDIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
ACTION ITEMS: O&M MANUAL SHOULD INCLUDE PROPER PROCEDURES FOR SOFTENER OPERATION OF MAINTENANCE.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0021-16-1	STARTUP/SHUTDOWN-OTHER THAN	SEQUENCING OF VALVE (XV-37) WITH ASSOCIATED PUMP INCORRECT.	SAME AS NO FLOW	A

COMMENTS: ADEQUATE WATER PRESSURE IS A STARTUP PERMISSIVE ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0021-17-1	ENGCY SD-OTHER THAN	FAILURE OF XV-40 TO CLOSE ON SHUTDOWN.	OVERFLOW OF QUENCH TANK Q-201 INTO SUMP.	A

COMMENTS: LIMIT SWITCH ON VALVE CLOSURE SHOULD BE PROVEN UPON SHUTDOWN. ADD 16-2 FOR LINE T0021 AND REFER TO 17-1. ACTION:

AUDIT NOTES:

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/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
1-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

MENTS: ACTION:

T NOTES:

HAZOP STUDY IDENTIFIER : SCRUBBER RECYCLE AND CAUSTIC MAKEUP
LINE OR EQUIPMENT DESIGNATION : T0022
LINE DESCRIPTION : CAUSTIC AND SCRUBBER BLEED TO QUENCH TANK
LINE/EQUIPMENT CONSIDERED : 2-BR-501-N-K BEGINS AT INTERSECTION O 1 1/2-XB-306-N-R AND 3-BR-501-N-K, AND TERMINATES AT QUENCH TANK Q-201
DRAWING DESIGNATION(S) : 32-03-713-0 REV 5 SHEET 3 OF 6 (7/23/91)

I/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
2-1-1	FLOW-NO	LOSS OF FLOW FROM SCRUBBER RECYCLE AND/OR CAUSTIC SYSTEM	SAME AS T0018 AND/OR T0020	

MENTS: ACTION:

IT NOTES:

I/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
2-1-2	FLOW-NO	LINE RUPTURE	RELEASE OF HOT (>150F) CAUSTIC INTO WORK AREA	C

MENTS: ACTION: REVIEW PIPING RUN FOR SAFETY

T NOTES: HAZOP TEAM: MEETING 11/91 NOTES; SAFETY PLAN SHOULD ADDRESS THIS ISSUE, ALSO IN THE HEALTHS SAFETY PLAN IF APPLICABLE.

RESPONSE: WESTON 11/5/91 REPORT; ROUTINE LINE INSPECTIONS WILL BE PERFORMED DAILY.
WESTON 2/21/92 SAME RESPONSE AS 11/91

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0022-2-1	FLOW-MORE	SAME AS T0020 OR T0018		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0022-3-1	FLOW-LESS	SAME AS T0020 OR T0018		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0022-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0022-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0022-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
-7-1	PRESSURE-NO	SAME AS T0020 OR T0018		

ENTS: ACTION:

NOTES:

ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
-8-1	PRESSURE-MORE	NOT APPLICABLE		

ENTS: ACTION:

NOTES:

ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
-9-1	PRESSURE-LESS	NOT APPLICABLE		

ENTS: ACTION:

NOTES:

ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

ENTS: ACTION:

NOTES:

ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
-11-1	TEMPERATURE-LESS	SAME AS T0018 OR T0020		

ENTS: ACTION:

NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0022-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0022-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0022-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0022-15-1	COMPOSITION-OTHER THAN	SAME AS T0018 OR T0020		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0022-16-1	STARTUP/SHUTDWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0022-17-1	EMGCY SD-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0022-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : SOFTENED WATER SUPPLY
LINE OR EQUIPMENT DESIGNATION : T0023
LINE DESCRIPTION : SOFTENED MAKEUP WATER TO SCRUBBER RECYCLE LINE
LINE/EQUIPMENT CONSIDERED : 2-WT-302-N-D,1-WT-305-N-D FROM 2-WT-301-N-D; TERMINATES AT 4-BR-503-H-K
DRAWING DESIGNATION(S) : 32-03-713-D REV 5 SHEETS 3 AND 5 OF 6 (7/23/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0023-1-1	FLOW-NO	INADVERTANT VALVE CLOSURE, LOSS OF INSTRUMENT AIR, PUMP P-207A/B FAILURE, LOSS OF CONTROL VALVE FCV-48	LOW WATER LEVEL IN SCRUBBER, SYSTEM SHUTDOWN	B

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0023-1-2	FLOW-NO	LINE RUPTURE	RELEASE OF SOFTENED WATER TO WORK AREA	B

COMMENTS: NO INDICATION IF RUPTURE DOWNSTREAM OF FE-48 ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0023-2-1	FLOW-MORE	LOSS OF CONTROL VALVE FCV-48	HIGH LEVEL IN SCRUBBER, INCREASED BLOWDOWN TO QUENCH TANK, AND INCREASED BLOWDOWN TO BRINE TANKS	A

COMMENTS: ACTION:

AUDIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
ACTION ITEMS: CONSIDER FLOW DEVIATION ALARM ON FIC-48

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0023-3-1	FLOW-LESS	IMPROPER VALVE POSITIONING, PUMP MALFUNCTION	LOWER LEVEL IN SCRUBBER AND SYSTEM SHUTDOWN	B

COMMENTS: LESS FLOW EXPECTED DURING STARTUP. DEVIATION ONLY OCCURS DURING NORMAL OPERATION ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0023-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0023-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0023-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0023-7-1	PRESSURE-NO	SAME AS NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0023-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0023-9-1	PRESSURE-LESS	SAME AS LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0023-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0023-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

NAZOP STUDY IDENTIFIER : SOFTENED WATER SUPPLY
LINE OR EQUIPMENT DESIGNATION : T0024
LINE DESCRIPTION : SCRUBBER TOWER DEMISTER FLUSH
LINE/EQUIPMENT CONSIDERED : 2"-wt-304-n-d, 1"-WT-304-N-D,
DRAWING DESIGNATION(S) : 32-03-713D SHEETS 3 AND 5 OF 6, REV 5, 7/23/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0024-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0024-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0024-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : SOFTENED WATER SUPPLY
LINE OR EQUIPMENT DESIGNATION : T0023
LINE DESCRIPTION : SOFTENED MAKEUP WATER TO SCRUBBER RECYCLE LINE
LINE/EQUIPMENT CONSIDERED : 2-WT-302-N-D,1-WT-305-N-D FROM 2-WT-301-N-D; TERMINATES AT 4-BR-503-H-K
DRAWING DESIGNATION(S) : 32-03-713-D REV 5 SHEETS 3 AND 5 OF 6 (7/23/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0023-15-1	COMPOSITION-OTHER THAN	SEE T0021		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER :
LINE OR EQUIPMENT DESIGNATION : T0023
LINE DESCRIPTION :
LINE/EQUIPMENT CONSIDERED :
DRAWING DESIGNATION(S) :

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0023-16-1	STARTUP/SHUTDWN-OTHER THAN	FCV-48 FAILS OPEN	UNCONTROLLED WATER INTO SCRUBBER CAUSING OVERFLOW TO SUMP.	A

COMMENTS: THIS LINE WILL NOT HAVE FLOW DURING STARTUP ACTION: CHANGE FAIL POSITION TO FAIL CLOSED ON VALVE FCV-48.

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; REPORT HAS TYPO, FCV-46 SHOULD BE

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FCV-48,WESTON 2/21/92 REPORT, FCV-48 WILL FAIL CLOSED

HAZOP STUDY IDENTIFIER : SOFTENED WATER SUPPLY
LINE OR EQUIPMENT DESIGNATION : T0023
LINE DESCRIPTION : SOFTENED MAKEUP WATER TO SCRUBBER RECYCLE LINE
LINE/EQUIPMENT CONSIDERED : 2-WT-302-N-D,1-WT-305-N-D FROM 2-WT-301-N-D; TERMINATES AT 4-BR-503-H-K
DRAWING DESIGNATION(S) : 32-03-713-D REV 5 SHEETS 3 AND 5 OF 6 (7/23/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0023-17-1	EMGCY SD-OTHER THAN	SEE ITEM 16-1		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0023-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : SOFTENED WATER SUPPLY
LINE OR EQUIPMENT DESIGNATION : T0024
LINE DESCRIPTION : SCRUBBER TOWER DEMISTER FLUSH
LINE/EQUIPMENT CONSIDERED : 2"-wt-304-n-d, 1"-WT-304-N-D,
DRAWING DESIGNATION(S) : 32-03-7130 SHEETS 3 AND 5 OF 6, REV 5, 7/23/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0024-1-1	FLOW-NO	INADVERTENT VALVE CLOSURE, LOSS OF INSTRUMENT AIR, PUMP FAILURE P-206A/B	PLUGGING OF SCRUBBER DEMISTER WITH SOLIDS OVER TIME	A

COMMENTS: INTERMITTENT FLOW IS DESIGN OPERATION. CYCLES TO BE ADJUSTED DURING STARTUP. ACTION:

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AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0024-1-2	FLOW-NO	LINE RUPTURE	SEE 1-1 AND RELEASE OF SOFT WATER TO WORK AREA, SYSTEM SHUTDOWN	B

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0024-2-1	FLOW-MORE	TIMER MALFUNCTION	INCREASED WATER USAGE	A

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0024-3-1	FLOW-LESS	SEE NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0024-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0024-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0024-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0024-7-1	PRESSURE-NO	SEE NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0024-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0024-9-1	PRESSURE-LESS	SEE LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

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NE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
1024-10	EMPERATURE-MORE	NOT APPLICABLE		

COMM: ACTION:

DIT N :

INE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0024-11-1	TEMPERATURE-LESS	NO CONSEQUENCE		

COMMENTS: ACTION:

UDIT NOTES:

INE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0024-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

UDIT NOTES:

INE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0024-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

UDIT NOTES:

NE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0024-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

DIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0024-15-1	COMPOSITION-OTHER THAN	SAME AS T0021		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0024-16-1	STARTUP/SHUTDWN-OTHER THAN	XV-54 OPENS	UNCONTROLLED WATER INTO SCRUBBER CAUSING OVERFLOW TO SUMP.	A

COMMENTS: ACTION: XV-54 SHOULD FAIL CLOSED

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; AGREED, XV-54 WILL FAIL CLOSED.
WESTON 2/21/92 RESPONSE SAME AS 11/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0024-17-1	EMERGENCY SD-OTHER THAN	SEE ITEM 17-1		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0024-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
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HAZOP STUDY IDENTIFIER : SOFTENED WATER SUPPLY
LINE OR EQUIPMENT DESIGNATION : T0025
LINE DESCRIPTION : pH FLUSH PROBE
LINE/EQUIPMENT CONSIDERED : 1 1/2"-WT-317-E-D, 1 1/2"-WT-318-E-D, 1 1/2"-BR-501-H-K, 1"-BR-501-H-K, 1 1/2"-BR-416-H-K, 1"-BR-416A-H-K, 1"-BR-416B-H-K,
DRAWING DESIGNATION(S) : 32-03-713D SHEET 3, 4 AND 5 OF 6, REV 5, 7/23/91

NE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
025-1-1	FLOW-NO	PUMP MALFUNCTION P-207A/B	POTENTIAL FOR ERRONEOUS pH READING WHICH MAY RESULT IN LOSS OF pH CONTROL IN QUENCH TANK AND/OR SCRUBBER SYSTEM	A

COMMENTS: SYSTEM IS MANUALLY OPERATED ACTION:

DIT NOTES:

NE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
025-1-2	FLOW-NO	LINE RUPTURE	SEE T0024 1-2	

COMMENTS: NORMAL OPERATION IS INTERMITTENT ACTION:

DIT NOTES:

NE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
025-2-1	FLOW-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

DIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0025-3-1	FLOW-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0025-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0025-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0025-6-1	FLOW-OTHER THAN	NOT APPLICALBE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0025-7-1	PRESSURE-NO	SEE NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

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E/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
25-8-1	PRESSURE-MORE	NOT APPLICABLE		

MENTS: ACTION:

T NOTES:

E/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
25-9-1	PRESSURE-LESS	NOT APPLICABLE		

MENTS: ACTION:

T NOTES:

E/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
25-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

MENTS: ACTION:

T NOTES:

E/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
25-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

MENTS: ACTION:

T NOTES:

E/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
25-12-1	COMPOSITION-MORE	NOT APPLICABLE		

MENTS: ACTION:

T NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0025-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0025-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0025-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0025-16-1	STARTUP/SHUTDWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0025-17-1	EMERGENCY SD-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0025-18-1	MAINTENANCE-OTHER THAN	NOT APPLICALBE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : QUENCH TANK SOLIDS REMOVAL
LINE OR EQUIPMENT DESIGNATION : T0026
LINE DESCRIPTION : QUENCH TANK RECIRCULATION
LINE/EQUIPMENT CONSIDERED : 6"-BR-316-H-K, 6"-BR-316A-H-K, 6"-BR-316B-H-K, Q-201 QUENCH TANK, P-205A/B QUENCH TANK RECIRCULATE PUMPS
DRAWING DESIGNATION(S) : 32-03-713D SHEET 3 OF 6, REV 5, 7/23/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0026-1-1	FLOW-NO	CLOGGED FILTER OR CLOGGED LINE, INADVERTANT VALVE CLOSURE	SOLIDS BUILDUP IN QUENCH TANK AND SEPARATOR, CAVITATION OF PUMPS P-205A/B	A

COMMENTS: FREQUENCY OF USE WILL DICTATE SOLIDS ACCUMULATION IN QUENCH TANK ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0026-1-2	FLOW-NO	LINE RUPTURE	RELEASE OF HOT WATER (190 F) TO WORK AREA, RELEASE OF HOT GASES TO WORK ENVIRONMENT AND DOWNSTREAM FRP EQUIPMENT, SYSTEM SHUTDOWN	C

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0026-2-1	FLOW-MORE	NO CONSEQUENCE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0026-3-1	FLOW-LESS	PARTIAL LINE PLUGGING, CLOGGED STRAINER, INADVERTANT VALVE POSITIONING	INEFFICIENT REMOVAL OF SOLIDS, PUMP CAVITATION, SHUTDOWN OF SOLIDS REMOVAL.	A

COMMENTS: OPERATIONAL EXPERIENCE WILL DICTATE WHEN AND HOW THE SOLIDS REMOVAL SYSTEM IS USED. ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0026-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0026-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0026-6-1	FLOW-OTHER THAN	NOT APPICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0026-7-1	PRESSURE-NO	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0026-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0026-9-1	PRESSURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0026-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0026-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0026-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0026-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0026-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0026-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0026-16-1	STARTUP/SHUTDWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0026-17-1	EMERGENCY SD-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0026-18-1	MAINTENANCE-OTHER THAN			

COMMENTS: SYSTEM USAGE IS MAINTENANCE-RELATED. ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : SOLIDS REMOVAL
LINE OR EQUIPMENT DESIGNATION : T0027
LINE DESCRIPTION : REMOVAL OF SOLIDS FROM QUENCH TANK
LINE/EQUIPMENT CONSIDERED : 6"-BR-316A-H-K, 6"-BR-316B-H-K, 6"-BR-315-H-K, 6"-BR-316-N-K, 4"-BR-316-H-K, 6"-BR-322-H-K, P-205A/B, Q-201
DRAWING DESIGNATION(S) : 32-03-713D SHEET 3 OF 6, REV 5, 7/23/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0027-1-1	FLOW-NO	PUMP FAILURE, INADVERTANT VALVE CLOSURE, PLUGGING OF LINE	SEE NO FLOW FOR LINE T0026	A

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0027-1-2	FLOW-NO	LINE RUPTURE	SAME AS T0026 LINE RUPTURE	C

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0027-2-1	FLOW-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0027-3-1	FLOW-LESS	PUMP MALFUNCTION, CLOGGED LINE, INADVERTANT VALVE POSITIONING	INEFFICIENT SOLIDS REMOVAL.	A

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0027-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0027-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0027-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0027-7-1	PRESSURE-NO	PUMP LOSS, INADVERTENT VALVE POSITIONING, INSTRUMENT AIR FAILURE, LINE PLUGGING	SEE NO FLOW	A

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0027-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0027-9-1	PRESSURE-LESS	SEE LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0027-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0027-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0027-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0027-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0027-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0027-15-1	COMPOSITION-OTHER THAN	MORE SOLIDS IN SYSTEM	INCREASED PUMP WEAR	A

COMMENTS: ACTION: MAINTENANCE ITEM

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; AGREED
WESTON 2/21/92 REPORT, THE O&M MANUAL WILL INCLUDE PUMP INSPECTION PROCEDURES.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0027-16-1	STARTUP/SHUTDWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0027-17-1	EMERGENCY SD-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0027-18-1	MAINTENANCE-OTHER THAN	SEE COMPOSITION.		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : SOLIDS REMOVAL
LINE OR EQUIPMENT DESIGNATION : T0028
LINE DESCRIPTION : KREBS VORTEX SEPARATOR
LINE/EQUIPMENT CONSIDERED : VORTEX SEPARATOR
DRAWING DESIGNATION(S) : 32-03-713D SHEET 3 OF 6, REV 5, 7/23/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0028-1-1	FLOW-NO	PUMP LOSS, PLUGGED EQUIPMENT	SOLIDS BUILDUP IN QUENCH TANK, MAINTENANCE REQUIRED TO CLEAN OUT SEPARATOR	A

COMMENTS: CAN BYPASS VORTEX SEPARATOR IF NECESSARY. ACTION:

AUDIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
ACTION ITEMS: CONSIDER WATER FLUSH OF VORTEX SEPARATOR AFTER USE.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0028-2-1	FLOW-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0028-3-1	FLOW-LESS	SEE NO FLOW	SEE NO FLOW	

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : SUB-X INCINERATOR
LINE OR EQUIPMENT DESIGNATION : T0029
LINE DESCRIPTION : DOWNCOMER
LINE/EQUIPMENT CONSIDERED : DOWNCOMER INTO QUENCH TANK
DRAWING DESIGNATION(S) : 32-03-713D SHEET 3 OF 6, REV. 5, 7/23/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0029-1-1	FLOW-NO	PLUGGED DOWNCOMER PORTS	SURGING OF QUENCH TANK AND EVENTUAL SYSTEM SHUTDOWN	B

COMMENTS: SITUATION PRECEDED BY LESS FLOW CONDITIONS - NOT EXPECTED TO PROGRESS TO A NO FLOW SITUATION. ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0029-2-1	FLOW-MORE	UNCONTROLLED FEED TO INCINERATOR	IMPROPER QUENCH OPERATION, SURGING OF COMBUSTION GASES, RISK OF DAMAGING EXPANSION JOINT, VIBRATION	C

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0029-3-1	FLOW-LESS	PLUGGED DOWNCOMER PORTS	POSSIBLE COMBUSTION GAS SURGING WITH POTENTIAL DAMAGE TO EXPANSION JOINT, VIBRATION	C

COMMENTS:

ACTION: RECOMMEND SEMI-ANNUAL MAINTENANCE PROGRAM INCLUDE INSPECTION OF PORTS

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; AGREED
WESTON 2/21/92 REPORT, O&M MANUAL WILL INCLUDE SEMI-ANNUAL INSPECTIONS.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0029-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0029-5-1	FLOW-REVERSE	NOT APPICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0029-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

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NE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
029-7-1	PRESSURE-NO	NOT APPLICABLE		

COMMENTS: ACTION:

DIT NOTES:

NE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
029-8-1	PRESSURE-MORE	PLUGGING OF DOWNCOMER PORTS	HIGHER THAN NORMAL PRESSURE IN INCINERATOR	

COMMENTS: PRESSURE DIFFERENCE WOULD BE MINOR AND WOULD NOT BE DETECTED. SURGING AND VIBRATION WOULD BE BETTER INDICATORS OF PLUGGED PORTS. PLUGGED PORTS COULD CAUSE PUMP CAVITATION.

ACTION:

DIT NOTES:

NE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
029-9-1	PRESSURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

DIT NOTES:

NE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
029-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

DIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0029-11-1	TEMPERATURE-LESS	NO CONSEQUENCES		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0029-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0029-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0029-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0029-15-1	COMPOSITION-OTHER THAN	LOSS OF NEUTRALIZATION	ACCELERATED CORROSION OF DOWNCOMER.	A

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0029-16-1	STARTUP/SHUTDWN-OTHER THAN	NO CONSEQUENCES		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0029-17-1	EMERGENCY SD-OTHER THAN	NOT APPLICALBE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0029-18-1	MAINTENANCE-OTHER THAN	SEE NO FLOW AND COMPOSITION		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0029-19-1	LEVEL-NO	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0029-20-1	LEVEL-MORE/LESS	SEE LEVEL ISSUES UNDER QUENCH TANK		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0029-21-1	LEVEL-LOW	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : CAUSTIC SUPPLY SYSTEM
LINE OR EQUIPMENT DESIGNATION : T0030
LINE DESCRIPTION : CAUSTIC MAKEUP TO SCRUBBER
LINE/EQUIPMENT CONSIDERED : 1 1/2-XB-320-E-R, 1-XV-321-H-R STARTS AT 1 1/2-XB-306-E-R AND TERMINATES AT 4-BR-503-H-K, 1 1/2-XB-320-H-R
DRAWING DESIGNATION(S) : 32-03-713-D REV 5 SHEETS 3 AND 5 OF 6 (7/23/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0030-1-1	FLOW-NO	INADVERTANT VALVE CLOSURE, INSTRUMENT AIR FAILURE, PUMP FAILURE (P-208A/B)	LOSS OF pH CONTROL IN SCRUBBER, HIGH EMISSIONS IN STACK	A

COMMENTS: RECOMMEND TRENDING ON AIC-56 ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0030-1-2	FLOW-NO	LINE RUPTURE	LOSS OF pH CONTROL IN SCRUBBER, HIGH EMISSIONS IN STACK, RELEASE OF CAUSTIC TO WORK AREA	C

COMMENTS:

ACTION: CONSIDER LOOKING AT SAFETY CONSIDERATIONS ASSOCIATED WITH LACK OF RUPTURE (FLOW OR PRESSURE) INDICATION ON LINE.

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; ROUTINE LINE INSPECTIONS WILL BE PERFORMED ON A DAILY BAISI TO VERIFY LINE AND TANK INTEGRITY.
WESTON 2/21/92 REPORT, AS DESCRIBED IN THE O&M MANUAL

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0030-2-1	FLOW-MORE	LOSS OF CONTROL ON VALVE FCV-56	HIGH pH IN SCRUBBER LOOP, POSSIBLE PRECIPITATION OF METAL HYDROXIDES	A

COMMENTS: LOSS OF CONTROL INDICATED BY CHANGE IN pH ONLY.

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0030-3-1	FLOW-LESS	INADVERTANT VALVE POSITIONING, LOSS OF INSTRUMENT AIR, LOSS OF CONTROL TO CONTROL VALVE FCV-56, LOSS OF SUPPLY PUMPS,	LOW pH IN SCRUBBER LOOP, HIGH EMISSIONS IN STACK	B

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0030-3-2	FLOW-LESS	LINE LEAK	SEE LINE RUPTURE	C

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0030-4-1	FLOW LL AS			

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0030-5-1	FLOW-REVERSE	NOT APPLICABLE - DOUBLE FAILURE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0030-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0030-7-1	PRESSURE-NO	SEE NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0030-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0030-9-1	PRESSURE-LESS	SEE LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0030-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0030-11-1	TEMPERATURE-LESS	LOSS OF HEAT TRACING	SEE LESS FLOW	A

COMMENTS: ACTION: REVIEW HEAT TRACING CONTROL AND MONITORING

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; NO HEAT TRACING MONITORING SYSTEM IS CURRENTLY IN PLACE. A MONITORING SYSTEM CAN BE ADDED AT A ADDITIONAL COST TO RMA.
2/21/92 WESTON RESPONSE; ELECTRICALLY MONITORING THE HEAT TRACING IS NOT INCLUDED IN THE PRESENT DESIGN.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0030-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0030-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0030-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0030-15-1	COMPOSITION-OTHER THAN	SEE LINE T0018, CAUSTIC TO QUENCH TANK		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0030-16-1	STARTUP/SHUTDWN-OTHER THAN	FAILURE OF FCV-56 TO FAIL CLOSED	INTRODUCTION OF CAUSTIC INTO SCRUBBER, SEE MORE FLOW.	C

COMMENTS: ACTION: OPERATOR SHOULD CONFIRM CLOSURE OF FCV-56 ON SHUTDOWN.

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0030-17-1	EMERGENCY SD-OTHER THAN	SEE ITEM 16-1		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0030-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : QUENCH TANK RECYCLE
LINE OR EQUIPMENT DESIGNATION : T0031
LINE DESCRIPTION : QUENCH RECYCLE SUCTION
LINE/EQUIPMENT CONSIDERED : 4"-BR-416-H-K, 4"-BR-416A-H-K, 4"-BR-416B-H-K, S-201 SEPARATOR, P-202A/B PUMPS
DRAWING DESIGNATION(S) : 32-03-713D SHEET 4 OF 6, REV 5, 7/23/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0031-1-1	FLOW-NO	INADVERTANT VALVE CLOSURE, STRAINER PLUGGING, LINE PLUGGING	LOSS OF RECYCLE TO DOWNCOMER, PUMP CAVITATION, SYSTEM SHUTDOWN, POSSIBLE OVERHEATING OF DOWNCOMER, LOSS OF BLOWDOWN	B

COMMENTS: PUMPS ARE PART OF EMERGENCY DIESEL GENERATOR SYSTEM. ACTION:
DP INDICATOR ACROSS STRAINERS SHOULD INDICATE A PROBLEM BEFORE COMPLETE PLUGGING.

AUDIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
ACTION ITEMS: O&M MANUAL SHOULD INCLUDE PROPER VALVE POSITIONING.

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0031-1-2	FLOW-NO	LINE RUPTURE	SEE LINE RUPTURE FOR T0026, QUENCH TANK RECIRCULATION	C

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0031-2-1	FLOW-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0031-3-1	FLOW-LESS	SEE NO FLOW	SEE NO FLOW	

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0031-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0031-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0031-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0031-7-1	PRESSURE-NO	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0031-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0031-9-1	PRESSURE-LESS	PLUGGING OF LINE, SOLIDS BUILDUP, PLUGGING OF STRAINER, FAILURE OF DP INDICATOR	PUMP CAVITATION P-202A/B,	

COMMENTS: ACTION: EVALUATE TRENDING POINT FOR DP INDICATOR

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AUDIT NOTES: HAZOP TEAM: MEETING 11/91 NOTES, THIS OPTIN IS AVAILABLE, WESTON PERFERES DEVIATION.

RESPONSE: WESTON 11/5/91 REPORT; TRENDING CAN BE PERFORMED BY THE PMCS.
2/21/92 WESTON, SAME AS ABOVE, ON A AS NEEDED BASIS

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0031-10-1	TEMPERATURE-MORE			

COMMENTS: ACTION:

AUDIT NOTES: Q. WILL LINE BE IDENTIFIED AS CONTAINING HOT FLUID AND BE ADEQUATELY EQUIPPED TO PROTECT WORKERS UPON A RELEASE?

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0031-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0031-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0031-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0031-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0031-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0031-16-1	STARTUP/SHUTDOWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ENSURE THAT UTILITIES SUCH AS CAUSTIC PUMPS SHUT OFF DURING SHUTDOWN. ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0031-17-1	EMERGENCY SD-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0031-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : QUENCH TANK RECYCLE
LINE OR EQUIPMENT DESIGNATION : T0032
LINE DESCRIPTION : QUENCH RECYCLE PRESSURE SIDE
LINE/EQUIPMENT CONSIDERED : 2"-BR-313-H-K, 4"-BR-313-H-K, 2"-BR-313A-H-K, 4"-BR-313A-H-K, 4"-BR-416B-H-K, 4"-BR-416A-H-K, 4"-BR-416-H-K, PUMPS P-202A/B, TO Q-201 QUENCH TANK
DRAWING DESIGNATION(S) : 32-03-713D SHEET 3 AND 4 OF 6, REV 5, 7/23/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0032-1-1	FLOW-NO	PUMP FAILURE, INADVERTANT VALVE CLOSURE, LOSS OF INSTRUMENT AIR, LINE PLUGGING	SYSTEM SHUTDOWN, SEE T0031.	B

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0032-1-2	FLOW-NO	LINE RUPTURE	SEE T0031	C

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0032-2-1	FLOW-MORE	UNBALANCE PRESSURE BETWEEN BLOWDOWN AND RECYCLE	NO BLOWDOWN	A

COMMENTS:

ACTION: ADD A RESTRICTING ORIFICE (VALVE) INCLUDING PRESSURE INDICATOR TO BALANCE PRESSURE BETWEEN RECYCLE AND BLOWDOWN LINES.

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; AGREED, REFERENCE REV. 7 ON P&ID 32-03-713-D, SHEET 3 AND 4 OF 6 (T-THERMAL).
2/21/92 WESTON REPORT, SAME AS ABOVE

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0032-3-1	FLOW-LESS	PUMP DETERIORATION, LINE PLUGGING, INADVERTANT VALVE POSITIONING	SEE LINE T0031	A

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0032-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0032-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0032-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0032-7-1	PRESSURE-NO	SEE NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0032-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0032-9-1	PRESSURE-LESS	PUMP WEAR, INADVERTANT VALVE POSITIONING, LINE PLUGGING	SEE LESS FLOW FOR LINE T0031	A

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0032-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: SEE TEMPERATURE COMMENTS ON LINE T0031 ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0032-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0032-12-1	COMPOSITION-MORE	MALFUNCTION OF DENSITY METERS AE-59A/B	BLOWDOWN TOO CONCENTRATED, GREATER TENDENCY TOWARD DEPOSITION OF SOLIDS IN QUENCH TANK AND SEPARATOR, INCREASED SOLIDS DEPOSITION IN RECIRC/SOLIDS REMOVAL	C

COMMENTS: EVENTUAL BUILDUP OF SOLIDS IN QUENCH TANK CAN RESULT IN SURGING, VIBRATION, LOSS OF EXPANSION JOINTS, CATASTROPHIC FAILURE. DENSITY METERS ARE REDUNDANT.

ACTION: (1)PROVIDE MIN FLOW LIMIT SWITCH INTERLOCKED TO WASTE FEED VALVE TO ENSURE MINIMUM BLOWDOWN DURING WASTE INCINERATION OPERATION.(2) RECOMMEND DEN. TREND.

AUDIT NOTES: RESPONSE; WESTON 2/21/92 REPORT, (1)ASHH-59 HAS BEEN ADDED AS INTERLOCK 72,(2) AGREED, TRENDING OF DENSITY IS INCLUDED

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0032-13-1	COMPOSITION-LESS	FAILURE OF DENSITY METERS AE-59A/B	DILUTE BLOWDOWN RESULTS IN CONSEQUENCE DOWNSTREAM INTO BRINE HOLDING TANKS.	

COMMENTS: ACTION: SEE COMPOSITION-MORE.

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0032-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0032-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0032-16-1	STARTUP/SHUTDWN-OTHER THAN	IMPROPER SEQUENCING OF VALVES XV-78A/B WITH PUMPS P-202A/B.	SEE NO FLOW.	

COMMENTS: FISL-57 IS A FLOW PERMISSIVE FOR STARTUP. SYSTEM IS DESIGNED NOT TO START UNLESS MINIMUM FLOW IS ESTABLISHED.

ACTION:

AUDIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
ACTION ITEMS: RECOMMEND PUMPS BE ALTERNATED SO OPERATING CONDITION IS KNOWN.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0032-17-1	EMERGENCY SD-OTHER THAN			

COMMENTS: PUMPS P-202A/B ARE OPERATED UNDER EMERGENCY SHUTDOWN THROUGH THE EMERGENCY DIESEL GENERATOR.

ACTION: CONFIRM WHETHER EMERGENCY DIESEL GENERATOR IS AUTOMATICALLY STARTED UPON EMERGENCY SHUTDOWN. IS EMERGENCY GENERATOR AUTOMATICALLY STARTED?

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT;THE EMERGENCY GENERATOR WILL START AUTOMATICALLY WITHIN 10 SECONDS OF A POWER FAILURE, HOWEVER P-203A/B ARENOT POWERED BY THE EMERGENCY GENERATOR.
2/21/92 WESTON REPORT SAME AS ABOVE.

HAZARD AND OPERABILITY STUDY - H A Z O P
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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0032-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : BRINE HANDLING SYSTEM
LINE OR EQUIPMENT DESIGNATION : T0033
LINE DESCRIPTION : BLOWDOWN TO BRINE TANKS
LINE/EQUIPMENT CONSIDERED : 2"-BR-313-H-K, 1 1/2"-BR-313-H-K, 2-WP-500-E-K, 1 1/2-BR-417-H-K, BEGINS AT 4-BR-416-H-K AND ENDS AT TANK TK-201 AND TK-202.
DRAWING DESIGNATION(S) : 32-03-713-D REV 5 SHEET 4 OF 6 (7/23/91) ; 03-04-015 REV 0 (7/31/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0033-1-1	FLOW-NO	INADVERTANT VALVE CLOSURE, LINE PLUGGING, CONTROL FAILURE ON FCV-58, INSTRUMENT AIR FAILURE, FAILURE OF P-202A/B PUMPS	BUILDUP OF SOLIDS IN SYSTEM, LOSS OF CONTROL ON QUENCH TANK LEVEL HIGH, SYSTEM SHUTDOWN.	B

COMMENTS: ACTION: INSTALL ALARM ON FI-83A LINKED TO DENSITY READING ON AIC-59.

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; AGREED, AN ALARM WILL BE ADDED.
RESPONSE;2/21/92 WESTON REPORT, ALARM ASHH-59 HAS BEEN ADDED AS INTERLOCK 72.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0033-1-2	FLOW-NO	LINE RUPTURE	RELEASE OF HOT LIQUID (190 F) IN WORK AREA AND OUT IN CONTAINMENT AREA.	C

COMMENTS: A RUPTURE UPSTREAM OF THE CONTROL VALVE FCV-58 WILL EMPTY THE QUENCH TANK AND CAUSE SYSTEM SHUTDOWN.

ACTION: REVIEW LACK OF RUPTURE/LEAK INDICATION (FLOW OR PRESSURE INDICATOR) DOWNSTREAM OF FCV-58.

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; ROUTINE DAILY LINE INSPECTIONS WILL BE PERFORMED.
RESPONSE; 2/21/92 WESTON REPORT; ADDITIONALLY, PI-57 HAS BEEN ADDED IN REV.7 OF THE P&ID

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0033-2-1	FLOW-MORE	FAILURE OF CONTROL ON FCV-58	BLOWDOWN OF DILUTE BRINE TO BRINE HOLDING TANKS AFFECTING STORAGE CAPACITY.	A

COMMENTS: PROBLEMS IN BRINE DISPOSAL LOGISTICS. ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0033-3-1	FLOW-LESS	PUMP WEAR ON P-202A/B, INADVERTANT VALVE POSITIONING, LOSS OF CONTROL ON CV-58, LINE PLUGGING	LESS BRINE FLOW TO BRINE TANKS, REFER TO CONCENTRATION DEVIATION FOR LINE T0032	A

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0033-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0033-5-1	FLOW-REVERSE	LOSS OF PUMPS P-202A/B WHILE SCRUBBER PUMPS CONTINUE TO RUN AND LINE 2"-BR-313A-H-K IS OPEN BRINGING SCRUBBER BLOWDOWN TO TK-101, TK-102	FLOW BACKUP, POSSIBLE OVERFLOW OF QUENCH SYSTEM	A

COMMENTS: NO CHECK VALVE TO PREVENT BACKFLOW. ACTION: PIPING DRAWINGS SHOW CHECK VALVES IN LINES; SHOW CHECK VALVES IN LINES ON P&ID.

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; CHECK VALVE WILL BE ADDED.
2/21/92 WESTON SAME AS ABOVE

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0033-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0033-7-1	PRESSURE-NO	SEE NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0033-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0033-9-1	PRESSURE-LESS	SEE LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0033-10-1	TEMPERATURE-MORE	REFER TO SAFETY CONSIDERATIONS ON HOT LINES (T0032,T0031,T0018)		

COMMENTS: ACTION:

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AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0033-11-1	TEMPERATURE-LESS	NO CONSEQUENCE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0033-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0033-13-1	COMPOSITION-LESS	SEE MORE FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0033-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0033-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0033-16-1	STARTUP/SHUTDWN-OTHER THAN			

COMMENTS:

ACTION: (1)RECOMMEND INSTALLATION OF F FLOW LIMIT SWITCH INTERLOCKED WITH WASTE FEED BLOCK VALVE.(2) RECOMMEND FLUSHING OF QUENCH TANK RECYCLE ON SHUTDOWN.

AUDIT NOTES: HAZOP TEAM: MEETING 11/91 NOTES; (1) INTERLOCK SWITCH ALREADY IN DESIGN (2) PART OF ROUTINE OPS TO CLEAN THE QUENCH TK

RESPONSE: WESTON 11/5/91 REPORT; (1) ALREADY INCLUDED IN DESIGN (2) NEED FOR FLUSHING WILL BE DETERMINED DURING OPERATION.

HAZOP TEAM; WESTON RESPONSE DOES NOT ADDRESS THE ACTION ITEM(2) SHOULD PROVIDE MORE DATA.
2/21/92 WESTON REPORT;(2) ADDITIONALLY,ONLY ONCE OR TWICE A YEAR IS ANTICIPATED.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0033-16-2	STARTUP/SHUTDWN-OTHER THAN	VALVE FCV-58 FAILS OPEN UPON SHUTDOWN	QUENCH TANK EMPTIES	C

COMMENTS:

ACTION: REPLACE FAIL OPEN VALVE FCV-58 WITH FAIL CLOSED VALVE.

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; FCV-58 WILL FAIL CLOSED. T-THERMAL DRG. REV 8, DRG. CHANGED TO SHOW FCV-58 FROM FO TO FC POSITION.
2/21/92 WESTON REPORT SAME AS ABOVE

HAZARD AND OPERABILITY STUDY - H A Z O P
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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0033-17-1	EMERGENCY SD-OTHER THAN	SEE STARTUP/SHUTDOWN 16-2		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0033-18-1	MAINTENANCE-OTHER THAN			

COMMENTS:

ACTION: LINE DESIGNATIONS ON P&ID ARE INCORRECT AND SHOULD BE REVISED TO SHOW/NOT SHOW HEAT TRACING.

AUDIT NOTES: RESPONSE: WESTON 2/5/92 REPORT; T-THERMAL HAS ISSUED REVISION 8 OF THE P&ID.
2/21/92 WESTON SAME AS ABOVE

HAZOP STUDY IDENTIFIER : QUENCH RECYCLE SYSTEM
LINE OR EQUIPMENT DESIGNATION : T0034
LINE DESCRIPTION : pH LOOP IN QUENCH RECYCLE
LINE/EQUIPMENT CONSIDERED : 2-BR-416-H-K, 1-BR-416-H-K, 1-BR-416A-H-K, 1-BR-416B-H-K, BEGINS AT 4-BR-416-H-K, ENDS AT S-201 QUENCH SEPARATOR
DRAWING DESIGNATION(S) : 32-03-713-D REV 5, SHEET 4 OF 6, 7/23/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0034-1-1	FLOW-NO	INADVERTANT VALVE CLOSURE, LOSS OF PUMPS P-202A/B, LINE PLUGGAGE	LOSS OF pH CONTROL IN QUENCH TANK, INCREASED USE OF CAUSTIC IN SCRUBBER LOOP, POSSIBLE HIGH EMISSIONS IN STACK, SYSTEM SHUTDOWN	B

COMMENTS:

ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0034-1-2	FLOW-NO	LINE RUPTURE	SEE LINE T0032 FOR NO FLOW LINE RUPTURE	C

COMMENTS: NO INDICATION OF LINE RUPTURE

ACTION: RECOMMEND EVALUATION OF SAFETY HAZARD FROM RELEASE OF HOT BRINE

AUDIT NOTES: NOTE: LINE DOES NOT HAVE ANY INDICATION OF LINE RUPTURE.

RESPONSE: WESTON 11/5/91 REPORT; ROUTINE LINE INSPECTIONS WILL IDENTIFY ANY LINE RUPTURES. REFERENCE SAFETY MANUAL FOR CONTINGENCY PLAN.
2/21/92 WESTON REPORT, REFERENCE HEALTH AND SAFETY PLAN FOR CONTINGENCY PLANS.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0034-2-1	FLOW-MORE	PLUGGAGE IN LINE T0032 DOWNSTREAM OF INTERSECTION	POTENTIAL pH PROBE DAMAGE	A

COMMENTS: FLOW WOULD BE DIVERTED TO LINE T0034 REDUCING QUENCH RECYCLE FLOW TO DOWNCOMER

ACTION: RECOMMEND EVALUATION OF PROBE DESIGN TO MINIMIZE POSSIBILITY OF DAMAGE DUE TO HIGH FLOW

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; CONCERN IS COVERED BY PROBE DESIGN.
2/21/92 WESTON SAME AS ABOVE

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0034-3-1	FLOW-LESS	INADVERTANT VALVE POSITIONING, LOSS OF PUMPS(P-202), LINE PLUGGAGE	ERRONEOUS pH READINGS IN QUENCH TANK, INCREASED CAUSTIC USAGE IN SCRUBBER, POSSIBLE HIGH STACK EMISSIONS CAUSING SHUTDOWN	B

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0034-4-1	FLOW-AS WELL AS	INADVERTANT VALVE POSITION WITH DOMESTIC WATER LINE LEFT OPEN	ERRONEOUS pH READINGS FROM DILUTION OF RECYCLE LIQUID WITH DOMESTIC SOFTENED WATER	A

COMMENTS:

ACTION: RECOMMEND EVALUATION OF ADDING TRENDING POINT TO CAUSTIC CONTROL LOOPS - AIC-56 AND AIC-64

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; TRENDING IS NOT REQUIRED. THE CONTROL SYSTEM CURRENTLY COMPARES ph SIGNALS BETWEEN PROBES.
2/21/92 WESTON SAME AS ABOVE

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0034-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0034-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0034-7-1	PRESSURE-NO	SAME AS NO FLOW		

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0034-8-1	PRESSURE-MORE	NO CONSEQUENCE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0034-9-1	PRESSURE-LESS	SAME AS LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0034-10-1	TEMPERATURE-MORE	NO CONSEQUENCE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0034-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0034-12-1	COMPOSITION-MORE	INCREASED SOLIDS ACCUMULATION IN RECYCLE LINE	GREATER TENDANCY TO COAT pH PROBE - REQUIRING MORE FREQUENT CLEANING AND FLUSHING	A

COMMENTS: ACTION:

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AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0034-13-1	COMPOSITION-LESS	INADVERTANT VALVE POSITION ON SOFTENED WATER FLUSH LINE	SEE AS WELL AS - FLOW	A

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0034-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0034-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0034-16-1	STARTUP/SHUTDWN-OTHER THAN			

COMMENTS: LINE T0034 SHOULD BE FLUSHED ONCE PUMPS (P-202A/B) HAVE BEEN SHUT DOWN ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0034-17-1	EMGCY SD-OTHER THAN	NO SPECIAL CONSIDERATIONS		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0034-18-1	MAINTENANCE-OTHER THAN	NOT FOLLOWING PROPER PROBE REMOVAL PROCEEDURE FROM LINE	RELEASE OF HOT BRINE INTO WORK AREA	C

COMMENTS:

ACTION: (1) RECOMMEND THAT ALL HOT LINES BE IDENTIFIED.(2) RECOMMEND SPLASH SHIELDS OR GUARDS INCLUDED AT PROBES

AUDIT NOTES: RESPONSE: WESTON 2/5/92 REPORT;(1) BRINE LINES ARE COLORED CODED(2) SAFETY TRAINING WILL ADDRESS THIS CONCERN AND SPLASH SHIELDS WILL BE PROVIDED.
2/21/92 WESTON SAME AS ABOVE

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0034-18-2	MAINTENANCE-OTHER THAN	INFREQUENT FLUSHING OF pH PROBES	ERRONEOUS pH READINGS CAUSED BY BUILDUP OF SCALE ON PROBE	A

COMMENTS: FREQUENCY OF FLUSHING TO BE ESTABLISHED BASED ON OPERATING EXPERIENCE, HOWEVER INITIAL FREQUENCY MAY CONSERVATIVE.

ACTION: RECOMMEND EVALUATION OF TRENDING OF pH CONTROLLER AIC-64

AUDIT NOTES: HAZOP TEAM: MEETING 11/91 NOTES; ROUTINELY MONITORED ph, BECAUSE AT PORTO RICO, CLEANING OF PROBES REQUIRED PERHAPS AS OFFEN AS DAILY.

RESPONSE: WESTON 11/5/91 REPORT; ROUTINE CLEANING OF THE PROBES WILL BE PERFORMED. IF THE PROBES CONTINUES TO MALFUNCTION, A REPLACEMENT PROBES WILL BE PROVIDED.
2/21/92 WESTON SAME AS ABOVE

HAZARD AND OPERABILITY STUDY - H A Z O P
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HAZOP STUDY IDENTIFIER : SCRUBBER/VENTURI RECYCLE SYSTEM
LINE OR EQUIPMENT DESIGNATION : T0035
LINE DESCRIPTION : VENTURI RECYCLE
LINE/EQUIPMENT CONSIDERED : 4-BR-505-H-K,3-BR-413-H-K,3-BR-505-H-K,2-BR-505-H-K,2-BR-411-H-K, BEGINS AT 6-BR-501-H-K AND TERMINATES AT VENTURI
DRAWING DESIGNATION(S) : 32-03-713-D SHEETS 4 & 5 OF 6 - REV 5 (7/23/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0035-1-1	FLOW-NO	INADVERTANT VALVE CLOSURE, LINE PLUGGING, LOSS OF INSTRUMENT AIR, LOSS OF CONTROL OF FCV-60, LOSS OF PUMPS P-203A/B, LOSS OF CONTROL OF FCV-62 AND FCV-65	LOW VENTURE PRESSURE DROP, DECREASED PARTICULATE REMOVAL, DECREASED PRESSURE IN INCINERATOR, SYSTEM SHUTDOWN	B

COMMENTS:

ACTION: RECOMMEND ADDITION OF FSLL-60 WASTE FEED INTERLOCK TO INTERLOCK MATRIX

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; FSLL-60 HAS BEEN ADDED TO THE INTERLOCK MATRIX.
HAZOP TEAM:REVISED INTERLOCK MATRIX SENT TO HAZOP TEAM 2/5/92, #18 INTERLOCK HAS TYPO(LSLL SHOULD BE FSLL,TEAM NOTIFIED T-THERMAL OF TYPO 3/10/92)
2/21/92 WESTON SAME AS ABOVE

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0035-1-2	FLOW-NO	LINE RUPTURE	RELEASE OF HOT BRINE INTO WORK AREA, ALSO SEE 1-1	C

COMMENTS: NO INDICATION OF SPILL IF LOCATION IS DOWNSTREAM OF FE-60

ACTION: RECOMMEND EVALUATION OF HAZARD BY SAFETY COMMITTEE

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; ROUTINE LINE INSPECTION WILL BE PERFORMED DAILY.
2/21/92 WESTON SAME AS ABOVE

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0035-2-1	FLOW-MORE	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0035-3-1	FLOW-LESS	SEE NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0035-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0035-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0035-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0035-7-1	PRESSURE-NO	SAME AS NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0035-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: A

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0035-9-1	PRESSURE-LESS	SAME AS LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0035-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

DIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0035-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

UDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0035-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0035-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0035-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0035-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0035-16-1	STARTUP/SHUTDWN-OTHER THAN			

COMMENTS: ACTION: RECOMMEND CONSIDERATION OF WHETHER STARTUP PERMISSIVE SHOULD INCLUDE FLOW OF WATER TO VENTURI

AUDIT NOTES: 2/21/92 WESTON RESPONSE; THE PERMISSIVE HAS BEEN INCLUDED IN THE INTERLOCK 18.

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0035-17-1	EMGCY SD-OTHER THAN			

COMMENTS: ACTION: RECOMMEND EVALUATION OF VALVE (FCV-60) FAIL POSITION

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; FCV-60 WILL FAIL CLOSED.
2/21/92 WESTON SAME AS ABOVE

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0035-18-1	MAINTENANCE-OTHER THAN			

COMMENTS: SEE COMMENTS CONCERNING SAFETY OF HOT LINE T0034 ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : QUENCH RECYCLE SYSTEM
LINE OR EQUIPMENT DESIGNATION : T0036
LINE DESCRIPTION : QUENCH SEPARATOR
LINE/EQUIPMENT CONSIDERED : S-201 QUENCH SEPARATOR - INCLUDES INTERCONNECTING DUCTS, EXPANSION JOINTS, AND QUENCH TANK
DRAWING DESIGNATION(S) : 32-03-713-D SHEET 4 OF 6 REV 5 (7/23/91); 6-02-3851-D REV 1 (3/27/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0036-1-1	FLOW-NO	SOLIDS ACCUMULATION AND PLUGGAGE OF LOWER EQUALIZATION DUCTS	IMPROPER QUENCH OPERATION, LOSS OF BRINE IN QUENCH TANK, AND SYSTEM SHUTDOWN	C

COMMENTS: SOLIDS CONTROL IS A CRITICAL ISSUE FOR THIS DEVIATION ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0036-2-1	FLOW-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0036-3-1	FLOW-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0036-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0036-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0036-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0036-7-1	PRESSURE-NO	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0036-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0036-9-1	PRESSURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0036-10-1	TEMPERATURE-MORE	LOSS OF BRINE IN QUENCH TANK AND BYPASS OF HOT GAS INTO VESSEL	DAMAGE TO VESSEL LINING	A

COMMENTS: REDUNDANT TEMPERATURE SWITCHES LOCATED IN CROSSOVER DUCT BETWEEN SEPARATOR AND VENTURI ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0036-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0036-12-1	COMPOSITION-MORE	NOT APPLICABLE	SEE NO FLOW	

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0036-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0036-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0036-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0036-16-1	STARTUP/SHUTDWN-OTHER THAN			

COMMENTS: TANK LEVEL IS A PERMISSIVE FOR STARTUP — ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0036-17-1	EMGCY SD-OTHER THAN	SEE MORE TEMPERATURE		

COMMENTS: — ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0036-18-1	MAINTENANCE-OTHER THAN	IMPROPER MAINTENANCE , WELDING ON VESSEL	DAMAGE TO LINING	C

COMMENTS: (1) THIS IS A LINED VESSEL - NO WELDING SHOULD BE ALLOWED — ACTION: (2) RECOMMEND THIS VESSEL BE INSPECTED ON A ROUTINE BASIS FOR LINING INTEGRETY AND SOLIDS BUILDUP

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; (1) AGREED (2) AGREED
2/21/92 WESTON, AGREED YEARLY

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0036-19-1	LEVEL-NO	RUPTURE OF INTERCONNECTING DUCTS OR RECIRCULATION PIPING OR VESSEL WALL. GASKET FAILURE. FAILURE OF EXPANSION JOINTS. LOSS OF LEVEL CONTROL.	SYSTEM SHUTDOWN. RELEASE OF 190F BRINE INTO WORK AREA. RELEASE OF HOT GASES INTO WORK AREA.	C

COMMENTS: LEVEL ALARMS FOR DETECTION. — ACTION: SEE MAINTENANCE

AUDIT NOTES: RESPONSE; WESTON 2/21/92 REPORT; AGREED

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0036-20-1	LEVEL-MORE	LOSS OF LEVEL CONTROL. PLUGGAGE OF LOWER RETURN DUCTS.	IMPROPER QUENCH OPERATION, VIBRATION OF VESSEL, LOSS OF EXPANSION JOINTS. SYSTEM SHUTDOWN. POSSIBLE RELEASE OF 190F BRINE AND GASES INTO WORK AREA.	C

COMMENTS: SEE NO FLOW

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0036-21-1	LEVEL-LESS	SEE NO LEVEL		

COMMENTS:

ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : FLUE GAS SYSTEM
LINE OR EQUIPMENT DESIGNATION : T0037
LINE DESCRIPTION : VENTURI
LINE/EQUIPMENT CONSIDERED : VENTURI
DRAWING DESIGNATION(S) : 32-03-713-D SHEET 4 OF 6 REV 5 (7/23/91); 6-05-129-D REV 2

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0037-1-1	FLOW-NO	NOT POSSIBLE		

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0037-2-1	FLOW-MORE	LOSS OF CONTROL OF VENTURI	INEFFICIENT PARTICULATE REMOVAL AND WASTE SHUTDOWN	B

COMMENTS:

ACTION: RECOMMEND ADDING CLOSURE OF VALVE XV-26 TO INTERLOCK PDSLL-53

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; PDSLL-52 HAS BEEN ADDED TO THE INTERLOCK MATRIX. TEAM INTERLOCK MATRIX COPY IDENTIFY AS # 34
2/21/92 WESTON REPORT SAME AS ABOVE

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0037-3-1	FLOW-LESS	SAME AS MORE FLOW	SYSTEM SHUTDOWN	B

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0037-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0037-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0037-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0037-7-1	PRESSURE-NO	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0037-8-1	PRESSURE-MORE	LOSS OF CONTROL, HIGH COMBUSTION GAS FLOW RATE FROM INCINERATOR, MECHANICAL FAILURE OF DAMPERS	IMPROPER COMBUSTION AND QUENCHING. SYSTEM SHUTDOWN	B

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0037-9-1	PRESSURE-LESS	SAME AS LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0037-10-1	TEMPERATURE-MORE	NO CONSEQUENCES		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0037-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0037-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0037-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0037-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE'		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0037-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0037-16-1	STARTUP/SHUTDWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0037-17-1	EMGCY SD-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0037-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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HAZOP STUDY IDENTIFIER : FLUE GAS SYSTEM
LINE OR EQUIPMENT DESIGNATION : T0038
LINE DESCRIPTION : INTERCONNECTING DUCT FROM QUENCH SEPARATOR S-201 TO VENTURI
LINE/EQUIPMENT CONSIDERED : CROSSOVER DUCT - QUENCH SEPARATOR TO VENTURI
DRAWING DESIGNATION(S) : 6-07-209-B REV 1 (12/28/90); 32-03-713-D REV 5 SHEET 4 OF 6 (7/23/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0038-1-1	FLOW-NO	RUPTURE	RELEASE OF HOT GASES INTO WORK AREA; WASTE FEED SHUTDOWN	C

COMMENTS: NO DIRECT INDICATION AVAILABLE, HOWEVER SEVERAL INDIRECT MONITORS WILL DETECT

ACTION: (1) RECOMMEND SAFETY ASPECTS OF THIS DEVIATION BE EVALUATED.(2) RECOMMEND THE ADDITION OF BURNER SHUTDOWN TO PDSLL-53 INTERLOCK.

AUDIT NOTES: HAZOP TEAM: MEETING NOTES 11/91; STILL AN OPEN ISSUE THAT NEEDS TO BE INCLUDED IN SAFETY PLAN.

RESPONSE: WESTON 11/5/91 REPORT; (1) NO WESTON REPONSE FOR THIS ITEM (2) THIS SHUTDOWN CONDITION IS INCLUDED IN THE SYSTEM DESIGN.
TEAM REVIEWED REVISED INTERLOCK MATRIX PDSLL 53 HAS BEEN ADDED.
2/21/92 WESTON REPORT; (1)HEALTH AND SAFETY PLAN WILL ADDRESS RUPTURE OF DUCT
(2)THIS SHUTDOWN CONDITION IS INCLUDED IN INTERLOCK 34, WHICH WILL SHUTDOWN THE BURNER AND THE WASTE FEED.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0038-2-1	FLOW-MORE	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0038-3-1	FLOW-LESS	SAME AS NO, PLUS LEAKAGE.	RELEASE OF HOT GAS WITHIN WORK AREA.	C

COMMENTS: NO INDICATION AVAILABLE

ACTION: RECOMMEND REVIEW OF CONSEQUENCES OF NO DETECTION.

AUDIT NOTES: HAZOP TEAM: MEETING 11/91 NOTES; LEAKS WILL SHOW UP IN FRP DUCT. PRESSURE IN DUCT IS LOW.

RESPONSE: WESTON 11/5/91 REPORT; DAILY LINE INSPECTIONS WILL BE PERFORMED.

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2/21/92 WESTON SAME AS ABOVE

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0038-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0038-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0038-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0038-7-1	PRESSURE-NO	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0038-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0038-9-1	PRESSURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0038-10-1	TEMPERATURE-MORE	LOSS OF WATER IN QUENCH TANK.	DAMAGE TO DUCT. POSSIBLE FIRE HAZARD.	C

COMMENTS: DESIGN INCLUDES USE OF FIRE RESISTANT FRP. ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0038-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0038-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0038-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0038-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0038-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0038-16-1	STARTUP/SHUTDOWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0038-17-1	EMGCY SD-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0038-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : FLUE GAS SYSTEM
LINE OR EQUIPMENT DESIGNATION : T0039
LINE DESCRIPTION : VENTURI SUMP
LINE/EQUIPMENT CONSIDERED : VENTURI SUMP
DRAWING DESIGNATION(S) : 32-03-713-D SHEET 4 OF 6 REV 5 (7/31/91); 6-05-125-D REV 3 (8/19/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0039-1-1	FLOW-NO	LINE OR VESSEL RUPTURE	RELEASE OF FLUE GAS OR HOT (190F) BRINE INTO WORK AREA.	C

COMMENTS: ACTION: (1)RECOMMEND EVALUATION OF SAFETY CONCERNS FOR RUPTURED VESSEL.(2) VESSEL IS 13 FEET ABOVE WORKING FLOOR.

AUDIT NOTES: HAZOP TEAM: MEETING 11/91 NOTES; WESTON WILL REVIEW THE SAFETY CONCERNS AND SAFETY PLAN
RESPONSE; WESTON 2/21/92 REPORT, (1)THESE CONCERNS WILL BE ADDRESSED IN THE HEALTH AND SAFETY PLAN (2) VESSEL IS WITHIN A CONTAINED CONCRETE AREA.

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0039-2-1	FLOW-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0039-3-1	FLOW-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0039-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0039-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0039-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0039-7-1	PRESSURE-NO	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0039-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0039-9-1	PRESSURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0039-10-1	TEMPERATURE-MORE	SEE LINE T0038		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0039-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0039-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0039-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0039-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0039-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0039-16-1	STARTUP/SHUTDWN-OTHER THAN			

COMMENTS: LEVEL LIT-62 IS PERMISSIVE FOR STARTUP ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0039-17-1	EMGCY SD-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0039-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0039-19-1	LEVEL-NO	SAME AS NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0039-19-2	LEVEL-NO	LOSS OF LEVEL CONTROL IN T-201. LOSS OF CONTROL OF FCV-62.	LOSS OF RECYCLE TO SCRUBBER. INCREASED STACK EMISSIONS. SYSTEM SHUTDOWN.	B

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0039-20-1	LEVEL-MORE	LOSS OF LEVEL CONTROL (FCV-62). LOSS OF PUMPS P-203A/B.	REDUCED FLUE GAS FLOW AND SYSTEM SHUTDOWN.	B

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0039-21-1	LEVEL-LESS	SAME AS NO LEVEL	CAVITATION OF PUMP P-203A/B. LOSS OF SCRUBBER EFFICIENCY. INCREASED EMISSIONS. POSSIBLE SYSTEM SHUTDOWN.	B

COMMENTS: THIS VESSEL (S-202 - VENTURI SUMP) AND T-201 (SCRUBBER) ARE DIRECTLY CONNECTED AND ACT IN CONSERT. ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : SCRUBBER/VENTURI RECYCLE SYSTEM
LINE OR EQUIPMENT DESIGNATION : T0040
LINE DESCRIPTION : SCRUBBER RECYCLE PUMP SUCTION
LINE/EQUIPMENT CONSIDERED : 8-BR-501-H-K, 8-BR-501A-H-K, 8-BR-501B-H-K, BEGINS AT T-201 SCRUBBER, ENDS AT P-203A/B RECYCLE PUMPS
DRAWING DESIGNATION(S) : 32-03-713-D REV 5 SHEET 5 OF 6 (7/23/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0040-1-1	FLOW-NO	INADVERTANT VALVE CLOSURE, LINE PLUGGING	CAVITATION OF PUMP P-203A/B, LOSS OF FLOW TO SCRUBBER AND VENTURI, SHUTDOWN OF WASTE	B

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0040-1-2	FLOW-NO	LINE RUPTURE	RELEASE OF HOT (190F) BRINE INTO WORK AREA, LOSS OF RECYCLE TO VENTURI AND SCRUBBER, LOW LEVELS IN S-202 SUMP AND T-201 (SCRUBBER)	C

COMMENTS:

ACTION: RECOMMEND SAFETY EVALUATION OF RELEASE OF HOT BRINE

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; REFERENCE SAFETY PLAN, ROUTINE DAILY LINE AND TANK INSPECTIONS WILL BE PERFORMED.
2/21/92 WESTON REPORT, HEALTH AND SAFETY PLAN CONTAINS A CONTINGENCY FOR LINE RUPTURE.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0040-2-1	FLOW-MORE	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0040-3-1	FLOW-LESS	SEE NO FLOW		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0040-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0040-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0040-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0040-7-1	PRESSURE-NO	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0040-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0040-9-1	PRESSURE-LESS	SAME AS LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0040-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION: RECOMMEND SAFETY REVIEW OF HOT LINE

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0040-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0040-12-1	COMPOSITION-MORE	BUILDUP OF SOLIDS	CAVITATION OF PUMPS, LOSS OF FLOW TO VENTURI AND SCRUBBER, HIGH STACK EMISSIONS, SYSTEM SHUTDOWN	B

COMMENTS: SOLUBILITY OF SOLIDS WILL BE DEPENDENT ON pH. IF pH CONTROL IS LOST, THE pHCONTROL WILL BE LOST AND WILL RISES ABOVE 10.0 CAUSING PRECIPITATION. ACTION:

AUDIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
ACTION ITEMS: CONSIDER HIGH pH ALARM IN AIC 56

NOTE: COMMENT FOR THIS LINE ITEM SHOULD BE REVIEWED

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0040-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0040-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0040-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0040-16-1	STARTUP/SHUTDWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0040-17-1	EMGCY SD-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0040-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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HAZOP STUDY IDENTIFIER : SCRUBBER/VENTURI RECYCLE SYSTEM
LINE OR EQUIPMENT DESIGNATION : T0041
LINE DESCRIPTION : SCRUBBER RECYCLE PRESSURE SIDE
LINE/EQUIPMENT CONSIDERED : 6-BR-501A-H-K, 6-BR-501B-H-K, 6-BR-501-H-K, 4-BR-503-H-K, 3-WP-503-L-XXXX, 3-BR-504-H-K, P-203A/B, ENDS AT T-201 SCRUBBER
DRAWING DESIGNATION(S) : 32-03-713-D REV 5, SHEET 5 OF 6 (7/23/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0041-1-1	FLOW-NO	LOSS OF PUMPS P203A/B, LINE PLUGGING, INADVERTANT VALVE CLOSURE, LOSS OF INSTRUMENT AIR, LOSS OF CONTROL OF FCV-65, PLUGGING OF SCRUBBER SPARGER NOZZLE	INSUFFICIENT SCRUBBING IN T-201, HIGH STACK EMISSIONS, SYSTEM SHUTDOWN	B

COMMENTS:

ACTION: RECOMMEND INVESTIGATION OF EMERGENCY FAIL POSITION OF VALVE FCV-65.

AUDIT NOTES: HAZOP TEAM: MEETING 11/91 NOTES; TEAM HAS VERIFIED P&ID CHANGE TO SHOW FAIL CLOSED FOR FCV-65.

RESPONSE: WESTON 11/5/91 REPORT; FCV-65 WILL FAIL CLOSED.
2/21/92 WESTON SAME AS ABOVE

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0041-1-2	FLOW-NO	LINE RUPTURE	RELEASE OF HOT BRINE (190 F) INTO WORK AREA, LOSS OF SCRUBBING, HIGH STACK EMISSIONS, SYSTEM SHUTDOWN	C

COMMENTS:

ACTION: INVESTIGATE SAFETY ASPECTS OF LACK OF RUPTURE DETECTION. NO INDICATION OF RUPTURE DOWNSTREAM OF FE-65

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; ROUTINE DAILY LINE AND TANK INSPECTIONS WILL BE PERFORMED.
2/21/92 WESTON SAME AS ABOVE

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0041-2-1	FLOW-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0041-3-1	FLOW-LESS	LOSS OF PUMPS 203A/B, PARTIAL LINE PLUGGING, INADVERTANT VALVE POSITIONING, LOSS OF CONTROL OF FCV-65, LOSS OF CONTROL OF FCV-62 AND/OR FCV-60	SAME AS NO FLOW.	B

COMMENTS: TRENDING OF FIC-65 WOULD INDICATE NOZZLE PLUGGING OR NOZZLE FAILURE. ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0041-3-2	FLOW-LESS	LINE LEAK	SEE LINE RUPTURE	C

COMMENTS: TRENDING FIC-65 WOULD INDICATE PLUGGING OF NOZZLE OR NOZZLE FAILURE. ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0041-4-1	FLOW-AS WELL AS	CAUSTIC FLOW INTO LINE WHEN NOT INTENDED	HIGH pH IN SCRUBBER, POSSIBLE HAZARD DURING MAINTENANCE BECAUSE CAUSTIC IS STILL FLOWING UNEXPECTEDLY.	C

COMMENTS: LOW FLOW IS INDICATED ON FSLL-65. ACTION: INSTALL INTERLOCK TO FCV-56 TO SHUT CAUSTIC FLOW IN THE EVENT OF INSUFFICIENT FLOW AT FE-65.

AUDIT NOTES: RESPONSE: WESTON11/5/91 REPORT; INTERLOCK HAS BEEN ADDED.
HAZOP TEAM; INTERLOCK #19 ONLY STOPS WASTE FEED, SUGGEST THAT WESTON REVIEW FEED/PUMP CONTROL AS AN ADDITIONAL INTERLOCK CONTROL.
2/21/92 WESTON REPORT; INTERLOCK 64 HAS BEEN ADDED

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0041-5-1	FLOW-REVERSE	LOSS OF PUMPS P-203A/B	CAUSTIC MAY BE INTRODUCED IN REVERSE FLOW ON 4"-BR-503-H-K TO 6"-BR-501-H-K, CAUSTIC IN LINE WHERE NOT EXPECTED.	C

COMMENTS:

ACTION: INVESTIGATE ADDITION OF CHECK VALVE AT INTERSECTION OF CAUSTIC LINE WITH 4"-BR-503-H-K, SEE RECOMMENDATION FOR INTERLOCK UNDER AS WELL AS FLOW.

AUDIT NOTES: HAZOP TEAM: MEETING 11/91 NOTES; T-THERMAL REV. 8 FOR CHANGE TO DRG.
RESPONSE: WESTON 11/5/91 REPORT; CHECK VALVE WILL BE ADDED.
2/21/92 WESTON REPORT, CHECK VALVE 342 HAS BEEN MOVED TO 1/2 WB-320.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0041-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0041-7-1	PRESSURE-NO	SEE NO FLOW		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0041-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0041-9-1	PRESSURE-LESS	SEE LESS FLOW, NOZZLE FAILURE		

COMMENTS: ACTION: INCLUDE INSPECTION OF NOZZLES ON A REGULAR BASIS.

AUDIT NOTES: RESPONSE; WESTON 2/21/92 REPORT, AGREED, O&M MANUAL INCLUDES ROUTINE NOZZLE INSPECTION

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0041-9A-1	PRESSURE-AS WELL AS	SEE AS WELL AS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0041-10-1	TEMPERATURE-MORE	SEE SAFETY CONSIDERATIONS RECOMMENDED UNDER ALL HOT LINES.		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0041-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0041-12-1	COMPOSITION-MORE	UNCONTROLLED ADDITION OF CAUSTIC	HIGH pH IN SCRUBBER, PRECIPITATION OF METAL HYDROXIDES	A

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0041-13-1	COMPOSITION-LESS	ADDITION OF LESS CAUSTIC THAN INTENDED	LOW pH IN SCRUBBER, INEFFICIENT SCRUBBER OPERATION, HIGH EMISSIONS, SYSTEM SHUTDOWN.	B

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0041-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0041-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0041-16-1	STARTUP/SHUTDWN-OTHER THAN	HIGH CAUSTIC IN SCRUBBER PIPELINES	POSSIBLE PLUGGED LINES, PLUGGED NOZZLE AND PACKING, SAFETY CONSIDERATION DURING MAINTENANCE	C

COMMENTS: ADD ITEM 16-2 - IMPROPER SEQUENCING OF PUMPS P-203A/B WITH VALVES XV-79A/B, CONSEQUENCE: SEE NO FLOW.

ACTION: (1) RECOMMEND SHUTDOWN OF CAUSTIC PUMPS PRIOR TO SHUTDOWN OF RECIRCULATION IN SHUTDOWN SEQUENCE,(2) RECOMMEND FSLL-65 BE INCLUDED AS BURNER STARTUP PERMISSIVE.

AUDIT NOTES: HAZOP TEAM: MEETING 11/91 NOTES; (1) COVERED IN ROUTINE STARTUP/SHUTDOWN PROCEDURES(2) WASTE FEED PERMISSIVE RATHER THAN BURNER PERMISSIVE.
RESPONSE: WESTON 11/5/91 REPORT: (1) AGREED (2) WILL EVALUATE AND INCLUDE IN PMCS, AS REQUIRED.
TEAM: NEED FUTHER INFORMATION BY WESTON/T-THERMAL FOR RESPONSE(2)
2/21/92 WESTON REPORT, (2) PERMISSIVE HAS BEEN INCLUDED AS INTERLOCK 19, BUT FOR WASTE FEED ONLY NOT FOR BURNER OPERATION.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0041-17-1	EMERGENCY SD-OTHER THAN	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0041-18-1	MAINTENANCE-OTHER THAN	PUMP WEAR AND/OR CORROSION	INEFFICIENT OPERATION OF PUMP	

COMMENTS:

ACTION: RECOMMEND ALTERNATING USE OF SPARE PUMP FOR ALL LINES.

AUDIT NOTES: HAZOP TEAM: MEETING 11/91 NOTES, CIRCULATE ONCE PER WEEK, NOT ROUTINE.
RESPONSE: WESTON 11/5/91 REPORT; AGREED
2/21/92 WESTON REPORT, PUMPS WILL BE ALTERNATED

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HAZOP STUDY IDENTIFIER : SCRUBBER/VENTURI RECYCLE SYSTEM
LINE OR EQUIPMENT DESIGNATION : T0042
LINE DESCRIPTION : pH CONTROL LOOP FOR SCRUBBER RECYCLE
LINE/EQUIPMENT CONSIDERED : 2-BR-501-H-K, 1-BR-501-H-K BEGINS AT 6-BR-501-H-K AND TERMINATES AT T-201 (SCRUBBER)
DRAWING DESIGNATION(S) : 32-03-713-D SHEET 5 OF 6 REV 5 (7/23/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0042-1-1	FLOW-NO	INADVERTANT VALVE CLOSURE, LINE PLUGGING, LOSS OF PUMP P-203A/B	LOSS OF CAUSTIC FEED TO SCRUBBER, INCREASED EMISSIONS TO STACK, SYSTEM SHUTDOWN.	B

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0042-1-2	FLOW-NO	LINE RUPTURE	SEE LINE T0041	C

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0042-2-1	FLOW-MORE	NO CONSEQUENCES		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0042-3-1	FLOW-LESS	INADVERTANT VALVE POSITIONING, PARTIAL LINE PLUGGING, DEGRADATION OF PUMPS	ERRONEOUS pH INDICATION, POSSIBLE INCREASED EMISSIONS TO STACK, POSSIBLE SHUTDOWN	B

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0042-3-2	FLOW-LESS	LINE LEAKS	RELEASE OF HOT BRINE, POSSIBLE HIGH EMISSIONS, POSSIBLE SHUTDOWN	C

COMMENTS: INABILITY TO DETECT LINE LEAKS. ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0042-4-1	FLOW-AS WELL AS	INADVERTANT VALVE OPEN ON DOMESTIC SOFTENED WATER SUPPLY.	INTRODUCTION OF SOFTENED WATER IN LINE, ERRONEOUS pH READING, POSSIBLE HIGHER EMISSIONS, POSSIBLE SYSTEM SHUTDOWN.	B

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0042-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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HAZOP STUDY IDENTIFIER :
LINE OR EQUIPMENT DESIGNATION : T0042
LINE DESCRIPTION :
LINE/EQUIPMENT CONSIDERED :
DRAWING DESIGNATION(S) :

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0042-6-1	FLOW-OTHER THAN	VALVE MISALIGNMENT	FLOW OF DOMESTIC WATER INSTEAD OF RECYCLE, HIGH EMISSIONS, POSSIBLE SYSTEM SHUTDOWN.	B

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : SCRUBBER/VENTURI RECYCLE SYSTEM
LINE OR EQUIPMENT DESIGNATION : T0042
LINE DESCRIPTION : pH CONTROL LOOP FOR SCRUBBER RECYCLE
LINE/EQUIPMENT CONSIDERED : 2-BR-501-H-K, 1-BR-501-H-K BEGINS AT 6-BR-501-H-K AND TERMINATES AT T-201 (SCRUBBER)
DRAWING DESIGNATION(S) : 32-03-713-D SHEET 5 OF 6 REV 5 (7/23/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0042-7-1	PRESSURE-NO	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0042-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0042-9-1	PRESSURE-LESS	SEE LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0042-10-1	TEMPERATURE-MORE			

COMMENTS: SEE COMMENTS/ACTION ITEMS UNDER ALL HOT LINES. ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0042-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0042-12-1	COMPOSITION-MORE	LOSS OF CONTROL ON FCV-56	HIGH pH IN LOOP CAUSING PRECIPITATION OF METAL HYDROXIDES AND FOULING OF pH PROBES AND POSSIBLE PLUGGING OF LINES.	A

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0042-13-1	COMPOSITION-LESS	SEE AS WELL AS FLOW.		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0042-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0042-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0042-16-1	STARTUP/SHUTDWN-OTHER THAN	CAUSTIC REMAINS IN LINE AFTER SHUTDOWN	POSSIBLE BUILDUP OF CAUSTIC/SOLID DEPOSITION	A

COMMENTS: ACTION: RECOMMEND FLUSHING OF LINES AFTER SHUTDOWN OF P-203A/B.

AUDIT NOTES: HAZOP TEAM: MEETING 11/91 NOTES; NOT RECOMMENDED BY WESTON BECAUSE 20% CAUSTIC IS OKMAINT. ITEM. NEED TO MINIMIZE FLUSH WATER, CAN BE ADDED LATER IF NEEDED.

RESPONSE: WESTON 11/5/91 REPORT; NOT RECOMMENDED
2/21/92 WESTON REPORT; NOT RECOMMENDED SINCE CAUSTIC IS ONLY 20%. FLUSHING WILL BE COMPLETED AS REQUIRED FOR MAINTENANCE.

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0042-17-1	EMERGENCY SD-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0042-18-1	MAINTENANCE-OTHER THAN	SOLIDS BUILDUP ON pH PROBES	ERRONEOUS pH READINGS	A

COMMENTS: (1) FREQUENCY OF FLUSHING TO BE DETERMINED UPON OPERATING EXPERIENCE.(2) FREQUENCY WILL BE CONSERVATIVE ON STARTUP.

ACTION: (3)RECOMMEND TRENDING OF CAUSTIC CONTROL VALVE FCV-56.

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; (1) AGREED (2) AGREED (3) NO, PROBES WILL BE ROUTINELY CLEANED TO PREVENT SLOIDS BUILDUP.
2/21/92 WESTON SAME AS ABOVE

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0042-18-2	MAINTENANCE-OTHER THAN	IMPROPER MAINTENANCE PROCEDURE ON REMOVING pH PROBE.	LEAK OF CAUSTIC INTO WORKPLACE	C

COMMENTS:

ACTION: RECOMMEND INSTALLATION OF SPLASH SHIELDS OR GUARDS ON PROBES.

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; AGREED
2/21/92 WESTON; SPLASH GUARDS WILL BE UTILIZED

HAZARD AND OPERABILITY STUDY - H A Z O P
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CA_HAZOP VER 1.3

HAZOP STUDY IDENTIFIER : SCRUBBER/VENTURI RECYCLE SYSTEM
LINE OR EQUIPMENT DESIGNATION : T0043
LINE DESCRIPTION : ALTERNATE BLOWDOWN TO BRINE TANK FROM SCRUBBER
LINE/EQUIPMENT CONSIDERED : 2"-BR-313A-H-K, 2"-BR-313B-H-K, BEGINS AT 3"-BR-501-H-K, ENDS AT 2"-WP-500-B-K AND 2"-BR-313-H-K
DRAWING DESIGNATION(S) : 32-03-713D SHEET 5 OF 6, REV 5, 7/23/91; 03-04-015 REV 0, 7/[illegible]/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0043-1-1	FLOW-NO	INADVERTANT VALVE CLOSURE, LINE PLUGGING, LOSS OF INSTRUMENT AIR, LOSS OF PUMPS P-203A/B, LOSS OF CONTROL ON FCV-62	INABILITY TO REMOVE EXCESS BRINE FROM SCRUBBER RECYCLE SYSTEM	A

COMMENTS: THIS LINE IS NORMALLY NOT IN USE- IS AN ALTERNATIVE TO NORMAL OPERATION AND IS ACTIVATED MANUALLY BY OPERATOR.

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0043-1-2	FLOW-NO	LINE RUPTURE	RELEASE OF HOT BRINE TO WORK AREA, UNABLE TO TRANSFER BRINE TO TANKS	C

COMMENTS: NO INDICATION OF LINE RUPTURE

ACTION: CONSIDER SAFETY RAMIFICATIONS OF LACK OF LINE RUPTURE INDICATION.

AUDIT NOTES: RESPONSE; WESTON 2/21/92 REPORT, ROUTINE DAILY INSPECTION OF LINES/TANKS WILL BE PERFORMED.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0043-2-1	FLOW-MORE	INADVERTANT VALVE POSITIONING	LOSS OF STORAGE CAPACITY, BRINE DISPOSAL PROBLEMS, INCREASED MAKEUP WATER FLOW TO QUENCH TANK	

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0043-3-1	FLOW-LESS	LINE PLUGGING, INADVERTANT VALVE POSITIONING, DETERIORATION OF PUMPS P-203A/B	INABILITY TO TRANSFER BRINE AT REQUIRED RATE.	A

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0043-3-2	FLOW-LESS	SEE LINE RUPTURE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0043-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0043-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0043-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0043-7-1	PRESSURE-NO	SEE NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0043-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0043-9-1	PRESSURE-LESS	SEE LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0043-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0043-11-1	TEMPERATURE-LESS	FREEZING OF FLUID IN LINE	INABILITY TO OPERATE LINE WHEN NECESSARY	A

COMMENTS:

ACTION: INVESTIGATE WHETHER LINE IS PROPERLY SLOPED TO DRAIN WHEN NOT IN USE.

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; ALTHOUGH NOT NORMALLY IN USE, THE LINE IS PROTECTED BY BEING INSIDE ANOTHER LINE (DOUBLELINE PIPE).

HAZOP TEAM: WESTON RESPONSE IS NOT CLEAR, WESTON SHOULD RE-EVALUATE THEIR RESPONSE.
2/21/92 WESTON REPORT; ALTHOUGH NOT NORMALLY IN USE THE LINE IS PROTECTED BY BEING INSIDE

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0043-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0043-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0043-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0043-15-1	COMPOSITION-OTHER THAN	HIGH SOLIDS IN LINE	LINE PLUGGING, SEE NO/LOW FLOW	A

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0043-16-1	STARTUP/SHUTDWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0043-17-1	EMERGENCY SD-OTHER THAN	LOSS OF LINE (LINE PLUGGING, ETC) WHEN INTENDED FOR USE FOR FLUSH WATER SUBSEQUENT TO EMERGENCY SHUTDOWN	INABILITY TO DISPOSE OF FLUSH WATER INTO BRINE TANKS	A

COMMENTS: MAY BE NECESSARY TO EMPTY LINES AND SCRUBBER TO DRAIN. ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0043-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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HAZOP STUDY IDENTIFIER : SCRUBBER/VENTURI SYSTEM
LINE OR EQUIPMENT DESIGNATION : T0044
LINE DESCRIPTION : SCRUBBER
LINE/EQUIPMENT CONSIDERED : SCRUBBER T-201
DRAWING DESIGNATION(S) : 32-03-713D SHEET 5 OF 6, REV 5, 7/23/91, 6-05-125D REV 3, 8/19/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0044-1-1	FLOW-NO	PLUGGED PACKING AND/OR DEMISTER, LOSS OF LEVEL CONTROL	LOSS OF FLOW THROUGH SCRUBBER, SYSTEM SHUTDOWN	B

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0044-1-2	FLOW-NO	VESSEL RUPTURE	RELEASE OF HOT GASES AND HOT SCRUBBER LIQUID TO WORK AREA	C

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0044-2-1	FLOW-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0044-3-1	FLOW-LESS	LEAKING MANWAY	RELEASE OF HOT GASES TO WORK AREA	C

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0044-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0044-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0044-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0044-7-1	PRESSURE-NO	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0044-8-1	PRESSURE-MORE	SEE NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0044-9-1	PRESSURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0044-10-1	TEMPERATURE-MORE	SEE LINE T0038 FOR MORE TEMPERATURE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0044-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0044-12-1	COMPOSITION-MORE	LOSS OF pH CONTROL OR FAILURE OF FCV-56	MORE CAUSTIC - GREATER TENDENCIES TO DEPOSIT SOLIDS ON PACKING CAUSING BLOCKAGE, IMPROPER SCRUBBING DUE TO CHANNELING.	A

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0044-13-1	COMPOSITION-LESS	LESS CAUSTIC - SEE ITEM 16-1	HIGH EMISSIONS OUT OF STACK, SYSTEM SHUTDOWN	B

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0044-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0044-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0044-16-1	STARTUP/SHUTDWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION: PROVIDE PERMISSIVE FOR STARTUP ON LSLL-62.

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT: INTERLOCK 35 HAS BEEN PROVIDED.
2/21/92 WESTON SAME AS ABOVE

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0044-17-1	EMERGENCY SD-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0044-18-1	MAINTENANCE-OTHER THAN	MATERIAL FAILURE	LOSS OF SCRUBBER	

COMMENTS: NORMAL MAINTENANCE IS VISUAL INSPECTION FOR CRACKS. SCRUBBER IS FRP MATERIAL

ACTION: INSURE THAT O&M CONTAINS PROPER MAINTENANCE PROCEDUERS FOR INSPECTION OF FRP

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0044-19-1	LEVEL-NO	SCRUBBER RUPTURE	RELEASE OF HOT GASES AND BRINE TO WORK AREA	C

COMMENTS: ACTION: INVESTIGATE CONTAINMENT FOR SPILLAGE CAPACITY

AUDIT NOTES: Q. WHAT SORT OF CONTAINMENT IS PROVIDED FOR VESSEL IN THE EVENT OF A RUPTURE?

HAZOP TEAM: MEETING 11/91 NOTES; WESTON FEELS THAT THEY HAVE ADEQUATE CONTAINMENT,WHAT THE SUMP WILL NOT HOLD THE CONTAINMENT WILL.
RESPONSE: WESTON 11/5/91 REPORT; CONTAINMENT IS ADEQUATE TO CONTAIN A SPILL AS A RESULT OF A RUPTURE TO THE SCRUBBER.

TEAM: HAZOP TEAM WAS NOT PROVIDED DETAIL ON VESSEL CONTAINMENT, WESTON SHOULD PROVIED TEAM WITH DETAIL ON CONTAINMENT TO RESOLVE THIAS ISSUE.
2/21/92 WESTON SAME RESPONSE AS 11/91

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0044-19-2	LEVEL-NO	FAILURE OF LEVEL INDICATOR/CONTROL SYSTEM	CAVITATION OF PUMPS, LOSS OF RECIRCULATION TO SCRUBBER AND VENTURI, HIGH EMISSIONS IN STACK, SYSTEM SHUTDOWN.	B

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0044-20-1	LEVEL-MORE	LOSS OF LEVEL CONTROL, PLUGGING OF PUMP SUCTION	RESTRICTION OF GAS FLOW, IMPROPER SYSTEM OPERATION, POSSIBLE SYSTEM SHUTDOWN	B

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0044-21-1	LEVEL-LOW	LOSS OF LEVEL CONTROL, INADEQUATE SCRUBBER WATER FEED	CAVITATION OF PUMPS P-203A/B, LOSS OF FLOW TO SCRUBBER AND VENTURI, LOSS OF SCRUBBING EFFICIENCY, HIGH EMISSIONS, POSSIBLE SYSTEM SHUTDOWN.	B

COMMENTS: ACTION:

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; CONTAINMENT IS ADEQUATE, NO WESTON RESPONSE FOR THE SAFETY EVALUATION FOR RELESE OF HOT BRINE INTO WORK AREAS.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0044-21-2	LEVEL-LOW	VESSEL/MANWAY LEAK	RELEASE OF HOT (190 F) SCRUBBING LIQUID TO WORK AREA, SEE 21-1, 19-1	C

COMMENTS: ACTION: SEE ACTION ITEM UNDER 19-1.

AUDIT NOTES: RESPONSE: WESTON 2/21/92 REPORT; CONTAINMENT IS ADEQUATE. THE HEALTH AND SAFETY PLAN WILL ADDRESS THE CONTINGENCY OF A RELEASE

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HAZOP STUDY IDENTIFIER : FLUE GAS SYSTEM
LINE OR EQUIPMENT DESIGNATION : T0045
LINE DESCRIPTION : STACK
LINE/EQUIPMENT CONSIDERED : DUCT FROM SCRUBBER TO STACK AND STACK
DRAWING DESIGNATION(S) : 32-03-713D SHEET 5 OF 6, REV 5, 7/23/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0045-1-1	FLOW-NO	NO FLOW FROM SCRUBBER	SEE NO FLOW FOR LINE T0044	B

COMMENTS: ACTION:

AUDIT NOTES: HAZOP TEAM: MEETING 11/91 NOTES, ROUTINE INSPECTION ARE INCLUDED IN THE SAFETY PLAN.
RESPONSE: WESTON 11/5/91 REPORT; NOT REQUIRED

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0045-1-2	FLOW-NO	RUPTURE	RELEASE OF HOT GASES INSIDE/OUTSIDE BUILDING IN WORK AREA, CEM SYSTEM WILL NOT MONITOR SAMPLE RESULTING IN ERRONEOUS READINGS AND SYSTEM SHUTDOWN.	C

COMMENTS: NO INDICATION OF RUPTURE BESIDE HIGH OXYGEN READING. ACTION: RECOMMEND EVALUATION OF NEED FOR INDICATOR ON STACK FOR RUPTURE.

AUDIT NOTES: RESPONSE; WESTON 2/21/92 REPORT; NOT REQUIRED

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0045-2-1	FLOW-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0045-3-1	FLOW-LESS	BUILDUP OF CONDENSED WATER IN DUCT AND/OR STACK OR EXCESSIVE CARRYOVER OF WATER FROM SCRUBBER DEMISTER.	IMPROPER SYSTEM OPERATION AND EVENTUAL SHUTDOWN	B

COMMENTS: (2) DRAIN IS LOCATED ON STACK, DUCT HAS NO DRAIN, UNKNOWN WHETHER DUCT IS SLOPED OR NOT.

ACTION: (1) RECOMMEND INVESTIGATING NECESSITY FOR INSTALLATION OF BIRD SCREEN

AUDIT NOTES: HAZOP TEAM: MEETING 11/91 NOTES, WESTON DOES NOT FEEL THAT THIS SCREEN IS NECESSARY.
RESPONSE: WESTON 11/5/91 REPORT (1) NOT REQUIRED (2) DUCT IS SLOPED SLIGHTY TOWARD THE SCRUBBER.
2/21/92 WESTON SAME AS ABOVE

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0045-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0045-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0045-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0045-7-1	PRESSURE-NO	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0045-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0045-9-1	PRESSURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0045-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0045-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0045-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0045-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0045-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0045-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0045-16-1	STARTUP/SHUTDWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0045-17-1	EMERGENCY SD-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0045-18-1	MAINTENANCE-OTHER THAN			

COMMENTS: (1) NOT ENOUGH INFORMATION EXISTS AT THIS POINT TO FULLY EVALUATE CEM.(2) CEM HAS THE ABILITY TO SHUT THE SYSTEM DOWN ON MALFUNCTION.

ACTION: (3)RECOMMEND ASSESSMENT OF CEM UPON AVAILABILITY OF COMPLETE INFORMATION.

AUDIT NOTES: RESPONSE: WESTON 2/5/92 REPORT, (1) AGREED,THE CEM P&ID SENT TO TEAM 2/92 (2) YES (3) AGREED.
TEAM: HAZOP TEAM HAS NOT REVIEWED THE CEM P&ID'S AS OF THIS DATE.
2/21/92 WESTON SAME AS ABOVE

HAZOP STUDY IDENTIFIER : SQI, WASTEWATER, BRINE, AND CAUSTIC DRAINS AND SUMPS
LINE OR EQUIPMENT DESIGNATION : T0046
LINE DESCRIPTION : DRAINS AND SUMPS
LINE/EQUIPMENT CONSIDERED : 1"-WD-003A-E-N, 1 1/2"-WD-004A-E-N, 3"-WD-015-E-K, 4"-WD-015-E-K, BEGIN AT SUMP TK-402A, END AT WASTEWATER TANK TK-104. SUMP TK-402A REPRESENTS REPRESENTATIVE SUMP FOR HAZOP
DRAWING DESIGNATION(S) : 03-04-010 REV 0, 7/31/91, 03-04-001 REV 0, 7/31/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0046-1-1	FLOW-NO	PLUGGED INTAKE LINE, INADVERTANT VALVE CLOSURE, FAILURE OF LEVEL CONTROL VALVE, PLUGGED DISCHARGE LINE, PUMP FAILURE	POSSIBLE OVERFLOW OF SUMP, LOSS OF FEED TO WASTEWATER TANK, RELEASE OF HOT BRINE, CAUSTIC, AND/OR BASIN F LIQUID TO WORK AREA.	C

COMMENTS: (2)WESTON AND T-THERMAL DRAWINGS HAVE NOT BEEN COORDINATED. UNCERTAIN WHETHER PIPING CONNECTS DRAINS TO SUMPS OR WHERE SUMPS ARE LOCATED. QUESTION DESIGN OF SUMP CAPACITY AND PUMP CAPACITY.

ACTION: (1)P&IDS SHOULD DESIGNATE FLOW PATH FROM DRAIN LINES TO SUMPS.(4) RECOMMEND ROUTINE INSPECTION OF SUMPS.(5) RECOMMEND REVIEW OF SUMP SIZING AND PUMP CAPACITY.

AUDIT NOTES: (3)Q. SUMP PUMP P-403 IS SIZED TO 50 GPM, SUMP IS 45 GALLONS VOLUME. WHY ARE

PUMP AND SUMP DESIGNED IN THIS MANNER?

RESPONSE: WESTON 2/5/92 REPORT, (1&2) THE P&IDs SHOW LINES WHICH ARE DIRECTED TO DRAINS, DETAILS OF THE PIPE ROUTING ARE SHOWNON THE MECH. P&IDs(3) SUMP P&ID ALSO SERVICES DRAINAGE FROM AN UPPER LEVEL AND HAVE BEEN INCREASED IN SIZE ACCORDINGLY (4) AGREED(5) PUMP SIZING AND CAPACITY WAS REVIEWED, P-403 IS LARGER BECAUSE OF THE POTENIAL FOR GREATER SERVICE.
2/21/92 WESTON SAME AS ABOVE 2/5/92

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0046-1-2	FLOW-NO	LINE RUPTURE	RELEASE OF BRINE, CAUSTIC, AND/OR BASIN F LIQUID	C

COMMENTS: SUMP LOCATION/PIPING IS UNCLEAR.

ACTION: RECOMMEND INVESTIGATION OF NECESSITY OF LINE RUPTURE INDICATION ON SUMPS.

AUDIT NOTES: HAZOP TEAM: MEETING 11/91 NOTES, ASSUMPTION THAT PIPING IS VISUALLTY AVAILABLE NOT IN CONCERT.

RESPONSE: WESTON 11/5/91 REPORT, ROUTINE INSPECTIONS OF SUMP AREAS AND ASSOCIATED PIPING WILL BE PERFORMED DAILTY.
2/21/92 WESTON SAME AS ABOVE, O&M MANUAL WILL INCLUDE THE ABOVE

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0046-2-1	FLOW-MORE	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0046-3-1	FLOW-LESS	QUANTITY PUMPED FROM SUMP LESS THAN INFLOW.	POSSIBLE SUMP OVERFLOW, SEE NO FLOW, REDUCED WATER TO WASTEWATER TANK.	C

COMMENTS: (2)LOCATIONS AND ELEVATION OF SUMPS IS UNCLEAR FROM P&IDS AND SCHEMATIC DRAWINGS.

ACTION: (1)RECOMMEND ROUTINE FLUSHING OF SUMP DISCHARGE

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT, (1)FLUSHING WILL BE DONE ON A AS NEEDED BASIS. OPERATIONS WILL DETERMINE THE FEQUENCY OF FLUSHING. (2) NO WESTON RESPONSE.
2/21/92 WESTON REPORT;(2) THE MECHANICAL LAYOUT DRAWINGS NEED TO BE CONSULTED FOR THE LOCATION AND ELEVATIONS OF THE SUMPS.

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0046-3-2	FLOW-LESS	SEE NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0046-3-3	FLOW-LESS	LINE LEAKS	SEE LINE RUPTURE	C

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0046-4-1	FLOW-AS WELL AS	NO CONSEQUENCE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0046-5-1	FLOW-REVERSE	FAILURE OF CHECK VALVE.		

COMMENTS: ELEVATION OF SUMP IS NOT CLEAR FROM DRAWINGS. ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0046-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0046-7-1	PRESSURE-NO	SEE NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0046-8-1	PRESSURE-MORE	SAME AS NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0046-9-1	PRESSURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0046-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0046-11-1	TEMPERATURE-LESS	FAILURE OF HEAT TRACING	POSSIBLE FREEZING OF LINE	B

COMMENTS: SEE COMMENTS/ACTION ITEMS UNDER LOSS OF HEAT TRACING FOR HEAT TRACING LINEs. ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0046-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0046-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0046-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0046-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0046-16-1	STARTUP/SHUTDWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: INTERMITTENT USE. ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0046-17-1	EMERGENCY SD-OTHER THAN	FEED OF FLUID TO SUMP GREATER THAN SUMP CAPACITY	SUMP OVERFLOW	C

COMMENTS: ACTION: RECOMMEND REVIEW OF SUMP SIZING.

AUDIT NOTES: RESPONSE; WESTON 2/21/92 REPORT, THE SUMPS HAVE BEEN SIZED TO PROVIDE THE SUMPS PUMPS WITH THE NECESSARY INLET CONDITIONS RATHER THAN TO PROVIDE A MINIMUM RETENTION CAPACITY.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0046-18-1	MAINTENANCE-OTHER THAN	FAILURE OF LEVEL CONTROLLER	LOSS OF LEVEL CONTROL, OVERFLOW OF SUMP	B

COMMENTS: ACTION: ENSURE LEVEL CONTROLLERS ARE INSPECTED ROUTINELY FOR PROPER OPRATION DUE TO SUMP CAPACITIES.

AUDIT NOTES: SEE RESPONSE ON LINE T0046-17-1

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0046-19-1	LEVEL-NO	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0046-20-1	LEVEL-MORE	FAILURE OF LEVEL CONTROL, FLOW TO SUMP EXCEEDS SUMP CAPACITY	SEE MORE FLOW	C

COMMENTS:

ACTION: SEE MAINTENANCE, ITEM 18-1

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0046-21-1	LEVEL-LESS	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : DRAINS AND SUMPS
LINE OR EQUIPMENT DESIGNATION : T0047
LINE DESCRIPTION : DRAINS FROM TANKS TK-201, 202
LINE/EQUIPMENT CONSIDERED : 6" DRAIN LINES FROM TANKS TK-202, TK-201
DRAWING DESIGNATION(S) : 03-04-015, REV 0, 7/31/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0047-1-1	FLOW-NO	LINE/DRAIN PLUGGING	NO FLOW TO SUMP, POSSIBLE RELEASE OF FLUID TO WORK AREA	C

COMMENTS:

ACTION: (1)INVESTIGATE POSSIBLE DRAIN FLOW TO SUMP AND ADEQUACY OF SUMP TO HANDLE FLOW.(2) REEVALUATE BOTTOM DRAIN LINE SIZING TO SUMP.

AUDIT NOTES: RESPONSE: WESTON 2/5/92 REPORT,(1) AS STATED, THE SUMP SIZING IS DESIGNED TO ACCOMMODATE THE PUMP AND TO PROVIDE A MINIMUM RETENTION CAPACITY (2) NO WESTON RESPONSE.
2/21/92 WESTON SAME AS ABOVE

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0047-2-1	FLOW-MORE	SEE NO FLOW, INADVERTANT VALVE POSITIONING.	POSSIBLE OVERFLOW OF LIQUID IN SUMP	C

COMMENTS:

ACTION: SEE ACTION ITEM UNDER NO FLOW, 1-1.

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0047-3-1	FLOW-LESS	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0047-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0047-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0047-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0047-7-1	PRESSURE-NO	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0047-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0047-9-1	PRESSURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0047-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0047-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0047-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0047-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0047-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0047-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0047-16-1	STARTUP/SHUTDOWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0047-17-1	EMGCY SHUTDOWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0047-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : BRINE DISPOSAL
LINE OR EQUIPMENT DESIGNATION : T0048
LINE DESCRIPTION : SUCTION SIDE OF BRINE TRANSFER TO TANK CAR
LINE/EQUIPMENT CONSIDERED : 6"-BR-503-P-K, 6"-BR-504-P-K, 4"-BR-503A-P-K, 4"-BR-503B-P-K BEGINS AT TK-201/TK-202, TERMINATES AT P-206A/B
DRAWING DESIGNATION(S) : 03-04-015 REV 0 7/31/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0048-1-1	FLOW-NO	INADVERTANT VALVE CLOSURE, SOLIDS ACCUMULATION, PUMP FAILURE P-206A/B	NO BRINE TRANSFER TO TRUCKS, DECREASE PLANT CAPACITY, POSSIBLE EVENTUAL SYSTEM SHUTDOWN	B

COMMENTS: ON OPERATOR DEMAND. ACTION:

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AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0048-1-2	FLOW-NO	LINE RUPTURE	BRINE SPILLAGE TO GROUND, BRINE STORAGE TANK EMPTIES, DRAINS TO SUMPS.	C

COMMENTS: ACTION: SEE RECOMMENDATION UNDER SUMPS FOR SUMP SIZING CONCERNS.

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT, SUMP SIZING IS IRRELEVENT TO AN AIR DIAPHARGM PUMP. THE SUMP PROVIDES SUCTION FOR THE PUMP ONLY, NOT CONTAINMENT.
HAZOP TEAM: WESTON RESPONSE HAS NOT ADEQUATELY ADDRESSED ACTION ITEM, ITEM REFERS TO A LINE RUPTURE FROM THE TANK TO PUMP AND WHETHER THE SUMP IS SIZED ADEQUATELY FOR SPILLAGE OF BRINE FROM THIS LINE RUPTURE.
2/21/92 WESTON SAME AS ABOVE 11/5/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0048-2-1	FLOW-MORE	INADVERTANT VALVE POSITIONING, OPEN WHEN NOT INTENDED	FLOW WHEN TANK CAR NOT IN POSITION	C

COMMENTS: HAZOP TEAM DOES NOT HAVE ADEQUATE LOADING PROCEDURES TO EVALUATE WHETHER MORE FLOW DEVIATION CAN OCCUR. ACTION:

AUDIT NOTES: COMMENT; HAZOP TEAM DOES NOT HAVE ADEQUATE LOADING PROCEDURES TO EVALUATE WHETHER MORE FLOW DEVIATION CAN OCCUR.
RESPONSE: WESTON 2/5/92 REPORT, SKETCHES REVISING THE P&IDs ACCOMPANY THE 2/5/92 REPORT.
HAZOP TEAM: SKETCHES ARE NOT ADEQUATE TO CONDUCT HAZOP ON THE LOADING SYSTEM. HAZOP SHOULD BE PERFORMED AFTER SKETCHES HAVE BEEN INCORPORATED INTO FINAL DESIGN FOR THIS PROJECT.
2/21/92 WESTON SAME AS ABOVE 2/5/92

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0048-3-1	FLOW-LESS	LINE LEAK	LEAKING OF BRINE INTO SUMP. SEE NO FLOW	C

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0048-3-2	FLOW-LESS	INADVERTANT VALVE POSITIONING	INEFFICIENT LOADING OPERATION	A

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0048-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0048-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0048-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0048-7-1	PRESSURE-NO	SEE NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0048-8-1	PRESSURE-MORE	NOT APPLICBLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0048-9-1	PRESSURE-LESS	SEE LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0048-10-1	TEMPERATURE-MORE			

COMMENTS: SEE ACTION AND COMMENTS FOR ALL HOT LINES ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0048-11-1	TEMPERATURE-LESS	FREEZING IN LINE	NO FLOW IN LINE	B

COMMENTS: UNLIKELY TO OCCUR AS FLOW RECIRCULATES, BRINE IS EXPECTED TO BE WARM/HOT; HOWEVER, THERE IS NO HEAT TRACING ON THE LINE. ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0048-12-1	COMPOSITION-MORE	FAILURE OF TANK TK-201/202 MIXER RESULTING IN BUILDUP OF SOLIDS ON BOTTOM OF TANK.	EXCESSIVE SOLIDS IN TANK, INEFFICIENT BRINE REMOVAL, POSSIBLE LINE BLOCKAGE, EXCESSIVE PUMP WEAR	

COMMENTS: (1)HOW DOES OPERATOR DETECT MIXER OPERATION?(2) DETECTION OF MORE SOLIDS IN LINE IS UNCLEAR.

ACTION:

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT; (1) FEEDBACK IS TRANSMITTED TO THE CONTROL ROOM. IF THE MIXER STOPS AN ALARM IS SOUNDED IN THE CONTROL ROOM.(2) EXCESSIVE SOLIDS IF PRESENT WILL BE REMOVED MANUALLY. RECIRCULATION OF THE STORAGE TANK CONTENTS IS PROVIDED TO KEEP SOLIDS IN SUSPENSION.
2/21/92 WESTON SAME AS ABOVE 11/5/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0048-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0048-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0048-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0048-16-1	STARTUP/SHUTDWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: LOADING/UNLOADING PROCEDURES ARE UNAVAILABLE TO EVALUATE - UNABLE TO DETERMINE DEVIATIONS IN OPERATING PROCEDURES

ACTION:

AUDIT NOTES: SEE HAZOP TEAM COMMENT ON LINE T0048(FLOW-MORE).

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0048-17-1	EMERGENCY SD-OTHER THAN	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0048-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

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HAZOP STUDY IDENTIFIER : BRINE DISPOSAL
LINE OR EQUIPMENT DESIGNATION : T0049
LINE DESCRIPTION : DISCHARGE OF PUMPS P-206A/B TO LOADING OF TRUCK/TANK CARS
LINE/EQUIPMENT CONSIDERED : P-206A/B PUMPS, 3"-BR-503A/B-P-K, 4"-BR-503A/B-P-K, 4"-BR-503A/B-P-H, 4"-BR-401-P-H, 4"-BR-401A-P-H, 6"-BR-401-E-K, 6"-BR-401A-E-K, TANK CAR LOADING ARMS A AND B, BEGINS AT PUMP P-206A/B, ENDS AT TANK CAR LOADING ARMS OR TK-201/202
DRAWING DESIGNATION(S) : 03-04-015 REV 0, 7/31/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0049-1-1	FLOW-NO	PUMP FAILURE, LINE BLOCKAGE, INADVERTANT VALVE CLOSURE, LOSS OF INSTRUMENT AIR	NO LOADING OF TANK CARS/TRUCKS WHEN DESIRED	B

COMMENTS: SEE COMMENT FOR LINE T0048(FLOW-MORE) ON STANDARD LOADING/UNLOADING PROCEDURES.

ACTION:

AUDIT NOTES: *HAZOP TEAM: REVISED MATRIX TABKE FOR INTERLOCKS, INTERLOCK 80 HAS BEEN ADDED TO THE MATRIX FOR LOADING ARM FEED A/B.*
RESPONSE: WESTON 11/5/91 REPORT, INTERLOCK 80 WILL COVER PUMP FAILURE. LOSS OF INSTRUMENT AIR WILL CAUSE VALVES TO GO TO FAIL SAFE POSITION.
2/21/92 WESTON SAME AS ABOVE 11/5/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0049-1-2	FLOW-NO	LINE RUPTURE	RELEASE OF BRINE TO GROUND/FLOOR. SEE NO FLOW ON LINE T0048	C

COMMENTS: (Q)WHAT IS POSITION OF VALVES ON FAILURE?

ACTION:

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT, VALVES WILL FAIL CLOSED. CONTAINMNET IS ADEQUATE TO HANDLE FULL RUPTURE.
2/21/92 WESTON SAME AS ABOVE 11/5/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0049-2-1	FLOW-MORE	SEE MORE FLOW FOR LINE T0048		

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0049-3-1	FLOW-LESS	INADVERTANT VALVE POSITIONING, PUMP WEAR	INEFFICIENT TANK CAR/TRUCK LOADING	A

COMMENTS: SYS[illegible] PARALLEL WITH EITHER PUMP ABLE TO SERVICE EITH[illegible]ANK AND TANK CAR. ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0049-3-2	FLOW-LESS	LINE LEAKS	SEE NO FLOW	C

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0049-4-1	FLOW-AS WELL AS	UTILITY WATER VALVE INADVERTANTLY OPEN	INEFFICIENT BRINE HANDLING AND DISPOSAL, DESIGNED BRINE STORAGE CAPACITY MAY BE EXCEEDED DUE TO INTRODUCTION INTO TANK OR REPLACEMENT OF BRINE IN TANK CAR/TRUCK	B

COMMENTS: ACTION:

AUDIT NOTES: UNABLE TO DTEERMINE SEVERITY OF CONSEQUENCE, UTILITY WATER LINE AND VALVE SIZE NOT SHOWN ON DRWGS.
RESPONSE: WESTON 2/5/92 REPORT, UNLIKELY, BECAUSE OF THE NUMBER OF HAND VALVES IN THE SYSTEM. MORE LIKELY SCENAIRO WOULD FILL UP LINE AND OVERFLOW INTO SUMP AREA. THE UTILITY WATER SUPPLY LINE IS SIZED IS 4 INCHES. THE DISTRIBUTION LINE IS 2 INCHES.
2/21/92 WESTON SAME AS ABOVE 2/5/92

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0049-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER :
LINE OR EQUIPMENT DESIGNATION : T0049
LINE DESCRIPTION :
LINE/EQUIPMENT CONSIDERED :
DRAWING DESIGNATION(S) :

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0049-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : BRINE DISPOSAL
LINE OR EQUIPMENT DESIGNATION : T0049
LINE DESCRIPTION : DISCHARGE OF PUMPS P-206A/B TO LOADING OF TRUCK/TANK CARS
LINE/EQUIPMENT CONSIDERED : P-206A/B PUMPS, 3"-BR-503A/B-P-K, 4"-BR-503A/B-P-K, 4"-BR-503A/B-P-H, 4"-BR-401-P-H, 4"-BR-401A-P-H, 6"-BR-401-E-K, 6"-BR-401A-E-K, TANK CAR LOADING ARMS A AND B, BEGINS AT PUMP P-206A/B, ENDS AT TANK CAR LOADING ARMS OR TK-201/202
DRAWING DESIGNATION(S) : 03-04-015 REV 0, 7/31/91

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0049-7-1	PRESSURE-NO	SEE NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0049-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0049-9-1	PRESSURE-LESS	SEE LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0049-10-1	TEMPERATURE-MORE	SEE LINE T0048		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0049-11-1	TEMPERATURE-LESS	SEE LINE T0048		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0049-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0049-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0049-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER :
LINE OR EQUIPMENT DESIGNATION : T0049
LINE DESCRIPTION :
LINE/EQUIPMENT CONSIDERED :
DRAWING DESIGNATION(S) :

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0049-15-1	COMPOSITION-OTHER THAN	SEE LINE T0048		

COMMENTS: ACTION:

AUDIT NOTES:

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AUDIT TRAIL SUMMARY REPORT
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HAZOP STUDY IDENTIFIER : BRINE DISPOSAL
LINE OR EQUIPMENT DESIGNATION : T0049
LINE DESCRIPTION : DISCHARGE OF PUMPS P-206A/B TO LOADING OF TRUCK/TANK CARS
LINE/EQUIPMENT CONSIDERED : P-206A/B PUMPS, 3"-BR-503A/B-P-K, 4"-BR-503A/B-P-K, 4"-BR-503A/B-P-H, 4"-BR-401-P-H, 4"-BR-401A-P-H, 6"-BR-401-E-K, 6"-BR-401A-E-K, TANK CAR LOADING ARMS A AND B, BEGINS AT PUMP P-206A/B, ENDS AT TANK CAR LOADING ARMS OR TK-201/202
DRAWING DESIGNATION(S) : 03-04-015 REV 0, 7/31/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0049-16-1	STARTUP/SHUTDWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0049-17-1	EMERGENCY SD-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0049-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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HAZOP STUDY IDENTIFIER : BRINE HANDLING
LINE OR EQUIPMENT DESIGNATION : W0050
LINE DESCRIPTION : BRINE STORAGE TANKS
LINE/EQUIPMENT CONSIDERED : TK-201/TK-202
DRAWING DESIGNATION(S) : 03-04-015 REV 0, 7/31/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0050-1-1	FLOW-NO	SEE LINE W0033 AND W0043.		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0050-2-1	FLOW-MORE	TANK RUPTURE	RELEASE OF HOT BRINE (190 F) TO WORK AREA, LOSS OF STORAGE CAPACITY, SYSTEM SHUTDOWN.	C

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0050-3-1	FLOW-LESS	SEE LINE W0048.		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0050-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0050-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0050-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0050-7-1	PRESSURE-NO	PUMPOUT WITHOUT VENT	POSSIBLE TANK COLLAPSE, RELEASE OF HOT BRINE TO WORK AREA	C

COMMENTS: ACTION: EVALUATE TANK SAFETY AND REVISE P&ID WHERE APPROPRIATE. NO VENTS SHOWN ON P&IDs

AUDIT NOTES: RESPONSE: 2/5/92 REPORT; VENTS ARE PROVIDED, SEE TANK DATA SHEETS. P&ID SKETCHES ACCOMPANY THE 2/5/92 REPORT.
HAZOP TEAM: AS BEFORE, SKETCHES CAN NOT BE USED AS P&ID DESIGN DRWINGS, HAZOP WILL NOT COMPLETED ON SKETCHES.
2/21/92 WESTON SAME AS ABOVE 2/5/92

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0050-8-1	PRESSURE-MORE	FAILURE OF HIGH LEVEL ALARM(LAH 84A/B) WITH CONTINUED PUMPING OF FLUID	POSSIBLE OVERPRESSURE OF TANK, POSSIBLE TANK RUPTURE	C

COMMENTS: NO INTERLOCKS SHOWN ON DRAWING, NO VENT ON TANK, NO TANK OVERFLOW, NO TANK SAFETY FEATURES SHOWN ON P&ID. ACTION: EVALUATE TANK SAFETY AND REVISE P&ID WHERE APPROPRIATE

AUDIT NOTES: COMMENT; NO INTERLOCKS SHOWN ON DRAWING, NO VENT ON TANK, NO TANK OVERFLOW, NO TANK SAEYT FEATURES SHOWN ON P&ID.
RESPONSE: WESTON 11/5/91 REPORT, INTERLOCK 80 PREVENTS BRINE FLOW FROM ENTERING A FULL TANK. VENTS AND TANK OVERFLOWS ARE PROVIDED SEE TANK DATA SHEETS.

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HAZOP TEAM: MEETING 11/91 NOTES, WESTON DOES NOT ANTICIPATE SHUTDOWN IS NECESSARY, BUT INTERLOCK IS FOR BACKUP DURING TRANSFER OPERATIONS.
TEAM: INTERLOCK VERFIED ON REV. MATRIX
2/21/92 WESTON SAME AS ABOVE 11/5/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0050-9-1	PRESSURE-LESS	PUMPOUT WITHOUT TANK VENT	POSSIBLE TANK COLLAPSE, RELEASE OF HOT BRINE TO WORK AREA	C

COMMENTS: (1)LOADING PROCEDURES ARE UNCLEAR.(2) UNCLEAR WHETHER LEVEL IS INDICATED LOCALLY AS WELL AS REMOTELY. ACTION:

AUDIT NOTES: (3)Q.DOES THE OPERATOR AT THE LOADING STATION NEED TO KNOW THE LEVEL AT THE TANKS?

RESPONSE: WESTON 11/5/91 REPORT, SEE ATTACHED LOADING PROCEDUES,(2) LEVEL IS INDICATED REMOTELY ON THE TANKS. LEVEL INDICATION FOR THE BRINE LOADING ARM IS ONLY LOCAL.(3)NO, INTERLOCK 80 WILL TURN OFF TRANSFER PUMPS WHEN LOW LEVEL IN THE TANK OCCURS. THE OPERATOR AT THE LOADING STSTION NEEDS TO RECEIVE THE OK TO LOAD PERMISSIVE ONLY TO START THE LOADING PROCEDURES.
TEAM: INTERLOCK 80 HAS BEEN VERIFIED.
2/21/92 WESTON SAME AS ABOVE 11/5/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0050-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0050-11-1	TEMPERATURE-LESS			

COMMENTS: IN THE EVENT THAT BRINE MUST BE STORED FOR A PERIOD OF TIME, COOLING CAN OCCUR. HOWEVER, BRINE MIXING IN THE TANK, RECIRCULATION OF BRINE, AND FEED OF HOT BRINE TO THE TANK SHOULD PRECLUDE FREEZING. ACTION:

AUDIT NOTES: HAZOP TEAM: MEETING 11/91 NOTES, WESTON NEEDS TO REVIEW HEAT TRACING OF BRINE LINES.
RESPONSE: WESTON 11/5/91 REPORT, AGREED, MAY ALSO TRANSFER BRINE FROM TANK TO TANK IF ABSOLUTELY NECESSARY.
2/21/92 WESTON SAME AS ABOVE 11/5/91

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0050-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0050-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0050-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0050-15-1	COMPOSITION-OTHER THAN	FAILURE OF BRINE TANK MIXER M-204/M-205	SOLIDS ACCUMULATION IN DISCHARGE WITH POSSIBLE PLUGGING OF LINE	A

COMMENTS: ACTION: EVALUATE NEED FOR MIXER MOTOR TRIP INDICATION.

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT, AN OPERATION SENSOR AND LOSS OF OPERATION ALARM IS PROVIDED IN THE CONTROL ROOM.
2/21/92 WESTON SAME AS ABOVE

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0050-16-1	STARTUP/SHUTDWN-OTHER THAN	BOTH TANKS FULL OF BRINE ON STARTUP	UNABLE TO STORE PRODUCED BRINE	B

COMMENTS: INADEQUATE INFORMATION TO EVALUATE CONSEQUENCE

ACTION: RECOMMEND EVALUATION OF NEED FOR INTERLOCK OR OPERATING PROCEDURES TO CHECK LEVEL ON BOTH TANKS ON STARTUP/SHUTDOWN WHEN BOTH TANKS ARE FULL.

AUDIT NOTES: RESPONSE: WETON 11/5/91 REPORT, AGREED, IF BOTH TANKS ARE FULL, THE SQI SYSTEM CAN NOT BE OPERATED. BRINE STORAGE CAPACITY MUST BE AVAILABLE IN ORDER TO OPERATE THE SYSTEM. THIS WILL BE ESTABLISHED AS A ROUTINE OPERATIONAL PROCEDURE.
2/21/92 WESTON, SAME AS ABOVE

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0050-17-1	EMERGENCY SD-OTHER THAN	EMERGENCY BLOWDOWN TO TANKS DURING EMERGENCY SHUTDOWN	INADEQUATE BRINE CAPACITY	B

COMMENTS:

ACTION: EVALUATE NEED TO MAINTAIN RESERVE CAPACITY IN TANK FOR EMERGENCY SHUTDOWN.

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT, NOT REQUIRED. IF RESERVE CAPACITY IS REQUIRED,A BRINE TANK MUST BE PUMPED. IF A RUPTURE HAS OCCURED THE BRINE WILL BE PUMPED BY THE SUMP TO THE WASTEWATER TANK.
2/21/92 WESTON SAME AS ABOVE

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0050-18-1	MAINTENANCE-OTHER THAN	SEE COMPOSITION FOR LOSS OF MIXER	EXCESSIVE SOLIDS ACCUMULATION REQUIRING TANK SHUTIN AND CLEANOUT.	B

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0050-19-1	LEVEL-NO	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0050-20-1	LEVEL-MORE	SEE MORE PRESSURE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0050-21-1	LEVEL-LESS	SEE MORE FLOW, LESS PRESSURE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : 50% CAUSTIC INJECTION
LINE OR EQUIPMENT DESIGNATION : W0051
LINE DESCRIPTION : CAUSTIC DELIVERY
LINE/EQUIPMENT CONSIDERED : 4"-XC-004-E-R, 3"-XC-004-E-R BEGINS AT CAUSTIC DELIVERY POINT, TERMINUS AT TK-204, CAUSTIC STORAGE TANK
DRAWING DESIGNATION(S) : 03-04-009 REV 0, 7/31/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0051-1-1	FLOW-NO	LINE RUPTURE, LINE PLUGEDGE	RELEASE OF CAUSTIC TO WORK AREA	C

COMMENTS: CAUSTIC DELIVERY AND UNLOADING PROCEDURES ARE UNAVAILABLE. ASSUME THAT UNLOADING OPERATOR OBSERVES RUPTURE AND INITIATES EMERGENCY PROCEDURES.
ACTION:

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AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0051-2-1	FLOW-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0051-3-1	FLOW-LESS	LOSS OF HEAT TRACING	SOLIDIFICATION OF CAUSTIC, PARTIAL BLOCKAGE OF LINE, INEFFICIENT DELIVERY	A

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0051-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0051-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0051-6-1	FLOW-OTHER THAN	IMPROPER DELIVERED MATERIAL	CONTAMINATION OF TANK TK-204 WITH IMPROPER MATERIAL	B

COMMENTS:

ACTION: UNLOADING PROCEDURES SHOULD INCLUDE A PROVISION FOR VERIFYING CONTENTS OF DELIVERY

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT, THE BILL OF LADEING WILL BE CHECKED.
2/21/92 WESTON, SAME AS ABOVE

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0051-7-1	PRESSURE-NO	PUMP FAILURE ON DELIVERY TRUCK	INEFFICIENT PUMPING	

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0051-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0051-9-1	PRESSURE-LESS	LINE LEAK	RELEASE OF CAUSTIC TO WORK AREA	C

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0051-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0051-11-1	TEMPERATURE-LESS	LOSS OF HEAT TRACING	RESTRICTION OF LOADING LINE DUE TO SOLIDIFICATION, INABILITY TO OFFLOAD TANK TRUCK.	B

COMMENTS: IS CAUSTIC LEFT IN LINE AFTER LOADING OPERATION? ACTION: EVALUATE DETECTION OF LOSS OF HEAT TRACING.

AUDIT NOTES: Q. IS CAUSTIC LEFT IN LINE AFTER LOADING OPS?
RESPONSE: WESTON 11/5/91 REPORT, NO HEAT TRACING MONITORING SYSTEM EXISTS.
PORTABLE HEATERS CAN BE UTLIZIED AS RQUIRED UNTIL THE CONDITION IS REPAIRED.
TEAM: ARE HEATERS AVAILABLE ON-SITE OR MADE AVAILABLE AS NEEDED.
2/21/92 WESTON, SAME AS ABOVE

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0051-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0051-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0051-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0051-15-1	COMPOSITION-OTHER THAN	SEE OTHER THAN FLOW		

COMMENTS: ACTION:

S:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0051-16-1	STARTUP/SHUTDWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

DIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0051-17-1	EMERGENCY SD-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

DIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0051-18-1	MAINTENANCE-OTHER THAN	FAILURE OF HEAT TRACING/ FAILURE OF LINE AT FLEX/FIXED JUNCTURE	POSSIBLE FAILURE AND RELEASE OF CAUSTIC	C

COMMENTS: ACTION: RECOMMEND INVESTIGATION OF FLEX/FIXED JUNCTURE ON LINE.

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AUDIT NOTES: RESPONSE: WESTON 2/5/92 REPORT, THE JUNCTURE WILL BE INSPECTED REGULARLY.
2/21/92 WESTON, SAME AS ABOVE

HAZOP STUDY IDENTIFIER : CAUSTIC DELIVERY SYSTEM
LINE OR EQUIPMENT DESIGNATION : W0052
LINE DESCRIPTION : CAUSTIC STORAGE TANK
LINE/EQUIPMENT CONSIDERED : CAUSTIC TANK TK-204
DRAWING DESIGNATION(S) : 03-04-009 REV 0, 7/31/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0052-1-1	FLOW-NO	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0052-2-1	FLOW-MORE	SEE MORE LEVEL		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0052-3-1	FLOW-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0052-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0052-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0052-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0052-7-1	PRESSURE-NO	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0052-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: OVERFLOW AND VENT ON TANK ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0052-9-1	PRESSURE-LESS	NOT APPLICABLE		

COMMENTS: SEE MORE PRESSURE ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0052-10-1	TEMPERATURE-MORE	RUNAWAY HEATER	OVERHEATING OF CAUSTIC	A

COMMENTS: HOW SELF-REGULATING IS THE HEATER? NO HIGH TEMPERATURE ALARM ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0052-11-1	TEMPERATURE-LESS	LOSS OF HEATER	POTENTIAL SOLIDIFICATION OF CAUSTIC, LOSS OF CAUSTIC TO SYSTEM, SYSTEM SHUTDOWN.	B

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0052-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0052-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0052-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0052-15-1	COMPOSITION-OTHER THAN	SEE ITEM 16-1 ON LINE W0051 FOR COMPOSITION.		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0052-16-1	STARTUP/SHUTDOWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0052-17-1	EMERGENCY SD-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0052-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0052-19-1	LEVEL-NO	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0052-20-1	LEVEL-MORE	FAILURE OF LEVEL INDICATOR LSH-204 INTERLOCKED WITH PUMP P-211A/B	OVERFLOW TO TANK TK-402, CAUSTIC SUMP	A

COMMENTS: ACTION:

AUDIT NOTES: NOVEMBER 5, 1992 HAZOP REVIEW SHELL OIL COMMENTS:
P&ID DOES NOT SHOW LDH..REVISE P&ID TO SHOW LDH IF APPLICABLE.

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0052-21-1	LEVEL-LESS	FAILURE OF LEVEL INDICATOR LSL-204 INTERLOCKED WITH PUMP P-211A/B.	LOSS OF CAUSTIC TO SYSTEM, PUMP CAVITATION, POTENTIAL SHUTDOWN OF SYSTEM	B

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : CAUSTIC DELIVERY SYSTEM
LINE OR EQUIPMENT DESIGNATION : W0053
LINE DESCRIPTION : SUCTION SIDE OF P-211A/B, DISCHARGE FROM TANK TK-204
LINE/EQUIPMENT CONSIDERED : 2"-XC-006-E-R, 2"-XC-007-E-R, BEGINS AT TK-204, TERMINUS AT PUMPS P-211A/B.
DRAWING DESIGNATION(S) : 03-04-009 REV 0, 7/31/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0053-1-1	FLOW-NO	INADVERTANT VALVE CLOSURE, PUMP FAILURE P-211A/B, LINE PLUGGING	LOSS OF CAUSTIC FEED TO PUMPS 211A/B, EVENTUAL SYSTEM SHUTDOWN	B

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W053-1-2	FLOW-NO	LINE RUPTURE	RELEASE OF CAUSTIC TO WORK AREA	C

COMMENTS: ACTION: EVALUATE DETECTION FOR LINE RUPTURE.

AUDIT NOTES: RESPONSE: WESTON 11/5/91` REPORT, ROUTINE LINE AND TANK INSPECTIONS ARE PERFORMED DAILY BY THE FIELD TECH.
2/21/92 WESTON, SAME AS ABOVE

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0053-2-1	FLOW-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0053-3-1	FLOW-LESS	PARTIAL LINE PLUGGING, INADVERTANT VALVE POSITIONING, PUMP WEAR	LOW FLOW TO CAUSTIC DILUTION TANK	A

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0053-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0053-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0053-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0053-7-1	PRESSURE-NO	SEE LINE RUPTURE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0053-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0053-9-1	PRESSURE-LESS	SEE LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0053-10-1	TEMPERATURE-MORE			

COMMENTS: SEE GENERAL COMMENTS FOR ALL HEAT TRACED LINES ON HEAT TRACING CONTROL ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0053-11-1	TEMPERATURE-LESS	LOSS OF HEAT TRACING	POTENTIAL LINE BLOCKAGE, LOSS OF FLOW	A

COMMENTS: SEE COMMENTS UNDER HEAT TRACING FOR ALL HEAT TRACED LINES

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0053-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0053-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0053-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0053-15-1	COMPOSITION-OTHER THAN	SEE ITEM 15-1 UNDER LINE W0051.		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0053-16-1	STARTUP/SHUTDWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0053-17-1	EMERGENCY SD-OTHER THAN	LINE PLUGGING ON STARTUP AFTER EMERGENCY SHUTDOWN	NO FLOW TO CAUSTIC DILUTION TANK	A

COMMENTS: (1)HEAT TRACING AND TANK HEATER ARE NOT ON EMERGENCY POWER SYSTEMS.(2) HOW DOES OPERATOR DETERMINE WHETHER CAUSTIC IS FLOWING IN THIS LINE DURING RESTART AFTER EMERGENCY SHUTDOWN

ACTION: (3)INCLUDE PROVISION IN OPERATOR/TRAINING MANUAL FOR DETERMINING WHETHER CAUSTIC IS FLOWING ON RESTART AFTER EMERGENCY SHUTDOWN.

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT, (1) HEAT TRACING IS ON EMERGENCY POWER SYSTEM (2) VISAUL INSPECTION, A FLOW METER IS INCLUDED IN CAUSTIC LINES,(3) AGREED HAZOP TEAM: THIS IS THE FIRST RESPONSE THAT INDICATED THAT HEAT TRACING IS COVERED BY EMERGENCY POWER, ARE ALL LINES COVERED OR JUST CERTAIN ONES? THERE SHOULD BE DESCRIPTION OF WHAT IS COVERED UNDER EMERGENCY POWER 2/21/92 WESTON, (3) O&M MANUAL WILL INCLUDE OPERATION INSPECTIONS

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0053-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

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HAZOP STUDY IDENTIFIER : CAUSTIC DELIVERY SYSTEM
LINE OR EQUIPMENT DESIGNATION : W0054
LINE DESCRIPTION : DISCHARGE FROM PUMPS P-211A/B
LINE/EQUIPMENT CONSIDERED : PUMPS P-211A/B, 1 1/2"-XC-008-E-R, 1 1/2"-XC-009-E-R, 1/2"-XC-010-E-R BEGINS AT PUMP DISCHARGE P-211A/B, TERMINUS AT TANK TK-205
DRAWING DESIGNATION(S) : 03-04-009 REV 0, 7/31/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0054-1-1	FLOW-NO	LOSS OF PUMPS P-211A/B, LINE PLUGGING, INADVERTANT VALVE CLOSURE, LOSS OF INSTRUMENT AIR	LOSS OF FEED TO CAUSTIC DILUTION TANK	A

COMMENTS: (1)INTERLOCKED WITH WATER LINE THROUGH FLOW METER FIC-205. (2)FAIL POSITION ON VALVE FCV-211 AND FCV-209 ON LINE W0008 IS UNCLEAR.

ACTION:

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT, (1) YES (2) FCV-209 FAIL CLOSED
2/21/92 WESTON, (2) FCV-211 AND FCV-209 FAIL CLOSED

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0054-1-2	FLOW-NO	LINE RUPTURE	RELEASE OF CAUSTIC TO WORK AREA	C

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0054-2-1	FLOW-MORE	FAILURE OF FLOW CONTROLLER FCV-211.	MORE FLOW OF CAUSTIC TO CAUSTIC DILUTION TANK RESULTING IN MORE CONCENTRATED CAUSTIC SOLUTION TO SCRUBBER AND QUENCH TANK.	A

COMMENTS:

ACTION:

AUDIT NOTES:

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LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0054-3-1	FLOW-LESS	FAILURE OF FCV-211, INADVERTANT VALVE POSITIONING [illegible] PARTIAL PLUGGIN[illegible]	LESS CAUSTIC TO DILUTION TANK THAN DESIGNED; POTENTIAL EVENTUAL SHUTDOWN DUE TO HIGH EMISSIONS FROM STACK	B

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0054-3-2	FLOW-LESS	LINE LEAKS	RELEASE OF CAUSTIC TO WORK AREA, SEE ITEM 3-1.	C

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0054-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0054-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0054-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0054-7-1	PRESSURE-NO	SEE NO FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0054-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0054-9-1	PRESSURE-LESS	SEE LESS FLOW		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0054-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0054-11-1	TEMPERATURE-LESS	LOSS OF HEAT TRACING	POSSIBLE LINE PLUGGING, NO FLOW TO CAUSTIC DILUTION TANK, POSSIBLE EVENTUAL SHUTDOWN OF SYSTEM	B

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0054-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0054-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0054-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0054-15-1	COMPOSITION-OTHER THAN	SEE ITEM 15-1 ON LINE W0051		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0054-16-1	STARTUP/SHUTDOWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0054-17-1	EMERGENCY SD-OTHER THAN	SEE LINE W0053		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0054-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

HAZOP STUDY IDENTIFIER : CAUSTIC DELIVERY
LINE OR EQUIPMENT DESIGNATION : W0055
LINE DESCRIPTION : CAUSTIC DILUTION TANK
LINE/EQUIPMENT CONSIDERED : 3"-XB-001-P-R, CAUSTIC DILUTION TANK TK-205
DRAWING DESIGNATION(S) : 03-04-009 REV 0, 7/31/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0055-1-1	FLOW-NO	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0055-2-1	FLOW-MORE	RUPTURE OF TANK	FLOW OF DILUTE CAUSTIC TO WORK AREA	C

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0055-3-1	FLOW-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0055-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0055-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0055-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0055-7-1	PRESSURE-NO	SEE TANK RUPTURE (MORE FLOW)		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0055-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0055-9-1	PRESSURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0055-10-1	TEMPERATURE-MORE	LOSS OF DILUTION WATER	HEATING OF LIQUID IN CAUSTIC DILUTION TANK DUE TO EXOTHERMIC HEAT OF SOLUTION.	A

COMMENTS: (2)CAN EXOTHERMIC REACTION GREATER THAN DESIGN? ACTION:

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT, A FIELD TECHNICIAN WILL BE PRESENT DURING ALL MIXING OPERATIONS (2) 50% CAUSTIC BOILS AT 290 DEGREES F - REFERENCE TANK DATA SHEET
2/21/92 WESTON, SAME AS ABOVE 11/5/91

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0055-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0055-12-1	COMPOSITION-MORE	LOSS OF FLOW CONTROLLERS FCV-211 AND FCV-209	GREATER CAUSTIC CONCENTRATION IN TANK THAN INTENDED.	A

COMMENTS: SEE MORE TEMPERATURE ACTION:

AUDIT NOTES: RESPONSE: WESTI=ON 11/5/91 REPORT, - SEE W0055-10-1 RESPONSE (INCREASED TEMPERATURE)
2/21/92 WESTON SAME AS ABOVE

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0055-13-1	COMPOSITION-LESS	LOSS OF FLOW CONTROLLER FCV-211 AND FCV-209	HIGH WATER CONCENTRATION AND LESS CONCENTRATION CAUSTIC IN TANK	A

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0055-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0055-15-1	COMPOSITION-OTHER THAN	LOSS OF TANK MIXER	IMPROPER MIXING, POSSIBLE FLUID STRATIFICATION, LOSS OF pH CONTROL IN QUENCH TANK AND SCRUBBER, POSSIBLE EVENTUAL SYSTEM SHUTDOWN	B

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0055-16-1	STARTUP/SHUTDWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0055-17-1	EMERGENCY SD-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0055-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER :
LINE OR EQUIPMENT DESIGNATION : T0056
LINE DESCRIPTION :
LINE/EQUIPMENT CONSIDERED :
DRAWING DESIGNATION(S) :

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
56-1-1	FLOW-NO	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0056-2-1	FLOW-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

HAZOP STUDY IDENTIFIER : PROCESS WATER SYSTEM
LINE OR EQUIPMENT DESIGNATION : W0056
LINE DESCRIPTION : PROCESS WATER TANK
LINE/EQUIPMENT CONSIDERED : TANK TK-203 - PROCESS WATER STORAGE TANK
DRAWING DESIGNATION(S) : 03-04-009 REV 0 (7/31/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0056-3-1	FLOW-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0056-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0056-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0056-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0056-7-1	PRESSURE-NO	TANK RUPTURE	LOSS OF PROCESS WATER TO PLANT	B

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0056-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0056-9-1	PRESSURE-LESS	SEE LINE W0008		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0056-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0056-11-1	TEMPERATURE-LESS	LOSS OF HEATER HP-203, FAILURE OF TEMPERATURE CONTROLLER	POSSIBLE LOSS OF WATER SUPPLY DUE TO FREEZING	B

COMMENTS:

ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0056-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0056-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0056-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0056-15-1	COMPOSITION-OTHER THAN	FAILURE OF WATER SOFTENER	POTENTIAL PRECIPITATION AND SCALING	A

COMMENTS: SEE LINE W0008 ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

HAZOP STUDY IDENTIFIER :
LINE OR EQUIPMENT DESIGNATION : T0056
LINE DESCRIPTION :
LINE/EQUIPMENT CONSIDERED :
DRAWING DESIGNATION(S) :

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0056-16-1	STARTUP/SHUTDWN-OTHER THAN	LACK OF PROCESS WATER	UNABLE TO STARTUP INCINERATOR DUE TO LACK OF WATER.	B

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
T0056-17-1	EMGCY SHUTDOWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : PROCESS WATER SYSTEM
LINE OR EQUIPMENT DESIGNATION : W0056
LINE DESCRIPTION : PROCESS WATER TANK
LINE/EQUIPMENT CONSIDERED : TANK TK-203 - PROCESS WATER STORAGE TANK
DRAWING DESIGNATION(S) : 03-04-009 REV 0 (7/31/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0056-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0056-19-1	LEVEL-NO	INSTRUMENTATION FAILURE(LIT-203), LOSS OF WATER SUPPLY	LOSS OF WATER IN TK-203 NO CAUSTIC/WATER MIX	B

COMMENTS: CHECK INSTRUMENTATION IDENTIFICATION LCS-205 FOR TANK TK-203 CONTROLLERS. ACTION:

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT - LEVEL INDICATION HAS BEEN PROVIDED ON TK-203. REFERENCE P&ID
2/21/92 WESTON SAME AS ABOVE

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0056-20-1	LEVEL-MORE	INSTRUMENTATION FAILURE CAUSING LCV-203 TO MAINTAIN FLOW INTO TANK WHEN ALREADY FULL.	OVERFLOW TANK TO SUMP T-402	A

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0056-21-1	LEVEL-LESS	SAME AS LESS PRESSURE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

HAZOP STUDY IDENTIFIER : WASTEWATER HANDLING SYSTEM
LINE OR EQUIPMENT DESIGNATION : W0057
LINE DESCRIPTION : SQI DAY TANK AND WASTEWATER TANK AREA
LINE/EQUIPMENT CONSIDERED : TK-104 (WASTEWATER TANK),
DRAWING DESIGNATION(S) : 03-04-001 REV 0 (7/31/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0057-1-1	FLOW-NO	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0057-2-1	FLOW-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0057-3-1	FLOW-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0057-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0057-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0057-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0057-7-1	PRESSURE-NO	TANK RUPTURE	RELEASE OF WASTEWATER INTO WORK AREA	B

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0057-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0057-9-1	PRESSURE-LESS	NOT APPLICABLE		

COMMENTS: TANK INCLUDES ADAQUETE VENTS ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0057-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0057-11-1	TEMPERATURE-LESS	LOSS OF HEATER	POTENTIAL TANK DAMAGE FROM FREEZING.	A

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0057-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0057-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0057-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0057-15-1	COMPOSITION-OTHER THAN	LOSS OF AGITATOR	POSSIBLE SOLIDS ACCUMULATION AND BLOCKING OF LINE W0006.	A

COMMENTS: ACTION: RECOMMEND EVALUATION OF NEED TO INDICATE MIXER MOTOR TRIP ON MAIN AND/OR LOCAL CONTROL PANEL.

AUDIT NOTES: RESPONSE: WESTON 11/5/91 - AN OPERATION SENSOR ON THE MIXER IS PROVIDED. SHOULD THE MIXER STOP AN ALARM IN THE CONTROL ROOM IS SOUNDED.

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0057-16-1	STARTUP/SHUTDWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0057-17-1	EMGCY SHUTDOWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0057-18-1	MAINTANANCE-OTHER THAN	WASTEWATER TANK OUT OF SERVICE	INABILITY TO FLUSH BASIN F FEED LINES. POTENTIAL PLUGGING OF FEED LINES DUE TO SOLIDS LEFT IN PIPING.	A

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0057-19-1	LEVEL-NO	LOSS OF LEVEL CONTROL	PUMPS P-104A/B CONTINUE OPERATION WITH NO WATER SUPPLY AND CAVITATE	A

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0057-20-1	LEVEL-MORE	LOSS OF LEVEL CONTROL LIT-105	OVERFLOW OF TANK. NO CAPACITY TO RECEIVE WATER FROM SUMPS OR FLUSH WATER.	A

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0057-21-1	LEVEL-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : WASTE FEED SYSTEM
LINE OR EQUIPMENT DESIGNATION : W0058
LINE DESCRIPTION : SQI INCINERATOR DAY TANKS
LINE/EQUIPMENT CONSIDERED : TK-105 AND TK-106
DRAWING DESIGNATION(S) : (3-04-001 REV 0 (7/31/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0058-1-1	FLOW-NO	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0058-2-1	FLOW-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0058-3-1	FLOW-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0058-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0058-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0058-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0058-7-1	PRESSURE-NO	TANK RUPTURE	RELEASE OF BASIN F FLUID INTO WORK AREA	C

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0058-8-1	PRESSURE-MORE	HIGH VAPOR PRESSURE IN TANK	VAPORS RELEASED THROUGH LIQUID SEAL	C

COMMENTS: RELEASE OF VAPORS INTO WORK AREA

ACTION: RECOMMEND PERIODIC INSPECTION OF LIQUID SEALS

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT - AGREED
2/21/92 WESTON REPORT, O&M MANUAL CONTAINS INSPECTION PROCEDURES

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0058-9-1	PRESSURE-LESS	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0058-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS:

ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0058-11-1	TEMPERATURE-LESS	LOSS OF HEATER	PRECIPITATION OF SOLIDS AND POTENTIAL PLUGGING OF DISCHARGE	B

COMMENTS:

ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0058-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0058-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0058-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
0058-15-1	COMPOSTION-OTHER THAN	FAILURE OF MIXER	SETTLING OF SOLIDS. STRATIFICATION OF TANK CONTENTS. POTENTIAL PLUGGING OF WASTE FEED TO P-201.	B

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0058-16-1	STARTUP/SHUTDWN-OTHER THAN	NO BASIN F FLUID IN TANK	NO WASTE FEED TO INCINERATOR	B

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0058-17-1	EMGCY SHUTDOWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0058-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0058-19-1	LEVEL-NO	LOSS OF LEVEL CONTROL	NO BASIN F FLUID IN DAY TANKS. NO FEED TO PUMPS P-201A/B.	B

COMMENTS: SOI WASTE FEED SYSTEM INCLUDES DUAL TANKS. ACTION: REVIEW DESIGNATIONS OF LEVEL INSTRUMENTATION SHOWN ON P&IDs

AUDIT NOTES: RESPONSE: WESTON 11/5/91 REPORT
(1) YES
(2) INTERLOCKS 60 AND 70 ARE TIED INTO THE TANK LEVELS AND WILL SHUT DOWN THE SYSTEM.
2/21/92 WESTON SAME AS ABOVE

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0058-20-1	LEVEL-LOW	LOSS OF LEVEL CONTROL	PUMP CONTINUES TO OPERATE WITH NO WASTE FEED. POTENTIAL FOR PUMP CAVITATION.	B

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0058-21-1	LEVEL-MORE	LOSS OF LEVEL CONTROL	OVERFLOW OF TANKS	C

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER : BASIN F STORAGE
LINE OR EQUIPMENT DESIGNATION : W0059
LINE DESCRIPTION : EXISTING BASIN F FLUID STORAGE TANKS
LINE/EQUIPMENT CONSIDERED : TK-101,102,103
DRAWING DESIGNATION(S) : 02-04-002 REV 1 (4/26/91)

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0059-1-1	FLOW-NO	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0059-2-1	FLOW-MORE	TANK RUPTURE	RELEASE OF BASIN F FLUID	C

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0059-3-1	FLOW-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0059-4-1	FLOW-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0059-5-1	FLOW-REVERSE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0059-6-1	FLOW-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0059-7-1	PRESSURE-NO	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0059-8-1	PRESSURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0059-9-1	PRESSURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0059-10-1	TEMPERATURE-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0059-11-1	TEMPERATURE-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0059-12-1	COMPOSITION-MORE	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0059-13-1	COMPOSITION-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0059-14-1	COMPOSITION-AS WELL AS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0059-15-1	COMPOSITION-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0059-16-1	STARTUP/SHUTDWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0059-17-1	EMGCY SHUTDOWN-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0059-18-1	MAINTENANCE-OTHER THAN	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0059-19-1	LEVEL-NO	TANK RUPTURE	RELEASE OF BASIN F FLUID	C

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0059-20-1	LEVEL-MORE	LOSS OF LEVEL CONTROL WHILE FILLING TANK FROM POND	OVERFLOW AND RELEASE OF BASIN F FLUID	C

COMMENTS: THIS DEVIATION IS HIGHLY UNLIKELY. ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
W0059-21-1	LEVEL-LESS	NOT APPLICABLE		

COMMENTS: ACTION:

AUDIT NOTES:

HAZOP STUDY IDENTIFIER :
LINE OR EQUIPMENT DESIGNATION :
LINE DESCRIPTION :
LINE/EQUIPMENT CONSIDERED :
DRAWING DESIGNATION(S) :

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
-	-			

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
-	-			

COMMENTS: ACTION:

AUDIT NOTES:

LINE/ITEM	PROCESS PARAMETER/ GUIDE WORD	POSSIBLE CAUSES	POSSIBLE CONSEQUENCE	CONSEQ./ LIKELIHOOD
-	-			

COMMENTS: ACTION:

AUDIT NOTES:

HAZARD AND OPERABILITY STUDY - H A Z O P
AUDIT TRAIL SUMMARY REPORT
CA_HAZOP VER 1.3

APPENDIX C

Preliminary
Hazard Analysis
(PHA)

July 11, 1990

Project No. 22206A-5000

INTERNAL REPORT:

PRELIMINARY HAZARD ANALYSIS (PHA) FOR ROCKY MOUNTAIN ARSENAL (RMA) BASIN F LIQUID SUBMERGED QUENCH & INCINERATION (30% DESIGN PACKAGE)

Woodward-Clyde Consultants
San Diego, California

July 11, 1990

a/vcn1

SUMMARY

Woodward-Clyde Consultants (WCC) acting as the Army's contractor in preformance of the Rocky Mountain Arsenal (RMA) Basin F Liquid Interim Remedial Action (IRA) document to use a Submerged Quench Incinerator (SQI) to treat the liquid. As part of implementation of the IRA objectives, RMA will prepare a System Safety Hazard Analysis Report (SSHAR) during the early SQI design phase. The report shall be prepared in accordance with Dept. of Defense (DOD) guidance (Military Standard System Safety Program Requirements 882B-30 March 1984). In performance of the IRA objective for the SSHAR requirement, WCC on 29 May 1990 began the Preliminary Hazard Analysis (PHA) on the SQI design package that is approximately 30% complete. The PHA was conducted by a six member team over a three day period. The scope and results of the PHA study follows.

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6.0	CONCLUSION	14

Appendices

A. Telephone Conversation Notes
B. PHA Study Notes

1.0 INTRODUCTION

The Preliminary Hazards Analysis (PHA) for the Basin F liquid waste transfer systems, submerged quench incinerator (SQI), vapor treatment system, and brine/solids handling systems was conducted in order to identify potential safety-hazards and/or operability problems with the design. The design package that was reviewed was currently at the 30% stage. The objective of the study was to pinpoint potential safety or hazardous problems early in the design phase so that design modifications or recommendations can be considered and/or implemented in a cost effective way.

The PHA team was composed of Woodward-Clyde Consultants (WCC) staff and included process and design engineers. Staff members participating in the study were:

Vince Noble	Project Scientist (Team Leader)	SDO
Louis Bulger	Project Engineer	SDO
Valorie Thompson	Project Engineer	SDO
Elaine Puch	Project Engineer	DEN
Mike Lawson	Project Engineer	SDO
Derek Pimlette	Senior Engineer	Plymouth Mtg.

The members of the team had experience in design and/or operation of incinerators and air pollution control devices, hazards analysis procedures and studies, or process design experience.

Team members initiated the study with a visit and tour of an operating submerged quench incinerator (SQI) unit at the Great Plains Gasification Plant (GP) in Beulah, North Dakota. Mr. George Gruber, Principal Process Engineer at GP, provided the PHA team with information on GP's operating experience, maintenance histories and design modifications, as well as accident histories for the facility.

In addition to the tour and discussions with GP personnel, Dr. Valorie Thompson also spoke with Mr. Ted Moss at the Eli Lilly (Lilly) facility in Clinton, Indiana, and with Mr. Gary Zaborowski of American Cyanamid (Cyanamid) in New Jersey concerning the

operation experiences they had with SQI unit. Lilly operates a SQI at their Clinton facility; Cyanamid operates a SQI at their Hannibal, Missouri facility. A record of the telephone conversations is contained in Appendix B.

The following sections provide information on past operating experience of the SQI units at other facilities, PHA structure, insights and recommendations, and items which may require further clarification or study. Section 2 contains a summary of information on past operating experience obtained from the tour of GP and the telephone conversations with Lilly and Cyanamid. Section 3 contains a description of the conduct of the PHA study. Section 4 contains insights and recommendations obtained from the study, and Section 5 contains items which may require further study or clarification. Section 6 outlines the study team's recommendations to be carried into the next level of design.

2.0 PAST OPERATING EXPERIENCE

Three separate facilities which operate T-Thermal SQI units were contacted to obtain information on operating experience, which included accident histories and design modifications. All three units have been in operation for at least five years.

During the PHA team's visit to the GP facility in North Dakota, several safety points were discussed. The facility has experienced two accidents during its operation. The first accident occurred before the unit was enclosed and was operating at an ambient temperature of -20°F. The combustion air intake froze over, shutting off air flow to the incinerator. When the unit was shut down, the fuel solenoid was also partially frozen and closed more slowly than designed. As a result, more fuel was input into the incinerator. Upon reaching the hot refractory, the fuel ignited, causing an explosion within the incinerator. GP subsequently constructed a building around the incinerator to contain the unit and guard against weather-related incidents, plus a procedure to add more purge air to the refractory after shutdowns.

The second accident occurred when the separator fluid level indicator failed. The vessel filled with brine and the fiberglass construction failed, causing the vessel to rupture and

release its contents. GP has since replaced all of the downstream FRP components with stainless steel.

GP had several general comments on the SQI system design. Operators felt that the instrumentation on the package was lightweight and GP has replaced most of the instrumentation with more robust equipment. GP also felt that the fiberglass construction was unsatisfactory and, as noted above, has replaced the FRP components with stainless steel. Modifications to the injection guns were made to allow for easier removal and nozzle replacement during incinerator operation. The nozzles clog regularly and must be replaced frequently. GP also went to a new nozzle design which was much less expensive than T-Thermal replacement nozzles. GP found the thermowells to burn out quickly due to contact with molten material in the incinerator. Their solution was to build "eyebrows" above the thermowells to deflect the molten salts and hot slag. GP also found that the refractory material had to be replaced often and has upgraded the refractory brick used in the incinerator. The material used on the support ledges was also replaced. In addition, solids collect in the bottom of the quench tank during operation and must be periodically cleaned out. GP experienced foaming in the quench tank and also experienced a great deal of equipment vibration during operation. Rubber expansion joints were replaced with metal flex joints. Downstream of the incinerator, the vapor scrubber packing material became plugged. GP believes that this was caused by the ash that was being used as a caustic to neutralize the acidic vapors. The packing material was removed and the scrubber is used without packing at this time. GP does not have an indoor monitoring program in place to monitor the workplace for potentially hazardous emissions from the SQI unit.

Both Cyanamid and Lilly have reported replacing the refractory brick inside the incinerator. Lilly has replaced their FRP quench tank with titanium, and Cyanamid has replaced all of their FRP components with stainless steel. Lilly has modified their guns for ease of removal for nozzle replacement, and Cyanamid has replaced rubber joints with metal flex joints. Details of the conversations with Cyanamid and Lily can be found in Appendix A.

3.0 PHA STUDY CONDUCT

On May 29, 1990, the PHA team assembled at WCC's Denver office to conduct a project scoping meeting of the SQI unit and transfer systems design package. Present at the meeting were:

Richard Carmichael	Project Manager	DEN
JoAnn Tischler	Project Manager	DEN
Brian Gallagher	Project Engineer	DEN
Richard Scheig	Project Engineer	DEN
Elaine Puch	Project Engineer	DEN
Vince Noble	Project Scientist	SDO
Louis Bulger	Project Engineer	SDO
Valorie Thompson	Project Engineer	SDO

This meeting included a discussion of the scope of work, state of the design, and the form of the deliverable for the PHA. It was decided that the deliverable shall take two forms, an internal written report and an oral presentation package for the RMA project staff.

The main PHA working team was identified as V. Noble, L. Bulger, E. Puch, M. Lawson, and V. Thompson. The team began the PHA by walking through the two design packages presented to the team by the WCC design group. The WCC package included the Basin F. fluids storage, transfer, bay tanks and waste water tanks plus the solid handling system downstream of the spray dryer unit. The second package included all the T-Thermal SQI designs plus the sub (NIRO). The overall design package was then broken down into study units. These study units are listed on Table 1

TABLE 1
PHA Study Units

UNIT 1	UNIT 2	UNIT 3	UNIT 4	UNIT 5
Pond A to Storage Tanks	Day Tanks to Incinerator	Brine/mixing Tanks	Gas from Separator to Venturi	Air
Storage Tanks	Combustion Air Blower	Transfer from Brine tanks to Dryer	Venturi	Water
Transfer to Day Tanks	Air Atomizer	Spray Dryer	Scrubber	Electrical
Day Tanks	Natural Gas	Spray Dryer to Baghouse	Caustic to Scrubber	Sump
Wastewater Tanks	Incinerator	Solids Handling	Liquid Recycle	Emergency Systems
	Quench Tank	Air to Dryer	Scrubber Liquor to Venturi	
	Quench Water System	Gases from Baghouse to Scrubber		
	Separator			

On May 30 and 31, 1990, the PHA team met and conducted a hazards review of each unit. The review involved a discussion of operation of each major vessel and line, identification of major potential failures and/or operational problems, and discussion of potential hazards or safety problems which could arise from a malfunction or operations error. The study team generated a list of design recommendations and insights which are listed in Section 4. The study team also generated a list of questions or items requiring further study or clarification, which is presented in Section 5.

Notes from the PHA study are presented in Appendix B. The support systems such as utility air, water, sump operation, and electricity were not discussed in detail as design was still conceptual at the time of the study.

4.0 STUDY INSIGHTS AND RECOMMENDATIONS

The following insights and recommendations are divided by units which follow the PHA Study Review.

Unit 1 Components
Basin F Liquid Ponds and Storage Tank
Transfer System to Day Tanks
Day Tanks and Waste Water Tank

1. Redundant indicators should be used on all equipment. All indicators to be local (at the vessel) and in the control room.

2. Visual monitoring of operations should be conducted once per shift. If liquid transfer line is covered with snow, visual checks may not be appropriate in winter.

3. Install flow totalizers on transfer lines.

4. Add level indicators in storage tanks. Level indicators (bubblers) could be installed from top of tanks.

5. Operating procedures should be clearly spelled out, especially for startup and shutdown. Clearly mark valves as to open and closed. Use tagging procedures.

6. Overflow design may be to Tank 4 (Wastewater tank for decon water). Install a flow switch in the overflow line to detect any overflow so that operator may take action.

7. Downsize pumps on exit from wastewater tank to limit rate at which this waste can be sent to the incinerator.

Unit 2 Components

Day Tank to Incinerator
Combustion Air Blower
Air Atomizer
Natural Gas Supply System
Incinerator Unit
Quench Tank
Quench Tank Water Make-up System
Separator Vessel

1. Consider monitoring the composition of fluid going into incinerator to avoid operation excursions.

2. Ensure that the design of the dedicated compressor for atomizing waste being supplied by T-Thermal is adequate. Great Plains had to increase the capacity of the compressor because the design was not adequate.

3. Inspect guns for clogging more frequently than recommended in T-Thermal's operating and maintenance instructions given experience of other operators.

4. Install pressure indicators at nozzles that are remote as well as local.

5. Install remote indicator for flow into incinerator. Ensure that redundant indicators exist.

6. Ensure that natural gas bleed is directed to a safe area and ensure that it does not vent near any combustion sources. Bleeder valve needs to be checked periodically for leakage.

7. Include design of backup fuel (propane) system on P&IDs. Design not indicated on current P&ID.

8. Upgrade the refractory brick in the incinerator.

9. Investigate the necessity for replacing refractory ledge supports in the incinerator.

10. Consider designing quench tank so that it is removable from beneath incinerator during changeout of bricks for ease of replacement.

11. Consider replacement of rubber joints on incinerator with metal flex joints.
12. Review instrumentation for quality and reliability.

13. Replace fiberglass (FRP) design of quench tank with stainless, titanium, or other stronger material.

14. Ensure that recycle entry from separator into quench tank be placed high enough so that it will not plug.

15. Install temperature indicator on separator/quench tank water as redundant indicator for level and cooling.

16. Address potential for foaming during incinerator operation. Potential mineral problem in make-up water

<u>Unit 3 Components</u>

Brine Liquid Mixing Tanks

Transfer System of Brine to Spray Dryer

Spray Dryer
Dryer to Baghouse Process
Solids Handling After Bag House
Air to Dryer
Gases From Baghouse to Scrubber

1. Consider disposal of liquid brine as it comes off the tank rather than going through the drying operation and disposing of solid brine. If brine disposal is the chosen option, only one holding tank will be used.

2. Check pump sizing on recycle to quench tank.

3. In comparing NIRO design with WCC system, ensure that proper checks valve and other design features are included to avoid contamination from solids released in the dryer operation.

4. Install an alarm to indicate loss of cooling water flow to spray dryer injection nozzle (possibly a flow meter or temperature indicator).

5. Move all local instrument panels to main remote control panel. Remote local indicators should also be used.

6. Consider potential for cleanout of solids from spray dryer.

7. Tie in pressure indicator on spray dryer gas inlet to shutdown.

8. Consider design modification, use induction transfer system on solids transfer through baghouse to disposal in lieu of a pressurized system. Potential for fugitive emissions with pressurized pneumatic system. Rotary valve may also be a problem.

9. Locate baghouse in a separate building or sealed off from main building to minimize exposure to emissions in other parts of the building.

10. Ensure that an open circuit on thermocouple in solids handling system is an alarm condition.

11. Include low pressure alarm as well as high alarm on baghouse to indicate bag failures.

5.0 ITEMS FOR FURTHER STUDY OR CLARIFICATION

The following items for study or clarification are also organized by units that the PHA conducted.

Unit 1 — Basin F Liquid Tanks and Transfer System.

1. Can input transfer line from Pond A be designed to inlet at the top of the storage tanks? This issue was raised in the past.

Unit 2 — Day Tanks to SOI Separator Vessel

1. What is material of transfer line from day tanks to incinerator that is proposed by T-Thermal?

2. There appears to be a discrepancy in the design specifications sent by T-Thermal as to whether the interlock will shut down the natural gas flow or whether the natural gas must be shut down by manual valves. Normal operating procedures for shutdown mention manual valves. Interlock system mentions automatic shutdown for natural gas, waste stream, atomizing air.

3. Proposed emergency backup fuel is propane. Upon loss of natural gas,propane system will come on line, mixed with air. Design not indicated on P&ID. Is propane the best alternative fuel? Propane storage may present a potential hazard.

4. How do operators detect quickly loss of brine level in the quench tank?

5. Separator operation is not discussed in T-Thermal package material.

6. Material construction of the separator? (Probably FRP) Recommend investigation of FRP material and consider potential for replacement with more robust material.

7. No indication of level in quench tank or separator-potential operational problems and potential for loss of level in quench tank.

8. No indication of temperature on liquid in separator/quench tank.

9. Location and detection of overflow of water in separator needs to be determined.

10. Is local instrumentation explosion proof?

Unit 3 — Brine Holding Tank to Spray Dryer

1. Size of mixing tank is still in question. Army had initially requested two-day storage. WCC did not agree that two-day storage was necessary. Mixing tank is not yet on P&IDs. Brine will contain both dissolved and suspended solids. Design is for two 40,000 gallon tanks. Brine will contain metals. Brine is not acutely hazardous to humans at this point.

2. Material for tanks is not determined.

3. P&ID states that flexible hoses will be used at transfer from brine tank to dryer. Is this correct?

4. Unclear at this level of design how an operational problem or malfunction of the spray dryer would be detected.

5. Materials of bags can be very sensitive to temperature. Design of materials are not clear at this point. If low temperature bags are used this may be another concern for release upon failure of material at high temperature. High temperature bag material may be more expensive and not last as often.

6. There is a potential with this design to pump particulates into atmosphere if baghouse fails. Another configuration may be to use a cyclone after the spray dryer and before the baghouse, using the baghouse as a final removal procedure. Baghouse is All work will be conducted on a Time and Material Basis. Monthly progress reports and invoices will track costs to date.

7. Time allowed for maintenance in planned operating parameters is felt to be inadequate.

8. Further investigation needs to be made to determine what the limitations are on rail transport. Additional analysis is needed for solid vs. liquid handling.

9. Release of particulates is a concern - as there is potential for bags to have holes, particulates can be released to the atmosphere. Have allowable emissions accounted for this?

10. What is the function of the vacuum pump on the inlet to the spray dryer?

11. Configuration of inlets to spray dryer (instrument air, purge water supply, cooling water) is unclear from drawing.

<u>Unit 4 - Gas/Liquid Process in Venturi and Scrubber</u>

1. What is failure mode of venturi? (open/shut)

2. Material of line is FRP. Need to confirm its adequacy for this service.

3. Level control on venturi? Assumed to be in equilibrium with level in scrubber. Level indicator on scrubber on low level additional fresh water makeup into scrubber.

4. Is level control redundant? It does not appear to be redundant on the P&ID. If level control instrumentation fails, untreated gas is emitted through the stack. Analyzers on stack should detect untreated gas.

5. What does interlock shut down? Incinerator/scrubber operation?

6. Blowdown is not directly controlled by liquid level in scrubber.

7. What is analyzer AIC to spray dryer surge tank analyzing for? We assume conductivity as it controls control valve to spray dryer surge tank but it is not indicated on P&ID.

8. Control of TDS in scrubber is unclear.

9. Are we sending caustic to the separator without pH control on separator liquid? It appears that addition of caustic can go to either downcomer water inlet and scrubber but pH is only measured at scrubber.

10. Check on heat evolved when mixing 50% NaOH with water down to 18%.

11. Controlled by level controls. Concerns about how solids buildup is controlled as per question/comment above. Potential to lose water in scrubber as discussed above.

12. Water balance? Same question about conductivity meter controlling water balance. What is mass balance on water - does Basin F liquid water stay in

system or does flue gas pull water out of the system? How much fresh water is coming in? If Basin F feed continues to come in, does conductivity increase? Mass balance shows 39 GPM of fresh makeup water into system.

13. We have some questions about the work environment and monitoring which we feel should be in place. There is the potential for release indoors of particulates, heavy metals, acid gases, and other emissions. We recommend indoor monitoring of the work environment.

14. Questions have been raised about the adequacy of the overdesign. It is possible that the SQI will take longer for startup than anticipated. Because of the tight schedule for removal of the Basin F liquids from the tanks by 1993, it may be prudent to include additional holding capacity to increase throughput if necessary.

6.0 CONCLUSIONS

The PHA has developed a list of recommendations and items which the team felt warranted further study. Key elements in the study are questions about the adequacy of the FRP material, redundancy of controls and indicators, potential for release of particulates and heavy metals from the baghouse either into the indoor environment or up the stack, thus increasing the emissions. Other issues include indoor air monitoring, refractory material replacement, incinerator nozzle design, and potential for brine disposal as an alternative to solids handling.

APPENDIX A

TELEPHONE CONVERSATION NOTES

On May 25, 1990, Dr. Valorie Thompson of WCC called American Cyanamid's office in New Jersey to discuss operation of the SQI unit located in Hannibal with Cyanamid engineers. According to Mr. Gary Zaborowski of Cyanamid, the operating SQI unit at Cyanamid's Hannibal facility has experienced some of the same difficulties as the unit at Great Plains Gasification Plant in North Dakota. Cyanamid has replaced most of the FRP materials with steel, as they found that temperature excursions downstream of the incinerator caused problems in the unit. Cyanamid has also replaced all rubber joints on the unit with metal flex joints. Cyanamid has replaced their refractory brick with material from Gillespie and Powers in St. Louis, Missouri. Mr. Zaborowski suggested the design team discuss refractory materials with Dr. Charlie K. Gillespie of Gillespie and Powers. As Cyanamid's makeup water has a high mineral content, the quench tank experiences solids buildup. Cyanamid has modified the design of the quench tank so that it can be removed from below the incinerator downcomer. This facilitates both quench tank cleanout and refractory replacement. Mr. Zaborowski suggested that Dr. Thompson call Marlow Severin, maintenance engineer at the Hannibal facility for further information. Cyanamid does not monitor indoor air quality.

On May 30, 1990, Dr. Thompson called the Eli Lilly facility in Clinton, Indiana. The operating SQI unit at the Lilly facility has been modified slightly. According to Mr. Ted Moss of Lilly, the refractory material has been replaced with a Green-L 90 brick hat is expensive but has held up under 1800 degree operating temperatures for three years. Lilly has also modified the injection guns to include a ball joint so that the guns can be removed during incinerator operation to replace plugged nozzles. Lilly also redesigned the nozzles in house to cut the replacement cost. Lilly has installed a clinker grinder beneath the quench tank to grind up solids in the slag, and has replaced their FRP quench tank with titanium. The rest of the FRP components are still in use. Lilly does not currently monitor indoor air quality but is considering a monitoring program.

APPENDIX B

PHA STUDY NOTES

PHA for Rocky Mountain Arsenal

May 30, 1990

Hazard Analysis Team Members Present:

V. Noble
L. Bulger
E. Puch
V. Thompson

System separated into five units:

UNIT 1	UNIT 2	UNIT 3	UNIT 4	UNIT 5
Pond A to Storage Tanks	Day Tanks to Incinerator	Brine/mixing Tanks	Gas from Separator to Venturi	Air
Storage Tanks	Combustion Air Blower	Transfer from Brine tanks to Dryer	Venturi	Water
Transfer to Day Tanks	Air Atomizer	Spray Dryer	Scrubber	Electrical
Day Tanks	Natural Gas Incinerator	Spray Dryer to Baghouse	Caustic to Scrubber	
Wastewater Tanks	Quench Tank	Solids Handling	Liquid Recycle	
	Quench Water System	Air to Dryer	Scrubber Liquid to Venturi	
	Separator	Gases from Baghouse to Scrubber		

UNIT 1

A. Pond A to Storage Tanks - 20 to 40 GPM

Operating Mode - Filling Tank

1. Loss of pump/power to pump

   Instrumentation: Pressure/flow indicators

   Lose flow to tanks. If valves are not open, we have cavitation of pumps. 2nd pump used as backup.

2. Third party accident - 1 1/2 inch line inner diameter pipe - 1500 feet long.

   Line is sloped to drain into sump in storage tank area or into impoundment. No check valves on drawing near tank. If line is completely severed, potential contamination, cleanup, H&S, odor problem.

   Line is fenced in - can be covered with snow. Leak detection on line - potentially electrical detection system (flow may be too low for DP/SCADA system). Permalert system recommended. Line has outer containment line.

   Redundant indicators recommended for everything.

3. Existing valves on tanks lead - structural integrity not known.

   Contamination/cleanup/H&S/odor problem.

4. Lines are heat traced - could have a problem with loss of heat tracing. Lines are insulated as well. Could have a potential freezing problem upon power interruption. Backup power supply available.

5. Pond capacity for holding all three tanks is not adequate - 1993 to drain tanks - if this is not achieved - potential overflow/capacity problems. May go to Pond B.

6. Operator error - pump direct from pond to tank - no catastrophic.

   Potential issues - can we put the input line to the top of the tanks? This issue was raised in the past.

   Recommendations - monitoring (visual) of operations - once per shift. If line is covered with snow, visual checks may not be appropriate in winter.

Recommendation - redundant indicators on everything. Install flow totalizers.

B. Storage Tanks - three

Tank 2 will be emptied first - structural integrity is in question. Phase 1 operation - emptying a single tank. Phase 2 - dual tank operations. No indicators on tank - only level switches with high and low alarms.

1. Add level indicators - lower from top of tanks - potentially use bubblers.

2. Level alarms fail - overfilling tank is not probable.

3. Failure of scrubber system - not considered critical. Not offgassing significantly. Offgassing may occur when filling tanks. Potential community relation/health problem.

4. Tank integrity - structural failure. Tanks are diked. No structural analysis has been done. Containment. May not use tanks if they are not structurally sound. Pumping tanks to ponds - potential to go into Pond A or Pond B.

5. Backup of Basin F liquids into water purge tank - suggest to use motor operated valves connected to pumps for purging - some contamination in water purge tanks.

   If valves leak - potential for release. Valve misalignment may be a consideration.

   Recommendations - spell out operating procedures - clearly mark valves as to open and closed. Use tagging procedures. Make this a part of operating procedures.

C. Transfer from Storage to Day Tanks

Line will be 1200 feet long.

1. Line break/leak in third party accident - potential to empty large storage tanks completely. Environmental concern with release of Basin F liquids. Requires operator to close manual valve to shut off flow. Leak detection system should detect.

2. Valve leak - environmental release - leak detection system.

3. Lines are situated outside of building. Line is doublewalled, heat traced. Loss of heat tracing can lead to potential for freezing in line at very low flow rates.

4. Potential for misoperating with incorrect valving. See recommendation for operating procedures above.

5. Tanks are filled on bottom of tanks.

D. Day Tanks

Two day tanks in operation. 15,000 gallon.

1. High level in day tanks. Transfer pumps will be shut off. If level indicator fails potential exists for overfilling tanks. Overflow will be added to tank design. Redundant indicators are not in current design package. Level indication is remote.

2. Materials to be used have not been established. The tanks will be indoors and probably will be insulated.

3. Loss of agitator. No consequence.

4. Offgassing not expected to be significant. Much ammonia is tied up in salts. It was expected that most of the ammonia has offgassed.

5. Vapor recovery system failure - potential for release of ammonia and other gases indoors. Vapor scrubbers are all carbon - no liquid scrubbing.

6. Tank switching is going to be motor operated, tied into level alarms. Valves tied into low and high level indicators. Potential for overfilling tanks if the instrumentation/valves fail. Tanks can overflow if overfilled.

7. Overflow design may be to Tank 4 (Wastewater tank for decon water). Should tank an overflow problem. Suggestion is to put a flow switch in the overflow line to detect any overflow so that operator may take action.

E. Wastewater Tank

Wastewater Tank is 15,000 gallons, also located indoors.

1. Truck Drain is removed from PFD, may have to decon rail cars - call it Solids Loading Decon.

2. Wastewater tank should be bled into day tanks slowly. If wastewater is pumped in quickly, this could case a problem downstream in incinerator with incinerator operation. On high level of wastewater it should feed into day tanks. One option is a design modification to downsize the pumps so that you can't get a quick flush of wastewater into the incinerator.

Recommendations: Downsize pumps on exit from wastewater tank. Possibly monitor the composition of fluid going into incinerator to avoid operation excursions.

UNIT 2

T-Thermal Design Package - Units 2, 3, 4,. T-Thermal has design from pumps forward.

A. Transfer from Day Tanks to Incinerator

1. Potential for monitoring composition of liquid going into incinerator to avoid operation excursions.

2. Strainers are designed for lines into injection guns to avoid plugging of nozzles.

3. What is material of line that is proposed by T-Thermal?

4. Leak from line - Basin F liquid inside building, drains to Wastewater Tank.

5. Two pumps on line - automatic back up pump operation.

6. Flow control valve fails closed - shuts down feed pumps. Incinerator may get hot.

B. Combustion Air Blower

1. Combustion Air Blower fails - no combustion air to incinerator, designed to shut down incinerator operation. there appears to be a discrepancy in the design specs sent by T-Thermal as to whether the interlock will shut down the natural gas flow or whether the natural gas must be shut down by manual valves. Normal operating procedures for shutdown mention manual valves. Interlock system mentions automatic shutdown for natural gas, waste stream. atomizing air.

2. If methane continues after air is shut down, potential may exist for explosion in incinerator.

C. Atomizing Air Blower

1. Dedicated compressor for atomizing waste being supplied by T-Thermal. Great Plains had to upsize the compressor as design was not adequate.

2. Loss of atomizing air - loss of burn efficiency, waste stream will go into quench tank. may have instant clogging of nozzles. Will require maintenance of guns.

3. We recommend more frequent inspection of guns for clogging given experience of other operators.

4. Pressure indicator at nozzle should be remote as well as local.

   Recommendation - all indicators of flow into incinerator should be remote as well as local and redundant.

5. Nozzle plugging/pulsing may be a significant source of vibration as experienced at Great Plains when operating at 20% design.

D. Natural Gas/Fuel Input

   Accident history at Great Plains Synfuel Plant, December 1984, indicates that air intake clogged due to frost, incinerator shutdown commenced. Fuel solenoid was also frozen and closed slowly, allowing gas to continue to flow into incinerator. This caused an explosion. Solution was to locate the unit inside a building to guard against extreme weather.

1. Block and Bleed - bleed should be directed to a safe area and ensure that it does not vent near any combustion sources.

2. Emergency backup fuel is propane. Upon loss of natural gas, propane system will come on line, mixed with air. Design not indicated on P&ID.

E. Incinerator

1. Refractory brick, according to Great Plains, Eli Lilly, and American Cyanamid, will require replacement shortly after beginning operation. We recommend that the refractory brick type be upgraded based on information from other SQI operators.

2. Ledge supports did not hold the refractory bricks. Materials had to be changed at Great Plains.

3. Cyanamid had quench tank designed so that it could be rolled away from incinerator during changeout of bricks for ease of replacement.

4. Rubber joins have been replaced by both Great Plains and Cyanamid as they may be burned up.

5. Thermocouple wells at Great Plains failed after only a few hours of service. Great Plains felt that the thermocouple design was inadequate for their use. Great Plains burns a wide variety of waste and fuel types.

6. Downcomer design - material for downcomer is Hastalloy. Pressure drop across holes in downcomer was lower than pulsation of water at Great Plains. Great Plains was operating at this time at 80 to 75% of rated waste flow.

7. Great Plains modified instrumentation. Review of instrumentation for quality and reliability is recommended.

F. Quench Tank

Fiberglass is the proposed material for the quench tank. Great Plains, Cyanamid, and Eli Lilly have replaced the fiberglass material on their SQI units with more robust materials. Cyanamid is going to all stainless in their latest designed incinerator.

1. Liquid level in quench tank - level indicator not present - low level, hot gas will run out of incinerator unit, shut down. Recommend potential backup control for quench tank. Overflow is into separator. Quench tank and separator should be operated at equilibrium. Temperature indicator on line to separator is interlocked to shut down and measure gas temperature from quench tank.

2. Maintenance will require that solids be mucked out. Recommend that design ensure that recycle entry from separator into quench tank be placed high enough so that it will not plug.

3. Inadequate recycle to quench tank - pump sizing should be checked.

4. Great Plains had some foaming problems in their quench tank. Potential for foaming at RMA should be addressed.

5. Material failure of Quench Tank - if fiberglass material fails, this could cause a release of very hot gases into work area and pose a potential danger to workers in the area.

Question: How do you detect quickly that you are losing level in the quench tank?

G. Quench Water System

WCC will design the tank to provide holdup. T-Thermal will draw from this tank for makeup water in addition to the recycle from the separator and scrubber.

1. Pump on makeup water fails. Backup pump should be available. Potential for loss of level and ultimate draining of quench tank. This situation should be identified by level.

2. Upon any leak of water, drain goes to sump, to wastewater tank and is recycled through the system.

H. Separator

Separator operation is not discussed in T-Thermal package material.

1. What material is separator? FRP-2? Recommend investigation of material and potential for replacement with more robust material.

2. Plugging in brine transfer line - recycle to quench tank is lost, lose brine to mix tanks to go to spray dryer. May detect by level indicator.

3. Level indicator fails - No indication of level in quench tank or separator - potential operational problems and potential for loss of level of quench tank.

4. No indication of temperature on liquid in separator/quench tank.

5. Material failure of separator - hot gases released into building. Gases will not be as hot as gases released from incinerator.

6. Location and detection of overflow of water in separator needs to be determined.

   Question: Is local instrumentation explosion proof?

UNIT 3

A. Brine Tank

Size of mixing tank is still in question. Army had initially requested two-day storage. WCC did not agree that two-day storage was necessary. Mixing tank is not yet on P&IDs. Brine will contain both dissolved and suspended solids. Design is for two 40,000 gallon tanks. Brine will contain metals. Brine is not acutely hazardous to humans at this point.

1. Loss of pump - one standby pump. Loss of both pumps, liquid level of separator rises, overflow and high level.

2. Plugging of line with suspended solids. Delta P indicator on pumps should detect.

3. Loss of agitator. If running continuously as designed, tank will not be full. Draw brine off bottom, feed from top. Potential for solids accumulation if brine tanks are used for storage.

4. Material for tanks is not determined.

   Comment: Brine can be disposed as it comes off the tank rather than going through the drying operation. If brine disposal is the chosen option, only one tank will be used.

B. Transfer from Brine Tank to Dryer

1. Line plugging - backup brine into brine tank, delta P on pumps should indicate.

2. Nozzle plugging - ditto.

   Question: P&ID states that flexible hoses will be used at transfer from brine tank to dryer. Is this correct?

C. Spray Dryer

1. Loss of air - potential backup of brine into spray dryer, possible carryover of brine into baghouse.

2. Purge water supply failure - no purging of nozzle, etc. In comparing NIRO design with WCC line, ensure that proper checks be made to avoid contamination.

3. Loss of cooling water to atomizer. Could possibly cause mechanical problems in atomizer. We recommend that an alarm be placed to indicate loss of cooling water flow, possibly a flow meter.

4. Unclear at this level of design how a malfunction of the spray dryer would be detected.

D. Spray Dryer to Baghouse

1. Loss of temperature indicator and control - potential for carryover of high temperature solids into baghouse and failure of baghouse.

   Recommendation: We recommend that local instrument panels all be on main remote control panel. Local indicators should also be used.

2. Plugging of line - high moisture content or large pieces in line. Spray dryer test is forthcoming. WCC may recommend including potential cleanout for spray dryer. Will be indicated by vacuum (low pressure) in baghouse, dryer pressure increases. Recommend that pressure indicator be tied in to shutdown.

E. Baghouse

1. Periodical cleaning is necessary for baghouse. Problems with bags binding or material collecting on bags and not removed. Holes in bags are possible, concentration is higher and particulates could be released into building and cause health problems (particulates and heavy metals). Changeout of bags is also an exposure problem. Potential exists for contamination of entire building.

2. All solids are being routed through baghouse which could cause problems.

3. Problems can be encountered removing dust through conveyor.

4. Materials of bags can be very sensitive to temperature. Design of materials are not clear at this point. If low temperature bags are used this may be another concern for release upon failure of material at high temperature. High temperature bag material may be more expensive and not last as often.

5. Potential of dust release while unloading the cone.

6. Cleaning of bags - depending on what kind of bags are used and what type of cleaning procedure is used, potential exists for bags to expand and release dust.

7. Transfer system of solids from baghouse - recommendation is to consider using induction transfer system rather than pressurized system. Rotary valve may also be a problem. Potential for fugitive emissions with pneumatic system.

   Recommendation: We recommend that the baghouse be housed in a separate building to minimize exposure to emissions in other parts of the building.

   Comment: There is a potential with this design to pump particulates into atmosphere if baghouse fails. Another configuration may be to use a cyclone after the spray dryer and before the baghouse, using the baghouse as a final removal procedure. Baghouse is sensitive and if it fails, entire system may need to be shut down. Brine tanks are oversized to account for shutdown.

   General Comment: Time allowed for maintenance in planned operating parameters is felt to be inadequate.

F. Solids Handling

1. Solids are being transferred into a silo which has two-hour storage.

2. Rail cars are used for transfer of solids. Loading is planned continuously. Reliance on rail transfer may be a bottleneck. Storage of material in rail cars will be on site, as there are regulatory limitations on the day and times that transport off site will be allowed, as well as limitations on import of caustic and empty rail cars. Single silo may not be adequate.

   Comment: Further investigation needs to be made to determine what the limitations are on rail transport and also needs for solid vs. liquid handling.

   Recommendation is to go with induced draft on all points of solids handling to cut down the dust generation.

G. Air to dryer

1. Loss of air, natural gas, or combustion air - assumption is that interlock exists to shut down dryer in the event of loss of these inputs.

2. Instrument failure - potential for low temperature, loss of drying ability and potential for clumping due to high moisture content downstream.

3. Instrument failure - potential for high temperature, carryover of high temperature material to baghouse and burnup for bags. No apparent redundancy on thermowells. Thermowell burnthrough is a possibility. Recommendation is to ensure that an open circuit on a thermocouple is an alarm condition.

H. Exhaust air from baghouse

1. Air does not go through scrubber, up stack from scrubber. May be designed to go through a separate stack.

2. Release of particulates is a concern - as there is potential for bags to have holes, particulates can be released to the atmosphere. Have allowable emissions accounted for this?

3. Pressure indicator on baghouse does not indicate low alarm, which would give an indication of hole in the bags. Recommend including low alarm as well as high alarm.

   Question: Configuration of inlets to spray dryer (instrument air, purge water supply, cooling water) is unclear from drawing.

UNIT 4

A. Vapors from Separator to Venturi

1. Low flow and/or low pressure - inadequate wetting of particulates and potential release of particulates through scrubber stack.

2. Leak in line - results in emissions of volatile and semi-volatile metals to building, as well as HCl gases.

3. Question: What is failure mode of venturi? (open/shut)

4. Material of line is FRP - question as to adequacy of fiberglass.

B. Venturi/Scrubber

1. Material of venturi is assumed to be hastalloy or stainless.

2. Level control on venturi? Assumed to be in equilibrium with level in scrubber. Level indicator on scrubber - on low level additional fresh water makeup into scrubber.

3. Loss of water in venturi - no removal of particulates in venturi. Level shutdown on low and high water levels.

Question: Is level control redundant? It does not appear to be redundant on the P&ID. If level control instrumentation fails, untreated gas is emitted through the stack. Analyzers on stack should detect increase in HCl.

Question: What does interlock shut down?: Incinerator/scrubber operation?

Question: Blowdown is not directly controlled by liquid level in scrubber.

Question: What is analyzer AIC to spray dryer surge tank analyzing for? We assume conductivity as it controls control valve to spray dryer surge tank but it is not indicated on P&ID>

C. Scrubber

Question: Control of TDS in scrubber is unclear.

D. Caustic to scrubber

Question: Are we sending caustic to the separator without pH control on separator liquid? It appears that addition of caustic can go to either downcomer water inlet and scrubber but pH is only measured at scrubber.

1. pH meter fails - pH meters are unreliable, especially as TDS increases. We recommend redundant controls. Low caustic - SO2 will not be

controlled. High caustic - potential plugging problems in packing and nozzles.

Comment: Check on heat evolved when mixing 50% NaOH with water down to 18%.

E. Liquid Recycle

1. Controlled by level controls. concerns about how solids buildup is controlled as per question/comment above. Potential to lose water in scrubber as discussed above.

2. Water balance? Same question about conductivity meter controlling water balance. What is mass balance on water - does Basin F liquid water stay in system or does flue gas pull water out of the system? How much fresh water is coming in? If Basin F feed continues to come in, does conductivity increase? Mass balance shows 39 GPM of fresh makeup water into system.

   Question: We have some questions about the work environment and monitoring which we feel should be in place. There is the potential for release indoors of particulates, heavy metals, acid gases, and other emissions. We recommend indoor monitoring of the work environment.

APPENDIX D.1

Weston Response
to
HAZOP

November 5, 1991

HAZOP SUMMARY FOR RMA BASIN F LIQUID INCINERATOR -5 NOV 91

Reference Drawing: 32-03-713-D, Sheet 1 of 6

Line/Item	Description
T0001-1-1	Loss of natural gas to the burner. 1. What is RMA history of gas supply reliability? 2. What is notification procedures for utility shutdown?
Response:	PMRMA
T0001-1-2	Rupture of natural gas line, release of gas in area. 1. Are combustible gas sensors located in building? 2. Safety contingency plan should be developed for required action.
Response:	1. Yes, Total Hydrocarbon and Ammonia in the SQI. 2. Agreed.
T0001-1-3	Gas line valve failure, or inadvert closing or opening wrong valves. 1. Training manual and O&M should include proper lockout/tag out procedures. 2. Gas lines should be color coded for easy identification.
Response:	1. Agreed. 2. Agreed.
T0001-10-1	Gas line pressure may not be adequate for incinerator feed system. 1. RMA to provide minimum 18 psig gas feed at skid. 2. T-Thermal to regulate to 10 psig.
Response:	1. PMRMA. 2. Agreed.
T0001-16-1	Concern whether gas composition will change. Establish whether gas characteristics can significantly change from utility.
Response:	PMRMA
T0001-17-1	Concern about startup of gas line at correct pressure or correct startup sequence. O&M manual and training should include correct startup procedures.
Response:	1. Agreed.

Line/Item	Description
T1001-17-2	Concern in startup/shutdown gas feed system, that procedures not followed. 1. Training and O&M Manual should address procedures in event valves do not open or sequence not correct. 2. Manual action should be detailed.
Response:	1. Agreed 2. Agreed.
T0002-19-1	Concern that pilot does not light. O&M should include instructions that operator check pilot if it does not light after two or three attempts.
Response:	1. Agreed.
T0003-1-1	Blower failure 1. Ensure routine maintenance of blower, including critical items monitored such as bearing temperature, etc. 2. Consider method of monitoring of vibration.
Response:	Bearing temperature and blower vibration will be monitored.
T0003-1-2	Interruption of air combustion air. 1. Assure that inlet filter is maintained. 2. Recommend installation of pressure gage on blower inlet after inlet filter.
Response:	1. Covered in O&M. 2. No
T0003-3-1	Reduction of air combustion air. 1. Add an alarm to indicate deviation from set point (FIT-16). 2. An interlock required for shut down.
Response:	1. Incorporated 2. Agreed
T0003-10-1	Prevention of excessive vacuum in day tank. Provide a deviation alarm from FIT-016 into day tank to shut off valve XV-17A.
Response:	Deviation Alarm will not solve this concern.
T0003-15-1	High ambient temperature result in high air temperature to blower. Consider adding temperature instrumentation to correct air flow rate.

Response: No. Correction is built into the incinerator system design: AIC-30.

Line/Item	Description
T0003-17-1	Quantity of vapors released from day tanks? Sampling should be done during initial plant operation to determine quantity of vapors released from day tanks to incinerator.
Response:	Agreed
T0003-19-1	Failure of emergency blower Failure of VX-17 to make switchover to emergency blower. 1. Develop contingency plan to start emergency blower B-201B from normal power source in emergency cases other than power failure. 2. Include alarm on position of XV-17.
Response:	1. Yes 2. Alarm has been included.
T0004-1-1	Malfunction of emergency blower or diesel generator when needed. O&M manual should include routine testing of generator and blower.
Response:	Agreed
T0004-18-1	Failure of emergency blower in other than emergency. Consider switch gear so that blower can be activated in other than emergency conditions.
Response:	Agreed
T0005-1-1	No combustion air to incinerator. Recommend installation of deviation alarm on line to indicate no air flow resulting from failure of blower, line rupture, or control valve failure.
Response:	Alarm has been included.

Reference Drawing: 32-03-713-D Sheet 2 of 6.

T0006-1-1	Failure of aqueous feed pumps P-201A,B. Recommend alternating operation of feed pumps to assure reliability.
Response:	Agreed

Line/Item	Description
T0006-1-3	Loss of aqueous waste flow due to line plugging. 1. Line loop should include flush connections. 2. Investigate moving three-way valve to suction side.
Response:	1. Agreed 2. No
T0006-1-4	Rupture of waste line, release of waste into area. 1. Install a high/low alarm on FI-04A, including interlock for shutdown 2. Is there a sump or collection dike beneath solids?
Response:	1. Agreed 2.
T0006-6-1	Reverse flow causes air into tank TK-105/106. Evaluate the location of check valve 324 if valve XV-26 fails open.
Response:	Moved valve 324 to eliminate possibility. See Rev 7, Sheet 2
T0006-15-3	Failure of heat tracing on aqueous lines. 1. How does operator detect failure in heat tracing? 2. Are thermocouples located on heat tracing or line?
Response:	1. There is no monitoring system in place to monitor the heat tracing. 2. Reference Weston Drg 00-03-009.
T0006-18-1	Valve malfunction in emergency could result in continue aqueous waste flow. Valve malfunction and reverse flow of air could result in continued waste flow. Contingency plan should include check of flow in FIT-04A to establish flow has ceased in emergency conditions.
Response:	Checks are incorporated into the software.
T0007-1-1	Loss of waste flow to feed pump P201. O&M manual should emphasize monitoring of pump suction strainers.
Response:	Agreed
T0007-1-3	Loss of waste flow due to control valve failure. Investigate that valve COV-105b,C can be manually

operated.

Response: All valves can be operated manually in the field.

Item/Line	Description
T0007-1-4	Line rupture could result in loss waste into into area. Is piping located in diked area?
Response:	Yes
T0007-3-1	Loss of waste flow due to line leak. Recommend trending pump discharge pressure (PIT-28).
Response:	No. Regular line inspections shall be performed by the field tech.
W0007-1	Vapors from day tank during startup/shutdown. Need backup carbon system.
Response:	Carbon system is not effective on ammonia vapors.
W0007-13-1	Maintenance of day tank vent lines. O&M should include maintenance schedule for conservation vents and blower intake filter.
Response:	Agreed

Reference Drawing: 03-04-009 Rev 0

W0008-1-1	Loss of city water for caustic dilution. Contingency plan should include trucking water to plant site.
Response:	No. No water; No operations.
W0008-1-4	Loss of water flow resulting from valve or instrument failure (FIC-205). Routine maintenance required.
Response:	Agreed
W0008-2-1	More water flow due to control malfunction (FIC-205). O&M manual should address maintenance and calibration of control loop.
Response:	Agreed

Line/Item	Description
W0008-9-1	Loss of water pressure resulting from failure of KIC-209A, and KIC-211A,B. Explain operation and function of these controls.
Response:	See Attachment 1
W0008-15-1	Heater E-203 in Tank TK-203. Explain purpose.
Response:	Freeze protection
W0008-16-1	Water Softener system failure. O&M should address operation and maintenance.
Response:	Agreed

Reference Drawing: 03-04-009, Rev 0; 32-03-713-D, Rev 5

W0009-1-2	Loss of process water flow due to inadvertent valve closure. 1. Why is valve in Line 3-WT-004-E-D shown normally closed? 2. O&M manual should address operation of this system.
Response:	1. The valve on 3-WT-004-E-D should be normally open. 2. Agreed
W0009-16-1	Failure of process water heat tracing. O&M manual should require checks of heat tracing system.
Response:	Agreed

Reference Drawing: 01-04-001 Rev 1; 02-04-002 Rev 1

W0001-1-1	Loss of Basin F fluid during transfer. 1. O&M procedures should cover maintenance pump intake screen and strainer. 2. Will procedures be written for routine cleaning of Pond A intake screen?
Response:	1. Agreed 2. Agreed
W0001-1-2	Loss of Basin F fluid transfer resulting from inadvertent closure of line valve. 1. Operator training should address this potential problem. 2. Will safety manual address safe operation of fed to TK-101?
Response:	

Line/Item	Description
W0001-1-3	Loss of Basin F flow due to P-101A failure. Operator training required to insure draining of line to prevent settling solids plugging when line becomes operational.
Response:	Shall be included in O&M Manual
W0001-1-4	Pump 101A/B shut down due to instrument malfunction. 1. Operating training required. 2. Will operating manual cover maintenance of instrumentation?
Response:	1. Agreed 2. Yes
W0001-1-5	Basin F transfer line broken, release outside pumphouse. 1. Verify what is included in pipe design to safely control release. 2. PID do not indicate whether pipe is pre-engineered or field run.
Response:	1. The design of the pipe includes double wall construction and interstitial leak detection to safely contain and detect releases. 2. Outside the pumphouse, the potential for releases is controlled by the specified double wall construction.
W0001-2-1	Loss of Basin F flow due to some blockage. Routine O&M procedures to assure that line is not building up solids and operating safely.
Response:	1. Agreed
W0001-4-1	Potential failure of Basin F transfer line due to overpressure. Include instrumentation to prevent overpressure.
Response:	High pressure alarms are provided on P-101A and P-101B discharge. Local PI-101C is provided on suction side.
W0001-5-1	Freezing of fluid in transfer line. Since this requires that both pump be off and line remain full, corrected by operator attention. O&M to include procedures to assure line is flushed and drained after pump failure.
Response:	O&M provides flushing of lines after transfer operations only. Other flushing will be determined by the operator on an "as required" basis.

Line/Item	Description
W0001-7-1	Assure proper maintenance of basin F transfer line. 1. Assure that O&M manual covers maintenance and training. 2. O&M manual procedures are properly implemented, and operators trained.
Response:	1. Agreed 2. Agreed
Reference drawing:	01-04-001, Rev 1
W0002-1-1	No flow of purge water due to inadvertent valve closure. O&M manual should cover proper procedures.
Response:	Agreed
W0002-1-2	Loss of purge water due to loss of city water supply. Contingency plan should include truck delivery of purge water.
Response:	No. No water; No operations.
W0002-2-1	Basin F fluid into purge water (failure check valve or improper valve position). 1. Consider adding reverse flow indication in line. 2. May want to consider addition of a high pressure alarm or reverse flow indication.
Response:	1. Not necessary. There are check valves in the line. 2. No, a field tech shall be present for all transfer and purge operations. If a reverse situation occurs he will be in a position to notify the operator and stop the purge or transfer.
W0002-3-1	Failure of heater in 101A or B. O&M manual to include instructions for check of heater and temperature control loop.
Response:	Agreed
Reference drawing:	01-04-001, Rev 1; 02-04-002, Rev 1.
W0001-8-1	Leak in basin F transfer line. O&M to require daily check of sight glass in 2-WK-030-P-K.
Response:	Agreed

Line/Item Description

Reference Drawing: 02-04-002 Rev 1; 03-04-001 (7/31/91)

W0003-1-2 No flow in waste liquid due to inadvertent valve closure. O&M should include checklist for valve positioning.

Response: Agreed

W0003-1-3 No waste liquid flow due to pump failure. Drawing should be corrected to show PI-103A and B as remote indicators in the main control room.

Response: Agreed, reference revision 2.

W0003-1-4 Pipeline break results in release of waste to area? 1. Verify that piping arrangements provides for containment of released waste. 2. Will contingency plan address release outside containment area?

Response: 1. Waste released from the piping will drop to the floor, which is sloped to drain to a sump servicing the containment area. 2. Yes.

W0003-1-5 Loss of waste flow due to solids accumulation. O&M plan will include routine flushing.

Response: Agreed

W0003-2-1 Failure of LIS-105 or 106 results in excessive flow and overflow of day tank. Consider adding flow switch and alarm day tank overflow line 3-WK-051-W-K.

Response: High level alarms LAH-105 and LAh-106 already exist to alarm high level in the tanks. A failure of LIS-105 or LIS-106 would be detected by the control room operator and can be investigated and repaired as required.

W0003-3-1 Crystal accumulation in line causes partial plugging. O&M manual to include partial flushing.

Response: Agreed

W0003-4-1 Basin F fluid flow into purge water tank TK-108. Consider adding flow switch to detect reverse flow in case check valve fails.

Response: No. A field tech will be present for all purge/transfer operations. If such a condition does

occur he will be present to notify the operator and stop the purge/transfer operation.

Line /Item	Description
W0003-5-1	Pipe leak into secondary containment. O&M manual to require daily check of sight glass and TK-109.
Response:	Agreed
W0003-7-1	Loss of heat trace and freezing of line. 1. Requires that pump not operating, line full, and loss of heat trace. 2. Operator to assure that line drained after pump failure and insure heat tracing system operable.
Response:	1. No response required. 2. Agreed
W0003-8-1	Excessive line plugging due to unanticipated composition of Basin F liquid. Contingency plan should be developed.
Response:	1. The composition of Basin F liquid has been determined previously. Heat tracing and flushing provisions have been included as contingency measures.
W0003-9-1	Maintenance of this system is critical. Maintenance issues include plugging, checking sight glasses for leaks, instrumentation calibration, pump maintenance, and monitoring for corrosion.
Response:	Agreed

Reference Drawing: 02-04-002 Rev 1

W0004-1-1	Purge water pump inoperable due to loss of power. 1. Contingency plan for loss of power should be developed. 2. Option to connect to fire water system for backup purge.
Response:	1. If a power outage occurs only the most critical systems will be operational. If the power failure is a local problem the situation will be repaired and the purge operation will commence. 2. No.

Reference Drawing: 02-04-002 Rev 1

W0004-17-1	Failure of heat tracing system with water trapped in pipe. O&M manual to address standing water in purge lines outside of building.

Response: If the heat tracing fails; temporary heaters will be used as required.

Line/Item	Description
W0004-25-1	Maintenance of system. 1. Recommend that FQI (flow totalizer) be installed on inlet to TK-108. 2. Should flow indicator be added to this line?
Response:	1. Why? 2. Flow indicating totalizer FQI-108 is provided on outlet.

Reference Drawing: 02-04-002 Rev 1 (4/26/91)

W0005-9-1	Blockage in sump pump discharge. Recommend routine inspection of sump and associated equipment.
Response:	Agreed
W0005-16-1	Buildup of solids in sump. Routine inspection of sump required.
Response:	Agreed
W0005-19-1	Maintenance. Primary maintenance issues are sump inspection, pump operation, and level instrumentation.
Response:	Agreed

Reference Drawing: 03-04-001 Rev 0 (7/31/91)

W0006-2-1	Loss of waste flow due to instrumentation failure. Explain meaning of COV label for valve 105 B&C etc, and how these valves operate.
Response:	COV indicates cylinder operated valves. These valves are pneumatic operated and work the same way an electrically operated valve works except they use plant air.
W0006-3-1	Waste pipe leak outside of designed containment. O&M manual should address leak detection and pipeline maintenance.
Response:	Agreed
W0006-9-1	Line block pump P-104A/B or inadvertent valve closure. Routine line maintenance required.
Response:	Line maintenance will be provided as required. All lines will be checked daily for leaks and obvious structural damage.

Line/Item Description

Reference Drawing: 03-04-001 Rev 0 (7/31/91); 32-03-713 Rev 5.

W0007-1-1 Flow of vent day gases into area. Personnel air should be available in the area.

Response: Personnel air is available in the SQI building.

W0007-1-3 Inability to vent day tanks when air blower down. Does system design include capability to vent tanks through carbon when incinerator is down on temporary basis?

Response: No.

W0007-2-1 High vacuum in vent line due to plugging of blower inlet filter or silencer. Routine check of these items required.

Response: Agreed

T0007-4-1 Uncontrolled wastewater in feed due to inadvertent opening of valve in line 1 1/2-WK-043-E-K. Recommend lockout capability be included on discharge of TK-104.

Response: Not required. FIC-104 controls the flow of wastewater into TK-104. If things get out of control the operator can turn off the transfer pump and close the COV from the control room or the field tech can stop the transfer pump and manually close the COV from the field.

Reference Drawing: 32-03-713-D Sheet 2 Rev 5 (11/2/90)

T0008-1-2 Loss of feed to individual injectors. 1. Proper maintenance and checks of hose should be emphasized. 2. Recommend adding trending capability for PIT-27A/E, and PIT-45A/E.

Response: 1. Agreed
2. Trending can be provided but not required. High and low flow alarms and actual feed rate is being monitored for all injectors.

T0008-2-1 Excessive flow due to instrument failure or operator error or open bypass on valve 322A/E. 1. Recommend adding high flow alarm on individual controllers FIC 22A/E. 2. Recommend reevaluation of lockout on bypass valves associated with these control valves.

Response: 1. Alarms have been added.
2. Agreed, a lock out mechanism will be provided.

T0008-7-1 Loss of injector flow due to manual air purge left open. 1. O&M manual should include troubleshooting checklist to check air purge valves if FIT-22A/E operating erratically.

Response: Agreed

Line/Item	Description
T-0008-18-1	Emergency shutdown. O&M manual should state operators should confirm that nozzles are clean before restart.
Response:	Agreed

Reference Drawing: 32-03-713 Sheet 2 of 6, Rev 5, 7/23/91.

T0009-1-1	No atomization air. 1. O&M include maintenance of compressor inlet screen, etc. 2. Ability to bring in outside compressor must be in contingency plan.
Response:	1. Agreed 2. Agreed
T0009-18-1	Loss of compressor from power loss. Establish that there is a "flywheel" effect so that compressor is on long enough after shutdown to cool nozzles.
Response:	There is no flywheel effect on this type of compressor, however, the reciever tank will provide enough backup air to cool the nozzles.

Reference Drawing: 03-04-009 Rev 0 (9/14/91); 32-03-713-D, Sheet 2 of 6 (7/23/91).

T0010-1-2	Rupture of hot water line. Recommend manual on/off control of pump be added (local and remote).
Response:	All pumps have local and remote capability.
T0010-15-1	Heater inadequately sized. Review sizing of heater and temperature requirements.
Response:	Heater must be capable of suppling 175°F water to the nozzles for flushing.

Reference Drawing: 32-03-713-D Sheet 2 of 6 Rev 5 (7/23/91).

T0011-1-1	Loss of atomization steam, boiler down or valve closed. Recommend a deviation alarm to FIT-76A.
Response:	Agreed. A deviation alarm has been provided.
T0011-1-2	Loss of atomization steam line rupture. Recommend a deviation alarm to FIT-76A.
Response:	Agreed. A deviation alarm has been provided.

Line/Item	Description
T0011-9-1	Loss of pressure due to boiler malfunction. Need to review boiler system and its controls to determine consequences. Drawing 03-04-014 not available.
Response:	
T0012-1-1	Line rupture of waste feed line, release of Basin F fluid into work area. 1. Add high/low flow alarm to FI-04B 2. Control valve (PCV-28) should be close to T-Thermal pipe rack as possible. 3. No indication available if rupture is downstream of PCV-28.
Response:	1. Agreed, high/low flow alarm was added. 2. 3. Routine line inspections will be performed daily.

Reference Drawings: SQI Incinerator Drawings.

T0014-19-1	Leaks from flanges, etc due to loss of integrity of seals. O&M manual should address this issue.
Response:	Agreed

Reference Drawings: 32-03-713D Sheet 3 of 6 and detailed incinerator drawings.

T0016-19-1	Corrosion or improper installation of heat shield; item 9 on dwg 6-02-3793D sheet 2 0f 2, Rev 2. Heat shield should be installed properly and inspected periodically during scheduled outtage.
Response:	Agreed
T0016-20-3	Releases of hot gases and high temperature liquids from incinerator tank leak or rupture. Determine whether containment berms exist and whether tank is below grade.
Response:	Containment berms do exist, however, the tank is not below grade.
T0017-10-1	Loss of pressure in caustic pump suction line. Recommend review of pump NPSH calcs.
Response:	1. P 208 requires 4 ft NPSH; a minimum of 30 ft is available.

Line/Item	Description
T0018-1-2	Caustic pump discharge line ruptures, release caustic into workplace. Recommend adding check valve and pressure switch at terminal point of line.
Response:	No. Routine line checks are performed daily to check for line ruptures and unplanned releases.
T0018-4-1	Recommend addition of interlock 65 to ACV-64 and interlock to loss of pumps P-202A/B.
Response:	Agreed, interlock 65 has been added.
T0018-17-1	Non sequenced positioning of valve XV-23 with associated pump p-208A/B during startup and shutdown. 1. Pump P-208A/B should be operating and flow proven at FE-41 prior to introduction of waste. 2. Recommend evaluation of adding interlock to shut down incinerator if caustic flow (FISL-41) is lost.
Response:	1. This has been provided for in the control logic. Reference interlock matrix. 2. FISL-41 has been added to the interlocks.
T0018-18-1	Emergency shutdown; failure of valve ACV-64 to close properly; uncontrolled release caustic into quench tank, and possibly through quench tank overflow. 1. Operator should confirm closure of this valve after emergency or normal shutdown. 2. Confirm whether heat tracing of this line is on emergency power supply (if not tracing will not be active).
Response	1. Proof of closure limit switches are included on all critical valves. 2. All heat tracing is included on the emergency power supply.
T0020-1-4	Scrubber recycle loop bleed line ruptures downstream of control valve; spill of hot scrubber blowdown into work area. Evaluate the need for pressure switch to indicate condition.
Response:	No, routine line inspections will note spills of this type.
T0021-1-2	Line rupture of soft water line. If upstream of FIT-39, get alarm and system shut down; downstream no indication available. Investigation need for pressure switch for loss of flow indication. 2. Location should be between WPR-7 and quench tank.

Response: 1. The current monitoring system is adequate.
2.

Line/Item	Description
T0022-1-2	Line rupture in caustic makeup line, release of hot caustic into workplace. Review piping run for safety.
Response:	Routine line inspections will be performed daily.
T0023-17-1	FCV-46 fails open in startup/shutdown, uncontrolled softened water makeup into scrubber causing overflow to sump. Change fail position to fail close on valve FCV-48.
Response:	Agreed, FCV-46 will fail closed.
T0024-17-1	XV opens startup and uncontrolled softened water into scrubber demister results in overflow to sump. XV-54 should fail closed.
Response:	Agreed, XV-54 will fail closed.
T0027-1	More solids in quench solids removal system results in increased pump wear. Maintenance item.
Response:	Agreed
T0029-3-1	Less flow in quench solids separator resulting from plugged downcomer ports. Recommend sem-annual maintenance program include inspection of ports.
Response:	Agreed
T0030-1-2	Line rupture of caustic makeup line with release of caustic. Consider looking at safety considerations resulting from caustic release resulting from lack of flow or pressure indication on line signaling rupture.
Response:	Routine line inspections will be performed on a daily basis to verify line and tank integrity.
T0030-16-1	Loss of heat tracing on caustic line. Review heat tracing control and monitoring.
Response:	No heat tracing monitoring system is currently in place. A monitoring system can be added at an additional cost to the customer.

Line/Item	Description
Reference Drawing:	32-03-713D, Sheet 4 of 6, 7/23/91
T0031-10-1	Loss of pressure, due to solids plugging, etc. Evaluate trending point for DP indication.
Response:	Trending can be performed by the PMCS.
T0032-2-1	More flow in quench recycle pressure side due to unbalance pressure between blowdown and recycle. Add a restricting orifice (valve) including pressure indication to balance pressure between recycle and blowdown lines.
Response:	Agreed. Reference revision 7.
T0032-16-1	Malfunction of density meters AE-59A/B results in excessive blowdown concentration. 1. Provide minimum flow limit switch interlocked to waste feed valve to ensure at least minimum blowdown during waste incineration. 2. recommend density trending.
Response:	1. AIC-59 has been added to the interlocks. 2. Agreed
T0032-18-1	Pumps P-202A/B are operated under emergency shutdown through the emergency diesel generator. Confirm that emergency diesel generator is automatically started upon emergency shutdown.
Response:	The emergency generator will start automatically within 10 seconds of a power failure, however P-202A/B are not powered by the emergency generator.
T0033-1-1	No flow in blowdown line to brine tanks. Install alarm of FI-83A linked to density reading on AIC-59.
Response:	Agreed, an alarm will be added.
T0033-1-2	Line rupture in blowdown line to brine tanks. Review lack of rupture/leak indication (flow or pressure indication) downstream of FCV-58.
Response:	Routine, daily line inspection will be performed.
T0033-6-1	Loss of pumps P-202A/B while scrubber pumps continue to run and line 2"-BR-313A-N-H is open bringing scrubber blowdown to TK-201, TK-202. Piping drawing show check valves in lines; show check valves in Lines on PID.
Response:	A check valve will be added

Line/Item	Description
T0033-17-1	Startup/shutdown. 1. Recommend installation of minimum flow limit switch interlocked with waste feed block valve. 2. Recommend flushing of quench tank recycle on shutdown.
Response:	1. Already included in design. 2. Need for flushing will be determined during operation.
T0033-17-2	Valve FCV-58 fails open upon shutdown. Replace fail open valve FCV-58 with fail closed valve.
Response:	FCV-58 will fail closed.
T0033-19-1	Maintenance. Line designations on PID are incorrect and should be revised to show/not show heat tracing.
Response:	
T0034-1-2	Line rupture in pH loop in quench. Recommend evaluation of safety hazard from release of hot brine
Response:	Routine line inspections will identify any line rupture. Reference safety manual for contingency plans.
T0034-2-1	Excessive flow in pH loop resulting in damage to pH probe. Recommend evaluation of probe design to minimize possibility of damage due to high flow.
Response:	Concerm is covered by probe design.
T0034-4-1	Domestic water into pH loop line results in dilution and erroneous pH readings. Recommend evaluation of adding trending point to caustic control loops AIC-56 and AIC-64.
Response:	Trending not required. The control system currently compares pH signals between probes.
T0034-20-1	Release of hot brine into workplace when removal of pH probes. 1. Recommend that all hot lines be identified. 2. Recommend splash shields or guard included at probes.
Response:	1. Brine lines are color coded. 2. Safety training will address this concern.

T0034-20-2 Erroneous pH readings result of buildup scale on probe. Recommend evaluation of trending of pH controller AIC-64.

Response: Routine cleaning of the probe will be performed. If the probe continues to malfunction a replacement probe will be provided.

T0035-1-1 No flow in venturi recycle line loss of control of FCV-60, plus other causes. Recommend addition of FS11-60 waste feed interlock to interlock matrix.

Response: FSLL-60 has been added to the interlock matrix.

T0035-1-2 Line rupture of venturi recycle line and release of hot brine. Recommend evaluation of hazard by safety committee.

Response: Routine line inspection will be performed daily.

T0035-18-1 Emergency shutdown. Recommend evaluation of Valve (FCV-60) fail position.

Response: FCV-60 will fail closed.

T0036-19-1 Improper maintenance, welding on vessel, resulting in liner damage. Recommend this vessel be inspected on a routine basis for lining integrity and solids buildup.

Response: Agreed

T0036-19-1 No level in quench tank. Recommend this vessel be inspected on a routine basis for rupture of ducts, piping, vessel wall, etc.

Response: Agreed

T0037-2-1 Excessive flow into venturi, loss of control. Recommend adding closure of valve SV-26 to interlock PDSLL-53.

Response: PDSLL-53 has been added to the interlock matrix.

T0038-1-1 Rupture of duct from quench separator to venturi. 1. Recommend safety aspects of this deviation be evaluated. 2. Recommend the addition of burner shutdown to PDSLL-53 interlock.

Response: 1.
2. This shutdown conditions is included in the system design.

T0038-3-1 Leaks in duct from quench to venturi. Recommend review of consequences of no detection.

Response: Daily line inspections will be performed.

T0039-1-1 Venturi sump; line or vessel rupture; release of flue gas or hot brine. 1. Recommend evaluation of safety concerns for ruptured vessel. 2. Vessel is 13 feet

above working floor.

Response: 1.
2.

Line/Item	Description
T0040-1-2	Line rupture of scrubber recycle suction piping, hot brine released. Recommend safety evaluation of release of hot brine.
Response:	Reference Safety Plan. Routine daily line and tank inspections will be performed.
T0041-1-1	No flow of scrubber recycle due to pump or instrumentation failure. Recommend investigation of emergency fail position of valve FCV-65
Response:	FCV-65 will fail closed.
T0041-2-1	Line rupture of scrubber recycle discharge piping, hot release of brine. Recommend safety evaluation of release of hot brine due to lack of detection.
Response:	Routine, daily line/tank inspections will be performed.
T0041-4-1	Caustic flow into scrubber recycle when not intended. Install interlock to FCV-56 to shut down caustic flow in the event of insufficient flow at FE-65.
Response:	Interlock has been added.
T0041-6-1	Loss of pumps P-203A/B resulting in caustic introduce in reverse flow on 4"-BR-503-H-K to 6"-BR-502-H-K. Investigate the addition of check valve at intersection of caustic line with 4"-BR-503-H-K.
Response:	Check valve will be added.
T0041-10-1	Loss of pressure or flow could indicate nozzle failure. Include inspection of scrubber recycle nozzles on a regular basis.
Response:	Agreed
T0041-17-1	High caustic in scrubber pipelines in startup/shutdown. 1. Recommend shutdown of caustic pumps prior to shutdown of recirculation in shutdown sequence. 2. recommend FSLL-65 be included as burner startup permissive.
Response:	1. Agreed 2. Will evaluate and include in PMCS, as required.

Line/Item	Description
T0041-19-1	Scrubber recirculating pump wear and or corrosion. Recommend alternating use of spare pumps for all lines.
Response:	Agreed
T0042-17-1	Caustic remains in pH control loop after shutdown. Recommend flushing of lines after shutdown of P-203A/B.
Response	Not recommended.
T0042-19-1	Solids buildup on pH probes. 1. Frequency of flushing to be determined upon operating experience. 2. Frequency will be conservative on startup. 3. Recommend trending of caustic control valve FCV-56.
Response:	1. Agreed 2. Agreed 3. No. Probes will be routinely cleaned to prevent solids buildup.
Reference Drawings:	32-03-713-D Sheet 5 0f 6 Rev 5 (7/23/91).
T0042-19-2	Improper procedure on removing pH probe results in leak of caustic into workplace. Recommend installation of splash shields or guards on probes.
Response:	Agreed
T0043-1-2	Line rupture of alternate blowdown line from scrubber to brine tank, release hot brine. Consider safety ramification of lack of line rupture indication.
Response:	Routine, daily inspection of lines/tanks will be performed.
T0043-15-1	Freezing of fluid of line. 1. This line normally not in use, is an alternative blowdown line from scrubber to brine tank, manually activated. 2. Investigate whether line is properly sloped to drain when not in use.
Response:	1. & 2. Although not normally in use, the line is protected by being inside.
T0044-17-1	Scrubber startup/shutdown. Provide permissive for startup on LSLL-62.

Response: Interlock 35 has been provided.

Line/Item	Description
T0044-20-1	Scrubber rupture with release of hot gases and brine. Investigate containment for spillage capacity.
Response:	Containment is adequate to contain a spill as a result of a rupture to the scrubber.
T0044-22-2	Vessel leak. 1. Investigate containment for spillage capacity. 2. Safety evaluation for release of hot gases and brine.
Response:	1. Containment is adequate. 2.
T0045-1-2	Stack rupture. Recommend evaluation of need for indication on stack for rupture.
Response:	Not required.
T0049-3-1	Reduction in stack flow. 1. Recommend investigating necessity for installing a bird screen. 2. Drain is located on stack, duct has no drain, unknown whether duct is sloped or not.
Response:	1. Not required. 2. Duct is sloped slightly toward the scrubber.
T0045-19-1	Maintenance of stack and CEM. 1. Not enough information exists at this point to fully evaluate CEM. 2. CEM has the ability to shut the system down on malfunction. 3. Recommend assessment of CEM upon availability of complete information.
Response:	1. Agreed 2. Yes 3. Agreed
T0046-1-1	SOI drains and sumps. 1. PID should designate flow path from drain lines to sump. 2. WESTON and T-Thermal drawings have not been coordinated. Uncertain whether piping connects drains to sumps or where sumps are located. 3. Sump P-403 is sized to 50 gpm, Sump is 45 gallons. Why are pump and sump designated in this manner? 4. Recommend routine inspection of sumps. 5. Recommend review of pump sizing and pump capacity.
Response:	1. 2. 3. 4. Agreed

T0046-1-2 Line rupture of sump piping. recommend investigation of necessity of line rupture indication on sumps.

Response: Routine of inspection of sump areas and associated piping will performed daily.

Line/Item	Description
T0046-3-1	Sump pump discharge less than inflow. 1. Recommend routine flushing of sump discharge. 2. Locations and elevation of sumps is unclear from PID and schematic drawings.
Response:	1. Flushing will be done on an as required basis. Operations will determine the frequency of flushing. 2.
T0046-18-1	Sump influent greater than discharge during emergency. Recommend review of sump sizing.
Response:	
T0046-19-1	Failure of sump level controller. Recommend review of sump sizing.
Response:	
T0047-1-1	Sump line or drain plugging. 1. Investigate possible drain flow to sump and adequacy of sump to handle flow. 2. Revaluate bottom drain line sizing to sump.
Response:	

Reference drawings: 03-04-015 Rev 0, 7/13/91

T0048-1-2	Suction side of brine line rupture results in excessive sump flow. Recommend review of sump sizing.
Response:	Sump sizing is irrelevent to an air diaphragm pump. The sump provides suction for the pump only, not containment.
T0048-2-1	Excessive brine flow to tank car. HAZOP team does not have adequate loading procedures to evaluate whether more flow deviation can occur.
Response:	Revised P&ID will be provided when available.
T0048-16-1	Brine line has excessive solids concentration. 1. How does operator detect mixer operation? 2. Detection of more solids in line is unclear.
Response:	1. Feedback is transmitted to the control room. If the mixer stops an alarm is sounded in the control room. 2. Excessive solids, if present, will be removed manually. Recirculation of the storage tank contents is provided to keep solids in suspension.

T0049-1-1 No flow in brine transfer line. Recommend review of sump sizing.

Response: Interlock 80 will cover pump failure. Loss of instrument air will cause valves to go to fail safe position.

Line/Item	Description
T0049-1-2	Brine line rupture. What is position of valves on failure?
Response:	Valves will fail closed. Containment is adequate to handle full rupture.
T0049-4-1	Utility water valve inadvertently open and flow into brine line or tank. Unable to determine severity of consequence, utility water line and valve size not show on drawing.
Response:	Unlikely because of number of hand valves in the system. More likely scenario would fill up line and overflow into the sump area. The Utility Water Line Size is [redacted] inches.
W0050-8-1	Brine storage tank pumpout with no vents. Evaluate tank safety and revise PID where appropriate.
Response:	Vents are provided. See tank data sheets. P&ID will be revised.
T0050-9-1	Failure of high level alarm LAH 84A/B with continued pumping of fluid. No interlocks shown on drawing. No vent on tank, no tank overflow, no tank safety features shown on PID.
Response:	Interlock 80 prevents brine flow from entering a full tank. Vents and tank overflows are provided; see tank data sheets.
T0050-1-1	Pumpout without tank vent; possible collapse and release of hot brine into area. 1. Unloading procedures are unclear. 2. Unclear whether level is indicated locally as well as remotely. 3. Does the operator at the loading station need to know the level at the tanks?
Response:	1. See attached loading procedure. 2. Level is indicated remotely on the tanks. Level indication for the brine loading arm is local only. 3. No, Interlock 80 will turn off transfer pumps when low level in the tank occurs. The operator at the loading station needs to recieve the "OK to load" permissive only to start the loading procedure.
T0050-15-2	Low brine storage temperature. In the event that brine must be stored for a period of time, cooling can occur. However, brine mixing in the tank, recirculation of brine, and feed of hot brine to the

tank should preclude freezing.

Response: Agreed. May also transfer brine from tank to tank if absolutely necessary.

T0050-16-1 Failure of brine tank mixer M-204/M-205. evaluate need for mixer motor trip indication.

Response: An operation sensor and loss of operation alarm is provided in the control room.

T0050-17-1 Both tanks full of brine on startup. Recommend evaluation of need for interlock or operating procedures to check level on both tanks on startup/shutdown when both tanks are full.

Response: Agreed. If both tanks are full the SQI system cannot be operated. Brine storage capacity must be available in order to operate the SQI system. This will be established as a routine operational procedure.

Line/Item	Description
T0050-18-1	Emergency blowdown to brine tanks during emergency shutdown, and inadequate storage capacity. Evaluate need to maintain reserve capacity in tank for emergency shutdown.
Response:	Not required. If reserve capacity is required a brine tank must be pumped. If a rupture has occured the brine will be pumped by the local sump to the wastewater tank.

Reference Drawing: 03-04-009 Rev 0, 7/31/91

W0051-7-1	Improper material delivered instead of caustic. Unloading procedures should include a provision for verifying contents of delivery.
Response:	The bill of lading will be checked.
W0051-15-2	Loss of heat tracing on caustic transfer lines. Evaluate detection of loss of heat tracing.
Response:	No heat tracing monitoring system exists. Portable heaters can be utilized as required until the condition is repaired.
W0051-19-1	Failure of heat tracing, failure of line at flex/fixed juncture. Recommend investigation of flex/fixed juncture on line.
Response:	
W0053-1-2	Rupture of caustic pump (P-211) suction line. Evaluate detection for line rupture.
Response:	Routine line/tank inspections are performed daily by the field tech.
W0053-18-1	Caustic pump suction line plugging on startup after emergency shutdown. 1. Heat tracing and tank heater are not on emergency power systems. 2. How does operator determine whether caustic is flowing in this line during restart after emergency shutdown? 3. Include provision in operator/training manual for determining whether caustic is flowing on restart after emergency shutdown.
Response:	1. Heat tracing is on the emergency power system. 2. Visual inspection; a flow meter is included in caustic lines 3. Agreed

W0054-1-1 Low of flow from pumps P-211. 1. Interlocked with water line through flow meter FIC-205. 2. Fail position on valve FCV-211 and FCV-209 on line W0008 is unclear.

Response: 1. Yes
2. FCV-211 and FCV-209 fail closed.

Line/Item	Description
W0055-15-1	Increase temperature in caustic dilution tank. 1. Heating of liquid in caustic dilution tank due to exothermic heat of solution. 2. Can exothermic reaction exceed tank design criteria?
Response:	1. A field tech will be present during all mixing operations. 2. 50% caustic boils at 290°F. Reference tank data sheet.
W0055-16-1	Increase temperature in caustic dilution tank due to greater caustic feed. 1. Heating of liquid in caustic dilution tank due to exothermic heat of solution. 2. Can exothermic reaction exceed tank design criteria?
Response:	See W0055-16-1 remarks.
W0056-20-1	No level indication in process water tank (TK-203) Check instrumentation identification LCS-205 for tank TK-203 controllers.
Response:	Level indication has been provided on TK-203. Reference P&ID.
W0057-16-1	Composition other required in day tank (TK-104), loss of agitation, solid accumulation? Recommend evaluation of need to indicate mixer motor trip on main and/or local control panel.
Response:	An operation sensor on the mixer is provided. Should the mixer stop an alarm in the control room is sounded.
W0058-9-1	High vapor pressure in day tanks (TK-105/106), resulting in release through liquid seal and into workplace. Recommend periodic inspection of liquid seals.
Response:	Agreed
W0058-20-1	Loss of level control in day tanks. 1. SQI waste feed system includes dual tanks. 2. Review designations of level instrumentation shown on PID.
Response:	1. Yes 2. Interlocks 60 and 70 are tied into the tank levels and will shut down the system.

APPENDIX D.2

HAZOP SUMMARY
for
RMA Basin F Liquid Incinerator

Response to HAZOP Study
Roy F. Weston

February 5, 1992

WESTON WAY
WEST CHESTER, PA 19380
PHONE (215) 692-3030
TELEX 83-5348

TRANSMITTAL FORM

To: JoAnn Tischler
Woodward-Clyde Consultants
Stanford Place 3, Suite 600
4582 South Ulster Street Parkway
Denver, CO 80237

Date: 31 January 1992
Reference: RMA Basin F Liquid Incineration Hazop
W.O. No.: 3886-44-01

Enclosed herewith are the following:

ITEM	REPORT DWG. OR SPEC. NO.	NO. OF COPIES	DESCRIPTION	STATUS
1		1	Revised Pages of 5 Nov 91 Mtg Notes	
2		1	Rev 8 T-Thermal PIDs	
3		1	CEM PIDs (11/6/91 issue)	
4		1	Nat'l Gas Supply Telecon	
5		1	Brine PID Sketch SK 205 M9	
6		1	Brine PID Sketch SK 204 M9	

REMARKS:

CC: E. Berry (w/o attachments)
C. Parker
P. Higgins

Very truly yours,

Amitava Sarkar
Project Manager

HAZOP SUMMARY FOR RMA BASIN F LIQUID INCINERATOR -5 NOV 91

Reference Drawing: 32-03-713-D, Sheet 1 of 6

Line/Item	Description
T0001-1-1	Loss of natural gas to the burner. 1. What is RMA history of gas supply reliability? 2. What is notification procedures for utility shutdown?
Response:	1. There has reportedly been two supply interruptions in approximately five years. 2. Even though the supply will reportedly be "interruptable", there is to be a backup supply agreement wherein the carrier agrees to provide gas should the supplier interrupt the supply. An "interruptable" supply provides for four hour notice, although one hour notice is possible. ~~PMRMA~~
T0001-1-2	Rupture of natural gas line, release of gas in area. 1. Are combustible gas sensors located in building? 2. Safety contingency plan should be developed for required action.
Response:	1. Yes, Ammonia in the SQI. ~~Total Hydrocarbon and Ammonia in the SQI.~~ 2. Agreed.
T0001-1-3	Gas line valve failure, or inadvert closing or opening wrong valves. 1. Training manual and O&M should include proper lockout/tag out procedures. 2. Gas lines should be color coded for easy identification.
Response:	1. Agreed. 2. Agreed.
T0001-10-1	Gas line pressure may not be adequate for incinerator feed system. 1. RMA to provide minimum 22 psig gas feed at interface shown on drawing 00-02-104 Rev 2. 2. ~~RMA to provide minimum 18 psig gas feed at skid.~~ ~~2.~~ T-Thermal to regulate to 10 psig.
Response:	1. Agreed. ~~PMRMA.~~ 2. Agreed.
T0001-16-1	Concern whether gas composition will change. Establish whether gas characteristics can significantly change from utility.
Response:	The quality of the natural gas supply is subjected to

specifications which will be included in the supply agreement under H.11 QUALITY.

~~PMRMA~~

T0001-17-1 Concern about startup of gas line at correct pressure or correct startup sequence. O&M manual and training should include correct startup procedures.

Response: 1. Agreed.

Item/Line	Description
T0007-1-4	Line rupture could result in loss waste into into area. Is piping located in diked area?
Response:	Yes
T0007-3-1	Loss of waste flow due to line leak. Recommend trending pump discharge pressure (PIT-28).
Response:	No. **Regular line inspections shall be performed by the field tech a minimum of once per shift.** ~~**Regular line inspections shall be performed by the field tech.**~~
W0007-11-1	Vapors from day tank during startup/shutdown. Need backup carbon system.
Response:	Carbon system is not effective on ammonia vapors.
W0007-13-1	Maintenance of day tank vent lines. O&M should include maintenance schedule for conservation vents and blower intake filter.
Response:	Agreed

Reference Drawing: 03-04-009 Rev 0

W0008-1-1	Loss of city water for caustic dilution. Contingency plan should include trucking water to plant site.
Response:	No. No water; No operations.
W0008-1-4	Loss of water flow resulting from valve or instrument failure (FIC-205). Routine maintenance required.
Response:	Agreed
W0008-2-1	More water flow due to control malfunction (FIC-205). O&M manual should address maintenance and calibration of control loop.
Response:	Agreed

Line/Item	Description
W0008-9-1	Loss of water pressure resulting from failure of KIC-209A, and KIC-211A,B. Explain operation and function of these controls.
Response:	See Attachment 1
W0008-15-1	Heater E-203 in Tank TK-203. Explain purpose.
Response:	Freeze protection
W0008-16-1	Water Softener system failure. O&M should address operation and maintenance.
Response:	Agreed

Reference Drawing: 03-04-009, Rev 0; 32-03-713-D, Rev 5

W0009-1-2	Loss of process water flow due to inadvertent valve closure. 1. Why is valve in Line 3-WT-004-E-D shown normally closed? 2. O&M manual should address operation of this system.
Response:	1. The valve on 3-WT-004-E-D should be normally open. 2. Agreed
W0009-16-1	Failure of process water heat tracing. O&M manual should require checks of heat tracing system.
Response:	Agreed

Reference Drawing: 01-04-001 Rev 1; 02-04-002 Rev 1

W0001-1-1	Loss of Basin F fluid during transfer. 1. O&M procedures should cover maintenance pump intake screen and strainer. 2. Will procedures be written for routine cleaning of Pond A intake screen?
Response:	1. Agreed 2. Agreed
W0001-1-2	Loss of Basin F fluid transfer resulting from inadvertent closure of line valve. 1. Operator training should address this potential problem. 2. Will safety manual address safe operation of fed to TK-101?
Response:	1. Agreed 2. Yes

Line/Item	Description
T0011-9-1	Loss of pressure due to boiler malfunction. Need to review boiler system and its controls to determine consequences. Drawing 03-04-014 not available.
Response:	The boiler PI&D is still not available from the vendor.
T0012-1-1	Line rupture of waste feed line, release of Basin F fluid into work area. 1. Add high/low flow alarm to FI-04B 2. Control valve (PCV-28) should be close to T-Thermal pipe rack as possible. 3. No indication available if rupture is downstream of PCV-28.
Response:	1. Agreed, high/low flow alarm was added. 2. PVC-28 is designed to be as close as access and aisle space requirements permit 3. Routine line inspections will be performed daily.

Reference Drawings: SQI Incinerator Drawings.

T0014-19-1	Leaks from flanges, etc due to loss of integrity of seals. O&M manual should address this issue.
Response:	Agreed

Reference Drawings: 32-03-713D Sheet 3 of 6 and detailed incinerator drawings.

T0016-19-1	Corrosion or improper installation of heat shield; item 9 on dwg 6-02-3793D sheet 2 0f 2, Rev 2. Heat shield should be installed properly and inspected periodically during scheduled outtage.
Response:	Agreed
T0016-20-3	Releases of hot gases and high temperature liquids from incinerator tank leak or rupture. Determine whether containment berms exist and whether tank is below grade.
Response:	Containment berms do exist, however, the tank is not below grade.
T0017-10-1	Loss of pressure in caustic pump suction line. Recommend review of pump NPSH calcs.

Line/Item	Description
T0033-17-1	Startup/shutdown. 1. Recommend installation of minimum flow limit switch interlocked with waste feed block valve. 2. Recommend flushing of quench tank recycle on shutdown.
Response:	1. Already included in design. 2. Need for flushing will be determined during operation.
T0033-17-2	Valve FCV-58 fails open upon shutdown. Replace fail open valve FCV-58 with fail closed valve.
Response:	FCV-58 will fail closed.
T0033-19-1	Maintenance. Line designations on PID are incorrect and should be revised to show/not show heat tracing.
Response:	T-Thermal has issued revision 8 of the PI&Ds.
T0034-1-2	Line rupture in pH loop in quench. Recommend evaluation of safety hazard from release of hot brine.
Response:	Routine line inspections will identify any line rupture. Reference safety manual for contingency plans.
T0034-2-1	Excessive flow in pH loop resulting in damage to pH probe. Recommend evaluation of probe design to minimize possibility of damage due to high flow.
Response:	Concerm is covered by probe design.
T0034-4-1	Domestic water into pH loop line results in dilution and erroneous pH readings. Recommend evaluation of adding trending point to caustic control loops AIC-56 and AIC-64.
Response:	Trending not required. The control system currently compares pH signals between probes.
T0034-20-1	Release of hot brine into workplace when removal of pH probes. 1. Recommend that all hot lines be identified. 2. Recommend splash shields or guard included at probes.
Response:	1. Brine lines are color coded. 2. Safety training will address this concern and

splash shields will be provided. ~~Safety training will address this concern.~~

T0034-20-2 Erroneous pH readings result of buildup scale on probe. Recommend evaluation of trending of pH controller AIC-64.

Response: Routine cleaning of the probe will be performed. If the probe continues to malfunction a replacement probe will be provided.

Line/Item	Description
T0044-20-1	Scrubber rupture with release of hot gases and brine. Investigate containment for spillage capacity.
Response:	Containment is adequate to contain a spill as a result of a rupture to the scrubber.
T0044-22-2	Vessel leak. 1. Investigate containment for spillage capacity. 2. Safety evaluation for release of hot gases and brine.
Response:	1. Containment is adequate. 2.
T0045-1-2	Stack rupture. Recommend evaluation of need for indication on stack for rupture.
Response:	Not required.
T0049-3-1	Reduction in stack flow. 1. Recommend investigating necessity for installing a bird screen. 2. Drain is located on stack, duct has no drain, unknown whether duct is sloped or not.
Response:	1. Not required. 2. Duct is sloped slightly toward the scrubber.
T0045-19-1	Maintenance of stack and CEM. 1. Not enough information exists at this point to fully evaluate CEM. 2. CEM has the ability to shut the system down on malfunction. 3. Recommend assessment of CEM upon availability of complete information.
Response: ~~Agreed~~	1. Agreed, the CEM PI&D accompanies this report. ✓ 2. Yes 3. Agreed
T0046-1-1	SOI drains and sumps. 1. PID should designate flow path from drain lines to sump. 2. WESTON and T-Thermal drawings have not been coordinated. Uncertain whether piping connects drains to sumps or where sumps are located. 3. Sump P-403 is sized to 50 gpm, Sump is 45 gallons. Why are pump and sump designated in this manner? 4. Recommend routine inspection of sumps. 5. Recommend review of pump sizing and pump capacity.
Response:	1. & 2. The PI&Ds show lines which are directed to drains; details of the pipe routing are shown on the mechanical piping drawings.

3. Sump P-403 also services drainage from an upper level, and has been increased in size accordingly.

~~2.~~
~~3.~~
4. Agreed
5. Pump sizing and capacity was reviewed; P-403 is larger because of the potential for greater service.

T0046-1-2 Line rupture of sump piping. recommend investigation of necessity of line rupture indication on sumps.

Response: Routine of inspection of sump areas and associated piping will performed daily.

Line/Item	Description
T0046-3-1	Sump pump discharge less than inflow. 1. Recommend routine flushing of sump discharge. 2. Locations and elevation of sumps is unclean from PID and schematic drawings.
Response:	1. Flushing will be done on an as required basis. Operations will determine the frequency of flushing. 2.
T0046-18-1	Sump influent greater than discharge during emergency. Recommend review of sump sizing.
Response:	
T0046-19-1	Failure of sump level controller. Recommend review of sump sizing.
Response:	
T0047-1-1	Sump line or drain plugging. 1. Investigate possible drain flow to sump and adequacy of sump to handle flow. 2. Revaluate bottom drain line sizing to sump.
Response:	

Reference drawings: 03-04-015 Rev 0, 7/13/91

T0048-1-2	Suction side of brine line rupture results in excessive sump flow. Recommend review of sump sizing.
Response:	Sump sizing is irrelevent to an air diaphragm pump. The sump provides suction for the pump only, not containment.
T0048-2-1	Excessive brine flow to tank car. HAZOP team does not have adequate loading procedures to evaluate whether more flow deviation can occur.
Response:	Sketches revising the P&IDs accompany this report. ~~Revised P&ID will be provided when available.~~
T0048-16-1	Brine line has excessive solids concentration. 1. How does operator detect mixer operation? 2. Detection of more solids in line is unclear.
Response:	1. Feedback is transmitted to the control room. If the mixer stops an alarm is sounded in the control room. 2. Excessive solids, if present, will be removed

Line/Item	Description
T0049-1-2	Brine line rupture. What is position of valves on failure?
Response:	Valves will fail closed. Containment is adequate to handle full rupture.
T0049-4-1	Utility water valve inadvertently open and flow into brine line or tank. Unable to determine severity of consequence, utility water line and valve size not show on drawing.
Response:	Unlikely because of number of hand valves in the system. More likely scenario would fill up line and overflow into the sump area. The Utility Water Supply Line Size is 4 inches. The distribution line is 2 in. ~~The Utility Water Line Size is --inches.~~
W0050-8-1	Brine storage tank pumpout with no vents. Evaluate tank safety and revise PID where appropriate.
Response:	Vents are provided. See tank data sheets. P&ID sketches accompany this report. ~~P&ID will be revised.~~
T0050-9-1	Failure of high level alarm LAH 84A/B with continued pumping of fluid. No interlocks shown on drawing. No vent on tank, no tank overflow, no tank safety features shown on PID.
Response:	Interlock 80 prevents brine flow from entering a full tank. Vents and tank overflows are provided; see tank data sheets.
T0050-1-1	Pumpout without tank vent; possible collapse and release of hot brine into area. 1. Unloading procedures are unclear. 2. Unclear whether level is indicated locally as well as remotely. 3. Does the operator at the loading station need to know the level at the tanks?
Response:	1. See attached loading procedure. 2. Level is indicated remotely on the tanks. Level indication for the brine loading arm is local only. 3. No, Interlock 80 will turn off transfer pumps when low level in the tank occurs. The operator at the loading station needs to recieve the "OK to load" permissive only to start the loading procedure.
T0050-15-2	Low brine storage temperature. In the event that brine must be stored for a period of time, cooling can occur. However, brine mixing in the tank,

Line/Item	Description
T0050-18-1	Emergency blowdown to brine tanks during emergency shutdown, and inadequate storage capacity. Evaluate need to maintain reserve capacity in tank for emergency shutdown.
Response:	Not required. If reserve capacity is required a brine tank must be pumped. If a rupture has occured the brine will be pumped by the local sump to the wastewater tank.

Reference Drawing: 03-04-009 Rev 0, 7/31/91

W0051-7-1	Improper material delivered instead of caustic. Unloading procedures should include a provision for verifying contents of delivery.
Response:	The bill of lading will be checked.
W0051-15-2	Loss of heat tracing on caustic transfer lines. Evaluate detection of loss of heat tracing.
Response:	No heat tracing monitoring system exists. Portable heaters can be utilized as required until the condition is repaired.
W0051-19-1	Failure of heat tracing, failure of line at flex/fixed juncture. Recommend investigation of flex/fixed juncture on line.
Response:	The juncture will be inspected regularly.
W0053-1-2	Rupture of caustic pump (P-211) suction line. Evaluate detection for line rupture.
Response:	Routine line/tank inspections are performed daily by the field tech.
W0053-18-1	Caustic pump suction line plugging on startup after emergency shutdown. 1. Heat tracing and tank heater are not on emergency power systems. 2. How does operator determine whether caustic is flowing in this line during restart after emergency shutdown? 3. Include provision in operator/training manual for determining whether caustic is flowing on restart after emergency shutdown.
Response:	1. Heat tracing is on the emergency power system. 2. Visual inspection; a flow meter is included in caustic lines 3. Agreed

APPENDIX D.3

Weston Response
to
HAZOP

March 20, 1992

WESTON
MANAGERS DESIGNERS/CONSULTANTS
1 WESTON WAY
WEST CHESTER, PA 19380-1499
PHONE: 215-692-3030
FAX: 215-430-3186

20 March 1992

Vince Noble
Woodward-Clyde Corporation
1550 Hotel Circle North
San Diego, CA 92108

PRAC Contract No.: DACW45-90-D-0015
Document Control No.: 3886-44-01-ACXX
HAZOP Comments/Responses

Dear Mr. Noble:

Here is the final summary of the responses to the action items identified in the Draft HAZOP Review Document.

In addition to the O&M manual, which will contain the majority of any recommended procedures which will be included as a result of the HAZOP review, I have compiled the following list of plans pursuant to your request for other related documents and plans.

1. Air Monitoring Plan
2. Safety Health and Emergency Response Plan
3. Volatile and Dust Emissions Plan
4. Site Security Plan
5. Document Control Plan
6. Environmental Protection Plan
7. Visitors Control Plan
8. Emergency Operations Plan
9. Wastes and Residues Handling Plan
10. Contingency and Emergency Plan
11. Expolsion Protection Measures
12. Power Failure Analysis
13. Day Tank Management
14. Human Health Risk Assessment
15. Startup Plan
16. Trial Burn Plan
17. Demobilization Plan

If I can be of further assistance to you, please contact me.

Very truly yours,

Roy F. WESTON, INC.

Quintin Todd

Quintin Todd, P.E.
Project Manager

QT:gmd
cc: A.Kam
M. Cosmos
A. Sarkar

WESTON WAY
WEST CHESTER, PA 19380
PHONE: 215-692-3030
TELEX: 83-5348

21 February 1992

Rocky Mountain Arsenal
AMX-RM-E
Building B-111
Commerce City, CO 80022

W.O. #7600-00-07

Attention: Mr. Ed Berry

PRAC Contract No.: DACW-45-90-D-0015
DCN: 3886-44-01-ACXA
Subject: Response to HAZOP Action Items

Dear Ed:

Please find enclosed with this letter a summary of the responses to all action items identified in the Draft HAZOPs Review Document.

The actions listed with each comment are in various stages of implementation. Actions such as procedures and inspections which were not yet written during the HAZOPs review have been incorporated into the Draft Operations and Maintenance Manual. Actions which have increased or changed construction drawings, specifications and scope are being finalized.

The implementation of the construction changes are being processed by Joe Borucki through the Corps of Engineers representative.

If you have any questions, please call me at (215) 430-7423.

Very truly yours,

ROY F. WESTON, INC.

Michael G. Cosmos, P.E.
Project Director

MGC:ma
Enclosure

cc: Q. Todd
J. Borucki
J. Dougherty
G. Stillman

HAZOP.221/MGC

REFERENCE DRAWING: 32-03-713-D, Sheet 1 of 6

LINE ITEM	DESCRIPTION

T0001-1-1 Loss of natural gas to the burner.

1. What is RMA history of gas supply reliability?
2. What is notification procedures for utility shutdown?

Response:
1. There has reportedly been two supply interruptions in approximately five years.
2. Even though the supply will reportedly be "interruptable", there is to be a backup supply agreement wherein the carrier agrees to provide gas should the supplier interrupt the supply. An "interruptable" supply provides for four hour notice, although one hour notice is possible.

T0001-1-2 Rupture of natural gas line, release of gas in area.

1. Are combustible gas sensors located in building?
2. Safety contingency plan should be developed for required action.

Response:
1. Yes, an area sensor for total Hydrocarbon and Ammonia is to be installed in the SQI.
2. Agreed, a contingency plan will be included in the Health and Safety plan.

T0001-1-3 Gas line valve failure, or inadvert closing or opening wrong valves.

1. Training manual and O&M should include proper lockout/tag out procedures.
2. Gas lines should be color coded for easy identification.

Response:
1. Agreed, the Health and Safety Plan will include a description of proper lockout tag.
2. Agreed, Weston will color code the natural gas line.

T0001-10-1 Gas line pressure may not be adequate for incinerator feed system.

1. RMA to provide minimum 18 psig gas feed at skid.
2. T-Thermal to regulate to 10 psig.

Response:
1. RMA to provide minimum of 22 psig at interface shown on drawing 00-02-104 Rev 2.
2. Agreed, T-Thermal to regulate to 10 psig.

T0001-16-1 Concern whether gas composition will change.

1. Establish whether gas characteristics can significantly change from utility.

Response:
1. The quality of the natural gas supply is subjected to specifications which will be included in the supply agreement under H.11 QUALITY.

T0001-17-1 Concern about startup of gas line at correct pressure or correct

1. O&M Manual and training should include correct startup procedures.

Response:
1. Agreed, included in O&M Manual.

T1001-17-2 Concern in startup/shutdown gas feed system, that procedures not followed.

1. Training and O&M Manual should address procedures in event valves do not open or sequence not correct.
2. Manual action should be detailed.

Response:
1. Agreed, the O&M Manual will in include procedures in the event of improper valve openings.
2. Agreed, the O&M Manual will include manual actions to address improper openings.

T0002-17-1 Concern that pilot does not light. O&M should include instructions that operator check pilot if it does not light after two or three attempts.

Response: 1. Agreed, but the O&M Manual will direct that an inspection occur after two failed attempts.

T0003-1-1 Blower failure

1. Ensure routine maintenance of blower, including critical items monitored such as bearing temperature, etc.
2. Consider method of monitoring of vibration.

Response: 1. Agreed, routine maintenance will be included in O&M Manual.
2. Monitoring bearing temperature and blower vibration will be addressed later.

T0003-1-2 Interruption of air combustion air.

1. Assure that inlet filter is maintained.
2. Recommend installation of pressure gage on blower inlet after inlet filter.

Response: 1. Agreed, filter inspection will be included in O&M.
2. As agreed, the existing equipment will provide adequate warning.

T0003-3-1 Reduction of air combustion air.

1. Add an alarm to indicate deviation from set point (FIT-16).
2. An interlock required for shut down.

Response: 1. Incorporated as FSD-16 on Rev 7 of the P&ID.
2. Agreed, interlock 67 has been provided on Rev 7 of the P&ID.

T0003-10-1 Prevention of excessive vacuum in day tank.

1. Provide a deviation alarm from FIT-016 into day tank to shut off valve XV-17A.

Response: 1. The tank is designed with a vacuum break.

T0003-15-1 High ambient temperature result in high air temperature to blower.

1. Consider adding temperature instrumentation to correct air flow rate.

Response: 1. Not required, correction is built into the incinerator system design: AIC-30.

T0003-17-1 Quantity of vapors released from day tanks?

1. Sampling should be done during initial plant operation to determine quantity of vapors released from day tanks to incinerator.

Response: 1. Tanks now outside, but we agree that quality and quantity of vapors will be screened at startup with an Hnu and OVA monitor. If the readings indicate detectable emissions of organics then further analysis will be performed.

T0003-19-1 Failure of emergency blower. Failure of VX-17 to make switch over to emergency blower.

1. Develop contingency plan to start emergency blower B-201B from normal power source in emergency cases other than power failure.
2. Include alarm on position of XV-17.

Response: 1. Agreed, a contingency for operating emergency blower.
2. Alarm has been included in Rev 8 of the P&ID.

T0004-1-1 Malfunction of emergency blower or diesel generator when needed.

1. O&M manual should include routine testing of generator and blower.

Response: 1. Agreed, once a week routine is specified in the O&M manual.

T0004-18-1 Failure of emergency blower in other than emergency.

1. Consider switch gear so that blower can be activated in other than emergency conditions.

Response: 1. Agreed, on/off/auto switches on each motor will allow this type of test.

T0005-1-1 No combustion air to incinerator.

1. Recommend installation of deviation alarm on line to indicate no air flow resulting from failure of blower, line rupture, or control valve failure.

Response: 1. Alarm has been included as FSD-16 and interlock 67 on Rev 7 of the P&ID.

REFERENCE DRAWING: 32-03-713-D, Sheet 2 of 6

LINE ITEM	DESCRIPTION
T0006-1-1	Failure of aqueous feed pumps P-201A,B.

1. Recommend alternating operation of feed pumps to assure reliability.

Response:
1. Agreed, the O&M Manual provides a discussion on in-line spares which will operate as follows: on ... week for 6 hours, B on; A on otherwise.

T0006-1-3 Loss of aqueous waste flow due to line plugging.

1. Line loop should include flush connections.
2. Investigate moving three-way valve to suction side.

Response:
1. Agreed, Weston will install flush connections at appro... ...cations.
2. As agreed, there is no benefit to moving the three way ...

T0006-1-4 Rupture of waste line, release of waste into area.

1. Install a high/low alarm on FI-04A, including interlock for shutdown.
2. Is there a sump or collection dike beneath skids?

Response:
1. Agreed, interlock 68 and alarms were added on Rev 7 to the P&ID.
2. Yes, under skid and nozzles, but not under piping, which is inside and over containment serviced by sump.

T0006-6-1 Reverse flow causes air into tank TK-105/106.

1. Evaluate the location of check valve 324 if valve XV-26 fails open.

Response: 1. Moved valve 324 to eliminate possibility. See Rev 7, Sheet 2 of P&ID.

T0006-15-3 Failure of heat tracing on aqueous lines.

1. How does operator detect failure in heat tracing?
2. Are thermocouples located on heat tracing or line?

Response: 1. O&M manual requires periodic surveillance, but there is no other automated monitoring system in place to monitor the heat tracing.
2. Reference Weston Drawing 00-03-009. Tracing is self regulating.

T0006-18-1 Valve malfunction in emergency could result in continue aqueous waste flow.

1. Valve malfunction and reverse flow of air could result in continued waste flow. Contingency plan should include check of flow in FIT-04A to establish flow has ceased in emergency conditions.

Response: 1. Checks will be incorporated into the software.

T0007-1-1 Loss of waste flow to feed pump P201.

1. O&M manual should emphasize monitoring of pump suction strainers.

Response: 1. Agreed, PDIT will be alarmed.

T0007-1-3 Loss of waste flow due to control valve failure.

1. Investigate that valve COV-105b,C can be manually operated.

Response: 1. All valves can be operated manually in the field.

T0007-1-4 Line rupture could result in lost waste into area.

1. Is piping located in diked area?

Response: 1. Yes

T0007-3-1 Loss of waste flow due to line leak.

1. Recommend trending pump discharge pressure (PIT-28).

Response: 1. Continuous trending of the pressure is not provided. Trending can be provided on an as needed basis by the control software. Regular line inspections shall be performed by the field technician a minimum of once per shift.

W0007-11-1 Vapors from day tank during startup/shutdown.

1. Need backup carbon system.

Response: 1. Carbon system is not effective on ammonia vapors. Tanks are now outside and venting is expected only during transfer.

W0007-13-1 Maintenance of day tank vent lines.

1. O&M should include maintenance schedule for conservation vents and blower intake filter.

Response: 1. Agreed, O&M Manual will include inspections of vents and filters.

REFERENCE DRAWING: 03-04-009 Rev 0

LINE ITEM DESCRIPTION

W0008-1-1 Loss of city water for caustic dilution.

1. Contingency plan should include trucking water to plant site.

Response: 1. As agreed, the operators are to be notified if city water supply is going to be interrupted, but if there is no water, there will be no SQI operations.

W0008-1-4 Loss of water flow resulting from valve or instrument failure (FIC-205).

1. Routine maintenance required.

Response: 1. Agreed, maintenance procedures for the valve and instruments will be included in O&M Manual

W0008-2-1 More water flow due to control malfunction (FIC-205).

1. O&M manual should address maintenance and calibration of control loop.

Response: 1. Agreed, maintenance and calibration procedures will be included in O&M Manual.

W0008-9-1 Loss of water pressure resulting from failure of KIC-209A, and KIC-211A,B.

1. Explain operation and function of these controls.

Response: 1. See Attachment 1

W0008-15-1 Heater E-203 in Tank TK-203.

1. Explain purpose.

Response: 1. Freeze protection

W0008-16-1 Water Softener system failure.

1. O&M should address operation and maintenance.

Response: 1. Agreed, the operation and maintenance of the water softener will be discussed in the O&M Manual.

REFERENCE DRAWING: 03-04-009, Rev 0; 32-03-713-D, Rev 5

LINE ITEM	DESCRIPTION

W0009-1-2 Loss of process water flow due to inadvertent valve closure.

1. Why is valve in Line 3-WT-004-E-D shown normally closed?
2. O&M Manual should address operation of this system.

Response:
1. The valve on 3-WT-004-E-D should be normally open.
2. Agreed, the operation of the water system will be included in the O&M Manual.

W0009-16-1 Failure of process water heat tracing.

1. O&M manual should require checks of heat tracing system.

Response:
1. Agreed, periodic inspections of the heat tracing will be provided in the O&M Manual.

REFERENCE DRAWING: 01-04-001 Rev 1; 02-04-002 Rev 1

LINE ITEM	DESCRIPTION

W0001-1-1 Loss of Basin F fluid during transfer.

1. O&M procedures should cover maintenance pump intake screen and strainer.
2. Will procedures be written for routine cleaning of Pond A intake screen?

Response:
1. Agreed, screen and strainer maintenance procedures will be included in the O&M Manual.
2. Agreed, intake screen cleaning procedures will be included in the O&M Manual.

W0001-1-2 Loss of Basin F fluid transfer resulting from inadvertent closure of line valve.

1. Operator training should address this potential problem.
2. Will safety manual address safe operation of feed to TK-101?

Response:
1. Agreed, the O&M will address proper valve positing.
2. Yes, safety manual will address the transfer of feed to TK-101.

W0001-1-3 Loss of Basin F flow due to P-101A failure.

1. Operator training required to insure draining of line to prevent settling solids plugging when line becomes operational.

Response:
1. Line flushing procedures will be included in O&M Manual.

W0001-1-4 Pump 101A/B shut down due to instrument malfunction.

1. Operating training required.
2. Will operating manual cover maintenance of instrumentation?

Response:
1. Agreed, training will review malfunction and trouble shooting responses.
2. Yes, maintenance of instrumentation will be included in the O&M Manual.

W0001-1-5 Basin F transfer line broken, release outside pumphouse.

1. Verify what is included in pipe design to safely control release.
2. PID do not indicate whether pipe is pre-engineered or field run.

Response:
1. The design of the pipe includes double wall construction and sight glasses for leak detection to safely contain and detect releases.
2. Outside the pumphouse, the potential for releases is controlled by the double wall construction that will be installed in the field.

W0001-2-1 Loss of Basin F flow due to some blockage.

1. Routine O&M procedures to assure that line is not building up solids and operating safely.

Response:
1. Agreed, the O&M Manual will include routine line flushing procedures.

W0001-4-1 Potential failure of Basin F transfer line due to over pressure.

1. Include instrumentation to prevent over pressure.

Response:
1. High pressure alarms are provided on P-101A and P-101B discharge. Local PI-101C is provided on suction side.

W0001-5-1 Freezing of fluid in transfer line.

1. Since this requires that both pump be off and line remain full, corrected by operator attention. O&M to include procedures to assure line is flushed and drained after pump failure.

Response: 1. As agreed, O&M provides flushing of lines after transfer operations only. Other flushing will be determined by the operator on an "as required" basis.

W0001-7-1 Assure proper maintenance of basin F transfer line.

1. Assure that O&M manual covers maintenance and training.
2. O&M manual procedures are properly implemented, and operators trained.

Response: 1. Agreed, the O&M Manual will include maintenance procedures.
2. Agreed, QA Plan will include quality review of procedures.

REFERENCE DRAWING: 01-04-001, Rev 1

LINE ITEM	DESCRIPTION

W0002-1-1 No flow of purge water due to inadvertent valve closure.

1. O&M Manual should cover proper procedures.

Response: 1. Agreed, the O&M Manual includes valve positioning instructions.

W0002-1-2 Loss of purge water due to loss of city water supply.

1. Contingency plan should include truck delivery of purge water.

Response: 1. As agreed, the operators are to be notified if no water is available, but if there is no water, there will be no SQI operations.

W0002-2-1 Basin F fluid into purge water (failure check valve or improper valve position).

1. Consider adding reverse flow indication in line.
2. May want to consider addition of a high pressure alarm or reverse flow indication.

Response: 1. Not necessary. There are check valves in the line.
2. No, a field technician shall be present for all transfer and purge operations. If a reverse situation occurs he will be in a position to notify the operator and stop the purge or transfer.

W0002-3-1 Failure of heater in 101A or B.

1. O&M manual to include instructions for check of heater and temperature control loop.

Response: 1. Agreed, the O&M Manual will include heater and temperature control maintenance procedures.

REFERENCE DRAWING: 01-04-001, Rev 1; 02-04-002, Rev 1.

LINE ITEM	DESCRIPTION
W0001-8-1	Leak in basin F transfer line.

1. O&M to require daily check of sight glass in 2-WK-030-P-K.

Response: 1. Agreed, the O&M Manual covers daily pipeline inspections.

REFERENCE DRAWING: 02-04-002 Rev 1; 03-04-001 (7/31/91)

LINE ITEM DESCRIPTION

W0003-1-2 No flow in waste liquid due to inadvertent valve closure.

1. O&M should include checklist for valve positioning.

Response: 1. Agreed, valve positioning included in O&M Manual.

W0003-1-3 No waste liquid flow due to pump failure.

1. Drawing should be corrected to show PI-103A and B as remote indicators in the main control room.

Response: 1. Agreed, the drawing has to be revised per Revision 2.

W0003-1-4 Pipeline break results in release of waste to area?

1. Verify that piping arrangements provides for containment of released waste.
2. Will contingency plan address release outside containment area?

Response: 1. Waste released from the piping will drop to the floor, which is sloped to drain to a sump servicing the containment area.
2. Yes, in contingency plan within Health and Safety Plan.

W0003-1-5 Loss of waste flow due to solids accumulation.

1. O&M plan will include routine flushing.

Response: 1. Agreed, routine pipeline flushing is included in O&M Manual.

W0003-2-1 Failure of LIS-105 or 106 results in excessive flow and overflow of day tank.

1. Consider adding flow switch and alarm day tank overflow line 3-WK-051-W-K.

Response: 1. High level alarms LAH-105 and LAH-106 already exist to alarm high level in the tanks. A failure of LIS-105 or LIS-106 would be detected by the control room operator and can be investigated and repaired as required.

W0003-3-1 Crystal accumulation in line causes partial plugging.

1. O&M manual to include partial flushing.

Response: 1. Agreed, the O&M Manual contains procedures for flushing.

W0003-4-1 Basin F fluid flow into purge water tank TK-108.

1. Consider adding flow switch to detect reverse flow in case check valve fails.

Response: 1. Not required. A field technician will be present for all purge/transfer operations. If such a condition does occur he will be present to notify the operator and stop the purge/transfer operation.

W0003-5-1 Pipe leak into secondary containment.

1. O&M manual to require daily check of sight glass and TK-109.

Response: 1. Agreed, procedures in the O&M Manual will describe daily pipe inspection.

W0003-7-1 Loss of heat trace and freezing of line.

1. Requires that pump not operating, line full, and loss of heat trace.
2. Operator to assure that line drained after pump failure and insure heat tracing system operable.

Response:
1. No response required.
2. Agreed, in procedures O&M Manual will describe the drain inspection.

W0003-8-1 Excessive line plugging due to unanticipated composition of Basin F liquid.

1. Contingency plan should be developed.

Response:
1. The composition of Basin F liquid has been determined previously. Heat tracing and flushing provisions have been included as contingency measures.

0003-9-1 Maintenance of this system is critical.

1. Maintenance issues include plugging, checking sight glasses for leaks, instrumentation calibration, pump maintenance, and monitoring for corrosion.

Response:
1. Agreed, inspection procedures will be included in the O&M Manual.

REFERENCE DRAWING: 02-04-002 Rev 1

LINE ITEM	DESCRIPTION

W0004-1-1 Purge water pump inoperable due to loss of power.

1. Contingency plan for loss of power should be developed.
2. Option to connect to fire water system for backup purge.

Response:
1. If a power outage occurs only the most critical systems will be operational. If the power failure is a local problem the situation will be repaired and the purge operation will commence.
2. Not required as discussed.

REFERENCE DRAWING: 02-04-002 Rev 1

LINE ITEM	DESCRIPTION

W0004-17-1 Failure of heat tracing system with water trapped in pipe.

1. O&M manual to address standing water in purge lines outside of building.

Response: 1. If the heat tracing fails; temporary heaters will be used as required.

W0004-25-1 Maintenance of system.

1. Recommend that FQI (flow totalizer) be installed on inlet to TK-108.
2. Should flow indicator be added to this line?

Response: 1. As discussed 5 Nov 91, this is not required.
2. Flow indicating totalizer FQI-108 is provided on outlet of tank TK-108.

REFERENCE DRAWING: 02-04-002 Rev 1 (4/26/91)

LINE ITEM	DESCRIPTION

W0005-9-1 Blockage in sump pump discharge.

1. Recommend routine inspection of sump and associated equipment.

Response: 1. Agreed, O&M Manual contains procedures for routine inspection of sumps.

W0005-16-1 Buildup of solids in sump.

1. Routine inspection of sump required.

Response: 1. Agreed, O&M Manual contains procedures for routine inspection of sumps.

W0005-19-1 Maintenance.

1. Primary maintenance issues are sump inspection, pump operation, and level instrumentation.

Response: 1. Agreed, O&M Manual contains pump and instrument maintenance information.

REFERENCE DRAWING: 03-04-001 Rev 0 (7/31/91)

LINE ITEM	DESCRIPTION
W0006-2-1	Loss of waste flow due to instrumentation failure.

1. Explain meaning of COV label for valve 105 B&C etc, and how these valves operate.

Response: 1. COV indicates cylinder operated valves. These valves are pneumatic operated and work the same way an electrically operated valve works except they use plant air.

W0006-3-1 Waste pipe leak outside of designed containment.

1. O&M manual should address leak detection and pipeline maintenance.

Response: 1. Agreed, O&M Manual contains procedures to inspect leak detection system.

W0006-9-1 Line block pump P-104A/B or inadvertent valve closure.

1. Routine line maintenance required.

Response: 1. Line maintenance will be provided as required. All lines will be checked daily for leaks and obvious structural damage.

REFERENCE DRAWING: 03-04-001 Rev 0 (7/31/91); 32-03-713 Rev 5.

LINE ITEM	DESCRIPTION
W0007-1-1	Flow of vent day gases into area.
	1. Personnel air should be available in the area.
Response:	1. Personnel air is available in the SQI building, and the tanks are outside.
W0007-1-3	Inability to vent day tanks when air blower down.
	1. Does system design include capability to vent tanks through carbon when incinerator is down on temporary basis?
Response:	1. No, but vent gases will be screened with an OVA and Hnu during startup.
W0007-2-1	High vacuum in vent line due to plugging of blower inlet filter or silencer.
	1. Routine check of these items required.
Response:	1. Agreed, O&M Manual will include inspection of blower inlet filter and silencer.
T0007-4-1	Uncontrolled wastewater in feed due to inadvertent opening of valve in line 1 1/2-WK-043-E-K.
	1. Recommend lockout capability be included on discharge of TK-104.
Response:	1. Not required. FIC-104 controls the flow of wastewater into TK-104. If things get out of control the operator can turn off the transfer pump and close the COV from the control room or the field technician can stop the transfer pump and manually close the COV from the field.

REFERENCE DRAWING: 32-03-713-D Sheet 2 Rev 5 (11/2/90)

LINE ITEM	DESCRIPTION

T0008-1-2 Loss of feed to individual injectors.

1. Proper maintenance and checks of hose should be emphasized.
2. Recommend adding trending capability for PIT-27A/E, and PIT-45A/E.

Response:

1. Agreed, O&M Manual will include inspection procedures.
2. Trending can be provided but not required. High and low flow alarms and actual feed rate is being monitored for all injectors. Rev 7 of the P&ID includes deviation alarms.

T0008-2-1 Excessive flow due to instrument failure or operator error or open bypass on valve 322A/E.

1. Recommend adding high flow alarm on individual controllers FIC 22A/E.
2. Recommend reevaluation of lockout on bypass valves associated with these control valves.

Response:

1. Alarms have been added on Rev 7 of the P&ID as FAH-22A/E.
2. Agreed, a lock out mechanism will be provided on the control valve bypasses.

T0008-7-1 Loss of injector flow due to manual air purge left open.

1. O&M manual should include troubleshooting checklist to check air purge valves if FIT-22A/E is operating erratically.

Response:

1. Agreed, the O&M Manual will include trouble shooting checklist.

T-0008-18-1 Emergency shutdown.

1. O&M manual should state operators should confirm that nozzles are clean before restart.

Response: 1. Agreed, in O&M.

REFERENCE DRAWING: 32-03-713 Sheet 2 of 6, Rev 5, 7/23/91.

LINE ITEM	DESCRIPTION
T0009-1-1	No atomization air.

1. O&M include maintenance of compressor inlet screen, etc.
2. Ability to bring in outside compressor must be in contingency plan.

Response:
1. Agreed, the O&M Manual will include inlet screen maintenance procedures.
2. Agreed, design includes connections for rented compressor

T0009-18-1 Loss of compressor from power loss.

1. Establish that there is a "flywheel" effect so that compressor is on long enough after shutdown to cool nozzles.

Response:
1. There is no flywheel effect on this type of compressor, however, the receiver tank will provide enough backup air to cool the nozzles.

REFERENCE DRAWING: 03-04-009 Rev 0 (9/14/91); 32-03-713-D, Sheet 2 of 6 (7/23/91).

LINE ITEM	DESCRIPTION
T0010-1-2	Rupture of hot water line.
	1. Recommend manual on/off control of pump be added (local and remote).
Response:	1. All pumps have local and remote capability.
T0010-15-1	Heater inadequately sized.
	1. Review sizing of heater and temperature requirements.
Response:	1. Heater must be capable of supplying 175°F water to the nozzles for flushing.

REFERENCE DRAWING: 32-03-713-D Sheet 2 of 6 Rev 5 (7/23/91).

LINE ITEM	DESCRIPTION
T0011-1-1	Loss of atomization steam, boiler down or valve closed.
	1. Recommend a deviation alarm to FIT-76A.
Response:	1. Agreed, a deviation alarm has been provided on Rev 7 of the P&ID as FSD-76A/E.
T0011-1-2	Loss of atomization steam,line rupture.
	1. Recommend a deviation alarm to FIT-76A.
Response:	1. Agreed, a deviation alarm has been provided on Rev 7 of the P&ID as FSD-76A/E.
T0011-9-1	Loss of pressure due to boiler malfunction.
	1. Need to review boiler system and its controls to determine consequences. Drawing 03-04-014 not available.
Response:	1. The boiler PI&D is still not available from the vendor. It will be forwarded as soon as possible.
T0012-1-1	Line rupture of waste feed line, release of Basin F fluid into work area.
	1. Add high/low flow alarm to FI-04B 2. Control valve (PCV-28) should be close to T-Thermal pipe rack as possible. 3. No indication available if rupture is downstream of PCV-28.
Response:	1. Agreed, high/low flow alarm was added on Rev 7 of the P&ID as FAH-04B and FAL-04B. 2. PVC-28 is designed to be as close as access and aisle space requirements permit 3. Routine line inspections will be performed daily.

REFERENCE DRAWINGS: SQI Incinerator Drawings.

LINE ITEM	DESCRIPTION
T0014-19-1	Leaks from flanges, etc due to loss of integrity of seals.
	1. O&M manual should address this issue.
Response:	1. Agreed, the O&M Manual contains routine inspection procedures.

REFERENCE DRAWINGS: 32-03-713D Sheet 3 of 6 and detailed incinerator drawings.

T0016-19-1 Corrosion or improper installation of heat shield; item 9 on drawing 6-02-3793D sheet 2 of 2, Rev 2.

1. Heat shield should be installed properly and inspected periodically during scheduled outage.

Response: 1. Agreed, the O&M Manual will include inspection procedures.

T0016-20-3 Releases of hot gases and high temperature liquids from incinerator tank leak or rupture.

1. Determine whether containment berms exist and whether tank is below grade.

Response: 1. Containment berms do exist, however, the tank is not below grade.

T0017-10-1 Loss of pressure in caustic pump suction line.

1. Recommend review of pump NPSH calcs.

Response: 1. Pump 208 requires 4 ft NPSH; a minimum of 30 ft of head is available.

T0018-1-2 Caustic pump discharge line ruptures, release caustic into workplace.

1. Recommend adding check valve and pressure switch at terminal point of line.

Response: 1. Routine line checks will be performed daily to check for line ruptures and unplanned releases and a check valve can be added.

T0018-4-1 1. Recommend addition of interlock 65 to ACV-64 and interlock to loss of pumps P-202A/B.

Response: 1. Agreed, interlock 65 and alarm FSHH-41 have been added.

T0018-17-1 Non sequenced positioning of valve XV-23 with associated pump p-208A/B during startup and shutdown.

1. Pump P-208A/B should be operating and flow proven at FE-41 prior to introduction of waste.
2. Recommend evaluation of adding interlock to shut down incinerator if caustic flow (FISL-41) is lost.

Response: 1. This has been provided for in the control logic. Reference interlock 66 on interlock matrix.
2. FISLL-41 has been added to the interlocks.

T0018-18-1 Emergency shutdown; failure of valve ACV-64 to close properly; uncontrolled release caustic into quench tank, and possibly through quench tank overflow.

1. Operator should confirm closure of this valve after emergency or normal shutdown.
2. Confirm whether heat tracing of this line is on emergency power supply (if not tracing will not be active).

Response 1. Proof of closure limit switches are included on all critical valves.
2. All heat tracing is included on the emergency power supply.

T0020-1-4 Scrubber recycle loop bleed line ruptures downstream of control valve; spill of hot scrubber blowdown into work area.

1. Evaluate the need for pressure switch to indicate condition.

Response: 1. As discussed, routine line inspections will note spills of this type.

APPENDIX E

MISCELLANEOUS CORRESPONDENCE

Memorandum

Woodward-Clyde Consultants

To: RMA HAZOP Team
E. Puch

From: Vince Noble

Office: San Diego

Date: September 24, 1991

Subject: RMA HAZOP Study Review

Attached is the RMA Hazard and Operability Study (HAZOP) Draft Summary Report conducted September 3 through September 17, 1991. During the HAZOP I told each participant of the HAZOP study that at the conclusions of the study I would prepare a review copy (summary report) for each participants review comment.

Please look over the attached summary document, check the line information, any action or comments and audit trail notes for errors. Please make any corrections to the document and return to me.

Tentatively, a working meeting to resolve HAZOP findings is scheduled for later part of October '91. I would like your comments/corrections returned to me so that I could incorporate those changes prior to the October meeting.

WESTON WAY
WEST CHESTER, PA 19380
PHONE (215) 692-3030
TELEX 83-5348

TRANSMITTAL FORM

To: Mr. Vince Noble
Woodward Clyde Consultants
1550 Hotel Circle North
San Diego CA 92108

Date: 4 September 1991
Reference:

W.O. No.: 3886-44-01

Enclosed herewith are the following:

ITEM	REPORT DWG. OR SPEC. NO.	NO. OF COPIES	DESCRIPTION	STATUS
1	Dwg# 03-04-0001		SQI Building Day Tank P&ID	
2	Dwg# 04-04-0009		Process Water & Caustic Storage P&ID	
3	Dwg# 03-04-010		Process Drain System P&ID	
4	Dwg# 03-04-013		Instrument Air P&ID	
5	Dwg# 03-04-015		Brine Storage & Disposal System P&ID	
6			Control Sequence for RMA	
7			Description for Computer Control Sys Spec PMCS-01	
8			Instrument Spec for DCS System	

REMARKS:

CC:

Very truly yours,

Amitava Sarkar

Shell Oil Company

One Shell Plaza
P.O. Box 4320
Houston, Texas 77210

October 17, 1991

Ms. Elaine Puch
Project Chemical Engineer
Woodward-Clyde Consultants
Stanford Place 3, Suite 1000
4582 South Ulster Street Parkway
Denver, CO 80237

Re: Basin F Liquid Incineration Project HAZOP

Dear Ms. Puch:

Per your request, enclosed is a marked up copy of the Preliminary Summary Report providing initial comments of the HAZOP review for the above referenced project. We are continuing to review the contents of the report and any additional comments will be forwarded as soon as available or provided at the planned working meeting of November 5, 1991.

Should you have any questions, please contact this office.

Sincerely,

M.T. Anderson
Projects Manager
Denver Site Project

Encls.

STEPHEN D. LUEDDERS
PROCESS ENGINEERING MANAGER
PROJECT MANAGER

MORRISON KNUDSEN CORPORATION

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Memorandum **Woodward-Clyde Consultants**

To: JoAnn Tischler, Denver

From: Vince Noble

Office: San Diego

Date: January 14, 1992

Subject: RMA HAZARD ANALYSIS STATUS REPORT SQI PROJECT

Your phone call the other day was very timely. I also felt that a status report was due because of the amount of work that has been done as well as the amount of unresolved issues that still remain.

Since September 1991, there have been several items completed. Starting in September, I assembled a HAZOP study team, organized the HAZOP study and conducted the HAZOP on most of the Weston's and T-Thermal's SQI design package. In October, the draft HAZOP study was sent out and reviewed by the study team. Their comments were sent back for incorporation into the study. In November, a working meeting was held in Denver to resolve the study audit trail notes and findings of the HAZOP study. (A list of the November meeting attendees is attached.)

The November meeting followed the HAZOP study response document prepared by Weston which addressed the audit trail notes and study findings. This response document was used as the agenda of the November 5 meeting. (Attached is a copy of that response document prepared by Weston.)

The following is a summary of important results of that meeting.

- At the conclusion of the HAZOP study in September, it was determined that Weston has not completed the design package. There were several missing P&IDs from the package that were needed to finished the HAZOP study. During the November meeting, Weston indicated that the missing P&IDs would be completed in January 1992. Mr. Ed Berry (RMA) told Woodward-Clyde that he wanted these missing P&IDs reviewed by the HAZOP team in order to finalize the HAZOP study. The missing P&IDs were: steam system, boiler system, brine loading system, caustic unloading/handling system, drain system and water softener unit.

- During the November 5 review meeting, Weston indicated that they would revise, correct and/or add detail to the P&IDs based upon the study's audit notes. There

was no specific time frame discussed but we assume that Weston would be revising the P&IDs by January '92.

- In addition to design drawing changes, Weston indicated that they would "follow-up" on several items found in the HAZOP study. Again the assumption was that by January '92 they would have completed these items.

  These revisions and/or changes would be addressed in the O/M manuals, Preventative Maintenance or Safety Plan that Weston was to finish. Our plan would be to verify that the study audit notes are addressed in the above manuals and plans as well as corrections to P&IDs.

The current status of RMA Hazard Analysis task is that Woodward-Clyde is waiting on Weston. Based on what was discussed in November, Weston should be contacting us regarding the status of their commitments on missing P&IDs, revision/corrections to existing P&IDs, completion of O/M manuals, safety plan and other responses to the study audit notes. It is still our understanding that RMA wants Woodward-Clyde to finish the HAZOP study on the missing P&IDs and prepare a final report.

To prepare a final report, the following items need to be completed:

- HAZOP the missing P&ID systems (steam, boiler, brine loading, caustic unloading and water softener)

- Verify that Weston has adequately addressed the study audit notes per their response document (5/11/91)

- Review the Weston Operation and Maintenance Manuals, Preventative Maintenance, Emergency Response Plan, and Safety Plan to verify that study findings are covered in those documents.

In summary, the status of the RMA Hazard Analysis task is on hold again awaiting for Weston, calls have been made to Mr. Amit Sarkar (Weston Project Manager) but to date no response has been received from Weston.

I would estimate that it would take approximately one week to finish the HAZOP on the missing P&IDs (if not overly complex) and maybe 2-4 weeks for review of the Weston responses to the HAZOP study (manual/plan review). The final report will only take about 2 weeks to finish and mail to you.

Please call me if you need more information or RMA needs more detail on the status.

Attendees at the November 5, 1991 meeting in Denver on the Weston/Woodward-Clyde review of the SQI HAZOP study.

Louis Bulger	WCC - San Diego
Valorie Thompson	WCC - San Diego
Colleen Parker	Weston
Jesse Clement	T-Thermal
Amit Sarkar	Weston
Ben Wachob	RMA
Dennis Heitmaan	Corps of Engineers
Ed Berry	RMA
Elaine Puch	WCC - Denver
Arnold Marsden	Shell Development
Larry Faith	Shell Oil Company
Stephen Luedders	Morrison-Knudsen (Shell)

THERMAL
SINCE 1949

T-THERMAL, INC.
BROOK ROAD
CONSHOHOCKEN, PA 19428
TEL: (215) 828-5400
FAX: (215) 825-4877

WOODWARD-CLYDE CONSULTANTS
1550 Hotel Circle North
San Diego, CA 92108

October 9, 1991

Attention: Mr. Vincent C. Noble
HAZOP Committee Chairman

Reference: Basin F Liquid Remedial Action
Rocky Mountain Arsenal
T-THERMAL job order #1-9350

Subject: Review of HAZOP comments

Dear Vince:

I have reviewed the RMA Hazard and Operability Study Draft Summary Report that you have forwarded. I have also attached our comments to those items pertinent to T-THERMAL. Many action items have already been or will be incorporated into the next revision to the T-THERMAL P&ID's. Other items will await WESTON's direction. I have not found any errors in the wording or the intent of the action/comments.

Please advise me of the time and location of the next meeting as soon as possible, so I can make necessary arrangements.

Sincerely

G. D. Bell
Project Manager

WCCLETTR.001

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RMA HAZOP INVESTIGATION
REVIEW OF COMMENTS
BY
T-THERMAL

October 9, 1991

LINE/ITEM	CODE	COMMENT/ACTION	T-T RESPONSE
T0001-10-1	--	RMA TO PROVIDE 18 PSIG AT T-T PIPE SKID.	T-T TO REGULATE TO 10 PSIG.
T0001-19-2	B	DELETE BYPASS NAT. GAS CONTROL VALVE FCV-09.	WESTON TO DIRECT T-T.
T0003-3-1	C	DEVIATION ALARM ALARM ON FIT-16.	ADD ON P&ID REV 7.
T0003-3-1	C	SHUTDOWN INTERLOCK.	ADD INTERLOCK #67 ON P&ID REV 7.
T0003-15-1	B	ADD TEMPERATURE CORRECTION TO C.A. AND S.A. FLOWS.	WESTON TO DIRECT T-T.
T0003-18-1	A	ADD LIMIT SWITCHES TO PERMISSIVE CIRCUIT.	T-T WILL INVESTIGATE ADDING TO ELECTRICAL SCHEMATICS.
T0005-1-1	B	ADD DEVIATION ALARM ON FIT-16/30.	ADD TO P&ID REV 7.
T0006-1-3	B	MOVE FLUSH CONN.	WESTON TO CHANGE PIPING DRAWINGS & INFORM T-T.
T0006-1-4	C	INSTALL HI/LO ALARMS ON FI-04A.	ADDED TO P&ID REV 6.
T0006-1-4	C	ADD INTERLOCK.	ADD INTERLOCK #68 ON P&ID REV 7.
T0006-3-3	C	SEE ABOVE.	SEE ABOVE.

T0006-6-1	C	LOCATION OF CHECK VALVE.	MOVED TO CORRECT LOCATION ON P&ID REV 6.
T0006-17-1	--	CROSS CONNECT XV-66 & XV-26.	CAN BE DONE THROUGH SOFTWARE.
T0006-18-1	B	CHECK FLOW IN FI-04A ON E.S.D.	CAN BE DONE THROUGH SOFTWARE.
T0008-1-2	C	TRENDING OF PIT-27A/E, PIT-18A/E, PIT-45A/E.	WESTON TO ADD TO CONTROL BID PACKAGE.
T0008-2-1	B	ADD HI FLOW ALARM TO FIC-22A/E.	ADDED TO P&ID REV 6.
T0009-7-1	B	ADD DEVIATION ALARM TO FIT-15A/E.	ADDED TO P&ID REV 6.
T0010-1-2	A	ADD MANUAL ON/OFF CONTROL OF PUMPS.	HAVE LOCAL/REMOTE STATION ON EACH PUMP.
T0010-15-1	A	REVIEW SIZING OF WATER HEATER.	WESTON TO PROVIDE 175°F FLUSH WATER.
T0011-1-1	A	ADD DEVIATION ALARM TO FIT-76A.	WILL ADD TO P&ID REV 7.
T0011-1-2	C	" "	" " "
T0012-1-1	C	ADD HI/LO ALARM TO FI-04B.	ADDED TO P&ID REV 6.
T0016-15-1	C	NEED REDUNDANT LEVEL ALARMS ON SEPARATOR.	ADDED LSLL-50 AND LSHH-50 SWITCHES ALONG WITH LIT-50 HI & LO ALARMS.
T0018-1-2	C	ADD CHECK VALVE AND PRESSURE SWITCH.	WESTON TO DIRECT T-T TO DO.
T0018-4-1	--	ADD INTERLOCK 65 TO ACV-64 & P-202 A/B.	WILL ADD #65 TO P&ID REV 7.
T0018-17-1	--	ADD INTERLOCK TO LOSS OF CAUSTIC FLOW ON FISL-41.	WILL ADD #66 TO P&ID REV 7.
T0018-18-1	--	VERIFY CLOSURE OF VALVE ACV-64.	WILL ADD PROOF OF CLOSURE SWITCH ZSC-64 ON P&ID REV 7.

T0020-1-4	C	ADD PRESSURE SWITCH.	WESTON TO DIRECT T-T TO DO.
T0021-1-2	B	ADD PRESSURE SWITCH.	WESTON TO DIRECT T-T TO DO.
T0021-18-1	A	PROVE LIMIT SWITCH UPON SHUTDOWN.	ALREADY HAVE PROOF OF CLOSURE SWITCH, INCORPORATE INTO SOFTWARE.
T0023-1-2	B	NO INDICATION OF LINE RUPTURE.	WESTON TO DIRECT T-T TO ADD NECESSARY INSTRUMENTATION.
T0023-17-1	A	CHANGE VALVE FCV-48 TO FAIL CLOSE.	CHANGED ON P&ID REV 6.
T0030-1-1	A	RECOMMEND TRENDING OF AIC-56.	WESTON TO INCORPORATE INTO SOFTWARE PACKAGE.
T0030-17-1	C	CONFIRM CLOSURE OF VALVE FCV-56.	HAVE ADDED PROOF OF CLOSURE SWITCH ZSC-56 ON P&ID REV 7.
T0031-10-1	--	RECOMMEND TRENDING OF PDIT-55.	WESTON TO INCORPORATE INTO SOFTWARE PACKAGE.
T0032-2-1	A	ADD RESTRICTING ORIFICE & PRESSURE INDICATOR.	HAVE ADDED ON P&ID REV 6.
T0032-16-1	C	ADD MIN FLOW LIMIT SWITCH TO FCV-58.	HAVE ADDED ZSL-58 TO VALVE ON P&ID REV 6.
T0033-1-1	B	ADD ALARM ON FI-83A LINKED TO AIC-59.	WESTON TO ADD ALARM ON FI-83A. T-T WILL ADD INTERLOCK #72 ON AIC-59 TO WASTE FEED.
T0033-1-2	C	REVIEW LACK OF LEAK INDICATION.	WESTON TO DIRECT T-T TO ADD NECESSARY INSTRUMENTATION.
T0033-17-2	C	CHANGE VALVE FCV-58 TO FAIL CLOSE.	CHANGED ON P&ID REV 6.
T0034-4-1	A	RECOMMEND TRENDING OF AIC-55 AND AIC-64.	WESTON TO INCORPORATE INTO SOFTWARE PACKAGE.
T0034-20-2	A	RECOMMEND TRENDING OF AIC-64.	WESTON TO INCORPORATE INTO SOFTWARE PACKAGE.

T0035-1-1	B	ADD FSLL-60 TO INTERLOCK WASTE FEED.	HAVE ADDED INTERLOCK #18 TO MATRIX.
T0037-2-1	B	ADD CLOSURE OF VALVE XV-26 TO INTERLOCK PDSLL-53.	ADDED TO INTERLOCK MATRIX.
T0038-1-1	C	ADD BURNER SHUT-DOWN TO PDSLL-53 INTERLOCK.	ADDED TO INTERLOCK MATRIX.
T0041-1-2	C	NO INDICATION OF LINE RUPTURE.	WESTON TO DIRECT T-T TO ADD NECESSARY INSTRUMENTATION.
T0041-3-1	B	RECOMMEND TRENDING OF FIC-65	WESTON TO INCORPORATE INTO SOFTWARE PACKAGE.
T0041-3-2	C	RECOMMEND TRENDING OF FIC-65	WESTON TO INCORPORATE INTO SOFTWARE PACKAGE.
T0041-4-1	C	ADD INTERLOCK TO FCV-56 TO SHUT DOWN CAUSTIC FLOW.	FSLL-65 IS ALREADY INTERLOCKED TO WASTE FLOW (#19), WESTON TO DIRECT T-T TO ADD INTERLOCK ON FCV-56.
T0041-6-1	C	ADD CHECK VALVE.	RECOMMEND MOVING CHECK VALVE 342 TO INTERSECTION OF 4"-BR-503 & CAUSTIC LINE.
T0041-17-1	C	ADD FSLL-65 TO BURNER START-UP.	T-T WILL INVESTIGATE & ADD TO ELECTRICAL SCHEMATIC IF NECESSARY.
T0042-19-1	A	RECOMMEND TRENDING OF FCV-65.	WESTON TO INCORPORATE INTO SOFTWARE PACKAGE.
T0044-17-1	--	ADD LSLL-62 TO BURNER START-UP.	T-T WILL INVESTIGATE & ADD TO ELECTRICAL SCHEMATIC IF NECESSARY.

RMA HAZOP Meeting - Denver

Nov 5, 1991

NAME	COMPANY
Louis Bulger	WCC - San Diego
Valorie Thompson	WCC - San Diego
Colleen Parker	Weston/TTSI
Jesse Clement	T-Thermal
Amit Sarkar	WESTON
Ben Wachob	PMRMA
Dennis Heitmann	COE (RMA)
Ed Berry	BMRMTT
Elaine Pugh	WCC
Arnold Marsden	Shell Development
Larry Faith	Shell Oil
Stephen Luedders	Morrison Knudsen

APPENDIX F

RMA HAZOP

Action Item - Summary Reports

March 27, 1992
Project No. 22206A-5000

Mr. Ed Berry and Mr. Ben Wachob
Rocky Mountain Arsenal
Building B-111
Commerce City, CO 80022

RMA HAZOP; ACTION ITEM SUMMARY REPORT

Mr. Berry and Mr. Wachob:

Pursuant to a phone conversation on March 24, 1992 between Mr. Ben Wachob of Rocky Moutain Arsenal (RMA) and JoAnn Tischler and Vince Noble of Woodward-Clyde Consultants (Woodward-Clyde) please find attached to this letter an Action Item Summary Report based primarly upon the findings of Weston's responses to the HAZOP study.

The data for Action Item Summary Report was gathered from the three Weston responses to HAZOP documents dated December 5, 1991, February 5, 1992 and February 21, 1992. Additionally, comments from Shell Oil Company and the HAZOP team review were addressed. The majority of the action items listed fall into the following catagories:

- HAZOP action items or audit trail items to whihc Weston has not responded.
- Items in the HAZOP which have been inadequately addressed or require additional discussion.

In addition to those above, many Weston responses were not verifiable or can not be closed due to lack of current revised P&IDs, or various plans and programs which were not available to HAZOP team to review. In order to resolve and close the remaining many line items in the HAZOP, the HAZOP team would need to review and verify that the responses in the study have been addressed in either the plans and programs or a current revision for P&ID referenced in the responses, for the SQI.

The following are the items which are not resolved and/or need additional review. This list represents an Action Item Summary list.

- <u>HAZOP Items not Addressed by Weston</u>

1. T0001-19-1 <u>Action</u>: Periodic inspection and maintenance of lines should be included in O&M Manual. Proper lockout/tagout procedures should also be included.

   <u>Audit Note</u>: Is there a procedure for checking shutdown and safety interlocks on a periodic basis?

2. T0001-19-2 Action: Bypass around natural gas control valve 319 should be questioned or eliminated.

3. T0013-16-1 Comment--Action Item: Operator training should pay special attention to importance of air/fuel (A/F) ratio.

4. T0020-17-1 Comment--Action Item: Operator should confirm proper closure of this valve (FCV-62) after shutdown.

5. T0021-18-1 Comment--Action Item: Limit switch on valve (XV-40) closure should be proven upon shutdown.

6. T0030-17-1 Comment--Action Item: Operator should confirm closure of FCV-56 on shutdown.

7. T0031-15-1 Comment--Action Item: Will line be identified as containing hot fluid and be adequately equipped to protect workers?

8. W0051-1-1 Comment--Action Item: Caustic delivery and unloading procedures are unavailable. Assume that unloading operator observes rupture and initiates emergency procedures.

   (Note) Caustic delivery and unloading procedures should be included in the HAZOP study. As soon as P&ID's and procedures are available, they should be provided to HAZOP team for review.

9. W0001-6-1 Action Item: Contingency plan should be developed.

10. W0007-1-2 Audit Note: Need clarification of operating and control of venting system.

- Items that are Inadequately Addressed or Required Additional Discussion

W0001-6-1: Unable to locate right comment to Weston response

W0008-9-1: Attachment not available to review

W0009-1-2: Provide P&ID revision number on change

W0003-1-3: P&ID revision change has not been verified to date

W0003-1-4: Not adequately addressed, outside containment is the issue that needs response.

T0003-1-1: Weston needs to provide additional data on blower maintenance

T0001-10-1: ~~Unable~~ Not to verify to date, ~~new review~~ revision P&ID

T0003-1-2: Provide additional detail on warning system

T0003-3-1: Not verified to date, new P&ID revision

T0003-10-1: Available P&ID does not contain adequate data for review

T0003-17-1: Provide additional data - NH_3 vapor monitoring and procedures on monitoring tanks

T0003-19-1: Unable to verify P&ID - new review change to date

T0005-1-1: Unable to verify P&ID not verified to date

T0006-1-4: Revision change on P&ID, not verified to date

T0006-6-1: Revision change on P&ID, not verified to date

T0006-18-1: Provide additional data on safety measure in the PCMS software

T0008-2-1: Revision change to P&ID, not verified to date

T0008-18-1: Inadequately addressed, nozzle maintenance should be detailed

T0010-15-1: Not adequately addressed, provide more non-detail on heater

T0011-9-1: Not adequately addressed, boiler system not part of HAZOP study

T0014-19-1: Not adequately addressed, health and safety concerns ~~in leaks~~

T0023-17-1: Revision change to P&ID, not verified to date

T0024-17-1: Revision change to P&ID, not verified to date

T0027-1-1: Typo should be T0027-16-1 also T0030-16-1 should be T0030-15-2

T0032-2-1: Revision change to P&ID, not verified to date

T0032-18-1: Provide data: Q-should pumps 202A/B be on emergency power system.

T0033-1-2: Revision change to P&ID, not verified to date

T0033-6-1: Provide specific location for new check valve and revision number for P&ID change

T0033-17-1: Provide flow limit switch location

T0033-17-2: Revision change to P&ID, not verified to date

T0033-19-1: Revision change to P&ID, not verified to date

T0034-1-2: Weston is depending ~~a lot~~ on routine visual tank and line inspection to catch ~~a lot~~ of potential problems - may want to ~~into~~ other methods of inspections/ protection

T0035-1-2: Not adequately addressed, health and safety concern of release

T0035-18-1: Is there a revision/P&ID change for this

T0038-3-1: Not adequately addressed, health and safety issue

T0040-1-2: Not adequately addressed, review action item

T0041-1-1: Is there a revision/P&ID change?

T0041-4-1: Revision change to P&ID, not verified to date

T0041-6-1: Revision change to P&ID, not verified to date

T0046-3-1: Mechanical P&ID were not reviewed in HAZOP study

T0048-2-1: Not adequately addressed, sketches are not acceptable for HAZOP review. please provide final P&ID's for this action item

T0049-1-1: Unable to verify, ~~matrix~~ for interlocks are not current.

T0050-8-1: Unable to verify, P&ID on tanks should be included in HAZOP - provide when available

T0050-9-1: See item T0049-1-1

T0050-10-1: See item T0049-1-1

T0051-19-1: Provide more detail on "regular"

W0054-1-1: New P&ID revision change, not verified to date

W0056-20-1: New P&ID revision change, not verified to date

W0058-9-1: Not adequately addressed, health and safety issue

W0058-20-1: See item T0049-1-1 - Provide current interlock matrix to address the new/change interlock changes or additions

Note - All Weston responses that indicated that a P&ID revision was done to respond to the HAZOP action or audit note. Weston should develop a document which identifies all changes to either the T-Thermal and/or Weston P&ID's that were changed from the P&ID

set that was used in September 1991. Currently, there are 3 or 4 revision changes to the P&ID's since September 1991, and too many changes to locate without some identification method to verify the changes.

HAZOP STUDY STATUS

Based upon the response from Weston, Shell Oil Company and HAZOP team members, Woodward-Clyde is in the process of adding the responses, comments and editorial changes to the study document. Items that can be closed based upon responses to action items or audit trail notes are being closed; items that still require additional responses, as per this action item summary report, will be closed as Weston addresses them. The completion of the study should be final in the next couple of weeks, assuming that Weston will respond to the summary report as soon as possible.

If Weston does not respond in the next few weeks, Woodward-Clyde will issue a interm final study with a draft report which will contain the RMA hazardous analysis process and the HAZOP study in a couple of weeks. At such time that Weston responds to the action item summary, we will complete the study and incorporate any additional comments.

Very truly yours,

WOODWARD-CLYDE CONSULTANTS

JoAnn Tischler
Project Manager

Vince Noble
Hazard Evaluation Task Manager

JT/VCN/lag

Enclosure

T0021-1-2 Line rupture of soft water line.

1. If upstream of FIT-39, get alarm and system shut down; downstream no indication available.
2. Investigate need for pressure switch for loss of flow indication.
3. Location should be between WPR-7 and quench tank.

Response:
1. The current monitoring system is adequate.
2. There is no need for a pressure switch.

T0022-1-2 Line rupture in caustic makeup line, release of hot caustic into workplace.

1. Review piping run for safety.

Response:
1. Routine line inspections will be performed daily.

T0023-17-1 FCV-46 fails open in startup/shutdown, uncontrolled softened water makeup into scrubber causing overflow to sump.

1. Change fail position to fail close on valve FCV-46.

Response:
1. Agreed, FCV-46 will fail closed.

T0024-17-1 XV opens startup and uncontrolled softened water into scrubber demister results in overflow to sump.

1. XV-54 should fail closed.

Response:
1. Agreed, XV-54 will fail closed.

T0027-1-1 More solids in quench solids removal system results in increased pump wear.

1. Maintenance item.

Response: 1. Agreed, the O&M Manual will include pump inspection procedures.

T0029-3-1 Less flow in quench solids separator resulting from plugged downcomer ports.

1. Recommend semi-annual maintenance program include inspection of ports.

Response: 1. Agreed, the O&M Manual will include semi-annual inspections.

T0030-1-2 Line rupture of caustic makeup line with release of caustic.

1. Consider looking at safety considerations resulting from caustic release resulting from lack of flow or pressure indication on line signaling rupture.

Response: 1. Routine line inspections as described in the O&M Manual will be performed on a daily basis to verify line. and tank integrity.

T0030-16-1 Loss of heat tracing on caustic line. Review heat tracing control and monitoring.

Response: 1. No heat tracing monitoring system is currently in place.

REFERENCE DRAWING: 32-03-713D, Sheet 4 of 6, 7/23/91

LINE ITEM	DESCRIPTION

T0031-10-1 Loss of pressure, due to solids plugging, etc.

1. Evaluate Trending point for DP indication.

Response: Trending can be performed by the PMCS on an as needed basis.

T0032-2-1 More flow in quench recycle pressure side due to unbalance pressure between blowdown and recycle.

1. Add a restricting orifice (valve) including pressure indication to balance pressure between recycle and blowdown lines.

Response: 1. Agreed. Reference Rev 7 of P&ID.

T0032-16-1 Malfunction of density meters AE-59A/B results in excessive blowdown concentration.

1. Provide minimum flow limit switch interlocked to waste feed valve to ensure at least minimum blowdown during waste incineration.
2. Recommend density trending.

Response:
1. ASHH-59 has been added as interlock 72.
2. Agreed, trending of density is included.

T0032-18-1 Pumps P-202A/B are operated under emergency shutdown through the emergency diesel generator.

1. Confirm that emergency diesel generator is automatically started upon emergency shutdown.

Response: 1. The emergency generator will start automatically within 10 seconds of a power failure, however P-202A/B are not powered by the emergency generator.

T0033-1-1 No flow in blowdown line to brine tanks.

1. Install alarm of FI-83A linked to density reading on AIC-59.

Response: 1. Agreed, alarm ASHH-59 has been added as interlock 72.

T0033-1-2 Line rupture in blowdown line to brine tanks.

1. Review lack of rupture/leak indication (flow or pressure indication) downstream of FCV-58.

Response: 1. Routine, daily line inspection will be performed and PI- 57 has been added in Rev 7 of the P&ID.

T0033-6-1 Loss of pumps P-202A/B while scrubber pumps continue to run and line 2"-BR-313A-N-H is open bringing scrubber blowdown to TK-201, TK-202.

1. Piping drawing show check valves in lines; show check valves in Lines on PID.

Response: 1. A check valve will be added.

T0033-17-1 Startup/shutdown.

1. Recommend installation of minimum flow limit switch interlocked with waste feed block valve.
2. Recommend flushing of quench tank recycle on shutdown.

Response:
1. Already included in design.
2. Need for flushing will be determined during operation, but only once or twice a year is anticipated.

T0033-17-2 Valve FCV-58 fails open upon shutdown.

1. Replace fail open valve FCV-58 with fail closed valve.

Response:
1. FCV-58 will fail closed.

T0033-19-1 Maintenance.

1. Line designations on PID are incorrect and should be revised to show/not show heat tracing.

Response:
1. T-Thermal has issued Revision 8 of the PI&Ds.

T0034-1-2 Line rupture in pH loop in quench.

1. Recommend evaluation of safety hazard from release of hot brine.

Response:
1. Routine line inspections will identify any line rupture. Reference Health and Safety Plan for contingency plans.

T0034-2-1 Excessive flow in pH loop resulting in damage to pH probe.

1. Recommend evaluation of probe design to minimize possibility of damage due to high flow.

Response: 1. Concern is covered by probe design.

T0034-4-1 Domestic water into pH loop line results in dilution and erroneous pH readings.

1. Recommend evaluation of adding trending point to caustic control loops AIC-56 and AIC-64.

Response: 1. Trending not required. The control system currently compares pH signals between probes.

T0034-20-1 Release of hot brine into workplace when removal of pH probes.

1. Recommend that all hot lines be identified.
2. Recommend splash shields or guard included at probes.

Response: 1. Brine lines are color coded.
2. Safety training on probe removal will address this concern and splash shields will be provided.

T0034-20-2 Erroneous pH readings result of buildup scale on probe.

1. Recommend evaluation of trending of pH controller AIC-64.

Response: 1. Routine cleaning of the probe will be performed. If the probe continues to malfunction a replacement probe will be provided.

T0035-1-1 No flow in venturi recycle line loss of control of FCV-60, plus other causes.

1. Recommend addition of FSLL-60 waste feed interlock to interlock matrix.

Response: 1. FSLL-60 has been added to the interlock matrix as interlock 18.

T0035-1-2 Line rupture of venturi recycle line and release of hot brine.

1. Recommend evaluation of hazard by safety committee.

Response: 1. Routine line inspection will be performed daily.

T0035-18-1 Emergency shutdown. Recommend evaluation of Valve (FCV-60) fail position.

Response: 1. FCV-60 will fail closed.

T0036-19-1 Improper maintenance, welding on vessel, resulting in liner damage.

1. Recommend this vessel be inspected on a routine basis for lining integrity and solids buildup.

Response: 1. Agreed, yearly.

T0036-20-1 No level in quench tank.

1. Recommend this vessel be inspected on a routine basis for rupture of ducts, piping, vessel wall, etc.

Response: 1. Agreed

T0037-2-1 Excessive flow into venturi, loss of control. Recommend adding closure of valve SV-26 to interlock PDSLL-53.

Response: 1. PDSLL-53 has been added to the interlock matrix as interlock 34.

T0038-1-1 Rupture of duct from quench separator to venturi.

1. Recommend safety aspects of this deviation be evaluated.
2. Recommend the addition of burner shutdown to PDSLL-53 interlock.

Response:
1. Health and Safety Plan will address rupture of duct.
2. This shutdown condition is included in interlock 34, which will shutdown the burner and the waste feed.

T0038-3-1 Leaks in duct from quench to venturi. Recommend review of consequences of no detection.

Response: Daily line inspections will be performed.

T0039-1-1 Venturi sump; line or vessel rupture; release of flue gas or hot brine.

1. Recommend evaluation of safety concerns for ruptured vessel.
2. Vessel is 13 feet above working floor.

Response:
1. These concerns will be addressed in Health and Safety Plan.
2. Vessel is within a contained concrete area.

T0040-1-2 Line rupture of scrubber recycle suction piping, hot brine released. Recommend safety evaluation of release of hot brine.

Response: 1. Health and Safety Plan contains a contingency for line rupture. Routine daily line and tank inspections will be performed.

T0041-1-1 No flow of scrubber recycle due to pump or instrumentation failure.

1. Recommend investigation of emergency fail position of valve FCV-65

Response: 1. FCV-65 will fail closed.

T0041-2-1 Line rupture of scrubber recycle discharge piping, hot release of brine.

1. Recommend safety evaluation of release of hot brine due to lack of detection.

Response: 1. Routine, daily line/tank inspections will be performed.

T0041-4-1 Caustic flow into scrubber recycle when not intended.

1. Install interlock to FCV-56 to shut down caustic flow in the event of insufficient flow at FE-65.

Response: 1. Interlock has been added as interlock 64.

T0041-6-1 Loss of pumps P-203A/B resulting in caustic introduce in reverse flow on 4"-BR-503-H-K to 6"-BR-502-H-K.

1. Investigate the addition of check valve at intersection of caustic line with 4"-BR-503-H-K.

Response: 1. Check valve 342 has been moved to 1/2 XB-320.

T0041-10-1 Loss of pressure or flow could indicate nozzle failure. Include inspection of scrubber recycle nozzles on a regular basis.

Response: 1. Agreed, the O&M Manual includes routine nozzle inspections.

T0041-17-1 High caustic in scrubber pipelines in startup/shutdown.

1. Recommend shutdown of caustic pumps prior to shutdown of recirculation in shutdown sequence.
2. Recommend FSLL-65 be included as burner startup permissive.

Response:
1. Agreed
2. Permissive has been included as interlock 19, but for waste feed only, not for burner operation.

T0041-19-1 Scrubber recirculating pump wear and or corrosion.

1. Recommend alternating use of spare pumps for all lines.

Response:
1. Agreed, pumps will be alternated.

T0042-17-1 Caustic remains in pH control loop after shutdown.

1. Recommend flushing of lines after shutdown of P-203A/B.

Response:
1. Not recommended, since the caustic is only 20 %. Flushing will be completed as required for maintenance.

T0042-19-1 Solids buildup on pH probes.

1. Frequency of flushing to be determined upon operating experience.
2. Frequency will be conservative on startup.
3. Recommend trending of caustic control valve FCV-56.

Response:
1. Agreed
2. Agreed
3. No. Probes will be routinely cleaned to prevent solids buildup.

REFERENCE DRAWINGS: 32-03-713-D Sheet 5 of 6 Rev 5 (7/23/91).

LINE ITEM	DESCRIPTION

T0042-19-2 Improper procedure on removing pH probe results in leak of caustic into workplace.

1. Recommend installation of splash shields or guards on probes.

Response: 1. Agreed, splash guards will be utilized.

T0043-1-2 Line rupture of alternate blowdown line from scrubber to brine tank, release hot brine.

1. Consider safety ramification of lack of line rupture indication.

Response: 1. Routine, daily inspection of lines/tanks will be performed.

T0043-15-1 Freezing of fluid of line.

1. This line normally not in use, is an alternative blowdown line from scrubber to brine tank, manually activated.
2. Investigate whether line is properly sloped to drain when not in use.

Response: 1. & 2. Although not normally in use, the line is protected by being inside.

T0044-17-1 Scrubber startup/shutdown.

1. Provide permissive for startup on LSLL-62.

Response: 1. Interlock 35 has been provided.

T0044-20-1 Scrubber rupture with release of hot gases and brine.

1. Investigate containment for spillage capacity.

Response: 1. Containment is adequate to contain a spill as a result of a rupture to the scrubber.

T0044-22-2 Vessel leak.

1. Investigate containment for spillage capacity.
2. Safety evaluation for release of hot gases and brine.

Response: 1. Containment is adequate.
2. The Health and Safety Plan will address the contingency of a release.

T0045-1-2 Stack rupture.

1. Recommend evaluation of need for indication on stack for rupture.

Response: 1. Not required.

T0045-3-1 Reduction in stack flow.

1. Recommend investigating necessity for installing a bird screen. 2. Drain is located on stack, duct has no drain, unknown whether duct is sloped or not.

Response: 1. Not required.
2. Duct is sloped slightly toward the scrubber.

T0045-19-1 Maintenance of stack and CEM.

1. Not enough information exists at this point to fully evaluate CEM.
2. CEM has the ability to shut the system down on malfunction. 3. Recommend assessment of CEM upon availability of complete information.

Response:
1. Agreed, the CEM PI&D accompanies this report.
2. Yes
3. Agreed

T0046-1-1 SOI drains and sumps.

1. PID should designate flow path from drain lines to sump.
2. WESTON and T-Thermal drawings have not been coordinated. Uncertain whether piping connects drains to sumps or where sumps are located.
3. Sump P-403 is sized to 50 gpm, Sump is 45 gallons. Why are pump and sump designated in this manner?
4. Recommend routine inspection of sumps.
5. Recommend review of pump sizing and pump capacity.

Response:
1. & 2. The PI&Ds show lines which are directed to drains; details of the pipe routing are shown on the mechanical piping drawings.
3. Sump P-403 also services drainage from an upper level, and has been increased in size accordingly.
4. Agreed
5. Pump sizing and capacity was reviewed; P-403 is larger because of the potential for greater service.

T0046-1-2 Line rupture of sump piping.

1. Recommend investigation of necessity of line r ture indication on sumps.

Response:
1. Routine of inspection of sump areas and associated piping will performed daily as described in the O&M Manual.

T0046-3-1 Sump pump discharge less than inflow.

1. Recommend routine flushing of sump discharge.
2. Locations and elevation of sumps is unclear from PID and schematic drawings.

Response:
1. Flushing will be done on an as required basis. Operations will determine the frequency of flushing.
2. The mechanical layout drawings need to be consulted for the location and elevations of the sumps.

T0046-18-1 Sump influent greater than discharge during emergency.

1. Recommend review of sump sizing.

Response:
1. The sumps have been sized to provide the sump pumps with the necessary inlet conditions rather than to provide a minimum retention capacity.

T0046-19-1 Failure of sump level controller.

1. Recommend review of sump sizing.

Response:
1. The sumps have been sized to provide the pumps with the needed NPSH rather than to provide a minimum retention capacity.

T0047-1-1 Sump line or drain plugging.

1. Investigate possible drain flow to sump and adequacy of sump to handle flow.
2. Revaluate bottom drain line sizing to sump.

Response:
1. As stated, the sump sizing is designed to accommodate the pump and to provide a minimum retention capacity.

REFERENCE DRAWINGS: 03-04-015 Rev 0, 7/13/91

LINE ITEM DESCRIPTION

T0048-1-2 Suction side of brine line rupture results in excessive sump flow.

1. Recommend review of sump sizing.

Response: 1. Sump sizing is irrelevant to an air diaphragm pump. The sump provides suction for the pump only, not containment.

T0048-2-1 Excessive brine flow to tank car.

1. HAZOP team does not have adequate loading procedures to evaluate whether more flow deviation can occur.

Response: 1. Sketches revising the P&IDs accompany this report.

T0048-16-1 Brine line has excessive solids concentration.

1. How does operator detect mixer operation?
2. Detection of more solids in line is unclear.

Response: 1. Feedback is transmitted to the control room. If the mixer stops an alarm is sounded in the control room.
2. Excessive solids, if present, will be removed manually. Recirculation of the storage tank contents is provided to keep solids in suspension.

T0049-1-1 No flow in brine transfer line.

1. Recommend review of sump sizing.

Response: 1. Interlock 80 will cover pump failure. Loss of instrument air will cause valves to go to fail safe position.

T0049-1-2 Brine line rupture.

1. What is position of valves on failure?

Response: 1. Valves will fail closed. Containment is provided.

T0049-4-1 Utility water valve inadvertently open and flow into brine line or tank. Unable to determine severity of consequence, utility water line and valve size not show on drawing.

Response: 1. Unlikely because of number of hand valves in the system. More likely scenario would fill up line and overflow into the sump area. The Utility Water Supply Line Size is 4 inches. The distribution line is 2 in.

W0050-8-1 Brine storage tank pumpout with no vents.

1. Evaluate tank safety and revise PID where appropriate.

Response: 1. Vents are provided. See tank data sheets. P&ID sketches accompany this report.

T0050-9-1 Failure of high level alarm LAH 84A/B with continued pumping of fluid.

1. No interlocks shown on drawing. No vent on tank, no tank overflow, no tank safety features shown on PID.

Response: 1. Interlock 80 prevents brine flow from entering a full tank. Vents and tank overflows are provided; see tank data sheets.

T0050-10-1 Pumpout without tank vent; possible collapse and release of hot brine into area.

1. Unloading procedures are unclear.
2. Unclear whether level is indicated locally as well as remotely.
3. Does the operator at the loading station need to know the level at the tanks?

Response:
1. See attached loading procedure.
2. Level is indicated remotely on the tanks. Level indication for the brine loading arm is local only.
3. No, Interlock 80 will turn off transfer pumps when low level in the tank occurs. The operator at the loading station needs to receive the "OK to load" permissive only to start the loading procedure.

T0050-15-2 Low brine storage temperature. In the event that brine must be stored for a period of time, cooling can occur. However, brine mixing in the tank, recirculation of brine, and feed of hot brine to the tank should preclude freezing.

Response:
1. Agreed. May also transfer brine from tank to tank if absolutely necessary.

T0050-16-1 Failure of brine tank mixer M-204/M-205.

1. Evaluate need for mixer motor trip indication.

Response:
1. An operation sensor and loss of operation alarm is provided in the control room.

T0050-17-1 Both tanks full of brine on startup.

1. Recommend evaluation of need for interlock or operating procedures to check level on both tanks on startup/shutdown when both tanks are full.

Response:
1. Agreed. If both tanks are full the SQI system cannot be operated. Brine storage capacity must be available in order to operate the SQI system. This will be established as a routine operational procedure.

T0050-18-1 Emergency blowdown to brine tanks during emergency shutdown, and inadequate storage capacity. Evaluate need to maintain reserve capacity in tank for emergency shutdown.

Response: 1. Not required. If reserve capacity is required a brine tank must be pumped. If a rupture has occurred the brine will be pumped by the local sump to the wastewater tank.

REFERENCE DRAWINGS: 03-04-009 Rev 0, 7/31/91

LINE ITEM DESCRIPTION

W0051-7-1 Improper material delivered instead of caustic.

1. Unloading procedures should include a provision for verifying contents of delivery.

Response: 1. The bill of lading will be checked by supervisor.

W0051-15-2 Loss of heat tracing on caustic transfer lines.

1. Evaluate detection of loss of heat tracing.

Response: 1. No heat tracing monitoring system exists. Portable heaters can be utilized as required until the condition is repaired.

W0051-19-1 Failure of heat tracing, failure of line at flex/fixed juncture. Recommend investigation of flex/fixed juncture, on line.

Response: 1. The juncture will be inspected regularly.

W0053-1-2 Rupture of caustic pump (P-211) suction line.

1. Evaluate detection for line rupture.

Response: 1. Routine line/tank inspections are performed daily by the field technician.

W0053-18-1 Caustic pump suction line plugging on startup after emergency shutdown.

1. Heat tracing and tank heater are not on emergency power systems.
2. How does operator determine whether caustic is flowing in this line during restart after emergency shutdown?
3. Include provision in operator/training manual for determining whether caustic is flowing on restart after emergency shutdown.

Response:
1. Heat tracing on the pipe is on the emergency power system.*
2. Visual inspection of the flow meter included in caustic lines
3. Agreed, O&M Manual will include operation inspections.

W0054-1-1 Low flow from pumps P-211A/B.

1. Interlocked with water line through flow meter FIC-205.
2. Fail position on valve FCV-211 and FCV-209 on line W0008 is unclear.

Response:
1. Yes
2. FCV-211 and FCV-209 fail closed.

W0055-15-1 Increase temperature in caustic dilution tank.

1. Heating of liquid in caustic dilution tank due to exothermic heat of solution. 2. Can exothermic reaction exceed tank design criteria?

Response:
1. A field technician will be present during all mixing operations.
2. No since even at boiling, 50% caustic will reach only 290°F. Reference tank data sheet.

W0055-16-1 Increase temperature in caustic dilution tank due to greater caustic feed.

1. Heating of liquid in caustic dilution tank due to exothermic heat of solution.
2. Can exothermic reaction exceed tank design criteria?

Response: 1. See W0055-15-1 remarks.

W0056-20-1 No level indication in process water tank (TK-203) Check instrumentation identification LCS-205 for tank TK-203 controllers.

Response: 1. Level indication has been provided on TK-203. Reference P&ID.

W0057-16-1 Composition other required in day tank (TK-104), loss of agitation, solid accumulation? Recommend evaluation of need to indicate mixer motor trip on main and/or local control panel.

Response: 1. An operation sensor on the mixer is provided. Should the mixer stop an alarm in the control room is sounded.

W0058-9-1 High vapor pressure in day tanks (TK-105/106), resulting in release through liquid seal and into workplace.

1. Recommend periodic inspection of liquid seals.

Response: 1. Agreed, the O&M Manual contains inspection procedures.

W0058-20-1 Loss of level control in day tanks.

1. SQI waste feed system includes dual tanks.
2. Review designations of level instrumentation shown on PID.

Response: 1. Yes
2. Interlocks 60 and 70 are tied into the tank levels and will shut down the system.

T001-2-1 Consider a leak in the line.

Response: 1. PALL-08 is included.

T0001-18-1 Emergency Shutdown can arise several ways.

1. Recommend operator training and suitable instructions in O & M.

Response: 1. O&M Manual will address emergency shutdowns and operator training will be provided.

T0001-19-2 Review bypass valve for elimination.

Response: 1. By pass remains, but will be locked out per the O & M manual.

T0001-6-1 Evaluate location of check valve.

Response: 1. Check valve was relocated in Rev. 6 of the P&ID.

T0006-17-1 Recommend line flushing as part of maintenance.

Response: 1. Line flushing will be specified in the O & M Manual.

T0006-18-1 Contingency plan should include check on flow in FIT-04A.

Response: 1. The operating interlocks will include provisions to check on flow in TIF-04A via a high flow alarm coordinated on the waste feed being shut off.

W0001-6-1 Recommend contingency plan for inability to pump Basin F. liquid.

Response: 1. A contingency plan will be developed.

T0007-4-1 Recommend valve lockout capability be included or discharge of TK-104.

Response: 1. Agreed.

T0030-15-2 Review heat tracing control and monitoring.

Response: 1. Electrically monitoring the heat tracing is not included in the present design.

T0035-17-1 Consider adding flow to venturi as a permissive for startup.

Response: 1. The permissive has been included in interlock 18.

T0040-15-1 Review safety of hot line in scrubber recycle pump section.

Response: 1. This safety issue will be addressed in Health and Safety Plan.

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15 May 1992

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DCN: 8127-03-00-AICR
W.O.: 3600-05-85

Attn: Richard C. McRae

Subject: Responses to 1 April 1992 HAZOP Action Items letter from WCC to Messrs. Ed Berry and Ben Wachob

Gentlemen:

The Operation & Maintenance (O&M) Manual and the factory acceptance test of the PMCS control system are both in progress. The responses which accompany this letter are provided with the best documentation that is currently available. Specifically, only sections 3.12 (Brine Handling System) and 3.13 (Caustic Handling System) are included from the O&M Manual, which is expected to be reissued in its entirety next week, when a copy can be forwarded to the HAZOP reviewers.

Since the Brine and Caustic Handling Systems are two of the more significant systems prompting continued HAZOP interest, the included sections should provide the reviewers with an opportunity to further refine their comments. However, complete resolution of their comments will probably have to await completion of the O&M Manual, consolidation of the sketches and drawings, and finalizing the PMCS program.

If we can be of further assistance in responding to the HAZOP reviewers, please contact me.

Sincerely,

ROY F. WESTON, INC.

Quintin R. Todd

Quintin R. Todd, P.E.
Project Manager

QRT:gmd
cc: B.Wachob (PMRMA)
E. Berry (PMRMA)
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ACTION ITEM SUMMARY REPORT:
HAZARDS AND OPERABILITY (HAZOP) STUDY

HAZOP Items Not Addressed by WESTON

Item No.	Action or Comment Required	Item
T0001-19-1	Action	Periodic inspection and maintenance of lines should be included in the O&M Manual. Proper lockout/tagout procedures should also be included. **Response:** See the O&M Manual.
Audit Note		Is there a procedure for checking shutdown and safety interlocks on a periodic basis? **Response:** See the O&M Manual.
T0001-19-2	Action	Bypass around natural gas control valve 319 should be questioned or eliminated. **Response:** Valve will be locked; however, some maintenance is facilitated by presence of the bypass.

ACTION ITEM SUMMARY REPORT:
HAZARDS AND OPERABILITY (HAZOP) STUDY

HAZOP Items Not Addressed by WESTON

Item No.	Action or Comment Required	Item
T0013-16-1	Comment-Action	Operator training should pay special attention to importance of air/fuel (A/F) ratio. **Response:** The A/F ratio will receive attention in operator training.
T0020-17-1	Comment-Action	Operator should confirm proper closure of this valve (FCV-62) after shutdown. **Response:** See O&M Manual.
T0021-18-1	Comment-Action	Limit switch on valve (XV-40) closure should be proven upon shutdown. **Response:** See O&M Manual.

ACTION ITEM SUMMARY REPORT:
HAZARDS AND OPERABILITY (HAZOP) STUDY

HAZOP Items Not Addressed by WESTON

Item No.	Action or Comment Required	Item
T0030-17-1	Comment-Action	Operator should confirm closure of FCV-56 on shutdown. **Response:** See O&M Manual.
T0031-15-1	Comment-Action	Will line be identified as containing hot fluid and be adequately equipped to protect workers? **Response:** Yes.

ACTION ITEM SUMMARY REPORT:
HAZARDS AND OPERABILITY (HAZOP) STUDY

HAZOP Items Not Addressed by WESTON

Item No.	Action or Comment Required	Item
W0051-1-1	Comment-Action	Caustic delivery and unloading procedures are unavailable. We assumed that the unloading operator observes ruptures and initiates emergency procedures. **Response:** See O&M Manual.
W0051-1-1 (continued)		Caustic delivery and unloading procedures should be included in the HAZOP study. As soon as P&IDs and procedures are available, they should be provided to HAZOP team for review. **Response:** See O&M Manual.

ACTION ITEM SUMMARY REPORT:
HAZARDS AND OPERABILITY (HAZOP) STUDY

HAZOP Items Not Addressed by WESTON

Item No.		Item
W0001-6-1	Action	Contingency plan should be developed. **Response:** Failure to pump Basin F liquid due to changes in its composition through precipitation will be dealt with through the flushing arrangements that are available.
W0007-1-2	Audit Note	Need clarification of operation and control of venting system. **Response:** The nature of any vapors that may be emitted by the operation of the day tanks is unknown at this time. Additional details and refinements can be added to the venting system should the vapors prove to need control.

ACTION ITEM SUMMARY REPORT:
HAZARDS AND OPERABILITY (HAZOP) STUDY

Items Inadequately Addressed or That Require Additional Discussion

Item No.	Action or Comment Required	Item
W0001-6-1		Unable to locate right comment to WESTON response: **Response:** See page 4 of Audit Trail Summary Report.
W0008-9-1		Attachment not available to review. **Response:** KIC-209A and KIC-211A/B are discussed in the O&M Manual.
W0009-1-2		Provide P&ID revision number on change. **Response:** HV-416 will be shown normally open.

ACTION ITEM SUMMARY REPORT:
HAZARDS AND OPERABILITY (HAZOP) STUDY

Items Inadequately Addressed or That Require Additional Discussion

Item No.	Action or Comment Required	Item
W0003-1-3		**Revision to P&ID has not been verified to date.** **Response: The needed revision has not been issued as yet.**
W0003-1-4		Not adequately addressed, outside containment is the issue that needs response. **Response:** The contingency plan will address releases that escape containment.
T0003-1-1		WESTON needs to provide additional data on blower maintenance. **Response:** See the O&M Manual.

ACTION ITEM SUMMARY REPORT:
HAZARDS AND OPERABILITY (HAZOP) STUDY

Items Inadequately Addressed or That Require Additional Discussion

Item No.	Action or Comment Required	Item
T0001-10-1		Revision to P&ID has not been verified to date. **Response:** See Revision 10.
T0003-1-2		Provide additional detail on warning system. **Response:** See O&M Manual.
T0003-3-1		Revision to P&ID has not been verified to date. **Response:** See Revision 10.

ACTION ITEM SUMMARY REPORT:
HAZARDS AND OPERABILITY (HAZOP) STUDY

Items Inadequately Addressed or That Require Additional Discussion

Item No.	Action or Comment Required	Item
T0003-10-1		Available P&ID does not contain adequate data for review. **Response:** The tank is provided with vacuum breaks.
T0003-17-1		Provide additional data - NH_3 vapor monitoring and procedures on monitoring tanks. **Response:** See O&M Manual.
T0003-19-1		Revision to P&ID has not been verified to date. **Response:** See 17A ZSC/O on Revision 8.

ACTION ITEM SUMMARY REPORT:
HAZARDS AND OPERABILITY (HAZOP) STUDY

Items Inadequately Addressed or That Require Additional Discussion

Item No.	Action or Comment Required	Item
T0005-1-1		Revision to P&ID has not been verified to date. **Response:** See Revision 7.
T0006-1-4		Revision to P&ID has not been verified to date. **Response:** See Revision 7.
T0006-6-1		Revision to P&ID has not been verified to date. **Response:** See Revision 7.

ACTION ITEM SUMMARY REPORT:
HAZARDS AND OPERABILITY (HAZOP) STUDY

Items Inadequately Addressed or That Require Additional Discussion

Item No.	Action or Comment Required	Item
T0006-18-1		Provide additional data on safety measure in the PMCS software. **Response:** PMCS programming and factory acceptance testing are in progress.
T0008-2-1		Revision to P&ID has not been verified to date. **Response:** See O&M Manual.
T0008-18-1		Inadequately addressed, nozzle maintenance should be detailed. **Response:** See O&M Manual.

ACTION ITEM SUMMARY REPORT:
HAZARDS AND OPERABILITY (HAZOP) STUDY

Items Inadequately Addressed or That Require Additional Discussion

Item No.	Action or Comment Required	Item
T0010-15-1		Not adequately addressed, provide more detail on heater. **Response:** See attached heater selection calculations.
T0011-9-1		Not adequately addressed, boiler system not part of HAZOP study. **Response:** See O&M Manual.
T0014-19-1		Not adequately addressed, potential leaks are still a health and safety concern. **Response:** See O&M Manual.

ACTION ITEM SUMMARY REPORT:
HAZARDS AND OPERABILITY (HAZOP) STUDY

Items Inadequately Addressed or That Require Additional Discussion

Item No.	Action or Comment Required	Item
T0023-17-1		Revision to P&ID has not been verified to date. **Response:** The needed revision has not been issued as yet.
T0024-17-1		Revision to P&ID has not been verified to date. **Response:** See Revision 10.
T0027-1-1		Typo should be T0027-16-1 also T0030-16-1 should be T0030-15-2. **Response:** N/A.

ACTION ITEM SUMMARY REPORT:
HAZARDS AND OPERABILITY (HAZOP) STUDY

Items Inadequately Addressed or That Require Additional Discussion

Item No.	Action or Comment Required	Item
T0032-2-1		Revision to P&ID has not been verified to date. **Response:** See Revision 10.
T0032-18-1		Provide data: Should pumps 202A/B be on emergency power system? **Response:** The operation of the emergency power system is described in the O&M Manual. Cooling the combustion chamber with the emergency air blower and the atomizing air compressor has taken precedence over recirculating the brine via Pumps 202A/B and/or the quench tank via Pumps 205A/B. The operation of the emergency power system is described in the O&M Manual. Pumps 202A/B have not been included on the emergency power supply primarily because cooling the combustion chamber with the 15-hp emergency air blower B-201B and the 250-hp atomizing air blower C-201A was given precedence. The domestic water inlet can be used to cool the SQI downcomer without introducing another power load.

ACTION ITEM SUMMARY REPORT:
HAZARDS AND OPERABILITY (HAZOP) STUDY

Items Inadequately Addressed or That Require Additional Discussion

Item No.	Action or Comment Required	Item
T0033-1-2		Revision to P&ID, has not been verified to date. **Response:** See Revision 7.
T0033-6-1		Provide specific location for new check valve and revision number for P&ID change. **Response:** The needed revision has not been issued as yet.
T0033-17-1		Provide flow limit switch location. **Response:** See ZSL58 on sheet 4 of 6.

ACTION ITEM SUMMARY REPORT:
HAZARDS AND OPERABILITY (HAZOP) STUDY

Items Inadequately Addressed or That Require Additional Discussion

Item No.	Action or Comment Required	Item
T0033-17-2		Revision to P&ID has not been verified to date. **Response:** See Revision 10.
T0033-19-1		Revision to P&ID has not been verified to date. **Response:** See Revision 10.
T0034-1-2		WESTON is depending heavily on routine visual tank and line inspection to catch potential problems - may want to include other methods of inspection/protection. **Response:** None required.

ACTION ITEM SUMMARY REPORT:
HAZARDS AND OPERABILITY (HAZOP) STUDY

Items Inadequately Addressed or That Require Additional Discussion

Item No.	Action or Comment Required	Item
T0035-1-2		Not adequately addressed, potential release still remains a health and safety concern. **Response:** See O&M Manual.
T0035-18-1		Is there a revision/P&ID change for this? **Response:** Not at this time.
T0038-3-1		Not adequately addressed health and safety issue. **Response:** See O&M Manual.

ACTION ITEM SUMMARY REPORT:
HAZARDS AND OPERABILITY (HAZOP) STUDY

Items Inadequately Addressed or That Require Additional Discussion

Item No.	Action or Comment Required	Item
T0040-1-2		Not adequately addressed review action item. **Response:** See O&M Manual.
T0041-1-1		Is there a revision/P&ID change? **Response:** Not at this time.
T0041-4-1		Revision to P&ID has not been verified to date. **Response:** See O&M Manual interlock matrix.

ACTION ITEM SUMMARY REPORT:
HAZARDS AND OPERABILITY (HAZOP) STUDY

Items Inadequately Addressed or That Require Additional Discussion

Item No.	Action or Comment Required	Item
T0041-6-1		Revision to P&ID has not been verified to date. **Response:** The needed revision has not been issued as yet.
T0046-3-1		Mechanical P&ID were not reviewed in HAZOP study. **Response:** The locations and elevations of the sumps are shown on the mechanical layout drawings.
T0048-2-1		Not adequately addressed; sketches are not acceptable for HAZOP review. Provide final P&IDs for this action item. **Response:** Only sketches are available at this time.

ACTION ITEM SUMMARY REPORT:
HAZARDS AND OPERABILITY (HAZOP) STUDY

Items Inadequately Addressed or That Require Additional Discussion

Item No.	Action or Comment Required	Item
T0049-1-1		Unable to verify; WCC copy of matrix for interlocks is not current. **Response:** See O&M Manual.
T0050-8-1		Unable to verify; P&ID on tanks should be included in HAZOP - provide when available. **Response:** Sketches and P&IDs need to be revised.
T0050-9-1		See item T0049-1-1. **Response:** See O&M Manual.

ACTION ITEM SUMMARY REPORT:
HAZARDS AND OPERABILITY (HAZOP) STUDY

Items Inadequately Addressed or That Require Additional Discussion

Item No.	Action or Comment Required	Item
T0050-10-1		See item T0049-1-1. **Response:** See O&M Manual.
T0051-19-1		Provide more detail on "regular." **Response:** See O&M Manual.
W0054-1-1		New P&ID revision not verified to date. **Response:** The needed revision has not been issued as yet.

ACTION ITEM SUMMARY REPORT:
HAZARDS AND OPERABILITY (HAZOP) STUDY

Items Inadequately Addressed or That Require Additional Discussion

Item No.	Action or Comment Required	Item
W0056-20-1		New P&ID revision not verified to date. **Response:** See LIT-203.
W0058-9-1		Not adequately addressed, health and safety still and issue. **Response:** See O&M Manual.
W0058-20-1		See item T0049-1-1 - Provide current interlock matrix. **Response:** See O&M Manual.

Woodward-Clyde Consultants

Engineering & sciences applied to the earth & its environment

June 4, 1992

Mr. Ed Berry and Mr. Ben Wachob
Rocky Mountain Arsenal
Building B-111
Commerce City, CO 80022

Subject: Task Order No. 1, Basin F Liquid Disposal Design, System Safety Hazard Analysis, HAZOP Action Item Summary Report, Weston Responses
Contract DAAA15-D0022/0001

Dear Mr. Berry and Mr. Wachob:

On March 27, 1992, Woodward-Clyde Consultants issued a letter providing a list of HAZOP Action Items that still needed to be addressed by Weston. On May 15, 1992, Weston responded to this list. Many of the items can now be considered "closed". However, there are still many other items that remain "open' because they cannot be verified by the O&M manual or other project documents, which are still being prepared and not available for review. Listed below are the items from the March 27 list that still remain open.

A. Open Items that require review of the O&M manual to verify adequate response

1. T0001-19-1 Action: Periodic inspection and maintenance of lines should be included in O&M Manual. Proper lockout/tagout procedures should also be included.

   Audit Note: Is there a procedure for checking shutdown and safety interlocks on a periodic basis?

2. T0020-17-1 Comment-Action Item: Operator should confirm proper closure of this valve (FCV-62) after shutdown.

3. T0021-18-1 Comment-Action Item: Limit switch on valve (XV-40) closure should be proven upon shutdown.

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4. T0030-17-1 Comment-Action Item: Operator should confirm closure of FCV-56 on shutdown.

5. W0051-1-1 Comment-Action Item: Caustic delivery and unloading procedures are unavailable. Assume that unloading operator observes rupture and initiates emergency procedures.
Note: This has been partially responded to by Weston. However, discussion of emergency procedures has not been provided.

6. T0003-1-1: Weston needs to provide additional data on blower maintenance.

7. T0003-1-2: Provide additional detail on warning system.

8. T0003-17-1: Provide additional data - NH_3 vapor monitoring and procedures on monitoring tanks.

9. T0008-2-1: Revision change to P&ID, not verified to date.

10. T0008-18-1: Inadequately addressed, nozzle maintenance should be detailed.

11. T0011-9-1: Not adequately addressed, boiler system not part of HAZOP study.

12. T0014-19-1: Not adequately addressed, health and safety concerns.

13. T0035-1-2: Not adequately addressed, health and safety concern of release.

14. T0038-3-1: Not adequately addressed, health and safety issue.

15. T0040-1-2: Not adequately addressed, review action item.

16. T0051-19-1: Provide more detail on "regular"
Note: Not clear where this is discussed in the O&M manual excerpts provided by Weston.

17. W0058-9-1: Not adequately addressed, health and safety issue.

18. W0058-20-1: See item T0049-1-1 - Provide current interlock matrix to address the new/change interlock changes or additions.

B. Open Items that Require Review of Revised P&IDs

1. W0009-1-2: Provide P&ID revision number associated with change.
Note: Weston response says that HV-416 will be shown normally open. P&ID revision 4, which was provided with the Weston response, shows this valve normally closed.

2. W0003-1-3: P&ID revision change has not been verified to date.

3. T0008-2-1: Revision change to P&ID, not verified to date.

4. T0023-17-1: Revision change to P&ID, not verified to date.

5. T0033-6-1: Provide specific location for new check valve and revision number for P&ID change.

6. T0035-18-1: Is there a revision/P&ID change for this?

7. T0041-1-1: Is there a revision/P&ID change?

8. T0041-4-1: Revision change to P&ID, not verified to date.

9. T0041-6-1: Revision change to P&ID, not verified to date.

10. T0048-2-1: Not adequately addressed, sketches are not acceptable for HAZOP review. Provide final P&ID's for this action item.

11. T0050-8-1: Unable to verify, P&ID on tanks should be included in HAZOP - provide when available.

12. W0054-1-1: New P&ID revision change, not verified to date.

C. Items Remaining Open for Other Reasons

1. W0007-1-2: Audit Note: Need clarification of operating and control of venting system.
Note: This item refers to the lack of vacuum in the vent line resulting in loss of venting of the tanks.

2. W0003-1-4: Not adequately addressed, outside containment is the issue that needs response.
   Note: This item will be addressed in a contingency plan that is not currently available.

Woodward-Clyde is in the process of adding the responses to the study document. Items that can be closed based upon responses to action items or audit trail notes are being closed; items that still require additional responses per this action item summary report will remain open. The completion of the study should be final in the next few days.

Very truly yours,

JoAnn Tischler
Task Order 1 Manager

ESR:dlt

(1 copy sent)

1c: File 22206

Woodward-Clyde Consultants

Engineering & sciences applied to the earth & its environment

July 29, 1992

Mr. Ed Berry
Mr. Ben Wachob
Rocky Mountain Arsenal
Building B-111
Commerce City, CO 80022

SUBJECT: Task Order No. 1, Basin F Liquid Disposal Design, System Safety Hazard Analysis, Top Action Items Closeout
Contract DAA[illegible]022/0001
WCC Project No. [illegible]206A (T5100)

Dear Mr. Berry and Mr. Wachob:

On June 10, 1992, a meeting was held at the arsenal to discuss the remaining open HAZOP action items. These items are listed in Woodward-Clyde Consultants' (WCC) letter dated June 4, 1992. At that meeting, WCC was given a copy of the O&M Manual, dated May 1992. This manual was needed to close the "A" list of items in the June 4, 1992 letter.

Additionally, it was decided to send a WCC engineer to Weston's office in West Chester, Pennsylvania to review the latest P&ID revisions in order to close out the "B" items listed in the June 4, 1992 letter. It was also agreed that WCC would review the current P&IDs to verify that significant changes were not made since the time of the original HAZOP.

Finally, the "C" list of items from the June 4, 1992 letter were discussed at the meeting.

Based on our review of the O&M Manual and current P&IDs, the items listed in the June 4, 1992 letter can be considered closed. The following discussion summarized the rationale for this conclusion.

A. The items listed below were not closed in the June 4, 1992 update of the Action Item Summary Report because they were addressed in the O&M Manual, which was not available at that time. Review of the Revised Draft Manual (22 May 1992) provided by Weston indicates that these items can now be closed. Each

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item, along with a description of how it is addressed in the manual is presented below.

1. *T0001-19-1 Action: Periodic inspection and maintenance of lines should be included in O&M Manual. Proper lockout/tagout procedures should also be included.*

   Audit Note: Is there a procedure for checking shutdown and safety interlocks on a periodic basis?

Inspection and monitoring is discussed in Section 15.1.1 and 15.1.2 in very general terms.

Lockout procedures are included in Appendix E. The Daily Preventative Maintenance (Figure 5-2) checklist requires frequent checks for leaks in the natural gas piping system.

2. *T0020-17-1 Comment-Action Item: Operator should confirm proper closure of this valve (FCV-62) after shutdown.*

Assume this will be included in Step 8 on page 4-81. This section lists valves that must be closed upon system shutdown. Also functional check of FCV-62 on "As Required" basis is specified in the Daily Preventative Maintenance Checklist (page 5-45).

3. *T0021-18-1 Comment-Action Item: Limit switch on valve (SV-40) closure should be proven upon shutdown.*

Assume this valve will be listed in Step 8 on page 4-81 of the O&M Manual.

4. *T0030-17-1 Comment-Action Item: Operator should confirm closure of FCV-56 on shutdown.*

Assume this valve will be listed in Step 8 on page 4-81 of the O&M Manual.

5. *W0051-1-1 Comment-Action Item: Caustic delivery and unloading procedures are unavailable. Assume that unloading operator observes rupture and initiate emergency procedures.*
Note: This has been partially responded to by Weston. However, discussion of emergency procedures has not been provided.

Emergency procedures are addressed in Section 16 - Emergency Response and Contingency Plan. Additionally, Appendix N provides information on spill response techniques.

6. *T0003-1-1 Weston needs to provide additional data on blower maintenance.*

Preventative maintenance schedule provided in Table 5-2. Troubleshooting procedures for the blower are included in Section 6.3.

7. *T0003-1-2 Provide additional detail on warning system.*

This item refers to the need for adequate warning of loss of combustion air to the SQI burner. The Preventative Maintenance Schedule (Table 5-2) requires frequent checks of the inlet filter. Pressure indicator (PI-19) and switch (PSL-20) and flow indicator (FE-16) are also included.

8. *T0003-17-1 Provide additional data - NH_3 vapor monitoring and procedures on monitoring tanks.*

Monitoring for ammonia is discussed in Section 3.1.1, 17.3.2.2, and 17.4 of the O&M Manual.

9. *T0008-2-1 Revision change to P&ID, not verified to date.*

This item refers to adding a high flow alarm on the individual controllers (FIC-22 A/E) for waste feed to individual injectors.

Review of drawing 32-03-0713-D Sheet 2 - Revision 10 indicates this has been done (see FAH-22 A/E).

10. *T0008-18-1 Inadequately addressed, nozzle maintenance should be detailed.*

The Daily Preventative Maintenance Checklist and Preventative Maintenance Schedule - Table 5-2 address nozzle inspections. Nozzle cleanout system is discussed in Sections 2.18, 3.8.1.3 and 3.18.

11. *T0011-9-1 Not adequately addressed, boiler system not part of HAZOP study.*

Deviation alarm was added to FIT-76A - per drawing 32-03-713-D Sheet 2 - Revision 10. O&M Manual Section 2.13 includes information on the boiler, which is a pre-engineered package system. Troubleshooting information is provided in Section 6.5. This item can be closed, assuming operators will be adequately trained to operate and maintain this system.

12. *T0014-19-1 Not adequately addressed, health and safety concerns.*

This item refers to possible leaks from flanges, etc., at the SQI incinerator chamber. The Preventative Maintenance Schedule - Table 5-2 requires frequent checks of potential leakage sites.

13. *T0035-1-2 Not adequately addressed, health and safety concern of release.*

The Preventative Maintenance Schedule - Table 5-2 requires frequent checks for leaks in the Venturi recycle piping.

14. *T0038-3-1 Not adequately addressed, health and safety issue.*

This item refers to potential leakage in the interconnecting duct from the quench separator to the venturi. The Daily Preventative Maintenance Checklist - Table 5-2, page 5-42 requires frequent checks for leaks.

15. *T0040-1-2 Not adequately addressed, review action item.*

This item refers to a rupture in the scrubber recycle pump section line. Response is same as Item 14.

16. *T0051-19-1 Provide more detail on "regular"*

The Daily Preventative Maintenance Checklist requires inspection of the 50 percent caustic delivery line once a shift (page 5-11).

17. *W0058-9-1 Not adequately addressed, health and safety issue.*

This item refers to the periodic inspection of the liquid seals in SQI Day Tanks TK-105 and 106. The Daily Preventative Maintenance Checklist requires weekly inspection of the seals.

18. *W0058-20-1 See item T0049-1-1 Provide Current interlock matrix.*

Updated interlock matrix is provided as Table 3-1 in the O&M Manual. Brine loading permissive interlock number 80 has been added. Discussion is also provided in Section 3.12.1 of the manual.

B. Items that Require Review of Revised P&IDs.

The 12 items on the June 4, 1992 list have been revisited. Recommended changes from HAZOP have been checked against the latest revision of drawings. If changes had not been made or if an adequate response was not given, the change was marked on the drawing. The drawings were in the process of being revised. This next revision was to accommodate the changes. WC has not seen these revised drawings as of this

letter. The following indicates which items are closed and those that are supposed to be closed after the next revisions to the drawings.

Additionally, review of the current P&ID drawings indicates that no significant process modifications have been made since the original HAZOP. Drawing revisions have been due to:

- changes to incorporate HAZOP comments
- addition of valve numbers, etc.
- revised line sizes and material numbers
- miscellaneous

1. W0009-1-2: Provide P&ID revision number associated with change. Note: Weston response says the HV-416 will be shown normally open. P&ID revision 4, which was provided with the Weston response, shows this valve normally closed.

This change was not made as of this review. Weston Drawing No. 03-04-009 Revision 5 was marked up to revise HV-416 to show normally open.

2. W0003-1-3: P&ID revision change has not been verified to date.

No remote pressure indication will be added to Weston Drawing No. 02-04-002 Revision 5. A comment was made to add a differential pressure with remote alarm to MCR.

3. T0008-2-1: Revision change to P&ID, not verified to date.

Local and remote alarm (FSH-22 (A-E) and FAH-22 (A-E) was added to T-Thermal Drawing No. 32-03-713, SH2/6, Revision 10. A comment was made on T-Thermal Drawing No. 32-03-713D, Sheet 2 of 6, Revision 10, dated 4/8/92, that a reference to Note C on Sheet 1 be added to alert that it is typical for B through E.

4. T0023-17-1: Revision change to P&ID, not verified to date.

T-Thermal Drawing No. 32-03-713D Sheet 3 of 6, Revision 10, dated 4/8/92, shows that FCV-48 still fails open. This item needs to be incorporated into the next revision.

5. T0033-6-1: Provide specific location for new check valve and revision number for P&ID change.

Weston Drawing No. 03-04-015, Revision 4, dated 6/16/92, shows check valve CK 417 has been added before the split to TK-201/202 (prior to HV418) Line 2"-BR-313-H-K from quench recycle (Drawing 32-03-713, Sheet 4) has a check valve added (no number ID) prior to HV423.

6. T0035-18-1: Is there a revision/ P&ID change for this?

T-Thermal Drawing No. 32-03-713 D, Sheet 4 of 6, Revision 10, dated 4/8/92, shows FCV-60 labeled as FO to fail open. Philosophy is to fail open on recycle.

7. T0041-1-1: Is there a revision/P&ID change?

T-Thermal Drawing No. 32-03-713 D, Sheet 5 of 6 Revision 10, dated 4/8/92, shows FCV-65 labeled as FO for fail open. Same philosophy as for FCV-60.

8. T0041-40-1: Revision change to P&ID, not verified to date.

T-Thermal Drawing NO. 32-03-713 D Sheet 5 of 6, Revision 10, dated 4/8/92, contains a comment that says a connection is needed between FSL65 and AIC56. The PLC

should contain logic to say if low flow is seen in FY65 then should turn off waste and caustic. Revisions to P&ID need to be verified.

9. T0041-6-1: Revision change to P&ID, not verified to date.

T-Thermal Drawing No. 32-03-713 D, Sheet 5 of 6 Revision 10, dated 4/8/92, shows check valve 342 has been added to the caustic line (1½ -XB-320-H-R) prior to its intersection with line 4-BR-503-H-K.

10. T0048-2-1: Not adequately addressed, sketches are not acceptable for HAZOP review. Provide final P&ID's for this action item.

Weston Drawing No. 03-04-015, Revision 4, dated 6/16/92 shows valves COV-84E with interlock 31 and COV 84F with interlock 30 have been added. Brine loading into truck won't occur without meeting loading permissives.

11. T0050-8-1: Unable to verify, P&ID on tanks should be included in HAZOP - provide when available.

Weston Drawing No. 03-04-015, Revision 4, dated 6/16/92, shows the tanks are closed top with vents.

12. W0054-1-1: New P&ID revision change, not verified to date.

Weston Drawing No. 03-04-009, Revision 5, dated 6/17/92, still shows FCV-211 and FCV-209 to fail open. A comment has been made on the drawing to change their designation to fail close.

C. Items Open for Other Revisions

1. *W0007-1-2 Audit Note: Need clarifications of operating and control of venting system.*

   Note: This item refers to the lack of vacuum in the vent line resulting in loss of venting of the tanks.

Weston has addressed this to a limited extent in Appendix B - Site Safety and Health Plan - Section 17 (Air Sampling/Monitoring Plan). Additionally, the Preventative Maintenance Schedule - Table 5-2 requires that day tank pressure be checked once a shift and the conservation vents be checked daily.

2. *W0003-1-4 Not adequately addressed, outside containment is the issue that needs response.*

   Note: This item will be addressed in a contingency plan that is not currently available.

Appendix B of the O&M Manual includes an Emergency Response and Contingency Plan (Section 16) that addresses leaks and spills. Additionally, Section 15 of Appendix B includes a Spill Prevention/Containment Plan.

Based on the above discussion, all of the action items listed in the June 4, 1992 letter have been sufficiently responded to by Weston.

Very truly yours,

WOODWARD-CLYDE CONSULTANTS

JoAnn Tischler
Task Order 1 Manager

JAT:sdw

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