FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS (FMECA)

OF THE WEST VALLEY NUCLEAR S VICES

SUPERNATANT TREATMENT SYSTER AND

THE CEMENT SOLIDIFICATION SYSTEM

DECEMBER 1987

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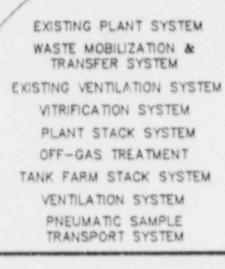
#### 1.0 SCOPE

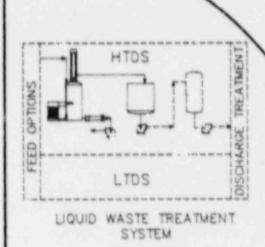
The scope of this task was to provide a reliability analysis of two major systems in the Radwaste Treatment System at the West Valley Demonstration Project: the Supernatant Treatment System (STS) and the Cement Solidification System (CSS) (Figure 1). The purpose of this analysis was to provide assurance that these systems are designed for safe operation during the supernatant processing phase of the project. The analysis was not intended to predict overall availability of the systems. The study, completed by Westinghouse Hanford Company (WHC), evaluated the major components located in the steady state main process flow stream of the STS and CSS (through the drum filling operation only) as shown in Figures 2 and 3. Drum handling before and after filling was not to be included in the analysis. Major components include tanks, pumps, heat exchangers, main stream remotely operated valves, and special equipment such as drum filling equipment; the specific components addressed are identified in Appendix A. analysis (Appendix B) did not address common cause failures and evaluated single failures only, i.e. failure of one component at a time. The analysis addressed the system design as specified in the documents listed in Appendix C and assumed the systems were constructed per those documents. Furthermore, the analysis assumed the operating procedures were current and correct, and the systems will be operated in accordance with these procedures.

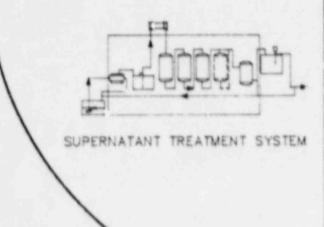
#### 2.0 OBJECTIVE

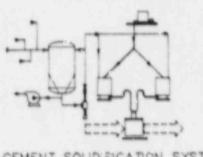
The objective of this analysis was to complete a systematic evaluation of postulated component failures, with the goal of providing confidence that the systems were designed for safe operation. The analytical method chosen for this task was a qualitative Failure Mode, Effects and Criticality Analysis (FMECA) which identifies the effects of postulated failures and provides judgement by the analyst regarding the severity and relative probability of occurrence of the postulated failure.

# RADWASTE AND HIGH LEVEL WASTE TREATMENT SYSTEMS



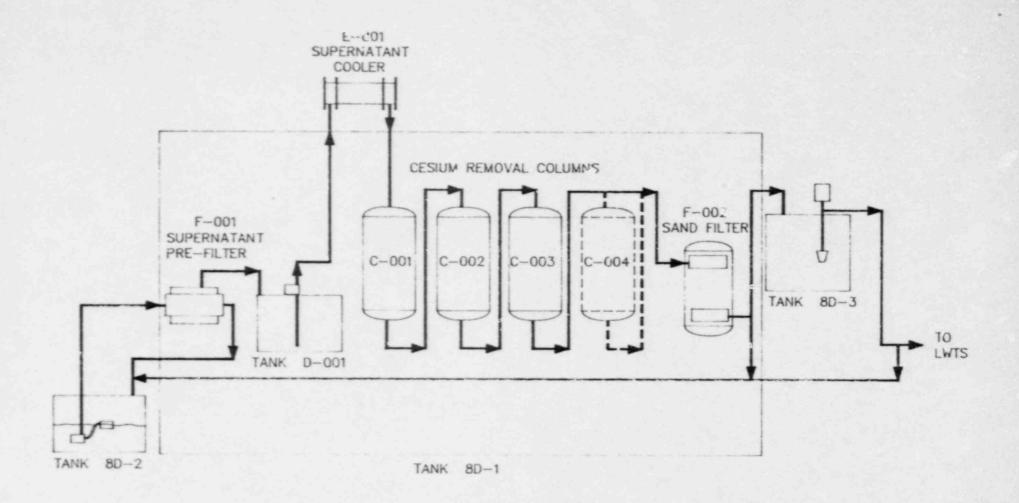






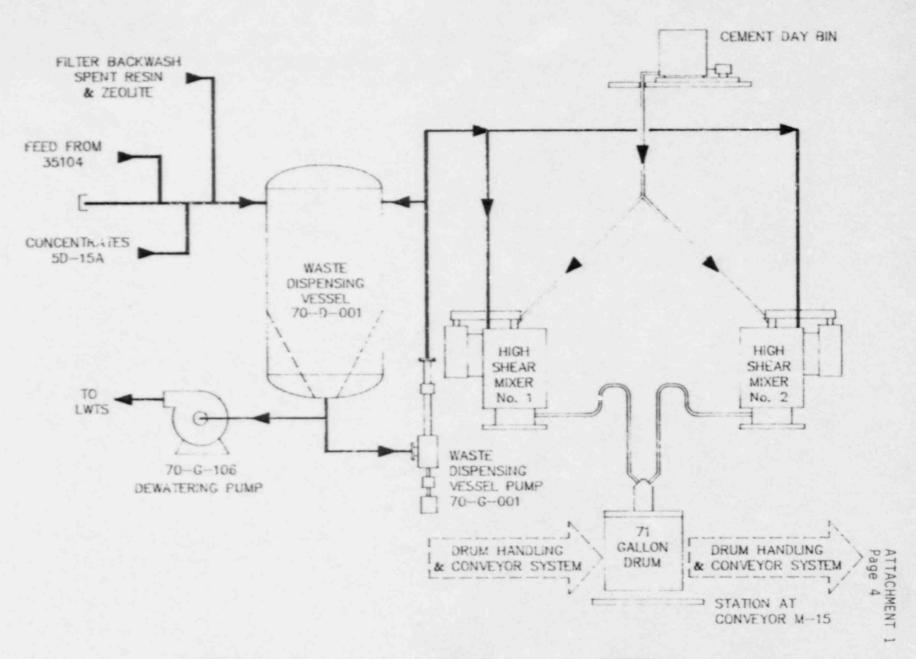
CEMENT SOLIDIFICATION SYSTEM

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ATTACHMENT Page 3

SUPERNATANT TREATMENT SYSTEM



CEMENT SOLIDIFICATION SYSTEM

#### 3.0 SUMMARY

Eighty-nine components were analyzed in the STS and 57 in the CSS. The number of failure modes postulated for the STS was 261 and 171 for the CSS.

Failures designated as "Class 1" (major severity combined with a high relative probability of occurrence) are of greatest concern. Failure definitions are shown in Table 1.

The number of failures that fall within the various categories of failure severity, including the number that fall within the various ranges of failure probability are shown in Table 2.

All postulated failures are identified in the worksheets of Appendix B; those judged to be of greater significance are summarized in Section 7.0. Also discussed in Section 7.0 are observations related to safety and reliability that were noted during the analysis, but were outside the specific work scope identified in Section 1.0. Recommendations for improvements in reliability and safety are included in Section 7.0 for information.

Although there are actions that should be taken to provide a safer and more reliable system, this independent analysis provides additional confidence that the STS and CSS are designed such that they can be operated safely.

		RELATIVE PROBABILITY OF FAILURE		
		LOW	MODERATE B	HIGH
SEVERITY OF FAILURE	MINOR III	CLASS		
	MEDIUM	3		CLASS 2
	MĀJOR I		CLASS 2	CLASS

#### SEVERITY

III MINOR:

RESULTS IN NO UNPLANNED PERSONNEL EXPOSURE AND OPERATIONS MAY

CONTINUE

II MEDIUM:

a) RESULTS IN AN UNPLANNED RELEASE OF CONTAMINATION TO A NORMALLY INACCESSIBLE AREA

RESULTS IN AN OPERATING OUTAGE OF LESS THAN 48 HOURS b)

I MAJOR:

a) RESULTS IN A RELEASE OF CONTAMINATION TO AN OPERATING AREA

b) RESULTS IN AN OPERATING OUTAGE OF GREATER THAN 48 HOURS

#### PROBABILITY

C. LOW:

HIGHLY UNLIKELY TO OCCUR DURING 2 YEAR PLANT MISSION

B. MODERATE: OCCURRENCE IS POSSIBLE BUT NOT LIKELY DURING 2 YEAR PLANT

MISSION

A. HIGH:

LIKELY TO OCCUR DURING 2 YEAR PLANT MISSION

TABLE 1 DEFINITIONS OF FAILURE PROBABILITY. SEVERITY AND CLASSIFICATION

#### NUMBER OF POSTULATED FAILURES FAILURE SEVERITY CSS COMBINED STS I (Major) II (Modium) III (Miner) RELATIVE PROBABILITY A (High) B (Moderate) C (Low) FAILURE CLASS

TABLE 2

FAILURE MODE, EFFECTS AND CRITICALITY ANALYSIS

POSTULATED FAILURE SUMMARY

#### 4.0 SYSTEM FUNCTION

### 4.1 Supernatant Treatment System (STS)

The function of the STS is to remove high level waste supernatant from the 8D-2 storage tank in the West Valley Radwaste Treatment System and extract Cesium-137 from the supernatant to a level that permits supernatant solidification and storage as low level waste. The STS utilizes a zeolite ion exchange process to separate cesium from the other constituents in the supernatant.

#### 4.2 Cement Solidification System (CSS)

The primary function of the CSS, during supernatant processing, is to immobilize the processed supernatant coming from the Liquid Waste Treatment System (LWTS) and package it into drums for storage in the Drum Cell. Materials handling is accomplished remotely and includes handling of empty and filled drums, and loading the drums onto vehicles for local shipment to the Drum Cell. Drum handling and ancillary functions, such as cement storage, were not to be addressed in this reliability analysis.

#### 5.0 SYSTEM AND PROCESS DESCRIPTION

#### 5.1 Supernatant Treatment System (STS)

Figure 2 provides a block diagram showing the main process flow in the STS. The system uses an ion exchange process with a cesium-specific zeolite contained in four separate ion exchange columns to remove cesium from the supernatant. The zeolite columns are suspended in Tank 8D-1.

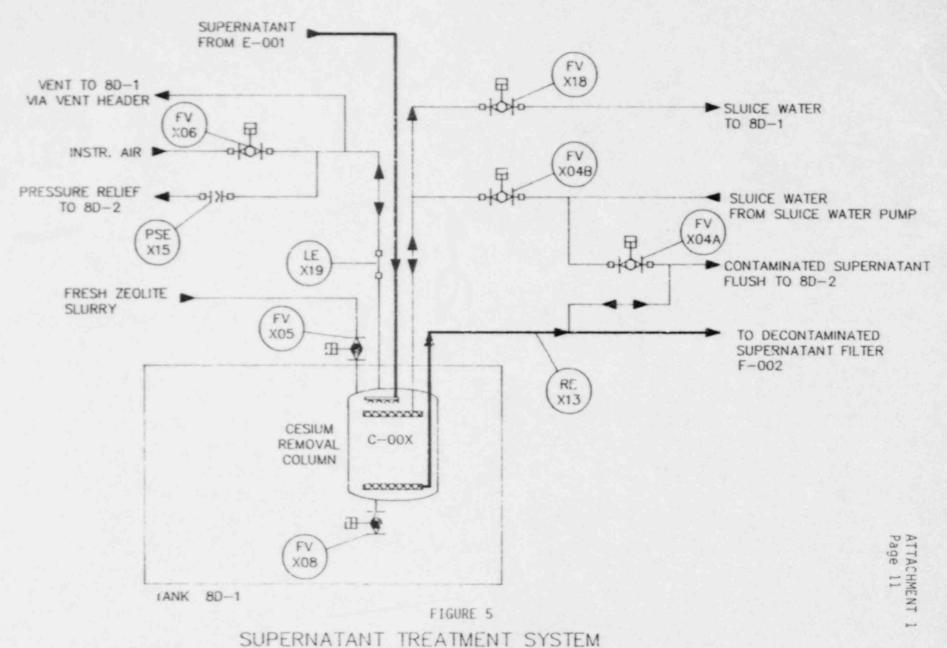
The system description can be followed on Figure 4 which includes all of the evaluated components up to the ion exchange columns. The supernatant is pumped from the high level storage tank (8D-2) and transferred via triple-contained piping to a pre-filter (F-001). This filtration prevents contamination of the zeolite by sludge particles suspended in the supernatant. The filtered supernatant is fed to an intermediate collection and feed tank (D-001) which provides about five hours of hold-up. Supernatant ready for ion exchange is then pumped through a cooler to ensure more effective cesium removal in the ion exchange columns. The supernatant is then directed to the first of three ion exchange columns arranged in series.

Figure 5 details the evaluated components and support systems for each ion exchange column. Processing is effected by down-flow through a six-foot zeolite bed in each column. Three successive columns are on line at all times; the fourth is off line undergoing rinse, backflush, sluice-out, zeolite replacement, or standby. Continuous on-stream radioactivity monitoring of the process supplements quantitative analytical sampling to detect column exhaustion and ensures that an appropriate process decontamination factor is achieved. Decontaminated supernatant exiting the third column in the series is passed through a sand filter (F-002) to remove zeolite fines which could contaminate the down stream process.

FIGURE 4

SUPERNATANT TREATMENT SYSTEM FILTRATION AND COOLING SECTION FLOW DIAGRAM ATTACHMENT :

ACAD: STS2 12-4-87



ION EXCHANGE SECTION

(TYPICAL 4 PLACES)

ACAD: STS5 12-1-87 Figure 6 depicts the actual evaluated components downstream of the ion exchange column. Filtered and decontaminated supernatant flows to a 15,000 gallon underground storage tank (8D-3) which serves as an intermediate collection and sampling tank prior to transfer to the Liquid Waste Treatment System. From 8D-3, the process fluid is pumped to the LWTS Tank 35104. A recycle line is provided back to Tank 8D-2 to enable reprocessing if required.

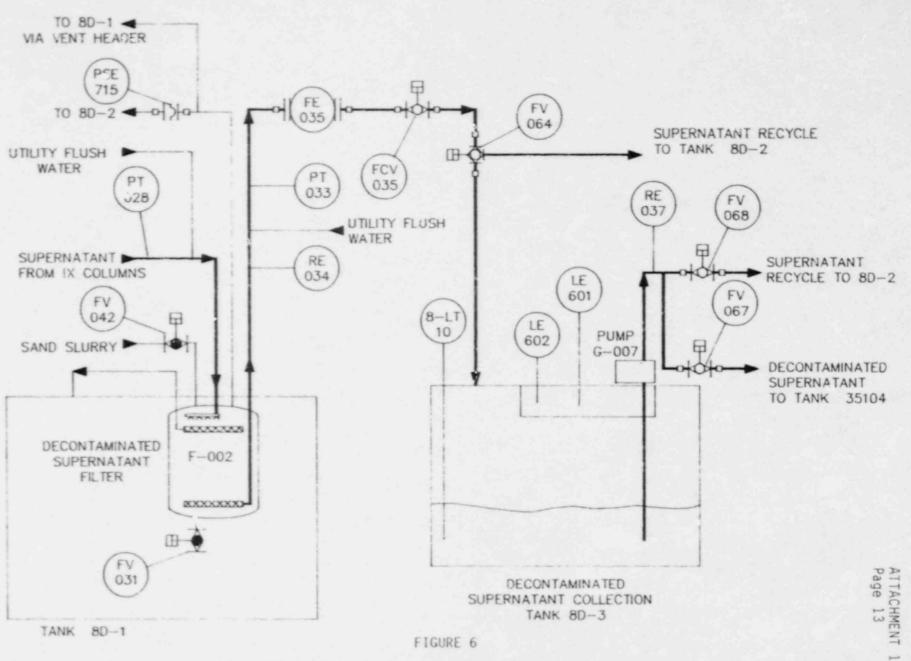
Spent zeolite and sand filter media are removed when required and discharged to and stored at the bottom of Tank 8D-1 for subsequent delivery to the Vitrification System.

Fresh zeolite is fed to the columns in the form of a slurry. Dry zeolite (from drums) is transferred to a water filled batch tank and backwashed to remove fines. After fines are removed, fresh zeolite is charged into the ion exchange columns as a water slurry.

Other support services required for STS operation include instrument air for the filter blowback (F-001) and sluice water for the ion exchange columns and sand filter (F-002).

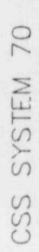
### 5.2 Cement Solidification System (CSS)

Figure 3 provides a block diagram showing the main process in the CSS. Supernatant concentrate is pumped from the LWTS to the Waste Dispensing Vessel (WDV) (70-D-001) in the CSS. The waste liquid is collected and stored here before mixing with cement. Figure 7 shows the process of feed delivery to the WDV. The Waste Dispensing Vessel Pump pumps the liquid waste slurry in batch quantities from the vessel into the High Shear Mixers. Recirculating the liquid back to the Waste Dispensing Vessel maintains homogeneity of the slurry. The slurry is fed into "e upper portion of the High Shear Mixers where it mixes with Portland cement in accordance with a predetermined recipe.



SUPERNATANT TREATMENT SYSTEM FINAL FILTRATION & STORAGE FLOW DIAGRAM

ACAD: STS4 12-3-87





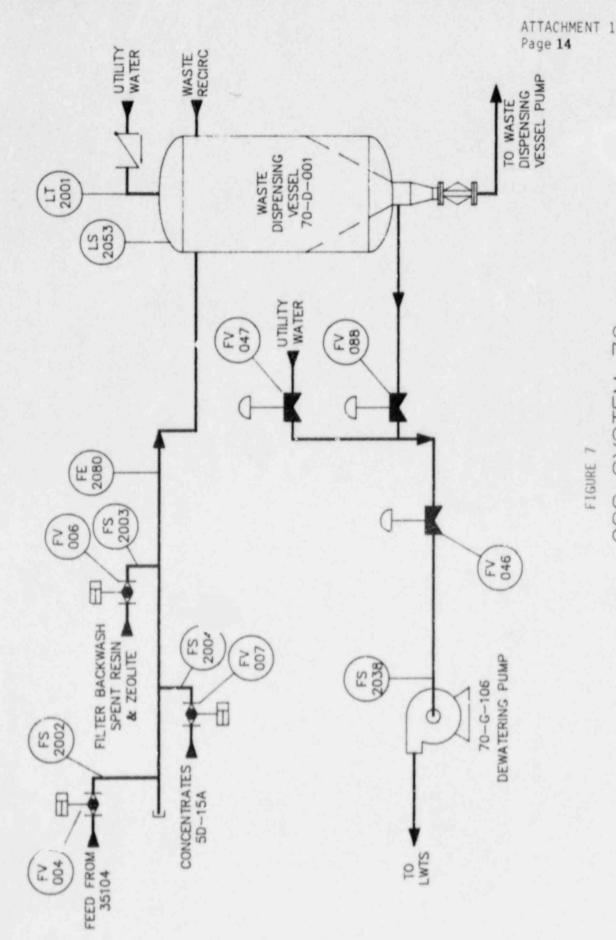
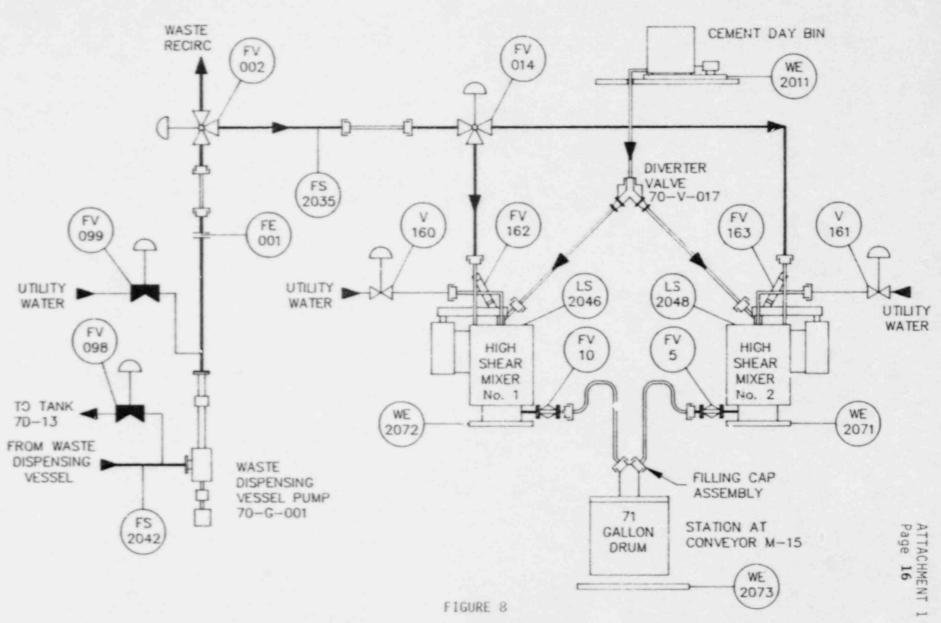


Figure 8 shows how the waste and cement is added to the mixers. The Cement Metering Subsystem consists of a cement day bin and feeder which dispenses metered amounts of dry cement into the High Shear Mixers via a diverter valve. The discharge rate is controlled based on the cement loss from the bin; as the cement feeds down into the mixer, the resulting decrease in weight is monitored by the control system.

The Cement Feed Diverter Valve alternately directs the cement into the two High Shear Mixers. The mixers provide the mechanical action to ensure adequate mixing of the waste slurry and cement. Additives can be introduced to adjust mixture setting time or the chemistry of the liquid wastes upstream of the mixers. Using the discharge head developed by a rotating blade in the mixer, the mixture batch (containing approximately 22 gallons of waste) is discharged through a special fill head and into a drum. Two mixer batches are placed into each drum. The fill head is designed to descend into the drum and seal the opening to prevent spillage of radioactive material. The fill head includes an internal vent that is normally vented to the process room. After each mixer completes its fill cycle, flush water is introduced into the mixer through spray nozzles which flush the top and side walls of the mixer to remove any residual material. This flush water becomes a part of the recipe for the next cycle and the process is repeated until the Waste Dispensing Vessel is emptied.



CSS CEMENT SOLIDIFICATION SYSTEM

ACAD: CSS2 11-23-87

#### 6.0 APPROACH AND ASSUMPTIONS

#### 6.1 Approach

The approach to this task was as follows:

- The scope of work and objective were developed in conjunction with WVNS.
- 2. The team leaders selected for each system travelled to West Valley where they received technical briefings. The briefings included review of system drawings, discussions with the system cognizant engineers, and inspection of the mechanical equipment and control systems.
- The documentation listed in Appendix C was used as the basis for the FMECA analyses.
- 4. In an effort to assure an accurate evaluation by Westinghouse Hanford Company (WHC) of the failure effects and to keep WVNS apprised of the results of the analysis, it was mutually agreed that WHC would transmit the FMECA worksheets on a daily basis for in-process review and comment by WVNS. It was also agreed that WVNS would return any comments to WHC within one day.
- 5. The definitions of failure probability, severity and classification, listed in Table 1, were developed jointly by WHC and WVNS prior to preparation of the FMECA worksheets.
- The FMECA was conducted using the general guidelines of MIL-STD-1629A.

7. The results of the analysis were summarized in a draft report and transmitted to WVNS for review and comment prior to issuing the final report.

#### 6.2 Basis for Analysis

The basis and assumptions applicable to the FMECA are as follows:

- The documents listed in Appendix C were assumed to be current and correct for use in the analysis.
- The support systems listed in Appendix A were treated as a "black box"; their discrete components were not examined individually.
- Only steady state conditions were considered; startup and shutdown operating modes were not to be included in the scope of this task.
- 4. The components addressed are those containing or monitoring supernatant flow during normal processing from storage tank 8D-2 through encapsulation in the CSS. Those components which are in support systems and those which are included in ancillary systems used for bypass, return flow, sampling, etc. were not considered. The specific components addressed in this analysis are listed in Appendix A under four categories: Mechanical Equipment, Valves, Instruments, and Support Systems.
- 5. The analysis of the CSS assumed that system operation is in automatic mode with the Programmable Logic Control er (PLC) and Data Acquisition System (DAS) fully operational, operating correctly and providing proper alarms. It was also assumed that if manual recovery was necessary, the proper corrective action would be taken by operations personnel.

- 6. In the STS, three of the STS ion exchange columns were evaluated as though they were in normal serial process flow. The fourth column was evaluated under standby conditions and under the zeolite replacement mode. The zeolite replacement mode was assumed to occur immediately following 95% resin breakthrough. Resin replacement is comprised of five rather distinct steps that include: 1) air purge that forces supernatant fluid from the column back to Tank 8D-2, 2) fill and rinse of column zeolite with sluice water, 3) backwash of the column zeolite that fluffs the zeolite in the column to a 50% greater volume, 4) sluicing of the fluidized zeolite out the bottom of the column into Tank 8D-1, and 5) loading of fresh zeolite into the column.
- 7. In the STS, the prefilter (F-001) was evaluated in both normal process flow and in the blowback condition. The sand filter (F-002) was evaluated in steps similar to the ion exchange columns, as well as normal process flow.

#### 7.0 FMECA FINDINGS AND OBSERVATIONS WITH RECOMMENDATIONS

The results of the analysis are shown in the FMECA worksheets in Appendix B. Worksheets number 50-1 through 50-65 address the STS. Worksheets number 70-1 through 70-41 address the CSS. Two hundred sixty-one postulated failures (failure modes) were analyzed for the STS and 171 postulated failures were analyzed for the CSS. A summary of the number of postulated failures that fall into the various categories of "failure severity", "relative probability", and "failure class" is shown in Table 2 (Section 3.0).

The majority of postulated failures are of minor severity and have a low probability of failure. Although the consequences of the majority of these failures may not be significant, they have the potential for decreasing system availability. Therefore, all postulated failures and their effects, which are identified in Appendix B, should be thoroughly reviewed in an attempt to reduce the possibility of these failures or mitigate their effect.

Section 7.1 discusses postulated failure modes which are considered to be significant enough to be discussed in further detail. Where appropriate, recommendations are provided.

In addition to the discussions of selected failure modes, a number of observations regarding safety and reliability of the STS and CSS are made that are significant but are not related to single failures of the components listed in Appendix A. These are discussed briefly in Section 7.2.

### 7.1 FMECA Findings of Greater Significance

#### 7.1.1 STS

Section 7.1.1.1 is a discussion of the failure modes that resulted in Class 1 failures (major severity combined with a high relative probability of failure). Section 7.1.1.2 is a discussion of the more significant Class 2 failures. All failure modes are discussed in the worksheets contained in Appendix B. Sections 7.1.1.1 and 7.1.1.2 also contain recommended actions for providing a safer and more reliable system.

#### 7.1.1.1 Class I Failures

The FMECA completed on the STS has identified three failure modes that could result in an extended operating outage requiring manned entry (personnel exposure) to repair the system. A detailed discussion of these failure modes is presented below with the 50-XXX number referring to the corresponding Appendix B worksheets.

#### 50-023 Prefilter Back Flushing

The 1 micron sintered metal filter medium is highly susceptible to plugging. In addition, successful blowback sequence completion requires careful operator attention and interpretation of system conditions and the collective reliability of numerous components. The blowback and system stabilization cycle duration takes approximately 15 minutes to complete. Additional blowback cycles must be operator initiated if flow/pressure parameters are not within operating limits. These conditions add to the difficulty of maintaining the filters in an acceptable "unplugged" condition.

Recommendation: Test actual supernatant containing sediments in a small scale test model. Evaluate the use of larger media orifice size if possible. Consider purchase of spare filter elements and provide a verified replacement procedure prior to hot startup.

### 50-518 Ion Exchange Column Resin Dump Valve Failure

The reliability of the Zeolite column dump valves is critical to STS operation. The Tank 8D-1 environment, to which the valves are exposed, is considered severe. Since the valve is inaccessible for maintenance or repair, any malfunction has the potential for serious system impact.

Recommendation: Review the valve, valve operator and support hardware to assure maximum service life. Factors to consider are: 1) optimum operating air pressure, 2) lubricants in the air, 3) air moisture and foreign debris, 4) valve and valve operator materials, 5) most desirable failure position, 6) visual access to valve operation. Alternate methods of resin removal should also be investigated to the extent that procedures have been developed and verified.

### 50-892 Heat Exchanger Pressurization

Because the E-001 heat exchanger has no pressure relief on the shell side, there is a potential for overpressurization especially if the vessel were isolated with cool brine in the shell and allowed to warm.

Recommendation: Review the "as built" configuration to verify vessel and tube integrity under all probable operating conditions. If overstressing potential is found to exist, a pressure relief modification is recommended. Administrative

control over operating conditions may suffice if this modification cannot be made.

### 7.1.1.2 Other Failures

#### 50-041 Heat Exchanger Tube Failure

Upon tube failure in E-001, particularly a small leak, brine fluid could be pumped into the supernatant stream without detection until the brine pump/pressurizer failed to maintain sufficient differential pressure (DP) across the tubes. At that point significant quantities of brine solution would have entered the supernatant. The loss of DP would alarm but no interlocks would be effected, i.e. the brine pump would continue to operate while G-002 would continue to pressurize the tube side.

Recommendation: Consider the addition of level alarm capability to the brine expansion tank. It would verify the intrusion of brine into the process or the loss of brine from the secondary side. Neither condition is directly detectable with instrumentation indicated on drawings. Evaluate the need to provide additional interlocks to shut down G-002 when this failure occurs.

### 50-490 Off-line Column Rupture Disc Failure

Loss of a column rupture disc during the refill mode will result in curtailment of resin replacement and the migration of resin to 8D-2. Conversations with WVNS personnel indicated that a rupture disc failure had occurred during cold tests.

<u>Recommendation</u>: These failures should be reviewed to assure that their causes are not related to system pressure transients, hydraulic shock or improper sizing. All disc failures should be fully evaluated.

#### 50-570 Flow Control Valve Failure

FCV-035 is the prime control element in the resin column flow stream. Without alternate routings for decontaminated supernatant, failure of this control element would suspend processing.

Recommendation: Reassess the relicality of this control valve and establish a spare replace in the valve isle for use in event of valve failure.

#### 50-330, 380, 470 On-line Column Rupture Disc Failure

Loss of the rupture disc for an on-line resin column will result in the process shut-down and the return of supernatant to tank 8D-2. Rupture disc reliability and the ability to identify rupture disc failures are important. Conversations with WVNS personnel indicate that there was a system disc failure during cold testing.

Recommendation: The cold test rupture disc failure should be reviewed to assure that the cause is not related to system pressure transients, hydraulic shock or improper sizing. Any disc failure during cold testing should be fully evaluated. The design should be reviewed to verify that all operating conditions have been considered (including warmup of ion exchange vessels C-001, 2, 3, and 4).

#### 7.1.2 CSS

Figures 7 and 8 show the major CSS components addressed in the FMECA. The figures show all the equipment, valves, instruments and support systems evaluated. Section 7.1.2.1 is a discussion of the failure modes that resulted in Class 1 failures (major severity combined with a high relative probability of failure). Section 7.1.2.2 is a discussion of the failure modes that resulted in Class 2 failures. All failure modes are discussed in the

worksheets contained in Appendix B. Sections 7.1.2.1 and 7.1.2.2 also contain recommended actions for providing a safer and more reliable system.

#### 7.1.2.1 Class I Failures

The FMECA completed on the CSS has identified four failure modes that could result in an extended operating outage requiring manned entry (personnel exposure) to repair the system. A detailed discussion of these failure modes is presented below with the 70-XXX number referring to the corresponding Appendix B worksheets.

#### 70-053 WDV Discharge Line Plugging

Since the Waste Dispensing Vessel will be needed to process both liquid (concentrates 5D-15A) and solids (spent resin and zeolite), flushing of the main process lines using pressurized water is necessary to prevent plugging with solids. The section of piping between the WDV and the WDV pump has no pressurized flushing capability. Since this line has a high potential for plugging with solids, the capability to flush this line is mandatory.

Recommendation: Add capability to flush this section of line from the WDV pump back to the WDV.

70-361, 70-371 Mixer Discharge Valves, FV-5 and FV-10 Failure FV-5 and FV-10 operate on air pressure with pressure required to close the valve. At times, failed closed is appropriate and at other times failed open is appropriate. Based on the control system operation of the air supply solenoid valves, a solenoid valve failure prevents the depressurization of FV-5 and FV-10 causing the valves to fail closed. Valve failure in the closed position would prevent mixer discharge while valve failure in the open position could potentially cause a mixer to discharge without a drum in position.

Recommendation: The system should remain as designed, however, an emergency method to manually depressurize these valves should be provided to allow opening the valves. Appropriate controls should be established to insure correct use of the method established.

#### 70-646 Failure of the HSCSS/DAS Control System

SOP-70-11 provides a means of operating the CSS with the Programmable Logic Controller (PLC) inoperative. Operation of the entire system can be performed in this manual mode. With the PLC inoperative, the 15 system alarms and the 8 DAS alarms are not functional. Therefore, manual operation of the system in this condition is not recommended. Operation of the system in manual with the PLC inoperative should only allow dumping a mixer after cement addition has been started to place the system in a safe shutdown condition. All other operations should be precluded.

Recommendation: With the HSCSS/DAS system providing all the control operations of the CSS, sufficient redundancy of the HSCSS/DAS control system should be provided to assure continued operation of the system. SOP-70-11 should be revised to allow only mixer dumping in manual mode without PLC being operational. Readily available spare components for PLC and DAS should be provided.

# 7.1.2.2 Other Failures

### 70-002 High Cement Feed

If too much cement is added, potential exists that a low water/cement ratio could cause cement setup in mixer.

Recommendation: Modify the HSCSS/DAS to limit the amount of time that the cement feeder may operate to ensure that excessive amounts of cement cannot be added.

### 70-027 Johnson Screen Plugging (WDV)

During handling of solids, the Johnson screen could plug, preventing further dewatering. Backflush of Johnson screens may then be required.

<u>Recommendation:</u> A procedure should be identified for backflushing of the screens.

### 70-079, 70-104 Mixer 1 and 2 Drainage

Detection of an accumulation of cement in the discharge line from mixers to drum, or within a mixer cannot be made.

Recommendation: Use the DAS to monitor changes in the tare weight of mixer and if this weight varies by more than 10-20%, flushing should be initiated and/or preparations made to replace the mixer.

The open or partially open failure of the FV-5 and FV-10 pinch valves causes the CSS process to be unable to continue. The likelihood of a pinch valve failing due to clogging appears to have a high probability in the projected two-year operation of the CSS. The valves being located horizontally have the potential to allow cement to remain in the valves. The downtime to fix, flush, or replace the valve should not be extensive if the parts are readily available. However, if the failure occurs during a batch cycle, the waste may empty to the drum before the addition of cement. If the valve failed during mixing, this would result in a premature mixture dump of cement into the drum.

<u>Recommendation</u>: Adequate spare parts or spare valves should be available.

#### 70-393, 70-394 Cement Diverter Valve

If the cement diverter valve is stuck partially open to one mixer or closed to both mixers, the program cannot continue. If waste/cement is in one mixer, then that mix cycle can be finished, but significant downtime may occur to fix or replace the cement diverter valve before the entire process can continue. This valve was projected to have a high failure probability because it has two cylinders, four limit switches, and interconnecting linkages associated with its operation.

<u>Recommendation</u>: Have available spares or spare valve to install as required.

#### 70-541, 70-551 Mixer Overfill Level Switches

The high level switch in each mixer is projected to fail indicating an overflow condition if the probe should become severely crusted with mixer residue. This will cause some downtime and is likely to happen in the two-year operation of the system. Failure of the switches will shut off the WDV pump and prevent the pump from running until the switches are repaired.

Recommendation: Some method of frequent cleaning of the level probe should be devised.

#### 7.2 General Observations

#### 7.2.1 STS

#### Observation 1 - Overflow Capacity

Many of the new vessels utilized in STS have no liquid overflows. The only overflow route from these vessels is through the Waste Tank Farm Vent System (WTFVS).

Recommendation: The flow rates and related volumes of both planned and unplanned fluid intrusions (liquid, steam, air)

into a vessel should be compared with the ability of the vessel and the downstream WTFVS to safely handle them. With respect to the WTFVS, simultaneous intrusions and balance-of-plant demand should be considered when assessing handling capability.

#### Observation 2 - Control Valve Failures

There are a limited number of key control valves that regulate the process flow through the ion exchange columns to 8D-3 and the feed from 8D-2 through the prefilter to D-001.

Recommendation: Spare jumper assemblies that include a valve should be available in the valve aisle. The following valves are recommended as a minimum complement of valve isle spares: HCV-004, FCV-015, FCV-035, HCV-059, and FV-064.

### Observation 3 - Rupture Disc Integrity Verification

Much of the pressure relief on STS vessels is achieved through the use of rupture discs which typically vent and gravity drain through a common header to 8D-2. Though all the discs are accessible from the valve aisle, there appears to be no off-line intentions to verify disc integrity while off-line. On-line methods of verification appear to be somewhat involved and possibly inconclusive.

Recommendation: Review the operating philosophy associated with rupture discs particularly assessing methods of verification which can quickly and assuredly identify failed discs.

# Observation 4 - Verification Of Valve Position

The STS control system and operating procedures are closely tied to the validity of valve position indication through limit switches. Though the reliability of such indication is considered

adequate, critical operations should include validation of valve operation through other and/or redundant process indicators.

Recommendation: Review key Standard Operating Procedures (SOP) to assure that there is not sole dependence on valve limit switch indication or, where dependence does exist, the consequences are understood and determined to be acceptable.

### Observation 5 - STS Tank Leak Indication

The existing tanks used as part of STS have leak pan and sump overflow indicators and alarms which readout in other facilities. Jet pumps associated with these sumps and pans are also operated from locations other than STS.

Recommendation: Consideration should be given to the operating benefit of placing these capabilities within STS. Where transfers originating within STS can potentially leak/overflow in other plant areas it may be prudent to have some indication, control or response capability located at STS. For G-007, in addition to the tank 8D-3 low level interlock, add a tank 35104 high level interlock to stop G-007.

# Observation 6 - Stagnant Ion Exchange Column Flow

There are numerous failure scenarios which can lead to stagnant supernatant flow within resin columns, filters, etc. all of which require operator response. Recognition of the exact cause of loss of flow (or very low flow) will be difficult.

Recommendation: If it does not already exist, develop a rigorous troubleshooting procedure.

# Observation 7 - Ion Exchange Column Failures

There are numerous scenarios which can lead to column failure, e.g., leaky vessels, valves, screens, etc. There is no way to

discover these failures other than through a loss of column efficiency or mass flow balance. The time required to deduce the reause from these effects could be quite extensive.

<u>Recommendation</u>: If it does not already exist, develop a rigorous troubleshooting procedure.

### Observation 8 - Vessel Overpressurization

Pressure relief/vent/overflow lines are smaller than the ircoming feed lines. This is acceptable when all the vessels, columns, and piping are designed for the maximum pressure in the feed lines. Although a few are higher, 100 psi is the normal maximum. (A complete evaluation of this issue is beyond the scope of this study.)

Recommendation: If any system components are not designed for 100 psi pressure, a detailed "fault tree" type analysis of the tank vent system is recommended to demonstrate excessive pressurization is not possible.

# Observation 9 - Ion Exchange Column Distributor Backflush

There are a number of operating errors, in addition to single component failures, which can transfer zeolite resin to the <u>inside</u> of the inlet distributors on the ion exchange columns. The small holes and fine screen openings of the inlet distributors may make it very difficult to back flush these screens. If the screens can not be cleaned, the ion exchange columns may have to be replaced. With several million curies of cesium in Tank 8D-1, column replacement would be very difficult and could extensively delay the operation.

Recommendation: A "cold" demonstration of the ability to back flush a distributor and screen should be done before "hot" operation.

#### Observation 10 - Sluice Water Screen

The screen on pump G-004 is a critical component. Failure of this screen to prevent particles of resin larger than 0.007 inches from entering pump G-004 could cause plugging of column screens. The water from tank 8D-1 is pumped via G-004 to tanks D-001 and D-004 and from there to the inside of the screens on the ion exchange columns.

Recommendation: The design of this screen should be reviewed to insure: mesh size at least as fine as the Johnson so eens on the columns, high integrity construction was uso and a provision for flushing is available.

#### Observation 11 - Tank Pressurization Consequences

The use of positive tank pressure in tank D-001 and D-004 to provide the required Net Positive Suction Head (NPSH) for pumps G-002 and G-003 (Engineering Change Notice 2024) was not evaluated as this was added during the FMECA review. Positive pressure tanks for radioactive solution storage and transfer have been involved in major contamination incidents. Great care should be exercised when using this approach. Of special concern is the instrumentation system for level and density. Back flow of solution in the transmitter lines will result in contamination in an operating area. Unless positive back flow prevention is provided in these lines they will operate as a single barrier to contamination release (WVNS-DC-013 sect. 5.1).

<u>Recommendation</u>: An analysis of the effects of positive tank pressure should be made before hot operation.

# Observation 12 - Data Logging

The operating data for STS is only manually recorded. Evaluation of process upsets will be difficult because of the lack of

detailed and accurate records. Several low cost data logging systems are available which are directly compatible with an IBM-PC and spread sheet software.

<u>Recommendation</u>: The cost/benefit for an automatic data logging system should be investigated.

### Observation 13 - Resin Routing Verification

The "Control Wiring Diagram Supernatant Treatment System [STS] Valve Box Interlocks" drawing, 9938-317-637A, shows inputs into the PLC from the zeolite hose. These inputs are not used in the program.

<u>Recommendation</u>: Ensure that the resin is directed to the right column with unused PLC inputs from the zeolite hose.

### Observation 14 - G-002 Interlock

The low differential pressure alarm, PCAL-093, between the supernatant side and the brine side of the supernatant cooler (E-001) does not stop pump G-002. Operation of this pump with a low differential pressure could possibly contaminate the brine.

<u>Recommendation</u>: An interlock of pump G-002 with PDAL-093 should be provided.

# Observation 15 - Supplemental Sequence Alarm

For those valve sequencers used to identify and alarm if an improper sequence is attempted, an alarm both at the control panel and in the valve operating gallery would minimize the time a valve is in the incorrect position.

Recommendation: A second alarm, in the valve operating gallery, should be provided.

#### Observation 16 - Program Valve Verification

In the program for the PLC used in the STS, Rung 351 needs to be changed. The counter's project value should be 25 rather than 24. The reason for this change is the next rung in the ladder. When the counter is finished, Rung 352 returns it to 1. As written, the program will get out of sequence on the transition from step 23 to step 24. Counter 460 is used to point to the "as is" condition and counter 461 points to the "to be" position. On the transition from step 23 to 24, Rung 351 causes counter 460 to change to value 24 which also sets bit 460/15. Rung 352 then sets counter 460 to 1. The situation the next time through the ladder is that the "as is" step is 24, the counter 460 "as is" is 1 and counter 461's "to be" step is 2. A delay of longer than 20 seconds on the transition from step 24 to step 1 will cause the alarm.

Recommendation: The PLC, Rung 351 should be checked to insure the correct preset value has been used.

#### Observation 17 - PLC for Resin Replacement

Use of a PLC sequencer (see Observation 16) is a good one. A similar sequencer could be made for the column resin change out. Much of the basic work was done in trying to do this task automatically. If the automatic approach is dropped, use the PLC to monitor the operation and identify improper valve sequencing. Regarding the automatic sequencer, the program data table has a bad value. Word 01000 is given as "ffff"H (hexidecimal). In the sequencer 447, attempting to input word 01000 through output table word 702, results in step 1 opening valves SV-X04a, -X04b, -X05,-X06, -X08, and -X18. Word 01000 should be "000" to have these valves closed at the start. Additional time would be needed to further evaluate the operation of this sequencer.

<u>Recommendation</u>: A valve sequencer for resin change out should be investigated.

#### Observation 18 - Tank 8D-3 Interlocks

In accordance with the updated interlock table description, an interlock is needed between the high level alarm on tank 8D-3, LAH-023, and either the diverter valve FV-064 or pump G-002 to stop filling the tank when the high level alarm occurs.

Recommendation: An interlock of value F1-064 and pump G-002 with LAH-023 should be provided.

#### 7.2.2 CSS

Observation 1 - Limit Switch Failure Modes Related to Automatic Sequencing

#### o Fails to Close:

This failure mode is detected by no light being illuminated on the CSS graphics panel and can be caused by corrosion on the switch contacts. If a limit switch contact fails to close when expected during automatic sequencing, the program will detect the failure by annunciating "Program on Hold" and/or "Sequence not Verified". In all cases of the CSS control system examined during the FMECA, the failure to close is detected with a timer verifying arrival at the expected state after a command was issued. This failure mode is detected by the system and no system changes are necessary.

#### o Fails to Open:

This failure mode is noted by the limit switch contacts remaining closed when mechanically the contacts should be open. This could occur due to a temporary short to ground or due to aged contacts driving inductive loads. In the case of the CSS control system,

this problem would be interpreted by the program as having already completed a step when in fact the step was never completed. In this mode the actual device the limit switches are indicating is at some other position. If additional actions are required, the program will initiate them and system failure could result. The only way this failure mode is detected is when the device moves from the failed limit switch to the other limit switch. Both extreme limit switches would be contacting. No annunciator or alarm would sound indicating a failure until the next sequence was detected as not being complete.

lis failure mode is extremely important in evaluating all automatic sequencing operations of the CSS, including FV-00'.,FV-014, FV-160, FV-161, the Cement Diverter Valve, FV-5, FV-10, the lid handler/flipper and fill head assembly.

Recommendation: An evaluation of the entire ladder diagram should be performed with this specific failure mode in mind. A possible solution to the program is to perform a status check during the PLC scan cycle of all limit switch positions to ensure that only one limit position is indicated for each device (valve, cylinder, etc.). If not, the program should annunciate the failure on the CSS alarm panel.

#### Observation 2 - Automatic versus manual operation of CSS

Review of the control system logic has shown that automatic operation of the CSS is an extremely safe operation. However, because of the number of control elements in the system, there exists high probability that frequent manual corrections are necessary to continue the process. Sufficient provisions for manual corrections have been provided. However, this also increases the potential for human errors during manual operations.

Recommendation: A reliability analysis of the CSS operation in manual mode should be performed to assure that appropriate hardwire interlocks are provided so that an operator error could not lead to an unsafe or unrecoverable operation.

#### 8.0 REFERENCES

- Letter, S.A. Spohr (WHC) to S. Marchetti (WVNS), "Request for Services - Proposal No. MA-069", dated November 5, 1987.
- MIL-STD 1629A, November 24, 1980, Military Standard Procedures for Performing a Failure Mode, Effects and Criticality Analysis, Including Notice 1 and Notice 2.

APPENDIX A

LIST OF COMPONENTS

#### FMECA COMPONENT LIST

#### Summary

TABLE 1 - STS TOTALS	
MECHANICAL EQUIPMENT	14
VALVES	41
INSTRUMENTS	26
SUPPORT SYSTEMS	8
	89
TABLE 2 - CSS TOTALS	
MECHNICAL EQUIPMENT	7
VALVES	19
INSTRUMENTS	1€
SUPPORT SYSTEMS	15
	57

### FMECA COMPONENT LIST SUPERNATANT TREATMENT SYSTEM (STS)

#### MECHNICAL EQUIPMENT

8D-2	HIGH LEVEL WASTE STORAGE TANK
G-001	PUMP (IN 8D-2)
F-001	SUPERNATANT PRE-FILTER
D-001	SUPERNATANT FEED TANK
E-001	HEAT EXCHANGER
C-001	CESIUM ION EXCHANGE COLUMN "A"
C-002	CESIUM ION EXCHANGE COLUMN "B"
C-003	CESIUM ION EXCHANGE COLUMN "C"
C-004	CESIUM ION EXCHANGE COLUMN "D"
80-1	SUPERNATANT TANK
8D-3	SUPERNATANT COLLECTION TANK
G-007	PUMP (IN 8D-3)
F-002	SAND FILTER
6-002	CENTRIFUGAL PUMP (IN D-001)

# SUPERNATANT TREATMENT SYSTEM (STS) (CONTINUED)

VALVES		
FV-077	FV-204A	FV-405
HCV-004	FV-206	FV-408
FCV-015	PSE-215	FV-418
FV-006	FV-205	FV-404B
SC-011	FV-208	FV-404A
FV-118	FV-306	FV-042
FV-104B	FV-305	FV-031
FV-104A	FV-308	FCV-035
FV-105	FV-304A	PSE-715
FV-108	FV-304B	FV-064
FV-106	FV-318	FV-067
PSE-115	PSZ-315	FV-068
FV-204B	FV-406	SC-014
FV-218	PSE-415	

#### FMECA COMPONENT LIST

### SUPERNATANT TREATMENT SYSTEM (STS)

#### (CONTINUED)

рΗ

#### INSTRUMENTS

TROPENTS	
AE-008 Turbidity	LE-219
FE-015 Magmeter	LE-119
TE-099	AE-019
TE-010	CE-058
FE-035	LE-017
RE-037	LT-016
RE-413	8-LT
RE-313	LE-602
RE-213	LE-601
R5-113	PDY-005
RE-034	
B-LT-10	
PT-033	
PT-028	
LE-419	
LE-319	

## FMECA COMPONENT LIST SUPERNATANT TREATMENT SYSTEM (STS) (CONTINUED)

#### SUPPORT SYSTEMS

Instrument Air - Prefilter Blowdown

Demin. H<sub>2</sub>O to D-001 dilution

NaOH / HNO<sub>3</sub> Addition to D-001

Heat Exchanger (E-001) Secondary Side

Zeolite (Supply) for C-004

Instrument Air for C-004

Sluice H<sub>2</sub>O for C-004

Sand Slurry (F-002)

#### FMECA COMPONENT LIST

#### CEMENT SOLIDIFICATION SYSTEM (CSS)

#### MECHANICAL EQUIPMENT

70-D-001-N Waste Dispensing Vessel	
70-G-001-N Waste Dispensing Vessel Pum	ip .
70-K-002-N High Shear Mixer and Motor	#1
70-K-004-N High Shear Mixer and Mutor	#2
70-V-002-N Filling Cap Assembly/Lid Ha	ndler
70-G-106-N Dewatering Pump	

#### VALVES

FV-004	FV-005
FV-006	FV-10
FV-007	CHECK VALVE-UW
FV-088	070-V-001 - CEMENT DIVERTER VALVE
FV-046	CHECK VALVE-UW
FV-047	CHECK VALVE-AIR
FV-098	CHECK VALVE-UW
FV-099	FV-160
FV-002	FV-161
FV-014	
FV-014	

#### FMECA COMPONENT LIST

#### CEMENT SOLIDIFICATION SYSTEM (CSS)

#### (CONTINUED)

#### INSTRUMENTS

WE-2071 (WT Mixer #2)

WE-2072 (WT Mixer #1)

WE-2073 (WT Drum)

LT-2001

WE-2011 (Cement WT)

FE 001 (Process Flow)

LS-2046 (Mixer Overflow)

LS-2048 (Mixer Overflow)

FS-2002 (Inlet Feed Flow)

FS-2004 (Inlet Feed Flow)

FS-2003 (Inlet Feed Flow)

FE-2080 (Main Inlet Flow)

FS-2042 (Recir Flow Indicator)

FS-2035 (Mixer Feed Flow Indicator)

FS-2038 (Dewatering Pump Flow)

LS-2053 (Level Switch WDV)

### CEMENT SOLIDIFICATION SYSTEM (CSS) (CONTINUED)

#### SUPPORT SYSTEMS

Feed from 35104

Resin and Zeolite Feed

Concentrate 5D-15A Feed

070-VE-053 (Vossel Vent)

070-UW-068 (H20 to D-001)

070-UW-090 (H2O to Mixer #2)

070-UW-094 (H<sub>2</sub>O to Mixer #1)

Cement Silo

Hydraulic Fluid to Cylinders

070-UW-005 (H2O to Return Line)

070-UW-067 (H2O to Supply Header)

070-UW-011 (H2O to Supply to Mixer)

070-DR-2-092

070-PL-014 (Return Line to LWTS)

HSCSS Control System

#### APPENDIX B

FAILURE MODE, EFFECTS AND CRITICALITY ANALYSIS WORKSHEETS

SIPPERMATAM! PRINCESSING - STEADY STATE

ENCINEES NOTOR DATE 12-4-87 NEVIEND Spilostamin 12-4-87

1110w	COMPONENT DESMITTERATION	FAILUR.	FAILURE OFFECTION METHODISS	RATURE REFECT	SEVERITY	RELATIVE	FALURE
56 65	50-2 Suptemptions Sauc	DUBING NOT STARTUP PROCESS LIQUID LEVEL RISES AND LEARS THROUGH A MALE BELOW THE RIGH LEVEL ALARM	LEAK WORLD ACCIMULATE IN 80-2   PAM. PAM LEVIL ACOLD HOUCATE ON   SISS PAMEL. LEAK COMDITION WORLD   ALADN ELSEWRERE IN THE FACILITY   BUT NOT IN SIS.	THE SCHRICE AND MACHITUSE OF THE LEAK ACRED OFFENNINE RESULTING THREAT TO SIS OPERATION. SIS OPERATION ACRED MOST THREAT BE SUSPENCED LIMITE. THIS DETERMINATION LAS MADE.	å *	30	a and
20 03	G-001 Plane 38 802	Puper FALLS TO STOP PURPLIED	NICH LEVEL ALARM LAN 016	ASSUMING POW G-001 FALLS TO STOP, SUPERMATANT LINE VEH READER TO FILL D-001 AND TRAVEL THROUGH THE VEHT READER GZG TO 80-1. DEPENDING ON MANAITOLD CONFIG. SUPERMATANT COULD MIGRATE TO B-004 AS WELL.	4		
8 91	5-001 May 38-802	Flore falls to chart electing	FIG BIS MAKED INDICATE COM/ WO PION, FCF BIS WOALD OPEN FULL AND FCW BIS WOALD CLOSE. PLOSE WOALD INDICATE COM/ NO PRESSURE.	SINCE FCV-024 CLOSURE IS EFFECTED BY A RANF FUNCTION, THERE'S SOME POTENTIAL TO ROUTE DENTH WATER IN-STREAM THROUGH LINE DOS BUT THE ANOMY WARED BE OF LITTLE CONSEGUENCE.	3		
89 913	G-001 ruer (n 802	Pow DISCHARGE 15 100 McCr	*		=	·	

RELIABILITY AMALTSIS - SUPERMATANT PROCESSING - STEADY STATE

ENGINEER MONOGEN DATE 12-4-87 REVIEWED & Libertamore 12-4-87

1164	SOMFOMENT IDENTIFICATION	FARLUNG   MODE	FAILUME DEFECTION METHOD(2)	FAZLURE	SEVERITY CATEGORY	PROBABILITY	FAILURE
\$6-013	5-001 mark in 902	PLANE DISCHARGE IS LESS THAN ADEQUATE.	LOW PRESSURE WOULD IMPICATE ON PRIORIE TON FLOW MONTO INDICATE ON THE FIGURE AND ALMON AT LOW DENIE WATER FLOW.	TOW FLOW OR PUMP PRESSURE WOULD BE OF LITTLE CONSEQUENCE. PREFILTER SHOULD NOT BE AFFECTED.	4	*	~
0.00-00	F-001 SUPERMATER! PREFILLER	LEAKS THEIGHGA DURING MCHANA, PROCESS FLOW	(A1 000 SANALD BE EMPECTED TO SHOW (AN INCREMENT AND ANN 1000 WALLS ALARDA, AN INCREASE EN TOLOGO ACROSS THE 2X COLUMN SOLT OF E-001 MARAD ALSO BE EMPECTED.	IN COCUMM MANUE BE EXPECTED TO PREMIUSELY FAIL. THRONGER THE ACCUMULATION OF PARTICULATES MOTION [LEAK THRONGER THE PREFILTER, DEPOSITION OF PASSED MATERIAL IS NOT EXPECTED TO ACCUMULATE IN E-001 OR MELATED PIPING.	£		
50 00	F-901 Surgement englistes	LEAKS (EXTERMAL) PRIOR TO FILTRATION DURING	LEAK IN EITHER FILTERED ON LUMILLERED SIREAM WOULD RESELT IN LEVEL INCREASE IN 80-1. LEVEL CHANGE WOULD INDICATE ON STS CONTROL PANEL BUT NOT ALMEN. DETECTION UNLIKELY FOR SAMLE. LEMES.	A SUSTAINED LEAK WAND LONER PRODUCTION PEED PROLUME TO 0-001 AND ACCHMULATE IN 80-1 AND REDUCE PRODUCTION EFF.CZENCY. LEAKAGE OF SUFERNATAT INTO 60-1 MAY REDUINE REPROCESSING OF 80-1 LIGHID.	ž		
20-023	F-001 Sprinarias! PacFis tex	LÉRES (ERTERNAL) AFTER FILTERATION DURING	LEAK IN ELIMEN FILTERED DR LOWFILTERED STREAM WAND RESULT IN LEVEL INCREASE ON BO 1. REVEL CHANGE WORLD INDICATE ON STS CONTROL PANEL DIOT NOT ALREK. DEFECTION UNIT NEELY FUR SMALL LEAKS.	A SUSTAINED LEAK WORLD LONER PRODUCTION FEED VOCUME TO 0-001 AND ACCOMUNATE IN NO-1.  LEPANGE OF SUPERMINAT INTO NO-1 MAY REQUIRE REPROCESSING OF NO-1 LIQUID.	ė		

DATE 04-Dec-87 PAGE 50-3

INCINETY ONCY DATE 12 4-87 CENTENDE SCHEDE 12-4-87

110x	COMPONENT IDENTIFICATION	ANTENNE FALLUME	FAILURE DETECTION METHOD(S)	FABLURE	SEVERITY	RELATIVE	FAILUME
50-053	9-001 SuPresentant Prefritter	CAN'T UMPLUS FILTER DUBING BLOW BACK	POT-005 WOULD SHOW NO CHANGE OR AN INCHEASE IN DIFFERENTIAL PRESSURE: FIC.015 CORLD ALSO SHOW A DECREASE IN FLOM: PIAM 005 MARCD ALARM IF F-001 PLUGS.	PRODUCT FLOW TO 0-001 MOND BE REDUCED AND POSSIBLY STORMED IF F-001 PLUGGED. DISCHARGE PRESSURE OF PAMP G-001 WORLD INCREASE MICH AN INCREMSE IN DISCHARGE TEMPERATURE.	a		-
20-02	9-00% SUFERMINAT PREFILTER	NIGH PRESSURE EXTERNAL LEAK DONING BLOW BACK	I LEME MONED RESULT IN LEVEL  INCHEASE IS 80-1, DETECTION MONEO   SE EXTREMELY DIFFICUET BECAUSE  OF THE INTERMITTANT MATURE  OF THE BLOMBACK SEGMENCE.	INE EFFICIENCY OF F-001 BLOMBACK CORD BE REDUCED REQUIRING WINE FREQUENT CTCLES AND LONER FEED VOLUME TO 0-001 LEAKAGE OF SUPERMATANT INTO 80-1 NAY REQUIRE BEPRICESSING OF 80-1 LIQUID.	£		~
80 05	D-001 SUPTEMBATANT FEED TANK	THE TAME LEACE THREE WIRMAL PROCESS FLOW	MANSA VOLLINE BALANCES AND NA PRESCONDED. LEVIL CHANCE IN BO-1   15 INDICATED ON STS PANEL BUT NO ALARM.	STATE OF LEAK MOND DETERMINE INPACT ON PROCESS. WITH D-001 AS THE SOLE STS FEED TANK A MAJOR LEAK WORLD STOP PRODUCTION. LEAKAGE OF SUPERNATART 1810 00-1 MAT REQUIRE REPROCESSING OF 50-1 LIQUID.	£	9	
98 98	E-001 NEAT ENCHANCES	THE TUBES BECOME PLUGGED	TANI, OTO MOULD ALARM AS TE OTO	WITH FLOW INTERNUPTION, IN COLUMNS MAY WARM MEDESSITATING COLUMN RESIN DUMP	£	u	*

RELIABILITY ANALYSIS - SUPERNATART PROCESSING - STEADY STATE

DATE OL- Duc. 87 PAGE 50-4

ENCHALTE DE LONG G. G-87 MOVIES & Liberton 12-4-87

SEVERITY | RELATIVE | PAILURE CLASS N [PROBABILITY ] CATEGORY 1 s, b d d 411 SYSTEM. G-002 MONTO CONTINUE TO OPERATE DRIVING DEPENDENC ON THE MAGNITURE/MATURE OF THE 1"MG, SUPERNATARE ON RESIR CALLS ACCOMMANTE IN NO. 1 CONTANTRATION COULD ENTER THE ENTIRE CHILLER ABANDONDED AND DOLNSTREAM COLLINS MAY BE PLUGGED. IF LEAK IS EXTENSIVE, COLUMN WOLLD HAVE TO BE | P1-114 10 P1-214 PRESSURE DROP | RESIN WORLD BE DEPOSITED ON DOWNSTREAM COLUMN CONTAMINATION INDUSCR INE FAILED TUBES. WITH FLOW INTERRIBITION, IN COLUMNS MAY LEAKAGE OF SUPERMETANT 1910 SD-1 MAY WARN MECESSITATING COLIMN RESIM DUMP REGISTRE REPROCESSING OF BD-1 LIQUID. FAILURE |L1-022 IMDICATES INCREASE IN 80-1| LIGHTO LEVEL .... NO ALARM IN ] PT MONED INDICATE REDUCED SUPPLY ALASM HI DUE TO STAGMANT SUPER-T POAL-095 MOULD ALARM MHEW LEAK RAM-DIA COULD ALAM MIGH 19 PERNATARI 11 OM MENCHES NE-014 COULD BE DETECTED DEPENDING ON ON MED TEMP MISE, TANK 010 MIGHT TEMP RISE, P.I. 620 MORED INCREASE STS. PRESSURE DROP ON P1-214 PRESSURE TO DOMNSTREAM COLUMN. FAILURE DETECTION METHODIS) IS SUFFICIENT IN REDUCE DP FLOW. TAM-112 MIGHT ALARM ON FIC OTS MOULD INDICATE LOW ACROSS PR1/SE - / E-001. SIZE OF LEAK. LONER SCREEK PLUGS IN THE PROCESS MINE COMER SCREEN LEAKS THROUGH IN THE COLUMN LEAKS IN THE PROCESS MODE PROCESS MIDE TUBES FAIL FASILIBRE ное C-001, CESTUM REMOVAL COLUMN C-001, CESTUM REMOVAL COLUMN C-001, CESTUM REMOVAL COLUMN COMPONENT TOENTIFICATION E-001 MEAT EXCHANGER 50-041 50-050 50-051 50-052 1168

RELIABILITY ANALYSIS - SUPERNATANT PROCESSING - STEADY STATE

DATE 10-pec-57 PAGE 50-5

SEVIENCE DE 1998 ... DATE 12-10-87

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SMGINEER

FAILURE CLASS m M m N PROBNALLITY | RELATIVE \* ú W SEVERITY CATEGORY 13 a, b di. 2 ä RAN-215 WOLLD ALARM AS A RESULT (RESIN WOLLD BE DEPOSITED ON DOARSTREAM COLLANS AND REQUIRING LATER TRANSFER TO 80-2 AND RECYCLE OF DEPENDING ON THE MAGNITUDE/MATURE OF THE LEAK SUPERMITANT OR RESIN COULD ACCOMPANTE IN 50-1 EXTENSIVE COLUMN MORED MAYE TO BE ABANDONED. POSSIBLY TO THE F-DOZ FILTER. IF LENK IS WITH FLOW INTERRUPTION, 1x COLUMNS MAY WITH FLOW INTERRUPTION, In COLUMNS MAY 29 INLET DISTRIBUTOR CANNOT BE CLEARED. COLUMN MIST BE ABANDONED OR REPLACED MARN MECESSITATING COLUMN RESIN DUMP MARN MECESSITATING COLUMN RESIN DIAN SUPERMATANT. EFFECT FAILURE 111-022 IMDICATES INCREASE IN 80-11 RISE. TANK-010 MIGHT ALARM HI DUS TAML-010 MIGHT ALARM NIGH DOE TO PT WOULD INDICATE REDUCED SUPPLY LIGUIL LEVEL .... NO ALARM IN STS. PRESSURE DROP ON PI-314 COALD BE DETECTED DEPENDING ON OF EXPOSLME TO MIGRATING RESIN SUPERNATAMI. SAMPLE OF SUPERN'T IPI WOULD INDICATE REDUCED SUPPLY FIC-035 MOULD IMPICATE LOW 7:0M TAN-212 MIGHT ALARM ON MED TEMP FIC-035 MOULD INDICATE LOW FLOW. PRESSURE TO DOMNSTREAM COLUMN. PRESSURE TO DOWNSTREAM COLUMN. TO STAGMANT SUPRN'T TEMP RISE. STAGMANT SUPERNATANT TEMP RISE. FAI . ME DETECTION METHOD(S) LEAVING THE IX COLUMN COULD DETECT PRESENCE OF RESIN. OR NIGH CURIT CONTENT SIZE OF LEAK. THEFT DISTRIBUTOR PLUGS IN THE PROCESS MODE LOMER SCREEK PLUGS IN THE PROCESS MODE LOMER SCREEN LEAKS THROUGH IN THE COLLEGE LEAKS IN THE PROCESS MIDE PROCESS MODE PALLURE C-502, CESTUM REMOVAL COLUMN C-002, CESTUM REMOVAL COLLANS C-502, CESTIAN RENDVAL COLUMN C-001, CESTUM REMOVAL COLUMN COMPONENT IDENTIFICATION 50-062 50-053 50-060 50-061 1168 9

REVIEWED BY 1 407094 DATE 12:10:67

ENGINEER DE CAROZZ DATE 12 9-87 NEVIENE Spiele Lavience 12-487

11EM     WO.	COMPONENT IDENTIFICATION	FAILURE   MODE		FAILURE EFFECT	CATEGORY	RELATIVE    PROBABILITY	CLASS
50-073   	C-043, CESTUM REMOVAL COLUMN	INLET DISTRIBUTOR PLUGS IN THE PROCESS MIDE		WITH FLOW INTERRIPTION, IX COLUMNS MAY WARM MECESSITATING COLUMN RESIN DUMP  IF INLET DISTRIBUTOR CANNOT BE CLEARED, COLUMN MUST BE ABANDONED OR REPLACED	mb   		3
50-080   	C-RO4, CESTUM REMOVAL COLUMN	VESSEL LEAKS IN THE STANDET MODE	NO DETECTION POSSIBLE SINCE   VESSEY WOULD BE ISOLATED FROM   ALL SYSTEMS. THERE WOULD BE   NO ALARM IN STS EVEN WITH   MAJOR LEAK	COLUMN FAILS WHEN PLACED IN SERVICE	] 111 1 1 1 1 1	C	5
50 081   	C-004, CESTUM REMOVAL COLUMN	WESSEL LEAKS IN THE REPLENISH MODE	NO DETECTION POSSIBLE SINCE   VESSEL MORLD BE ISOLATED FROM   ALL SYSTEMS. THERE WOULD BE   NO ALARM TR. STS EVEN WITH   MAJOR LEAK	COLUMN FAILS WHEN PLACED IN SERVICE	1 111 1 1 1 1 1 1		3
50-062   	C-004, CESTUM REMOVAL COLUMN	I IPPER SCREEN LEAK THROUGH IN THE REPLENISH MODE	RESIN MOND MIGRATE WITH SCUICE     MATER TO 80-1 BUT MOND BE VERY     DIFFSCULT TO DETECT	NOME .	111 		,

DATE 04.0ec-87 PAGE 50-6

ENCINEER MONDY DATE 12-9-87 REVIEWED SELBS SAMINE 13-451

110w   100	COMPONENT SERVISPORTION	FAILURE NOCE	FASTLINE DESECTION METHODISS	FALLURE	SEVERITY	PROBABILITY	FAILURE
50-063	C-906, CESTUR REMOTAL COLUMN	UPPER SCREEG PLUGS "INSIDE" DUPLUK. THE REPLEMESA MODE	F1-084 WOULD INDICATE NO FLOW. THE CONDITION WANTO NOT ALARM.	ALTERNATE WETHOD OF REWSTRG COLUMN MORED MANE TO BE FOUND TO MAINTAIN USEFULNESS OF COLUMN. DEAD HEAD PHANE OFFERTION COLLD LEAD TO EARLY PLANE FAILURE.	4	0	_
70 00	C-004, CESTUM REMOVAL COLUMN	UPPER SCHEEK PLUCS, ONTSTOE DURING THE REPLEMES MICH	ACTION TED SACCIANS NOULD DEAD HEAD G-003 AND INDICATE ON P1-414 NO ALARN. L1-044 NOULD INDICATE NO LEVEL COMMICE IN LATER FEED TANK D-004.	ANTEGNATE METHOD OF FLOFFING COLUMN MONED MAVE TO   BE FOUND TO MAINTAIN USEFULNESS OF COLUMN. DEAD   NEAD POWER OFERATION COLUMN. DEAD TO EARLY PLANE   FAILURE.	ē		
8 8	C-DOK, CESTUM REMOVAL COLUMN	ACONCR SCREEN LEAKS INNOUGH IN THE REPLENESS MODE	WESTS WAND STURME WITH FLUSSE   WATER TO BD 2 BUT WAND BE VERY   DIFFEORET	COLUMN FALLS WICH PLACED IN SERVICE			
26-08	C-004, CESTUM REMOVAL COLUMN	IONER SCREEN PLUCS "INSIDE" DUBLING. THE REPLENIES (BACKLUSSE) WOOL	F1-064 WOULD INDICATE NO FLOW. CONDITION WANTED NOT ALARM.	INMENLETY TO FLUFF THE COLUMN. ALTERNATE METHOD OF FLUFFING WANG MANGE TO BE FORMS TO MAINTAIN USEFLUANESS OF COLUMN. DEAD HEAD FUMP FAILURE IF MOT DETECTED EARLY.	<b>f</b>	u	

ENGINEER DAG TO CONETE G. 87 NEW BOXE GOS SANCE 12-4-87

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1108	COMPONENT LOCKLIFICATION	5411.0E	FAILURE DETECTION METHODES)	FARCI	SEVERITY CATEGORY	RELATIVE    PROBABILITY	CLASS
780 05	C-DOA, CESTIAN REMOVAL COLUMNS	1) (OMER SCREEN PLOSS "GOTSIDE" SURING. THE REPLENISH (REPUBLE) MODE	F1-026 INDICATES LOW PLOW	ALTERNATE METHOD OF PUBLING COLUMN MORED AND TO BE FORMED.	4.		
		2) LOWER SCREEN PLUCS "DUTSIDE" DURING THE REPLENISM (RIMSE) MCDE	11-044 MONED INDICATE NO LEVEL  CRANGE OR WATER PEED TANK 0-004,   F1-084 MONED INDICATE NO FLOM.	ALTERNATE METHOD OF FLUSHING COLUMN WORLD HAVE TO BE FORMO TO RINSE COLUMN. DEAD NEAD FLUY OPERATION COMED LEAD TO EARLY PURP FAILURG.	<u> </u>		-
20 05	C-00%, CESTON REMOVAL DAGGES	NESTH INCET LINE CONSIDE PV-4055 PLUGS	11-627 WORLD INDICATE NO CHANGE 18 FEED TANK 0-002 LEVEL. NO OTHER INDICATION MONITO OCCUR.	COLUMN RESIN CORED NOT BE NEFFLEED LUTTL PLUS UNS LINS LINS LINS LINS LINS LINS LINS LI	1		
8 8	SD-1 SUPERMETARY TANK	AS THE LIGHTD LEVEL BISES THE TANK LEAKS AT A SEAM WEAR THE BOTTOM	SEVEL ENCHANCE IN RO-1 LEAK PAN WAND INDICATE ON STS PANEL BUT NOT ALARM. IT WOULD ALARM IN AMOTHER FACILITY.	LIVEL INCREMSE IN NO-1 LEAK PARK PRODUCTION WOMED BE TERMINATED AND ALL DISCHARGES WOMED INDICATE ON SIS PARKE BUT   FROM SIS TO 80-1 SUSPENDED.  AND ALARM. IT WALLD ALARM IN	e		*
8 9	80-3 COLUECTION LANG	CAME HAS A SEEP LEAK AT A SEAM AS THE BOTTOM	SHALL LEAK WORLD BE DIFFICALT TO	TOW   SPACE LEAK WONED WE DEFFICIALT TO PROMITTOW JOHN DE SUSPENMED AND ALL FEEDS TO NO.5.    DEFECT IF ACCOMPLATION IN PART IS   TCRMIMATED. ALIERAATE COLLECTION TANK AND MOLING.      MELOW ALARM FREESWILD. LEAK   10 35104 WOMED NAVE TO BE FORMO TO CONTINUE      WONED WE COLLECTED IN TK LEAK PARM   PRODUCTION.      MAD ALARM IN MAIN CONTRC! BY BUT        MOT IN STS. LAT 023 WONED ALARM	2		•

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SEVERITY | RELATIVE | FAILURE CLASS 105 PROBABILITY . şá CATEGORY 11 4, 5 đ ij ā NIGHTEPE: FOR P.CEIVING TAME (35104 IF OVENION IS DETECTED. SIMP MORED OVERFLOW MONED BE SUSPENDED. BD 3 COMED OVERFEOW IF LEVE. | UNCESS JECTED EMEDIACIETY, PUMP 6-007 COALS RIM 055 MORED INDICATE AD ALAM ON | 24.8.5. MATERIA: CAN SE PUNDED ON JETTED DAT OF (41 975 (OM 35104) UNIVED ENDICATE | PEED TO EMMENANCE OR HISSE L'SPENSING WESSEL CAPACITY OF 805 IS COMSIDERABLY LARGER THAN 3510s. ONERFIGN OF 35104 FLOWS TO GCR SIMP SUPERMATART FLOW FROM 50-3 IS REDUCED. OF THE LEME, SUPERMINATION SALD DEPENDING OF THE MAGRITUDE/NALURE COMED ACCIDING ATE IN 80-1. ALABMS 1258E TOMORED. DATE AND FAIR. EFFECT SALLING LOW 80-3 THUS LEVEL. " A MAD LANK | LAL GZS WILL ALARM INDVALING | THAT NO MATERIAL IS BEING TRANS-(FLO'D, P1-069 MORED SAC'T NO PRET LAN 023 MORES ALARN 19 80-3 DIER IND. WO MATERIAL IS BEING IRANS. 35104. PI-069 ARLD INDICATE FERRED FROM 80-3, LI-625 MRULD METHER COMPITION MORED ALARM. FAILURE DESECTION METHOD(S) G-007 S ON LINE. F1-669, 11 623, FOI - 028 PURP FAILS TO STOP PURPING UPON COMMAND PLANT DISCREMENT IS LESS THAN ADDRUGATE FILTER LEAKS DURING THE PROCESS MOSE PLANT FAILS TO START PLANTING FA11.188 100m G-907 PUMP, DECONTANTANTED C. DG7 FURD, DECONTANTANTED 4 DECEMBER OF CHIEF COMPONENT EDGMITFICATION SUPERMINANT FROM 80-3 SUPERATARI SER BD-5 SIFTRUSTRAL FROM NO. 3 4-502, SAM: 5111ER 50-110 56 315 50-12D 50-111 1168

ENCINEER MODELL DATE 12-9-87 NEVIEWED ELECTRON 12-4-87

FAILURE   CLASS			-	
PROBABILITY				
CATEGORY	£	4	=	4
1 (ARICIES	SAND IN PIPING REDUCES PROCESS LIGACIO FIGA RATE AND POSSOY SAND AND ZEOLITE FIX AD US IN 80-3	PROCESS FLOW VIRFSRLT SIDPS. IF BACKFLOW DOES NOT RESOLVE PLOGGING, THE FILTER MUST BE NEWOUDD FOR MEPRIN. PRESSURE DROP ACROSS FILTER INCHESES.	NOTES TOW VIR. DULY STOPS. IF BACKFOW DOES NOT RESULT FOR PLUGGING, THE FILTER WAST BE RENDED FOR REPAIR. PHYSICS DOEP ACROSS FILTER INCA-ACRS.	D-001 LEVEL RECEDES ALEMANN POSSINCE CAVITATION AND LOSS OF FLOM AND PURP SAILURE AND POSSINCE TANK NO-3 OVERFLOW
FAILURE DETECTION METHODES)	#1C-035	POAL-028, PD1-028	FEAN GZB, PD1 GZB, P1-628	P1 020, F1C-035, L1 025, P1 023, L1 036, P1 028, P0 028 CSUMM 78:50#
, fattam:	THE LONG'S SCREEN LEVYS TWOMEN DURING THE PROCESS MIDE	THY SMEAT DISTRIBUTION PLUGG DURING THE PROCESS MODE	THE LANGE SCHEEN PLUICE DIRECTOR TOC	Plane PAILS TO STOPAMPTING LIFOR COMMAND
COMPONENT INNUITATION	F-072, SAND FELLOR	F.C., Sam Fillers	7-002, SAND FEL-19	G-002, CONTRIFICAL PUMP IN D-641
1108	121 - 85	\$ 12	23 8	8 2

RELIABILITY ANALYSIS - SUPERNATANT PROCESSING - STEADY STATE

11E# #0.	COMPONENT IDENTIFICATION	1 SAILURE NOGE	FAILURE DETECTION METHOD(S)	FALLINE EFFECT	SEVERITY   CATEGORY	RELATIVE  PROBABILITY	FAILURE
50-131	6-002, CENTRIFUCAL PUMP IN 0-001	POWP FAILS TO START PUMPING	F1-020, F1C-035 (1-023, P1-033, L1-016, P1-028, LARH-017, P01-028, LAR-016 COLUNN	PROCESS SUAPENDED UNTIL PROBLEM RESOLVED	<u> </u>		~
56-132	6.002, CENTRIFUCAL NAP IN D-001	PLAN DISCHALGE IS LESS THAN ADEQUATE	FIC-035 POI-028 REDUCED COLUMN PRE'SSURES	INABILLIY TO MEET PROCESS RC 20' "ENTS.	4		,
20 200	FV -G/7 GURTHG MORNAL PROCESS FLOW	FAIL; CLOSED	РАМЕТ LIGHTS P01-005 P1-002 F1C-P15 F1C-P15 F1C-P15	PROCE'S CANNOT CONTINUE NORMALLY.	4		~
20-201	170-V7	LEAKS TO ENVIRONMENT	LIQUID IN VALVE AISLE	MO SIGNIFICANT PRICESS EFFECT. VALVE REPLACEMENT MAY BE REQUIRED.			*

RELIABILLIT ANALYSIS - SUPERNATANT PROCESSING - STEADY STATE

ENCINE LICENSAMEN DATE (2-4 8 ) REVIEWED OF TO CONG ( 011E 12-9-89

115x	COMCONENT SOCYTFICATION	FATLURE MODE	FAILURE DETECTION METHODIS)	FFECT	SEVENITY	RELATIVE    PROBABILITY	-
50-210	MCV-004 DURING MORMAL PROCESS FLOW	FAILS OPEN	, , , , , , , , , , , , , , , , , , ,	CONTINUED PROCESS FLOW IS LOST. WITH FLOW INTERRUPTION, IN COLUMNS MAY WARM NECESSITATING COLUMN RESIN DUMP	a	a	~
50-211	MCV-004 DURING FILTER BLOW BJCK	FALLS TO OPEN	LIMIT SATICA P1-094 71-002	REDUCED LFFICIENCY OF BLOMBACK	₫		-
29-230	FCV-015	FALLS TO OPEN	F01-005, F01-015, LIMIT SUITCH F1-015 FML-024	MORMAL PROCESS IS STOPP"9 AFTER F-00; BECOMES LOADED. LITH FLOW INTERRUPTION, IN COLUMNS MAT WAMM WFCESSITATING COLUMN RESIN DUMP	e	as	~
36-221	FCV-015 PURINC KORMA - OLL SS FLOM	CONTROLS FLOW ABOVE SETPOINT	FG, 015, [SMH-017, AWD LAH-016, LAMN-016, LI-016 FI-015	D-001 MAY BECOME OVER-FILLED RESULTING IN G-001 SHU100AM. CONTROLS MAY MEED REPAIR.	£	•	-

RELIABILITY ANALYSIS - SUPLEMATANT PROCESSING STEADY STATE

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#0 .	COMPONENT IDENTIFICATION	FATCURE	FALLINE DETECTION METHOP(S)	FAILURE	SEVERITY   CATEGORY	SEVERITY   RELATIVE	FAILURE
22.22	FCV-015 DURING NORMAL PRINCESS FLOW	CONTROLS FLOW BELOW SELFOINT	FII-015	0-001 LIQUID LEVE, LONERS DANIGING G-002.	=	1.	Ī-
52 9.	FCV-015 GURING FILTER BLOW BACK	PAILS TO CLOSE	F01-015 71-015 PAYEL LIGHTS	NO SIGNIFICANT EFFECT.	ļ.		
85.06	- V- 000	DUBING MORMAL PROCESS FLOW VALVE LEAKS THROUGH	FIC-015 MAY BE ERRATIC	AIR IS FWERAIMED IN THE PROCESS FLUID			
E 8		DURING FLATER BLOW BACK NALVE FALLS OPEN	LIMIT SUITCR ON FV-0PG, PG1-005, P1-094.	SUPERNATANT AND AIR MAY PRESSURIZE D-001, COMPROMISING INSTR. CALIBRATIONS. PRESSURIZING BD-2 IS POSSIBLE.	<u>.</u>		

RELIABILITY ANALYSIS - SUPERNATANT PROCESSING - STEADY STATE

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116#     #0.	COMPONENT IDENTIFICATION	FAILURE	FAILURE DETECTION METHOD(S)	FAILURE EFFECT	SEVER, TY CATE DRY	SEVER, IY RE A. IVE   CATE DRY   PROGABILITY	CLASS !
72 PK	FV - 006	DURING FILTER BLOW BACK VALVE FAILS CLOSED	F-31-005, F-31-005, F-31-005, F-31-005	UNABLE TO ACCOPPLISH BLOMBACK OF FILTER.	2	# 100 to	~
99-290	SC-011, CHCK VALVE D -< IN. MATER SUPPLY	VALVE FAILS OPEN	Ĭ,	NOM.	=		-
56.53	SC-011, CHECK VALVE DENEM, LAFER SUPPLY	WALVE FAILS CLOSED	FAL-02*, MCV-024 POSITION, P1-073	DILUTION OF THE SUPERNATANT ENTERING 0-001 IS NOT POSSIBLE. DILUTION MUST BE ACCOMPLISHED BY OTHER METHODS.	<u>=</u>		
20-22	SC-01., CLECK VALVE DÉRIR, MATER SUPPLY	WALVE PARTS LGOSER		NO STGNIFICANT EFFECT	=	v	-

EZITABILITY AMALYSIS - SUPERNATANI PROCESSING - STEADY STATE

ENGINEE GLIBALANIN DATE (2-48) REVIEWED BY MONAY, DATE 12-4-89

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SEVERITY | RELATIVE | FAILURE CLASS -M CATEGORY |PROBABILITY | , 111 q. 1111 q: SUPERNATANT PROCESS FLUID WILL BE RETURNED TO BO-TI 11-022 INDICATES INCREASE IN 80-1] SUPERNATANT AND RELIN COLID ACCUMILATE IN 80-1 SLIGHT PRODUCTION EFFICIENCY REDUCTION SLIGHT PROBUCTION EFFICIENCY REDUCTION LEAL-GE OF SUPERNATANT INTO 80-1 MAY LEAKAGE OF SUPERNATANT INTO 80-1 MAY REQUIRE REPROCESSING OF 80-1 LIQUID. REQUIRE REPROCESSING OF 80-1 LIQUID. EFFECT FAILURE FAILURE OFTECTION METHOD(S) 11-922 INDICATES INCREASE IN 80-1 LIQUID LEVEL. NO ALARM IN STS NO ALARM IN STS. NONE NONE LEAKS THROUGH DURING PROCESS NODE LEAKS THROUGH IN PROCESS MODE CEAKS THROUGH IN PRICESS MODE LEAKS THROUGH IN PROCESS MODE FAILURE FV-118, SLUICE WATER TO 80-1 FV TO48, SLUTCE WATER SUPPLY FV-104A, SLUICE MATER SUPPLY COMPONENT IDENTIFICATION FW-105, ZEURITE SUPPLY TO BOTTOM SCREEN TO TOP SCREEN 50-276 50-300 56-280 50-290 1158 .08

RELIABILITY ANALYSIS - SUPERNATANT PROCESSING - STEADY STATE

ENCINEER Stibolaminate 12-47 NEV 340 00 1 Mana, C DATE 12-4-87

116# 160.	COMPONENT IDENTIFICATION	MODE	FAILURE DETECTION METHOD(S)	FAILURE	SEVERITY	_ <u>z</u>	CLASS
105.05	FV-105, ZEOLITE SUPPLY	VALVE LEAKS EXTERNALLY DURING PROCESS MODE	RADIOACTIVITY IN VALVE BOX	VALVE BOX COLLECTS RADIOACTIVE LIQUID SUBSTANCE		g a	-
56-310	FV-108, ZEOLITE DISCHARGE VALVE	VALVE LEAKS THRU DURING PROCESS MODE	LT-022 INDICATES INCREASE IN 80-1   NO ALARM IN STS.		e		-
	FV-106, ZEOLITE ETSCHARGE VALVE	VALVE LEAKS EXTERNALLY DURING PROCESS NIGG	L1-022 INDICATES INCREASE IN 80-1   NO ALARM IN STS.	L1-022 INDICATES INCREASE IN 80-1  SUPERNATANT AND RESIN COULD ACCIMULATE IN 80-1.  NO ALARM IN STS.  LEAKAGE OF SUPERNATANT INTO 80-1 MAT  REQUIRE REPROCESSING OF 80-1 LIQUID.	e		-
027 -05	PV-106 INSTRINENT ATR SUPPLY VALVE. TO IN-C. 001	VALVE LEAKS IMPONCH DURING PROCESS MODE	FIC-035 (INDICATIONS MAY BECOME ERRATIC) AND RE LE-X19 NO LEVEL INDICATION. P1-X14	LIQUID MAY BE DISPLACED IN ALL COLUMNS AND THE SAMD FILER, ULTIMATELY VENTING THROUGH RD-3 VENT SYSTEM, EFFECTIVENESS OF ZEOL, IE MAY BE REDUCED TO AN UNACCEPTABLE LEVEL BECAUSE THE RESIDENCE TIME IS DECREASED, THEREBY SHORTENING. THE EFFECTIVE LIFE OF THE ZEOLITE.	e .		~

RELIABILITY ANALYSIS - SUPERNATANT PROCESSING - STEADY STATE

DATE 19-DOC-87 1-4GE 50-18

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110M	COMPONENT EDGNITETCATION	FALLURE MODE	FAILURE DETECTION METHOD(S)	FAILURE	CATEGORY	PROBABILITY	CLASS
20-330	PTE-115, COLUMN A VESSEL BLAST DISC	REPTURE ALLOWS PROCESS FLUID TO SE RECYCLED TO 30-2	FIC-035 AND OTHER PRESSURE INDICATORS WILL GIVE LEAKAGE INDICATION	WILL	<u> </u>		N
26-34	FW-2048, SIGHICE MATER SUPPLY TO TOP SCREEK	LEAKS THROUGH IN PROCESS MODE	No.	SLIGHT LOSS IN PRODUCTION EFFICIENCY	ļ <sub>=</sub>	u	•
50-350	FV-218, SLUICE WATER TO 68-1	LEAKS THROUGH IN PROCESS M.DE	LI-022 INDICATES INCREASE IN 60-1 LIQUID LEVEL. NO ALARM IN STS	SUPERMATANT PROCESS FLUID WILL BE RETURNED TO 80-1 LEAKAGE OF SUPERMATANT INTO 80-1 MAY REQUIRE REPROCESSING OF 80-1 LIQUID.	2		•
98.98	FV-204A, SLUICE WATER SUPPLY TO BOTTOM SCREEN	LEAKS THROUGH IN PROCESS MODE	<b>Y</b>	SLIGHT PRODUCTION EFFICIENCY REDUCTION	=		-

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ENGINEER_	<u> </u>	DATE	REVIEWED BY_	1 Dargi DATE 12-10-89

11EM   NO.	COMPONENT IDENTIFICATION	FAILURE   MODE	FAILURE DETECTION METHOD(\$)	FAILURE EFFECT		RELATIVE    PROBABILITY	CLASS
56-370	FV-206, INSTRUMENT AIR SUPPLY	E VALVE LEAKS THROUGH DURING PROCESS MODE  I	FIC-035 (INDICATIONS MAY  BECOME ERRATIC) AND RE	LIQUID MAY BE DISPLACED IN ALL COLUMNS AND THE SAND FILTER, ULTIMATELY VENTING THROUGH 80-3 VENT SYSTEM. EFFECTIVENESS OF ZEOLITE MAY BE REDUCED TO AN UNACCEPTABLE LEVEL BECAUSE THE RESIDENCE TIME IS DECREASED, THEREBY SHORTENING THE EFFECTIVE LIFE OF THE ZEOLITE.	l lb		2
50-380	PSE-215, TO IX C-302	BURST DISC RUPTURES DURING PROCESS MODE	FIC-035 AND OTHER PRESSURE INDICATORS WILL GIVE LEAKAGE INDICATION IF LEAKAGE IS LARGE	SUPERNATANT PROCESS FLUID WILL BE RETURNED TO 80-2.	l tb	•	2
50-390	FV-205, ZEOLITE SUPPLY	LEAKS THROUGH DURING PROCESS MODE		SUPERNATANT AND RESIN COULD ACCUMULATE IN 80-1.  LEAKAGE OF SUPERNATANT INTO 80-1 MAY REQUIRE REPROCESSING OF 80-1 LIQUID.	1b   1   1   1   1   1   1   1   1   1	] C	3
50-391	FW-205, ZEOLITE SUPPLY	VALVE LEAKS EXTERNALLY DURING PROCESS MODE	RADIOACTIVITY IN VALVE BOK	VALVE BOX COLLECTS RADIOACTIVE LIQUID SUBSTANCE	IIe   III   III	c	3

ENGINEER Siebstamen DATE 12-4-87 REVIEWED BY DATE 12-9-8"

NO.	COMPONENT IDENTIFICATION	FAILURE MODE	FAILURE DE: CTION No THOO(S)	FAILURE FESSET	SEVERITY	RELATIVE	FAILURE
50-400	FV-208, ZEOLITE DUMP	VALVE LEAKS THROUGH IN PROCESS MODE	LI-UZZ INDICATES INCREASE IN 80 7. NO ALARM IN STS.	SUPE. NATANT AND RESIN COULD ACCUMULATE IN 80-1  LEAKAGE OF SUPERNATANT INTO 80-1 HAY  REQUIRE REPROCESSING OF 80-1 LIQUID.	l ib l l l	C	3
50-601	FV-208, ZEOLITE DUMP	VALVE LEAKS EXTERNALLY DURING PROCESS MODE	LI-022 INDICATES INLAEASE IN 80-1. NO ALARM IN STS.	SUPERNATANT AND RESIN COULD ACCUMULATE IN 80-1  LEAKAGE OF SUPERNATANT INTO 80-1 MAY REQUIRE REPROCESSING OF 80-1 LIQUID.	   16   		3
30-410	FV-306, INSTRUMENT AIR SUPPLY	VALVE LEAKS THROUGH DURING PROCESS MODE	FIC-035 (INDICATIONS MAY BECOME ERRATIC) AND RE	LIQUID MAY BE DISPLACED IN ALL COLUMNS AND THE SAND FILTER, ULTIMATELY VENTING THROUGH 80-3 VENT SYSTEM. EFFECTIVENESS OF ZEOLITE MAY BE REDUCED TO AN UNACCEPTABLE LEVEL BECAUSE THE RESIDENCE TIME IS DECREASED, THEREBY SHORTENING THE EFFECTIVE LIFE OF THE ZEOLITE.	ib		2
50-420 ]	FV-305, ZEOLITE SUPPLY	LEAKS THROUGH DURING PROCESS MODE	LI-022 INDICATES INCREASE IN BO-1	SUPERNATANT AND RESIN COULD ACCUMULATE La 80-1.	Ib	C	3

RELIABILITY ANALYSIS - SUPERNATANT PROCESSING - STEADY STATE

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116w 10.	COMPONENT IDENTIFICATION	FAILURE	FAILURE DETECTION METHOD(S)	FAILURE	SEVERITY   CATEGORY	RELATIVE	SEVERITY   RELATIVE   FAILURE CATEGORY   PROBABILITY   CLASS
127-05	'V-305, ZEOLITE SUPPLY	WALVE LEAKS EXTERNALLY DURING PROCESS MODE	RADIOACTIVITY IN VALVE BOX	VALVE BOX COLLECTS RADIOACTIVE LIQUID	=		and and
067-06	FV-508, 2EOLITE DUMP	VALVE LEAKS THROUGH DONING PROCESS MODE	LI-022 INDICATES INCREASE IN 00-1, NO ALARM IN STS.	SUPERMATANT AND RESIN COULD ACCUMULATE IN 80-1 LEAKAGE OF SUPERMATAN, INTO 80-1 NAY REQUIRE REPROCESSING OF 80-1 LIQUID.	2		,
50-631	FV-508, 2EOLITE DUMP	VALVE LEAKS EXTERNALLY  GURING PROCESS MADE	LI-022 INDICATES INCREASE IN 80-1. NO ALARM IN STS.	SUPERNATANT AND RESIN COULD ACCUMULATE IN 80-1 LEAKAGE OF SUPERNATANT INTO 80-1 MAY REQUIRE REPROCESSING OF 80-1 LEGUID.			~
077-05	FV-SOGB, SLUTCE WATER SUPPLY TO TOP SCREEK	LEAKS THROUGH IN PROCESS MODE	¥0	SLIGHT "TS OF PRODUCTION EFFICIENCY			•

RELIABILITY ANALYSIS SUPERNATANT PROCESSING - STEADY STATE

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ENGINEER	1.3	DATE	200	REVIEWED BY	"CROS-	DATE 12-10-89
				9.	/ .	

ITEM     COMPONENT IDENTIFICATION		FAILURE MODE		FAILURE EFFECT	SEVERITY   CATEGORY	[ RELATIVE   [PROBABILITY ]	FAILURE CLASS	1
50-450	FV-318, SLUICE WATER TO 80-1	LEAKS THROUGH IN PROCESS MODE	L1-022 INDICATES INCREASE IN     80-1 LIGUID LEVEL.     NO ALARM IN STS	SUPERNATANT PROCESS FLUID WILL BE RETURNED TO 80-1  LEAKAGE OF SUPERNATANT INTO 80-1 MAY REQUIRE REPROCESSING 05 80-1 LIQUIL.	1b		3	
50-460	FV-304A, SLUICE WATER SUPPLY TO BOTTOM SCREEN	LEAKS THROUGH IN PROCESS MODE	NONE	SLIGHT LOSS IN PRODUCTION EFFICIENCY	1 211	c	3	
50-470	PSE-315, TO 1X C-003	BURST DISC RUPTURES DURING PROCESS MODE	FIC-035 AND OTHER PRESSURE   INDICATORS WILL GIVE LEAKAGE   INDICATION IF LEAKAGE IS LARGE	SUPERNATANT PROCESS FLUID WILL BE RETURNED TO 80-2.	1b	•	2	
50-480 i	FV-406, INSTRUMENT AIR SUPPLY TO IX-C-004	VALVE LEAKS THROUGH WHILE COLUMN D IS IN THE STANDBY MODE I	PI-414 WILL READ THE SAME   PRESSURE AS THE INSTRUMENT   AIR SUPPLY PRESSURE	NO SIGNIFICANT EFFECT	111	( C	3	

ENGINE Epibelanie DATE 12-4-87 REVIEWED BY MORCEY DATE 12-4-87

11FM     MO.	COMPONENT IDENTIFICATION	FAILURE   MODE	FAILURE DETECTION METHOD(S)	FAILURE EFFECT	SEVERITY	PROBABILITY	FAILURE   CLASS
50-481                   	PV-406, INSTRUMENT A'R SUPPLY TO IX-C-004	VALVE FAILS TO OPEN DURING  AIR PURGE CYCLE  I	LIMIT SWITCH, FI-026 AND   PI-414	THE NOAMAL ZEOLITE REFILL CYCLE CANNOT PROCEED.	11b		3
50-482   	FV-406, INSTRUMENT AIR SUPPLY TO IX-C-004	VALVE FAILS TO CLOSE DURING AIR PURGE CYCLE	'INIT SHITCH, F1-026	THE ZEOLITE REFILL CYCLE CANNOT PROCEED	Ib		3
50-43	FV-406, INSTRUMENT AIR SUPPLY TO .x-C-004	VALVE LEAKS THROUGH DURING  AIR PURGE CYCLE  I	NONE (SMALL LEAKAGE)	MONE	111		3
1 50-484	FV-406, INSTRUMENT AIR SUPPLY TO IX-C-004	VALVE LEAK'S THROUGH DURING RINSE CYCLE	NONE (SMALL LEAKAGE)	MONE	111		3

ENGINES Libelanin DATE 12 487 REVIEWED BY MORAY DATE 62 4-89

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10 IS COME. INSTRUMENTALE SUPPLY WHAT LEAST INSTRUMENTALE SUPPLY INSTRUMENTALE SUPPLY WHAT LEAST INSTRUMENTALE SUPPLY WHAT LEAST INSTRUMENTALES WHOSE SUPPLY WHAT LEAST INSTRUMENTALES WHOSE SUPPLY WHO SUPPLY WHO SUPPLY WHO SUPPLY WHO SUPPLY WHO SUPPLY WHAT COLUMN INSTRUMENTAL SUPPLY WHO SUPPLY WH	1 1168 1 80.	COMPONENT IDENTIFICATION	, 6AIV™E ™	FALLURE DETECTION METHOD(S)	FAILURE		RELATIVE	FAILURE   CLASS
10 IS-C-004, INSTRUMENT AIR SUPPLY NALVE LEAKS TRROUGH JURING. NORE (SMALL LEAKAGE) KIGHE   1111   C    10 IS-C-004, INSTRUMENT AIR SUPPLY NALVE LEAKS TRROUGH DURING.   NORE (SMALL LEAKAGE)   NORE (SMALL LEAKAGE)   NORE    10 IS-C-004, INSTRUMENT AIR SUPPLY NALVE LEAKS TRROUGH DURING.   NORE (SMALL LEAKAGE)   NORE (SMALL LEAKAGE)   NORE    10 IS-C-004, INSTRUMENT AIR SUPPLY NALVE LEAKS TRROUGH DURING.   NORE (SMALL LEAKAGE)   NORE (SMALL LEAKAGE)   NORE    10 IS-C-004, INSTRUMENT AIR SUPPLY NALVE LEAKS TRROUGH DURING THE AIR NAME   NORE    10 IS-C-004, INSTRUMENT AIR SUPPLY NALVE LEAKS TRROUGH DURING THE AIR NAME   NORE    10 IS-C-004, INSTRUMENT AIR SUPPLY NALVE LEAKS TRROUGH DURING THE AIR NAME   NORE    10 IS-C-004, INSTRUMENT AIR SUPPLY NALVE LEAKS TRROUGH LEAKS TRROUGH THE INDIRECTION THAT	\$	FV-406, INSTRUMENT AIR SUPPLY TO IX-C-004	VALVE CEAKS THROUGH CARING BACKLASH	NONE (SMALL LENGAGE)	PCME.	Ē	ű	,,
FOR 400, INSTRUMENT AIR SUPPLY VALVE LEAKS THROUGH DURING NOWE (SMALL LEAKAGE) NOWE 1111 C  TO IX C 004  TO IX C 004  TO IX C 004  POR 415, COLUMN D VESSEL BARST DISC PARTIAL RUPTURE ALLOAG COMMUNICATION PT 414 WILL READ LOAGE THAN PT-414 WILL GIVE A PREMATRIE INDICATION THAT ID 8  RETHERN COLUMN D AND VEHIS FLUIDS TO NOWHAL DURING THE AIR PUNCE THE COLUMN LIQUID HAS BEEN DISCLACED. LIQUID  60-2 WHILE IN THE REFILL NAME 1008 THE AIR PUNCE THE COLUMN THAT THE DURING THE FLUISH WAY PARTIALLY SHORT CIRCUIT  10 DOS 2.	\$ \$	FV-406, INSTRUMENT AIR SUPPLY TO IN-C-004.	VALVE LEAKS THROUGH JURTING ZEOLITE SLUICING	NOME (SMALL LEAKAGE)	KOK	1	u	n
PSE-415, COLUMN D VESSEL BURSI DISC PARTIAL RUPTURE ALLOAG COMMUNICATION P1-414 WILL GIVE A PREMATURE INDICATION THAT I ID 8   8   8   8   8   8   8   8   8   8	9 9	FV-406, INSTRUMENT AIR SUPPLY TO IX-C-004	VALVE LEAKS THROAGH OLRING ZEOLITE LOADING	NOME (SW2)1 LEANAGE)	ROME	=	u	,
	8 8	PSE-415, COLUMN D VESSEL BURST DISC	PARTIAL RUFTURE ALLOAG COMMUNICATION RETWEEN COLUMN D AND VENTS FLUIDS TO 80-2 WHILE IN THE REFILL MODE	PI-414 WILL READ LOWER INAM NORMAL DURING THE ALR PURGE	PI-414 WILL GIVE A PREMATURE INDICATION THAT THE COLUMN LIQUID HAS BEEN DISPLACED. LIQUID DURING THE FLUSH MAY PARTIALLY SHORT CIRCUIT TO 80-2.	2		~

RELIABILITY SARITSIS - SUPERHATANT PROCESSING - STEADY STATE

ENCINE Libertamen DATE 12-4-87 NEVICLED BY MONGS DATE 12-4-89

SEVERITY | RELATIVE | FAILURE
CATEGORY | PROBABILITY | CLASS м 111 1111 Ξ === NO SIGNIFICANT EFFECT NO SIGNIFICANT EFFECT FAILURE NONE MONE FAILURE DETECTION METHOD(S) NONE NONE NONE NONE VALVE LEAKS THROUGH DURING RINSE MODE VALVE LEAKS EXTERNALLY DURING VALVE LEAKS EXTERNALLY WITH COLUMN D IN THE STANDBY MODE VALVE LEAKS THROUGH WITH COLLIMN D IN STANDBY MODE AIR PURGE FAILURE MODE FV-405, ZEOLITE SUPPLY VALVE FW-405, ZEOLITE SUPPLY VALVE FV-405, ZEOLITE SUPPLY VALVE FV-405, ZEOLITE SUPPLY VALVE COMPONENT IDENTIFICATION 50-500 50-504 ¥ 9 50-501 50-502

ENGINES Sieberhamen DATE 12-4-MREVIEWED BY Wary DATE 12-9-89

NO.	COMPONENT IDENTIFICATION	FAILURE MODE	FAILURE DETECTION METHOD(S)	FAILURE   EFFECT	SEVERITY CATEGORY	RELATIVE	FAILURE
5: 505	FV-405, ZEOLITE SUPPLY VALVE	VALVE LEAKS EXTERNALLY OURING RINSE MODE	AADIGACTIVITY IN VALVE BOX	VALVE BOX COLLECTS RADIOACTIVE LIQUID SUBSTANCE	11a 	C     C	3
50-506	FW-405, ZEOLITE SUPPLY WALVE	VALVE LEAKS THROUGH DURING BACKWAS.: MODE	NOME	NONE	111   111 		3
50-507 ]	FV-405, ZEOLITE SUPPLY VALVE	VALVE LEAKS EXTERNALLY DURING BACKWASH MODE	RADIOACTIVITY IN VALVE BOX	VALVE BOX COLLECTS RADIOACTIVE LIQUID SUBSTANCE	l lia	1	3   3   1   1   1   1   1   1   1   1
50-508	FV-405, ZEOLITE SUPPLY VALVE	VALVE LEAKS THROUGH DURING  ZEOLITE SLUICING MODE	NONE	I NONE  I  I  I  I  I	111	c     l   l   l   l   l   l   l   l	3   1   1   1   1   1   1   1   1   1

ENGINEER Silbalanier Date 12-4-87 REVIEWED BY WARRY DATE 12-4-89

17EM     NO.	COMPONENT IDENTIFICATION	FAILURE   MODE	FAILURE DETECTION METHODISS	FAILURE   EFFECT	SEVERITY	RELATIVE	FAILURE
1 50-509   1   1   1   1   1   1   1	FV-405, PORTE SUPPLY VALVE	J VALVE LEAKS EXTERNALLY DURING ZEOLITE SLUICING MODE  1	NONE	NONE  I  I  I		C     C	3
50-509A	FV-405, ZEOLITE SUPPLY VALVE	VALVE FAILS TO OPEN DURING ZEOLITE LOADING	POSITION INDICATOR LIGHTS AND AN ALARM WILL INDICATE THAT THE VALVE HAS NOT ASSUMED THE CORRECT POSITION.	COLUMN REFILL WITH RESIN WILL NOT BE POSSIBLE.	I Ib		2 1
50-5096	FV-C05, ZEOLITE SUPPLY VALVE	VALVE FAILS TO CLOSE DURING  2EGLITE LOADING  1	POSITION INDICATOR LIGHTS AND AN ALARM WILL INDICATE THAT THE YALVE HAS NOT ASSUMED THE CORRECT POSITION.	USE OF THE COLUMN MAY NOT BE ACCEPTABLE WITHOUT OUBLE VALVE ISOLATION AT AN ENVIRONMENTAL INTERFACE.  I	l lb	c     l   l   l   l   l   l   l   l	3
50-509C	FW-405, ZEOLITE SUPPLY VALVE	VALVE LEAKS THROUGH DURING ZEOLITE LOADING  ZEOLITE LOADING	NONE	NONE	111	c	3     1     1     1

RELIABILITY ANALYSIS - SUPERNATANT PROCESSING - STEADY STATE

ENGINERAL PARAMENTONIE 12-4-87 REVIEWED BY MODAY, DA. 312-4-89

= - 1				
FAILURE   CLASS			^	^
RELATIVE  PROBABILITY	u			
SEVERITY   CATEGORY	•		1	I
FATURE	LIQUID ACCUMILATES IN VALVE PIT.	жж	and the same of th	SALTS MAT BE DEPOSITED IN 80-1. LEAKAGE OF SUPERMAIANT INTO 80-1 MAY REQUIRE REPROCESSING OF 80-1 LIQUID.
FAILURE DETECTION METHOD(S)	SHOW.	ЭКОИ	Y .	*
300W	VALVE LEAKS EXTERNALLY DURING ZEOLITE LOKDING	VALVE LEAKS FRIGOIGH WITH COLUMN D SN THE STANGET MODE	VALVE LEAKS EXTERNALLY UNILE COLUMN D IS IN THE STANDBY MODE	VALVE LEAKS THROUGH DUBI-NG AIR PURGE
COMPONENT IDENTIFICATION	A 116 %	FV-408, 2501.11E DUMP	FV-408, 2504.THE DUMP	FV-408, ZEOLITE DUMP
116# 80	905-908	25.9.	E 08	28-58

ENGINE Billestamin DATE 12-4-87 EVIEWED BY WORKY TO DATE 12-4-89

176H ] HO. ]	COMPONENT IDENTIFICATION	FAILURE MODE	FAILURE DETECTION METHOD(S)	FAILURE EFFECT	SEVERITY	RELATIVE	FAILURE
50-513	PV-408, ZEOLITE DUMP	VALVE LEAKS EXTERNALLY DURING AIR PURGE	MONE	SALTS MAY BE DEPOSITED IN 80-1.  LEAKAGE OF SUPERNATANT INTO 80-1 MAY REQUIRE REPROCESSING OF 80-1 LIQUID.	111 	¢	3
50-514	FV-408, ZEOLITE DUMP	VALVE LEAKS THROUGH DURING RIWSE CYCLE	MOME	SOME SALTS FROM THE SUPERNATANT WILL ENTER THE  80-1 TANK. EFFECTS ARE JUDGED TO BE MINOR.  LEAKAGE OF SUPERNATANT INTO 60-1 MAY  REQUIRE REPROCESSING OF 80-1 LIQUID.	1 111	c	3
50-515	FV-408, ZEOLITE DUMP	VALVE LEAKS EXTERNALLY DURING RINSE CYCLE	NONE	SOME SALTS FROM THE SUPERNATANT WILL ENTER THE 80-1 TANK. EFFECTS ARE JUDGED TO BE MINOR.  LEAKAGE OF SUPERNATANT INTO 80-1 MAY REQUIRE REPROCESSING OF 80-1 LIQUID.			3
50-516   	EV-408, ZEOLITE DUMP	NALVE LEAKS THROUGH DURING BACKWASH CYCLC	NONE	NONE		c	3   3   1   1   1   1

ENGINE Sibelanier DATE 12-4-87 REVIEWO BY Caragin DATE 12-4-87

11EM     NO.	COMPONENT IDENTIFICATION	FAILURE   MODE	FAILURE DETECTION METHOD(S)	FAJLURE EFFECT	SEVERITY	RELATIVE	FAILURE
50-517   	FV-408, ZEOLITE DUMP	VALVE LEAKS EXTERNALLY DURING   BACKWASH CYCLE	! NONE	NONE	111	C	3
50-518   	FV-408, ZEOLITE DUMP	1	POSITION SHOICATOR LIGHTS  AND AN ALARM WILL INDICATE THAT I THE VALVE HAS NOT ASSUMED THE I CORRECT POSITION.	EXPENDED RESIN CANNOT BE DUMPED	1b		1
50 > 19	FV-408, ZEOLITE DUMP	VALVE FAILS TO CLOSE DURING  ZEOLITE SLUICING	POSITION INDICATOR LIGHTS AND AN ALARM WILL INDICATE THAT   THE VALVE HAS NOT ASSUMED THE   CORRECT POSITION.	THE COLUMN CANNOT BE LOADED.	1b	C	3
50-519A	FV-408, ZEOLTTE DUMP	VALVE LEAKS THROUGH DURING ZEGLITE LOADING	MONE   1	THE COLUMN MOULD FAIL WHEN PLACED IN SERVICE.	1 111	c   1   1   1   1   1   1   1   1   1	3

ENGINE Existence DATE 12-4-87 EMIENED BY COMMY DATE 12-4-87

NO.	CUMPONENT IDENTIFICATION	FAILURE   MODE	FAILURE DETECTION METHOD(S)	FAILURE EFFECT	SEVER 'Y	RELATIVE	FAILURE
30-5199   	FV-408, ZEOLITE DUPP	VALVE LEAKS EXTERNALLY DURING ZEOLITE LOADING	NONE	THE COLUMN MOULD FAIL WHEN PLACED IN SERVICE.	1 111		3
50-520	FV-418, SLUTCE WATER TO BD-1, VALVE	VALVE LEAKS THROUGH WITH COLUMN D IN THE STANDRY MODE I	NONE	NONE	III   III   I   I   I   I   I   I   I		3
50-521	FV-418, SLUICE WATER TO 80-1, VALVE	LEAKS THROUGH IN AIR PURGE HODE	NONE	NONE	1 111	c	3
50-522	FV-418, SLUICE WATER TO 80-1, VALVE	LEAKS THROUGH IN RINSE MODE	NONE	NONE	1 111	c	3

ENGINE E Biebelanier Date 12-4-3 Reviewed BY Jaky Date 12-4-89

1168     NO.	COMPONENT IDENTIFICATION	FAILURE   MODE		FAILURE   EFFECT	SEVERITY	RCLATIVE	FAILURE
50-523   	FV-418, SLUICE WATER TO 80-1, VALVE	FAILS TO OPEN IN BACKWASH MODE	POSITION INDICATOR LIGHTS AND AN ALARM WILL INDICATE THAT THE VALVE HAS NOT ASSUMED THE	EXHAUSTED RESIN WITHIN THE COLUMN COULDN'T BE    FLUFFED. IT IS POSSIBLE THAT THE RESIN COULD      STILL BE SLUTCED OUT OF THE COLUMN. ULTIMATELY      THE VALVE MOULD HAVE TO BE REPLACED. RESULTING IN      AN EXTENDED ONTAGE.	11b		3
50-524   	FV-418, SLUICE WATER TO 80-1, VALVE	FAILS TO CLOSE IN BACKWASH MODE	POSITION INDICATOR LIGHTS AND AN ALARM WILL INDICATE THAT	SESIN COULD BE LOADED, BUT THE VALVE MOULD HAVE     TO BE CHANGED OUT BEFORE THE COLUMN WAS PLACED ON     LINE FOR USE. THE ANTICIPATED CHANGE OUT PROCESS     RESULTS IN AN EXTENDED OUTAGE.	Ib		3
50-525   	FV-418, SLUICE WATER TO 80-1, VALVE	LEAKS THROUGH IN BACKWASH MODE	NOME	WONE	111	C	3
50-526   	FV-418, SLUICE WATER TO 80-1, VALVE	LEAKS THROUGH IN ZEOLITE SLUICING MODE	MOME	I NONE	111		3

ENGINE Siebelanier DATE 12-4-87 REVIEWED BY DATELY DATE SO-33

	COMPONENT IDENTIFICATION	FAILURE MODE	FAILURE DETECTION METHOD(S)	FAILURE   EFFECT	SEVERITY	RELATIVE	FAILURE
50-527	FV-418, SLUICE LATER TO 80-1, VALVE	FAILS TO OPEN IN ZEOLITE LOADING MODE	POSITION INDICATOR LIGHTS AND AN ALARM WILL INDICATE THAT THE VALVE HAS NOT ASSUMED THE CORRECT POSITION.	THE COLUMN WOULD NOT BE LOADED SATISFACTORILY.	lib	8	3 1
50-528   	FV-418, SLUICE WATER TO S0-1, VALVE	FAILS TO CLOSE IN ZEOLITE LOADING MODE	AND AN ALARM WILL INDICATE THAT	RESIN COULD BE LUADED, BUT THE VALVE MOULD HAVE FOR BE CHANGED OUT BEFORE THE COLUMN WAS PLACED ON LINE FOR USE. THE ANTICIPATED CHANGE OUT PROCESS I RESULTS IN AN EXTENDED OUTAGE.  I	ib		3
50-529 	FV-418, SLUICE WATER TO	LEAKS THROUGH OURING ZEOLITE LOADING MODE	NONE	NONE	ш	C	3
50-530 	PV-GOCK, SLUTCE WATER TO TOP SCREEN	VALVE LEALS THROUGH WHILE COLUMN D IS IN STANDBY MODE	NONE	WONE	m	C	3   1   1   1   1   1   1   1   1   1

RELIABILITY AMALYSIS - SUPERMATANT PROCESSING - STEADY STATE

ENGINEER LES LES LANGERS ON PAGE SO. SA. DATE 12.9.P.)

FAILURE			~	<u> </u>
KELATIVE   F	9			
CATEGORY IP	=	=	<u>a</u>	<u>a</u>
FA1625	NOME		SUPERMATANT RINSE TO 80-2 PRIOR TO SUPETING RESIN TO 80-1 CAN OCCUR 801 LESS EFFECTIVE. SALTS IN SUPERMATANT CAN CONTAMINATE THE 80-1 TANK.	DOESN'T PRECLUDE RINSE BUT CANNOT FLUFF OR RETURN TO SERVICE.
FAILURE DETECTION METHOD(S)	KOME	жом	POSITION INDICATOR LIGHTS AND AN ALARM WILL INDICATE TAXT   THE VALVE AND MOT ASSUMED THE   CORRECT POSITION.	POSITION INDICATOR LIGHTS  AND AN ALARM ULL INDICATE TART  THE VALVE HAS NOT ASSUMED THE CORRECT POSITION.  PT-415 WILL INDICATE SALUCE CUPPLY PRESSURE.
FAILURE NOCE	CEAKS THROUGH IN AER PURGE MODE	LÉACS THRONGH IN RINSE MODE	FAILS TO OPEN IN RINSE MODE	PAILS TO CLOSE IN RINSE MODE
COMPONENT IDENTIFICATION	PV-4048, SLUTCE MATER TO TOP SCREEN	FV-404B, SLUICE MATER TO TOP SCREEN	FV 404B, SLUICE MATER TO TOP SCREEN	FV-404B, SLUICE WATER TO TOP SCREEN
	12.95	26-525	29-533	26 - 53 A

ENGINEER E) Walter DATE 10/4/87 REVIEWE STEED LANGUAGE 12-4-87

116x   80.	COMPONENT IDENTIFICATION	FAILURE MODE	FAILURE DETECTION METHOD(S)	FAILURE EFFECT	SCJERITY   CATEGORY	RELATIVE	FAILURE 1
50-535 	TV-4048, SLUICE WATER TO TOP SCREEN	LEAKS THROUGH IN BACKWASH MODE	NONE	DOESN'T PRECLUDE BACKWASHING BUT MAY ALLOW RESIN TO ENTER PIPING	11		3
50-536 	FV-40-8, SLUICE WATER TO TOP SCREEN	LEAKS THROUGH IN ZEOLITE SLUTCING HODE	NONE 1	MONE	III   	C	3
50-537 	FV-404B, SLUTCE WATER TO TOP SCREEN	LOADING MODE	NONE	NOME	111         		3
50-540 	LOWER SCREEN	VALVE LEAKS THROUGH WHILE COLUMN D IS IN THE STANDBY MODE	NONE	NOME	III	C	3

ENGINEER EJ Waller DATE 12/4/87 REVIEWED Extilochamian 12-4-87

COMPONENT IDENTIFICATION	FAILURE   MODE		FAILURE EFFECT	SEVERITY   CATEGORY	RELATIVE	FAILURE CLASS
FV-404A, SLUICE MATER TO LOMER SCREEN	LEAKS THROUGH IN AIR PURGE MODE	NONE	SMALL AMOUNT OF MATER MAY BE ADDED TO 80-2.	111	C	3
FV-406A, SLUTCE WATER TO LOMER SCREEN	LEAKS THROUGH IN RINSE MODE  I  I  I	I NOME I	SMALL ANOUNT OF WATER MAY BE ADDED TO 80-2.	111	C	3
FV-404A, SLUICE WATER TO LOWER SCREEN	VALVE FAILS TO OPEN IN BACKWASH MODE	POSITION INDICATOR LIGHTS [   AND AN ALARM MILL INDICATE THAT	BACKWASHING CANNOT OCCUR.	l ib		2 1
FV-404A, SLUTCE WATER TO LONER SCREEN	VALVE FAIL TO CLOSE IN BACKWASH MODE	POSITION INDICATOR LIGHTS  AND AN ALARM WILL INDICATE THAT    THE VALVE HAS NOT ASSUMED THE    CORRECT POSITION. F1-084	CANNOT RETURN COLUMN TO SERVICE.	1 ib		3
	FV-404A, SLUICE WATER TO LOWER SCREEN  FV-404A, SLUICE WATER TO LOWER SCREEN  FV-404A, SLUICE WATER TO LOWER SCREEN	FV-404A, SLUICE MATER TO LEAKS THROUGH IN AIR PURGE MODE  FV-404A, SLUICE MATER TO LEAKS THROUGH IN RINSE MODE  LOWER SCREEN  FV-404A, SLUICE MATER TO LOWER SCREEN  FV-404A, SLUICE MATER TO VALVE FAILS TO OPEN IN BACKMASH MODE  FV-404A, SLUICE MATER TO VALVE FAIL TO CLOSE IN BACKMASH MODE	FV-404A, SLUICE WATER TO LEAKS THROUGH IN AIR PURGE MODE  FV-404A, SLUICE WATER TO LOWER SCREEN  FV-404A, SLUICE WATER TO LOWER SCREEN	COMPONENT IDENTIFICATION  MORE  FAILURE  FY-404A, SLUICE MATER TO  LEARS THROUGH IN AIR PUBGE MORE  FY-404A, SLUICE MATER TO  LOWER SCREEN  FY-404A, SLUICE MATER TO  VALVE FAILS TO OPEN IN BACKMASH MODE  FY-404A, SLUICE MATER TO  LOWER SCREEN  FY-404A, SLUICE MATER TO  VALVE FAIL TO CLOSE IN BACKMASH MODE  FY-404A, SLUICE MATER TO  LOWER SCREEN  FY-404A, SLUICE MATER TO  VALVE FAIL TO CLOSE IN BACKMASH MODE  FY-404A, SLUICE MATER TO  VALVE FAIL TO CLOSE IN BACKMASH	FV-404A, SLUICE WATER TO LEAKS THROUGH IN AIR PURGE MODE  FV-404A, SLUICE WATER TO LOMER SCREEN  FV-404A, SLUICE WATER TO VALVE FAILS TO OPEN IN BACKMASH MODE FV-404A, SLUICE WATER TO LOMER SCREEN  FV-404A, SLUICE WATER TO VALVE FAILS TO OPEN IN BACKMASH MODE FV-404A, SLUICE WATER TO LOMER SCREEN  FV-404A, SLUICE WATER TO VALVE FAILS TO CLOSE IN BACKMASH MODE FV-404A, SLUICE WATER TO LOMER SCREEN  FV-404A, SLUICE WATER TO VALVE FAIL TO CLOSE IN BACKMASH MODE FV-404A, SLUICE WATER TO LOMER SCREEN  FV-404A, SLUICE WATER TO VALVE FAIL TO CLOSE IN BACKMASH MODE FV-404A, SLUICE WATER TO LOMER SCREEN  FV-404A, SLUICE WATER TO VALVE FAIL TO CLOSE IN BACKMASH MODE FV-404A, SLUICE WATER TO VALVE MAS NOT ASSUMED THE THE VALVE MAS NOT SOLOMED THE THE VALVE MAS NOT SOLOMED THE THE VALVE MAS NOT SOLOMED THE	COMPONENT IDENTIFICATION  NODE  FAILURE  FAILURE  FAILURE DETECTION METHOD(S)  EFFECT  CATEGORY PROPRIABILITY  FV-GOGA, SLUTCE WATER TO  LEAKS INFORMER HE PURGE MODE  NONE  SMALL ANGUST OF MATER MAY BE  III C  LOMER SCREEN  FV-GOGA, SLUTCE WATER TO  LEAKS THROUGH IN RINSE MODE  HOME  SABLL ANGUST OF MATER MAY BE ADDRED  III C  FV-GOGA, SLUTCE WATER TO  LOMER SCREEN  FV-GOGA, SLUTCE WATER TO  VALVE FAILS TO OPEN IN BACKMASH MODE  FV-GOGA, SLUTCE WATER TO  LOMER SCREEN  FV-GOGA, SLUTCE WATER TO  VALVE FAILS TO OPEN IN BACKMASH MODE  FV-GOGA, SLUTCE WATER TO  LOMER SCREEN  FV-GOGA, SLUTCE WATER TO  VALVE FAILS TO CLOSE IN BACKMASH MODE  FV-GOGA, SLUTCE WATER TO  LOMER SCREEN  FV-GOGA, SLUTCE WATER TO  VALVE FAILS TO CLOSE IN BACKMASH MODE  FV-GOGA, SLUTCE WATER TO  LOMER SCREEN  FV-GOGA, SLUTCE WATER TO  VALVE FAIL TO CLOSE IN BACKMASH MODE  FV-GOGA, SLUTCE WATER TO  VALVE FAIL TO CLOSE IN BACKMASH MODE  FV-GOGA, SLUTCE WATER TO  VALVE FAIL TO CLOSE IN BACKMASH MODE  FV-GOGA, SLUTCE WATER TO  VALVE FAIL TO CLOSE IN BACKMASH MODE  FV-GOGA, SLUTCE WATER TO  VALVE FAIL TO CLOSE IN BACKMASH MODE  FV-GOGA, SLUTCE WATER TO  VALVE FAIL TO CLOSE IN BACKMASH MODE  FV-GOGA, SLUTCE WATER TO  VALVE FAIL TO CLOSE IN BACKMASH MODE  FV-GOGA, SLUTCE WATER TO  VALVE FAIL TO CLOSE IN BACKMASH MODE  FV-GOGA, SLUTCE WATER TO  VALVE FAIL TO CLOSE IN BACKMASH MODE  FV-GOGA, SLUTCE WATER TO  VALVE FAIL TO CLOSE IN BACKMASH MODE  FV-GOGA, SLUTCE WATER TO  VALVE FAIL TO CLOSE IN BACKMASH MODE  FV-GOGA, SLUTCE WATER TO  VALVE FAIL TO CLOSE IN BACKMASH MODE  FV-GOGA, SLUTCE WATER TO  VALVE FAIL TO CLOSE IN BACKMASH MODE  FV-GOGA, SLUTCE WATER TO  VALVE FAIL TO CLOSE IN BACKMASH MODE  FV-GOGA, SLUTCE WATER TO  VALVE FAIL TO CLOSE IN BACKMASH MODE  FV-GOGA, SLUTCE WATER TO  VALVE FAIL TO CLOSE IN BACKMASH MODE  FV-GOGA, SLUTCE WATER TO  VALVE FAIL TO CLOSE IN BACKMASH MODE  FV-GOGA, SLUTCE WATER TO  VALVE FAIL TO CLOSE IN BA

ENGINEER EXWEDE DATE 12/4/87 NEVIEW Extilo Lamina 12-4-87

116M ] NO.	COMPONENT IDENTIFICATION	FAILURE   MODE	FAILURE DETECTION METHOD(S)	FAILURE EFFECT	CATEGORY	RELATIVE    PROBABILITY	CLASS.
0-545	FV-404A, SLUICE WATER TO LOMER SCREEN	WALVE LEAKS THROUGH IN BACKWASH HODE	NOME	NONE	1 10	, c	3
		1 E 1			1		
0-546	FV-404A, SLUICE WATER TO LOWER SCREEN	VALVE FAILS TO OPEN IN THE ZEOLITE  SEUICING MODE  I	POSITION INDICATOR LIGHTS AND AN ALARM WILL INDICATE THAT THE VALVE HAS NOT ASSUMED THE CORRECT POSITION.	ZEOLITE WILL BE DIFFICULT TO PEN VE FROM TANK.	l lb		2
0-547	FV-404A, SQUICE MATER TO LONGR SCREEN	WALVE FAILS TO CLOSE IN THE ZEOLITE SLUICING MODE	SAME AS ABOVE.	WALVE MUST BE FIXED BEFORE RETURNING TO SERVICE.	1b   1   1   1   1   1   1   1   1   1	c	3
0-548	FV-404A, SLUTCE WATER TO LOMER SCREEN	VALVE LEAKS THROUGH IN THE ZEOLITE LOADING MODE LOADING MODE LOADING MODE	NONE I	CONTAMINATION OF NEW ZEOLITE WITH 80-1 CESIUM.	11 a, b	C	3

MELIABILITY ANALYSIS - SUPERNATANT PROCESSING - STEADY STATE

DATE DA-Dec-87 PAGE 50-38

ENGINEER SEWALT DATE 12/4/87 NEVIEWESKIEBERLANDER 12-4-87

FAILURE			~	-
PROBABILITY	,	v	•	J
SEVERITY CATEGORY	4	:	£	<u>e</u>
FAILURE	SAFERNATMAT COLC. LEME 1970 80-1.	WALVE BOY COLLECTS RACIOACTIVE LIGUID SOCTANCE	THOUGH WYT ANTICIPME, D TO REQUIRE CHANGEOUT, THE FAILURE OF THIS VALVE MORAD PRECIPITATE AN EXTENDED OUTAGE. THE VALVE MUST BE CHANGED OR REPAIRED BEFORE THE FILTER COULD BE REFLILED BITH SAND.	FAILURE TO CLOSE WOURD PRECLUDE USE OF TRIS FILTER DURING PROCESS FLOW. NO PROVISION HAS BEEN MADE TO BYPASS THE FILTER SY VALVE FAILURE IN THIS MANNER WOULD INTERRUPT PROCESS FLOW.
FALLURE DETECTION METHOD(S)	LI-022 INDICATES AND INCREASE IN 80-1, NO ALARM IN SIS.	RADIOACTIVITY IN VALVE BOX	POSITION INDICATOR LIGHTS	POSITION INDICATOR LIGHTS  VILL INDICATE THAT THE VALVE RAS    NOT ASSUMED THE CORRECT POSITION.
Miller	UNIVE LEMES THROUGH DURING NORMAL PROCESS	WOLVE LEAKS EXTERNALLY DURTHG MORMAL PROCESS	- ALLS TO GPEN FOR F .002 SAND REFILL	VALVE FAILS TO CLOSE FOLLOWING F-002 SAND REFILL
COMPONENT IDENTIFICATION	FV-D42, FOOZ SAMD SUPPLY VALVE	FV-042, F002 SAND SUPPLY VALVE	FV-042, F002 SAMD SUPPLY VALVE	FV-042, F002 SAMO SUPPLY VALVE
11£# #0.	89-350	55.85	28-28	86.98

DATE 04-0ec-87 PAGE 50-39

ENCINEER S. 1868 DATE 12/4/87 REVIEWERZELSGESSENIE 12-487

SEVERITY | RELATIVE | FAILURE CLASS • n -CATEGORY | PROBABILITY | u u 1111 9 q = LIGUID COCCO ACCUMULATE IN THE VALVE PIT. SUPERMATANT COME LEAK INTO 80-1 SUPERMATANT COULD LEAK 1810 80-1 FAILURE NONE FAILURE DETECTION METHOD(S) LI-022 INDICATES AN INCREASE IN 80-1. NO ALARCI IN STS. LI-022 INDICATES AN INCHEASE IN 80 1. NO LIARM IN STS. NONE MONE VALVE LEAKS THRONGH DURTING NORMAL PROCESS | VALVE LEAKS EXTERNAL DURING WORMAL GPERATION VALVE LEAKS EXTERNALLY DURING VALVE LEAKS THROUGH DURING F 002 FILTER MEDIA REFILL F-002 FILTER MEDIA REFILL FAILURE FV 031, F-002 SAND DUMP VALVE FV 031, F-002 SAMD DIMP VALVE FV-042, FOE? SAMD SUPPLY VALVE FV-042, FD02 SAMD SUPPLY VALVE MOTTACT TOENT TOWN OWN 50-560 50-555 50 561 20 274 1168 9

AMITS - SIFENATANT PROCESSING - STEADY STATE

DATF 04-Dec-87 PAGE 50-40

ENGINEER EJ. LOLEN. DATE 12/4/87 REVIETALISATIONER 12-4-87

115# 80.	CA-POWENT 1D-CUTTONTON	FATURE	1 MATCH DETECTION METHOD(S)	FAILGRE	SEVERITY CATEGORY	RELATIVE	FATLURE
292-262	FF-631, F-002 SAND DONG WAS	WALVE FAILS TO OPEN DURING SZAD DUMP	POSITION INDICATOR A COURSE MAS WOT ASSUMED THE CORRECT POSITION.	POSITION INDICATOR LIGHTS DUNPING OF SAMD MONED WOLF DE ACCOMPLISHED. SINCE    WILL INDICATEAT THE WAYVE HAS THERE IS NO MAY TO BYPASS THE FILTER. THE VALVE    NOT ASSUMED THE CORRECT PPSITION.   MONED HAVE TO BE REPAIRED OR ANOTHER MAY OF    RAPITIMG THE FILTER MONED HAVE TO BE DEV. SED.	e		~
50-562	FV-051, F-002 SAMD DUMP VALVE	WALVE FAILS TO GLOSE DURING SAND DUMP	POSITION INDICATOR LIGH'S [WILL INDICATA THE VALVE HAS [NOT ASSUMED THE CORPECT POSITION.]	SINCE PREME IS ) MAY TO BYPASS THE FILTER, THE YALVE WAND MAYE TO BE REPAIRED.	e		
995-05	FY-031, F-0G2 SAMD DUMP VALVE	VALVE LEAKS THROACH DUSING FILTER HEDIA REFILL	*	F-002 FAILS WHEN RETURNED TO LERVICE.			
59-36	FV-051, F-002 SAND DUMP VALUE	VALVE LEAKS EXTERNAL LURING		F-002 PAILS LINER RETURNED TO SERVICE.	<b>=</b>	,	m

RELIABILIT: AMALYSIS - SUPERMATAMY PROCESSING - STEACY STATE

DATE 72 - 70-57 NEVET 450 BT 1 NO. CATE 12 - 15 - 57

1 1168 1	COMPUMENT IDENTIFICATION	SODA I	FAILURE DETECTION METHOD(S)	FAILURE	SEVERITY   CATEGORY	PROBABILITY	CLASS
8-5-70	FCY-035, PROCESS FLOW CONTROL, VALVE DOMNSTREAM OF 9-002	VALVE FAILS TO OPEN DURING MORMAL PROCESS	FIG. 035 PROVIDES AN INDICATION OF NO FLOW AS WELL AS   POI-028. IN ADDITION, PRESSURE   G-002 WOALD CYON THE FAILURE OF   I'ME WALVE TO OPEN. VALVE POSITION	PROCESS FLOW WOLLD BE INTERRUPTED. THE IN COLUMNS WAY JARM NECESSITATING COLUMN RESTANDAMP	<u>s</u>	•	N
\$6.571	FCV-035, PROCESS FLOW CONTROL VALVE DOMNS REAM OF F-002	VALVE FAILS OPEN DORING MORPHL PROCESS	POSITION IMPICATOR LIGHTS  WILL IMPICATE THAT THE WALVE WAS   WOT ASSUMED THE CORRECT POSITION     POI-028 PROVIDES INFO TO IMPICATE     VALVE COMDITION. RAD DETECTORS     WAY ALSO IMPICATE THE RESULTS OF     RIGH FLOW. FIC-035	THE FLOW THROUGH THE IX COLUMNS AND F-002 WOULD BE ENCESSIVE. THIS COULD RESULT IN D'S LOWER THAN EXPECTED ATOMS WITH SHORTER RESIN LIFE.	<u> </u>	u	•
225-08	FCV-035, PROCESS FLOW CONTROL VALVE DOMESTREAM OF F-002	VALVE CONTROLS FLOW RIGHER THAN SIGNAL, DURING NORMAL, PROCESS	POSITION LIGHTS WILL INDICATE     TAMF THE VALUE MAS NOT ASSURED     THE CORRECT POSITION. POI-028     PROVIDES INFC TO INDICATE VALUE     COMDITION. NAD DETECTORS NAT ALSO     INDICATE THE PESULES OF MICH     PLOM. "-1C-035, 11-023	THE FLOW THROUGH THE LA COLUMNIS AND 5002 WOLLD BE ENCESSIVE. THIS COLLD RESULT IN 04-5 MUCH LOWER THAT EXPECTED ALONG WITH SHORTER RESIN LIFE.	£	u	•
\$ 55.08	FCV-C35, PROCESS FLOW CONTACK. VALVE DOMNSTREAM OF F-502	VALVE (ROLS FLOW DARR FRAME SIGNA. "THE MORROL PROCESS	POI-0C3 WILL IMPICATE A LONGE DIFFEREATIAL PRESSURE TAMA WOALD BE EXPECTED. LI-016 ON D-001 FEED TAME. LI-023	THE AMOUNT OF PRODUCT WILL BE RESUGED.	ß.		•

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RELIABILITY ANALYSIS - SUPERHAIANT PROCESSING - STEADY STATE

DATE D4-Dec-87 28GE 50:42

ENCINEER ELLELIE DATE 14/4/87 NEVIEWE SELESPERATURE 12-4-87

1 1169 1	COMPONENT IDENTIFICATION	FAILURE	FALLUNE DE SETTON METHOR:53	FALLURE EFFECT	SEVERITY   CATEGORY	RELATIVE  FROSABILITY	FAILURE
725-06	FCF-035, PROCESS FLOW CORTROL. WALVE DOUBL TEAM OF F-002	VALVE FAILS TO CLOSE DURING THE F-00" FILTER MEDIA FLUIDIZING	VALVE POSITION INDICATION	FILTER MEDIA REFILL WALLD BE INHIGHTED RCALSE "O(0" SAND CAN'T BE REMOVED.	<u> </u>	u	Ī-
65.95	'SV-635, PROCESS FLOW CGJRDN, MALVE DOMESTREAM OF F-502	VALVE LEAKS THROUGH DURING THE F-PQZ FILTER MEDIA FLUIDIZING.	*	MINIMAL INFACT, BACKLINSH MATER WOLLD LEAK 1870 SD-3			
96 - 58	FAC-715, 7-002, DECONTANINATED SL.CHMATANT FILTER	BLAST DISC BUPTURES	PRESSURE INSTRUMENTATION	SUPERMIANT PROCESS FLUID WAND BE SETURNED TO 80-2	e		
96-58	FV-064, WAY PROCESS BLOCK VALVE	WALVE FAILS TO MOVE TO "TANKSFER TO 80-3" "DOSTITON IN THE PROCESS MODE	PANEL INDICATION REPLECTS VALVE ALLGAMENT. IN ADDITION, LEVEL OF BO-3 MALO MOT INCREASE AS ENPECTED.	PRODUCT CATMON BE MADE AVAILABLE TO LUTS. DECONTANTANTED PRODUCT BACK TO 50-2.	e	•	~

RELIABILITY AMALYSIS - SLPERMATANT PROCESSING - STEADY STATE

DATE 04-Dec- 67 PAGE 50-43

ENCINEER EG. Welle DATE 12/4/87 NEVIEWER/LIGHTONION 12-487

11 14-166, 3-wr 12 14-166, 3-wr 14-166, 3-wr 15-166, 3-wr 16 14-166, 3-wr 16 14-166, 3-wr 17-462, 06cma	. C#	COMPONENT IPENTIFICATION	FAILURE	FALLURE DETECTION METHOD(S)	FABLURE	SEVERITY CATEGORY	RELATIVE	CLASS
TV-064, 3 way process block with teast helding in process sade.  FV-064, 3 way process block with teast helding in process sade.  FV-064, 3 way process block with teast helding in process sade.  FV-064, 3 way process block of process sade.  FV-064, 3 way process block of process sade.  FV-067, block with the process sade.  FV-067, blo	0-501	FV-664, 3-407 PROCE - BLOCK WALVE	CO2" POSITION IN THE PRIVESS MODI.	PAMEL INDICATION RELECTS VALVE ALICHENT. TAME 80-3 LEVEL MONID INCREASE.	PRODUCT WITH RIGH C4-137 ACTIVITY WAY BE   IC+ JUNED TO NO. 3, CONTAMINATING THE VESSEL. THE SUPERMAINST COMED BE DIVERTED FROM 80-3 TO 80-2 INSTEAD OF GOING TO 3-194.	<u></u>		*
PV-027, DECOMPRENATARY WITH PAIRS OFFER VALVE POSITION INDICATION AND UNANCEPTABLE PRODUCT MAY BE DIRECTED 1D C BLOCK VALVE (G-007 DISCUSSION)  LAN-055 NATURE (G-007 DISCUSSION)  LAN-055 NATU	0.585	FV-066, 3-MY PROCESS BLOCK VALVE	VALVE LEAKS THEORIGH IN PROCESS MODE	MAY BE DETECTED BY ERRATTIC FILL OF 80-3	SERVICED PROCESS BATE.	e	U	•
YY -467, DECORMANDER: SUPERMAINED   WALVE PRILES TO OPER   WALVE POSITION INDICATION   PRODUCT CANNOT NE DIFFICED TO TANK 35104   11-   8	907-0	FV-GCT, DECOSTANSMATED SUPERMATANT BLOC. VALVE (G-307 DISCHARGE)	WE'VE FAILS OPEN	VALVE POSITION INDICATION 15 PADVIDED 14AN-055 OR 11-055 INCREASE 18 35104 DORING SAMPLING	AM UMACCEPTABLE PRODUCT MAT BE DIRECTED 3-0 TAME \$5164 OR OVERFION OF 35164	2		•
		**, od.f., dicompositate supersantati bedek value eg-867 dischasee)	WALLY FAILS TO OPEN (OR RAN-OS) FAILURE)	VALVE POSITIOM INDICATION  15 PROVIDED.  RAN-037 MAY INDICATE THAT  THE DETECTOR EAS FAILED.	PRODUCT CANNOT NE DIRECHED TO TANK 35104	4		~

MELIABILITY AMALYSIS - SLPCRMATANT PROCESSING - STEADY STATE

DATE DA-Dac-87 PAGE 50-44

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SEVERITY | RELATIVE | FAILURE CLASS 85 CATEGORY | PROBABILITY | 3 u all 2 ā 43 OUT OF SPECIFICATION PROPICT CONTAINED IN 80-5 POTENTIAL OVERPLOW OF 35164 OR AN UNACCEPTABLE CANNOT BE DIREC'ED TO SD-2 FOR REPROCESSING. PRODUCTION RATE WILL DECREASE SLIGHTLY. PRODUCT DELIVERED TO 35104 REDUCED PRODUCT EFFICIENCY EFFECT PATELORE IS PROVIDED. CAMOT TRANSFER 15 PROVIDED, LI-055 DOES NOT LOSS OF LEVEL IN 50-3 DURING FAILURE DETECTION METHOD(S) VALVE POSITION INDICATION VALVE POSITION IMPICATION INDICATE AN INCREASE TO 80-2 FROM SO-3. 11-055, OR LAN-055 SAMPLING VALVE LEAKS THROUGH WALVE FAILS TO CLOSE VALVE LEATS THROUGH VALVE FAILS CLOSED FALLURE RECYCLE BLOCK VALVE (G-007 DISCHARGE) RECYCLE BLOCK VALVE (G-007 DISCHARGE) RECYCLE BLOCK VALVE (G-057 DISCHARGE) FV-067, DECONTANTHATED SUPERNATANT BLOCK VALVE (G-007 DISCHARGE) COMPONENT IDENTIFICATION FV-068, SUPERMATANT FV-068, SUPERMITANT FV-008, SUPERMATANI 50-610 50-612 50-602 50-611 E 9

Exchely Sieberhamen DATE 12-487 NEVIENES BY ES Walter DATE 12/4/87

NO.	COMPONENT IDENTIFICATION [	FAILURE		FAILURE     EFFECT	SEVERITY	RELATIVE	FAILURE
50-630	SC-014, CHECK WALVE IN CAUSTIC SODA,   MITRIC ACID OR WATER SUPPLY	VALVE FAILS CLOSED	YSS, AE-019, CE-JSB, AND TANK	ASSUMING THAT CHEMICAL ATDITION IS NECESSARY, AN     OUTAGE WOULD BE NECESSARY TO REPLACE THE FAULTY   VALVE JUMPER.	Ib		3
50-631	SC-014, CHECK VALVE IN CAUSTIC SOON,   NITRIC ACID OR WATER SUPPLY	VALVE FAILS OPEN	KONE	#OME	111		3
50-632	SC-014, CMECK VALVE IN CAUSTIC SODA,   NITRIC ACID ON WATER SUPPLY	VALVE LEAKS THROUGH	NONE	NONE	111		3
50-633	SC-014, CHECK VALVE IN CAUSTIC SODA,     NITRIC ACID OR WATER SUPPLY	VALVE PARTS LOOSEN	NOW I	SMALL PARTS BECOME LODGED WITHIN  HV-059 OR EDUCTOR G-014 AND PRECLIDE  THE MIXING OF 0-001.	116		3

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NO.	COMPONENT IDENTIFICATION	FAILURE ! MIDE	SAILURE DETECTION METHOD(S)	FAILURE   EFFECT	SEVERITY	RELATIVE	FAILURE
20-71)	TE-099 TEMPERATURE IMDICATION (PROCESS UPSTREAM E-002)	TEMPERATURE INDICATES HIGHER THAN ACTUAL	MONE.	MONE.	111		3 1
50-711	TE-099 TEMPERATURE INDICATION (PROCESS UPSTREAM E-002)	TEMPERATURE ENDICATES COMER THAN ACTUAL	MONE.	NOME.	***		3
50-715	TE-010 TEMPERATURE INDICATION (PROCESS UPSTREAM E-002)	TEMPERATURE INDICATES HIGHER THAN ACTUAL	IX COLUMN THAT IS FIRST IN LINE HAS TEMPERATURE READINGS LOWER THAN EXPECTED FOR THE INDICATED 1 11-01G TEMPERATURE.	JACTUAL PRODUCT TEMPERATURE IS LOWER THAN SETPOINT     TEMPERATURE OF THE IN COLUMNS.	111		3
50-716	FE-010 TEMPERATURE INDICATION (PROCESS UPSTREAM E-C-22)	TEMPERATURE INDICATES LOWER THAN ACTUAL	1 1x COLUMN THAT IS FIRST IN LINE   HAS TEMPERATURE READINGS HIGHER   THAN EXPECTED FOR THE INDICATED   11-010 TEMPERATURE.		II		3 1

RELIABILITY ANALYSIS - SUPERNATANT PROCESSING - STEADY STATE

DATE 04-Dec-87 PACE 50-47

ENGINEER Stibestamonnin 12 48) PENTENCO ON EGUALLO DATE 12/4/87

CLASS	^		**	-
PROBABILITY				
SEVERITY CATEGORY	=	1	2	1
FARCT	INCREASED SAMPLIEG WELLANCE TO IDENTIFY RESIN	SMCREASED MONITORING OF RE-313 FOR RESTR. RREACTHRONON. INDICATION OF RESTR. BRE-VCHRONON DESALTING IN RESTR. CHANGEOUT REFORE FURL LONDING MAS ACHIEVED.	FAILURE TO DETECT RESIN BREAKTHROUGH. POSSIBLE REDUCTION IN DOMNSTREAM MEDIA'S TIME BEFORE BREAKTHROUGH AND CHANGEOUT.	INCREASED MONITORING OF RT-213 FOR RESIN BREAKTHRONGN. POSSIBLE EARLIER INDICATION OF RESIN BREAKTHRONGN RESULTING IN RESIN CHANGOUT BEFORE FULL LOADING ANS ACHTEVED.
FAILURE DETECTION METHOD(S)	RAM-413 ALABMING; B1-413 AND RAM-413 LESS TAMA SETPOINT. SINCE TRIS COLUMN IS IN STANDBY OR HAVING ITS RESIN MEPLACED, RAM-413 DOES NOT CLEAR UNEN COLUMN IS RETURNED TO SERVICE	RI-313 AND RR-313 ARE LESS THAN THE SETPOINT, SAMPLES TAKEN AT THE IX COLUMN OUTLET ARE LONER THAN THE RADIATION SETPOINT.	RI-313 AND KR-313 ARE ABOVE THE ALARN SEPPOINT. SAMPLES TAKEN AT THE IX COLUMN OUTLET ARE NIGHER THAN THE RADIATION SETPOINT.	RI-233 AND RR-213 ARE LESS THAN THE SETPOTHT. SAMPLES TAKE. AT THE IX COLUMN OUTLET ARE LONGR THAN THE RADIATION SETPOINT.
FALLURE NOG	INDICATES HIGH ALARM WHEN LEVEL IS LOW	INDICATES NIGH ALARM WHEN LEVEL IS LOW	INDICATES NO ALAMM UNEN LEVEL IS NIGH	INDICATES NICH ALARM WHEN LEVEL IS LOW
COMPONENT IDENTIFICATION	RSH-415 RIGH ALABM SWITCH (COLUMN D DISCHARGE)	RSH-313 KIGH ALABH SMITCH (COLUMN C DISCHARGE)	SSR-513 RIGH ALARM SAFICE (COCUMN C DISCHARGE)	KSR-213 RIGH ALARM SALTOR CORUMN B DISCHARGE)
MO. 1	50-750	\$6-735	87.02	50-740

RELIABILITY ANALYSIS - SUPSRIANT PROCESSING - SIEADY STATE

DATE 04-Dec-87 PAGE 50-48

ENGINE Libertamon DATE (248 TREVIEWED BY EQUALIS DATE 12/4/87

1 110s	COMPONENT NOEWTHINGS	FAILURE	FALLINE DETECTION METHODICS)	FALURE	SEVERITY	SEVERITY   RELATIVE	FAILURE
127.02	RSH-215 NIGH ALARM SALITON (COLUMN: 8 DISCHARGE)	SMOICATES NO ALARM UNEN LEVEL 55 NIGH	RI-215 AND RR-213 ARE ABOVE THE ALARM SEPDINT. SAMPLES TAKEN AT THE IX COLUMN COLLECT ARE NICHER THAN THE RADIATION SEPDINT.	FAILURE TO DETECT JESIN BREATHROACH. POSSIBLE REDUCTION IN DOANSTREAM MEDIA'S TIME BEFORE BREATHROACH AND CHANGEOUT.	4		
87.08	RSn-113 HIGH ALMON SAITOR (COLUMN A DISCHARGE)	INDICATES RIGH ALADM WHEN LEVEL IS LOW	Ri3 AND RR-113 ANE LESS TANK THE SETPOLNT. SAMPLES TAKEN AT THE IN COLUMN DUTLET ANE LONER THAN THE RADIATION SETPONT.	INCREASED WENTORING OF RI-113 FOR BESIN BREATHROACH. POSSIBLE EARLIER INDICATION OF RESIN BREAKTHROACH RESULTING IN RESIN CHANGEOUT BEFORE FULL LONDING WAS ACHIEVED.			
99.76	RSH-113 NION ALARM SAITON (COLUMN A DISCHARGE)	INDICATES NO ALARM UNEW LEV IS SICA	RI-113 AND RN-113 ARE MOVE THE ALARM SETPOINT. SAMPLES TAKEN AT THE IX COLUMN OUTLET ARE HIGHER THAN THE RADIATION SETPOINT.	FAILURE TO DETECT RESIN BREAKTHROACH. POSSIBLE REDUCTION IN DOMNSTREAM NEDIA'S TIME BEFORE BREAKTHROACH AND CHANGEOUT.	4	<u>.</u>	
\$6.75¢	6-11-10 NIGH ALARM SATTOR (80-3) (LAN-025)	INDICATES RICH ALARM MICH LEVEL IS LOW	LEVEL INDICATION LI 023 IS LESS   INDA THE SETPOINT TET LAN-023 IS   ALABMING.				

RELIABILITY ANALYSIS - SUPERNATANT PROCESSING - STEADY STATE

DATE 04-Dec-87 PAGE 50-49

Mine Stillebanion care 7 4 8 nevienes or Allkohm care 124/8

SEVERITY | RELATIVE | FAILURE CLASS CATEGORY | PROBABILITY | 118 II P g 4 PUMP G-007 C' & MOT BE STARTED WITHOUT THE ALARM BEING CLEARED. AFTER A PERIOD OF TIME, THE POTENTIAL FOR OVERFILLING TANK &C-3 EXISTS. POSSIBLE OVERFLOW OF TANK BO-3. POSSIBLE DAMAGE TO G-007. POSSIBLE DAMAGE TO G-007. EFFECT PAILURE LEVEL INDICATION LI-023 IS MAKE THAN THE SETPOINT TET LAN-023 IS LAL 023 NOT ALARMING AND LI-023 READING ABOVE THE SETPOINT WITH CAVITATION OF G-007 RESULTING IN FAILURE DETECTION METHOD(S) SETPOINT WITH LAL-023 ALARNING. ALARMING. POSSIBLE CAVITATION LI-023 READING MORE THAN THE 11-023 READING LESS THAN THE OF G-BOT RESULTING IN LOW SETPOINT WITH LAL-023 MOT LOW READING ON P1 069. PUMP G-007 \$10PS. REACTING ON PI 009. NOT ALARMING. METER INDICATES NIGHER THAN ACTUAL LEVEL INDICATES NO ALARM . . . N LEVEL 15 HIGH INDICATES LOW ALARM WHEN LEVEL IS BIGH INDICATES NO ALARM WHEN LEVEL IS LOW FAILURE MODE | 8-17-10 LOW LEVEL ALARM SMITCH (50-3) | 8-11-10 LOW LEVEL ALARM SWITCH (80-3) B-LT-10 HIGH ALASH SWITCH (BD-3) B-LT-10 LEVEL IMDICATION (80-3) COMPONENT IDENTIFICATION (LAM-023) (LAL-023) (LAL-023) (11-023) 50-757 57 . 755 50-758 50-7 HIEN .08

RELIABILITY ANALYSIS - SUPERNATARY PROCESS. . S - STEADY STATE

DATE DK-Dec- 87

PAGE 50-50

enemelylibelanion one (3 48) nevience or Allelow one 12/4/87

SEVECITY | PRINTING | FAILURE CATEGORY | PROGRABILITY | CLASS m u ш u 111 = H 111 PLUGGING. BACKUP INDICATION OF FILTER PLUGGING IS PRUVIDED INDIRECTLY BY THE ABILITY OF FCV-035 PLUGGING IS PROVIDED INDIRECTLY BY THE ABILITY OF REDUCED ABILITY TO MEASURE F - 002 FILTER DP AND PRO-10ED BY THE ABILITY OR INABILITY OF FCY-035 LOSS OF THE ABILITY TO DETERMINE SAMP FILTER CLOGGING. BACKUP INDICATION FOR CLOGGING IS FILTER PLUGGING. SACKLP INDICATION OF FILTER THEREFORE THE LOSS OF THE ABILITY TO IDENT: FY INABILITY TO MEASURE F-002 FILTER DP AND THEREFORE THE ABILITY TO IDENTIFY FILTER TO COMPROR. THE FLC. AT 175 SETFORMT. FCV-035 TO MAINTAIN P.OM. TO MAINTAIN FLOW. FAILURE EFFECT MOME. METER TABLCATES ZERO PRESSURE NO MATTER WHAT POAK-028 ALARMS AND PI-033 READS | | METER INDICATES BIGHER THAN ACTUAL PRESSURE [PI-033 WILL INDICATE BIGHER THAN ] OF TIME THE FILTER NAS BEEN IN EXPECTED FOR THE TIME THE FILTER NORMAL PRESSURE FOR THE AMOUNT USE. THE FILTER DP., PDI-028, FELLURE DEFECTION NETHODES) PI-053 MILL INDICATE HIGH. PDI 028 WILL INDICATE LOW. WILL INDICATE LONGR THAN HAS BEEN IN USZ. NOME. 100 | METER INDICATES ZERO PRESSURE NO MATTER LINE | METER INDICATES LOWER THAN ACTUAL LEVEL THE ACTUAL LINE PRESSURE THE AC IL LINE PRESSURE FAILURE 8-LT-TO LEVEL INDICATION (30-5) PT-033 PRESSURE TRANSOUCER PT-033 PRESSURE TRANSDUCER PT-033 PRESSURE TRANSDUCER COMPONENT IDENTIFICATION AT F-002 DISCHARGE AT \$ - 902 DISCHARGE AT F-502 DISCHARGE (11-023) 26-760 50 762 50-759 50-761 # · ·

BELIABILITY AMALYSIS - SUPERMATANT PROCESSING - STEADY STATE

DATE 04 Dec- 67 PAGE 50-51

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	COMPONENT ITSMT191CATION	FAILURE MODEL	FAILURE DETECTION METHODES)	FAILURE	CATEGORY	PROBABILITY	I FAILURE
29 98	PT-033 PRESSURE TRANSCRICE AT F-002 DISCHARGE	METER INDICATES LONER THAN ACTUAL PRESSURE	P7-033 WILL INDICATE LOUGH THAN WORNAL PRESSURE FOR THE ANDJUST OF THE THE FILTER NAS BEEN IN USE. THE FILTER DP, PD1-026, WILL INDICATE NIGHER THAN SANS BEEN IN USE.	REDUCED ABILITY TO MEASURE F-002 FILTER DP. BACKUP INDICATION OF FILTER PLUGGING IS PROVIDED BY FCV-035.			n
25 08	P1-028 PRESSURE TRANSDUCER AT F-0G2 SUPPLY	METER INDICATES ZEAD PRESSURE NO MATTEZ MANT THE ACTUAL LINE PRESSURE.	(% P07-028, LOW READING ON P1,1ER DP P1-028, LOW READING ON P1-028.	INABILITY TO MEASURE F-002 FILIER DP AND THEREFORE THE LOSS OF THE ABILITY TO TORNTIFY FILLER PLUGGING. BACKED INDICATION OF FILTER PLUGGING IS PROVIDED INDIRECTLY BY THE ABILITY OF FCV-035 TO MAINTAIN FLOW.	1		^
35 00	PT-028 PRESSURE TRANSDUCER AT T-002 SUPPLY	METER INDICATES TULL PRESSURE 40 MATTER UNM1 NICH FLICER DP ALARM, POAR-028.  THE ACTUAL LINE PRESSURE.  HICH READING ON P1-028.		INMESTITY TO MEASURE F-002 FILTER DP AND THEREFORE THE LOSS OF THE ABILITY TO IDENTIFY FILTER PLUGGING. BACKUP INDICATION OF FILTER PLUGGING IS PROVIDED INDISCILLY BY THE ABILITY OF FCV-035 TO MAINTAIN FLOW.			
20 700	PT-026 PRESSURE TRANSDUCER AT F-002 SUPPLY	METER INDICATES NIGHER THAN ACTUAL PRESSURE	PI-028 WILL INDICATE RICHER THAN MONHAL PRESSURE FOR THE AMENAT OF "THE THE FILTER HAS BEEN IN JOE. THE THE POI-02P WILL INDICATE MICHER THAN EXPECTED FOR THE THE FILTER MAS BEEN IN USE.	F-002 FILTER DP 15 IN ERROR. OTHER INSTRINGER'S AND FIC-035 ARE USED FOR CONTINUED OPERA, JON.	1	,	•

RELIABILITY ANALYSIS - SUPERNATARY PROCESSING - STEADY STATE

DATE Dk. Dec. 87 PAGE 50:52

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	COMPONENT IDENTIFICATION	FATURE	FAILURE DETECTION METHOD(S)	FAILURE	SEVERITY CATEGORY	PROBABILITY	FALLURE
*	PT-028 PRESSURE TRANSDUCER AT F-002 SUPPLY	METER INDICATES LOWER THAN ACTUAL PRESSURE	PI 028 WILL IMPICATE LOWER THAM MOMENT, PRESSURE FOR THE AMOUNT OF THE THEER WAS BEEN IN USE. THE FILTER DP., POI 028, WILL IMPICATE LOWER THAN EXPECTED FOR THE THE THE FILTER HAS BEEN IN USE.	REDUCED ABILITY TO MEASURE F - 002 FILTER DF AND THERE FLUGGING. BACKED INDICATION OF FILTER PLUGGING IS PROVIDED INDIRECTLY BY THE ABILITY OF FCY-035 TO MAINTAIN FLOW.	l:		-
	PT-02B ATCH ALABM SWITCH AT 8-002 SUPPLY	TACLOURS WIGH ALARM WIEN LEVEL IS LOW	POAN 026 ALABMS, PD1-028 IMPICATES LESS THAN THE SET POINT VALUE.				
	PT-02B NIGH ALABM SMITCH AT \$-002 SAPPLY	INDICATES NO ALABN UNEN LEVEL IS NICH	POI-028 INDICATES HIGHER THAN THE SET POINT. FCV-035 UNABLE TO MAINTAIN THE PROPER FLCG.   MAINTAIN THE PROPER FLCG.   PRESSURES ON THE IX COLUMNS.	FIC-035 AND OTHER PRESSURE INDICATORS WILL BE USED FOR CONTINUED OPERATION.		u	
2	LE -LTO NIGO LEWEL ALABON SATTON	INDICATES NICH ALAMM WHEN LEVEL IS LOW	THE ALARM DOES NOT CLEAR DOBING. THE IN COLUMN RESIN DUMP CYCLE.	IMABILITY TO VERIFY PROPER FILLING OF THE COLUMN MITH RESIN SCHREY. INABILITY TO IDENTIFY IN DUMP VALVE FRILING. TO CLOSE.	e		

RELIABILITY AMALYSIS - SUPERMATANT PROCESSING - STEADY STATE

DATE 04-Der -87 PAGE 50-53

encine Libertains one (2-48) reviews on Equation one 124/87

SEVERITY | RELATIVE | FAILURE CATEGORY | PROBABILITY | CLASS 205 M m u ų ā 111 Ξ H IMABILITY TO VERIFY PROPER FILLING OF THE COLLING | WOME. THE LEVEL IMDICATION IS ONLY USED DURING NOME. THE LEVEL INDICATION IS ONLY USED DURING | NOME. THE LEVEL INDICATI'N IS ONLY USED DURING INABILITY TO TOENTIFY IX DUMP VALVE THE COLUMN RESIN REPLACEMENT CYCLE. THE COLUMN RESIN RESTACEMENT CYCLE. THE COLUMN RESIN REPLACEMENT CYCLE. WITH RESIN SLURRY. FAILURE TO CLOSE. FAILURE EFFECT THE ALARM DOKS NOT OCCUR DURING | FAILURE DETECTION METHOD(S) THE IX COLUMN RESIN ADDITION ALARM CLEARS DURING MORMAL ALARM CLEARS DURING MORMAL ALARM CLEARS DURING NORMAL CYCLE AS EXPECTED. OPERATION. OPERATION. OPERATION. PROTCATES NO ALARM WHEN LEVEL IS NIGH INDICATES NICH ALARM UNEN LEVEL IS LOW INDICATES NO ALARM WHEN LEVEL IS RIGH INDICATES HIGH ALARM WHEN LEVEL IS LOW FALLURE LE-419 HIGH LEVEL ALARM SMITCH LE-219 HIGH LEVEL ALARM SWITCH 12 319 HIGH ALARM SALTER LE-119 RIGH ALASM SMITCH COMPONENT IDENTIFICATION ON COLUMN B ON COLUMN 0 ON COLLINS C 50-780 50-771 50-775 50-785 1168

MINESS - SUPPRESENTANT DESCRIPTION - CTUMEN CHAIR

DATE 04-Dec-87 PAGE 50-54

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FAILURE	•			
PROBABILITY			v	
CAT-CORY	5	=		<b>I</b>
FALURE	SAMPLING IS RELIED LFOM FOR pm DETERMINATION	SAMPLING IS RELIED LAFON FOR pH DETERMINATION	SAMPLING IS REQUIRED FOR DETERMINATION	SAMPLING IS REQUIRED FOR or DETERMINATION
FAILURE DETECTION METHAD(S)	SUDDEM UNEXPLAINED CHANGE IN READING, OR MISHATCH BETWEEN REFOING AND PERIODIC SAMPLE RESULTS.	SERDING, OR HISMATCH SCIMEN READING, OR HISMATCH SCIMEN READING AND PERIODIC SAMPLE RESIGIS.	SKODEN UNEXPLATNED CHANCE IN READING, OR MISMATCH BETWEEN READING AND PERIODIC SAMPLE RESULTS.	SECOGN UNEXPLATMED CHANGE IN READING, OR MISMATCH BETWEEN READING AND PERIODIC SAMPLE RESULIS.
MORE	METER INDICATES MINIMUM OR NO MATTER LIBERT THE ACTUAL OR IS.	METER INDICATES MAXIMUM pe no MATTER MANT. THE ACTUAL, pm 15.	METER INDICATES NIGHER THAN ACTUAL OF	METER INDICATES LONCE TANK ACTUAL per
COMPONENT IDENTIFICATION	AE-019 pe IMDICATION AT G-002 DISCHARGE	AE-019 ps indication at 6-002 discenses	AE 019 pa 1401CA:108 AT G-002 015CHARGE	AE-019 pe imbication AT 6-002 DISCRARGE
116# 80.	96 79	Ē	26-792	86 78 100 100 100 100 100 100 100 100 100 100

ABILLITY ANALYSIS - SUPCOMATANT PROCESSING - CITARDY CTARK

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ENGINEE Liberture 12 W 87 NEVICED IN EL WIELD DATE 12/4/87

116w 80.	COMPONENT IDENTIFICATION	300m	FAILURE DETECTION METHODES)	FAILURE	SEVERITY   CATEGORY	RELATIVE	FAILURE CLASS
86-78	CE-056 COMBUCTIVITY INDICATION AT G-002 DISCHARGE	MATTER INDICATES MINIMAN COMDUCTIVITY NO MATTER ANALTHE ACTUAL COMDUCTIVITY 15.	SUDDER LINEXPLAINED CHANGE IN READING, OR MISMATCH BETWEEN READING AND PERIODIC SAMPLE RESULTS.	SAMPL ING. 15. REQUIRED FOR COMDUCTIVITY DETERMINATION	 	Ţ	-
92. 05	CE-058 COMPUCTIVITY IMPICATION AT 4-062 DISCHARGE	METER INDICATES MANIMAM COMOUCTIVITY NO MATTER WHAT THE ACTUAL COMOUCTIVITY IS.	SUDDEN UNELPLAINED CHANGE IN READING, ON MISMATCH DETUGEN RADING AND PERIODIC SAMPLE RESULTS.	SAMPLING IS REQUIRED FOR CONDUCTIVITY DETERMINATION	3		•
767.02	CE-056 COMPLCTIVITY INDICATION AT G-002 DISCHARGE	METER IMPICATES MIGNER THAN ACTUAL COMPLETIVITY	SERDIER UNEXPLAINED CHANGE IN READING, OR HISMATCH BETWEEN READING, AND PERIODIC SAMPLE RESOLIS.	SAMPLING IS REGULRED FOR CONDUCTIVITY DETERMINATION	I		
So-798	Of 956 CORDUCTIVITY INDICATION AT G-902 DISCHARGE	METER INDICATES LONGR THAN ACTUAL, COMPUCTIVITY	SKOOGN UNEXPLAINED CHANGE IN READING, OR MISHATCH BETWEEN READING AND PERIODSC SAMPLE RESALIS.	SAMPLING IS REGULRED FOR COMMUNITY DETERMINATION	I	,	

BLIMBH ITTY AMALYSIS - SUPERMATANT PROCESSING - STEADY STATE

DATE DL. Dec. 67 PAGE

ENGINEES Lisbolanie 12-487 nevienes or 2/2/26/6 DATE 12/4/27

SEVERITY | RELATIVE | FAILURE CLASS CATEGORY |PROBABILITY | ē 1111 1111 [LANN-017 DMDICATES AN ALARM WHEN |PUMP G-001 WILL STOP OPERATING AND NOT BE ABLE TO | | PLIMP G-001 WILL STOP DIRE TO THE MIGH LEVEL ALARM ON LAHS -016. REPAIRS SHOULD BE MADE TO LAHR-017 PRICE TO CONTINUED OPERATION SINCE IT PROVIDES RESTART UNTIL THE LEVEL ALARM IS REPAIRED. THE BACKUP FOR LANK-OTG IN PREVENTING THE OVERFLOW OF 0-001 FAILURE EFFECT MOME NON | ALARM DOES NOT OCCUR WHEN LI-016 | LI-016 IS WITHIN 1TS NORMAL LPMR 016 IMDICATES AM ALASM PARLUME DETECTION METHOD(S) ALARM OCCURS WER 11-016-15 I IS ABOVE THE ALASM SETPOINT. BELOW THE ALARM SETPOINT. WHILE LAMM-017 DOES MOT. RANGE INDICATES NO ALARM WHEN LEVEL IS HIGH INDICATES MIGH ALARM WHEN LEVEL IS LOW INDITATES NICH ALARM WHEN LEVEL IS LOW IND. CATES NO ALARM UNER LEVEL IS RIGH FALLING MODE A -017 RIGH BICK ALARM SWITCH LE-OIT HIGH-HIGH ALARM SWITCH LT 016 RIGH ALARM SWITCH COMPONENT IDENTIFICATION LT-016 RIGH ALARM SWITCH OM D - 001 0w 0 - 001 50-801 50-803 50-805 50-800 1158

MELIABILITY APALYSIS - SUPERMATANT PROCESSING - STEADY STATZ

DATE 04-Dec- 67 PAGE 50-57

enomia Libertanon une 12-4 Fluencies en Eliteta une 12-4-87

H0.	CUMPONENT SDENTSFSCATSON	FAILURE NEDE	FAILURE DETECTION METHOD(S)	SWICHE FANCE	SEVERITY	PROBABILITY	CLASS
ă X	17-016 MIGH BIGH ALARM SAFICE ON 0-001	IMDICATES NICH NICH ALABM WER LEVEL IS LESS THAN NICH NICH	I CAME OT INDICATES AN ALARM WERE PLAP C-001 VILL S 1-1-016 IS WITHIN ITS MORNAL. RESTART UNTIL RANCE AND LAMM-017 IS MOT ALARMING.	PARP G-001 WILL S / CPERATING AND NOT DE ABLE TO RESTART UNTIL SME LEV-T. ALARM IS REPAIRED.	9		-
S8 95	11-016 MIGH MIGH MARK SMITCH ON 0-001	INDICATES NO ALARM UNER LEVEL IS RECO-SEGR	LAMM-016 DOES MOT OCCUR UNEW [LAMM-017 DOES AND UNEW LI-016 IS ] INDICATING ABOVE THE SETPOINT FOR THE MIGH-MICH ALARM.	POSE G-001 WILL STOP DUE TO THE NIGH LEVEL ALARM ON LAMB 077. REPAIRS SHOULD BE MADE TO LAMB-016 PRIOR ES CONTINUED OFERATION SINCE IT PROVIDES THE BACKUP FOR LAMB-017 IN PREVENTING THE OVERFLOW OF 0-001	£		-
8	41-016-18984, IMDECATION GW-0-061	METER IMPICATES NIMIMAN LEVEL NO MATTER LAND ACTUAL LEVEL 15.	PUMP G-001 IS ROMBIFS, FLOW INDICATIONS F1-015 AND F1-02* SHOW FLOW INTO THE TANK PAGE THE LEVEL IS NOT GOING UP. POSSIBILT, AN ALARM ON LANN-017 WITH LI-010 READING LOW.	1055 OF IMDICATION OF TANK LEVEL FOR D-001. LOSS OF BACKLE INDICATION OF ENCESSIVELY RIGH LEVEL IN D-001 USED TO STOP PAMP G-001.	g =	•	
) <del>6</del> 00	11-016-18VEL 180FCAZ108	METER INDICATES MAXIMUM LEVEL NO MATTER UNMET THE ACTUAL LEVEL 15.	LAMM OTG INDICATES AN ALABN WERN LLI OTG IS AT THE CATREME NACH [RMD OF 175 NAMES AND LAMM OT 15 NOT ALABNING.	LI-DTG INDICATES AN ALARM WHEN   PLAMP G-DD1 WILL STOP OPERATING AND NOT BE ABLE TO   LI-DTG IS AT THE EXTREME MICH   RESTART UNTIL THE LEVEL INDICATION AND ALARM IS   RWD OF ITS RANGE AND LANN-DIT IS   REPAIRED.  NOT ALARMING.	= = = = = = = = = = = = = = = = = = = =		

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ENCINCES Libertamonne 12-4-87 nevicus or ENUE has some 12-4-87

112# 1 #0. 1	COMPONENT IDENTIFICATION	FAILURE	FAILURE DETECTION METHOD(S)	FAILURE	SEVERITY	PROBABILITY	FAILURE
90-05	AT-016 LEWIL INDICATION ON 0-001	METER INDICATES NIGHTR TRANS ACTUAL, TANK LEVEL.	A SIGNER IMERPLAINED SHIFT IN THE LEVEL INDICATION. NO ALARM ON LANS-017 UNER LI-016 IS INDICATING AN ALARM LEVEL.		=		~
000	17-016-18/11, INDICATION On 0-001	METER HODICATES LOWER THAN ACTUAL. TAME LEVEL	A SUCCESS LIMESPLATMED SHIPT IN THE LEVEL IMPICATION. AN ALARM ON LAND OIT AND LI-DIG IS INDICATING AN ALARM LEVEL.		E	•	m
2 0	8-11 (11-011) 10/05, IMDICATION ON 80-2	METER MOTCATES MINIMAN LEVEL AD MATTER AMAI THE ACTION, LEVEL 15.	A SUDDEF UNEXPLAINED LEVEL CRANGE, THE LEVEL DORS NOT INCREASE WITH ADDITIONS TO THE	UMARLE TO START PURP G-001 BY PROCEDURE. WO INTERLOCK EXISTS DETAKER THE PURP AND THIS LEVEL IN. CATION.	=	v	
ii s	8-17 (11-011) 15/95, 38010ATON ON 80-2	MATTER UMMAT THE ACTUAL LEVEL IS.	A SUDDER UNEXPLAINED LEVEL CRANGE, THE LEVEL INCREASES   WITHOUT ADDITIONS TO THE TANK;     THE LEVEL DOES NOT DECREASE ANTER   THE PLAPE IS ALMRING.	*	<b>=</b>		•

I'V AMELYCIC - CLOSOMATANT DESCRICES. CISADY CTATS

DATE GL Dec 67 PACE 50-59

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1 116#	COMPONENT SOUNTSFICATION	SOON SOON	FALLUME DETECTION METHOD(S)	FALLURE	SEVERITY   CATEGORY	PROBABILITY	FAILURE
26 8	8-47 (44-011) 1EVEL INDICATION On 80-2	METER IMPICATES STUNER THAN ACTUAL. TANK LEVEL	A SLODEN UNEPPLAINED LEVEL   CARNOG; FME LEVEL INCREASES     WITHOUT ADDITIONS TO THE TANK;     THE LEVEL DOES NOT DECREASE WHEN     THE PLAPE IS RUNNING.	¥	=		
8	8-17 c.t 6113 teves, implication	METER IMPEGATES LONER THAN ACTUAL. TANK LEVIL	A SLOCEN LARDPLAINED LEVEL   CHANGE; THE LEVEL DECREASES     WITHOUT PURPLUE, FROM THE TANK;     THE LEVEL DOES NOT INCREASE WHEN     ADDITIONS ARE MADE.	*			
88 88	LE-662 MIGH LEVEL, ALMAN SAFTCH IN G-007 PIT	INDICATES MIGH ALABM UNEN LEVEL, IS LOW	SO MATER VISIBLE IN PART PLAT	¥		J	-
96 95	16 602 Nich LEVEL ALARM SWITCH 18 G-007 P11	INDICATES NO ALARM DRIN LEVEL 15 11CM	WATER VISSBLE IN PAPE			u	•

MELIABILITY ANALYSIS - SUPERNATANT PROCESSING - STEADY STATE

DATE 04-Dec-87 PAGE 50-60

CHINE Libertamen onte 12 4 87 HEVIEWE EN BILLIM DATE 12/4/87

SEVERITY | RELATIVE | FAILURE CLASS NO. m PROBABILITY u CATESORY Ξ 111 111 Ξ LOSS OF THE ABILITY TO IDENTIFY FILTER F-001. CLOGGING. BACKUP INDICATION IS PROVIDED BY THE 1002 OF THE ABILITY TO IDENTIFY FILTER F-001 CLOGGING. BACKUP UNDICATION IS PROVIDED BY THE INABILITY OF FCV-015 TO CONTROL THE FLOMBATE. INABILITY OF FCV-015 TO CONTROL THE FLOMBATE. FATILURE MONE NOME PROPER FLOARATE UNILE INDICATING | PAN-005 ALARM; P1-002 OR P1-005 PRESSURE INDICATION ON PT-005 OR FC - 015 UNABLE TO PROVIDE THE WATER BOT VISIBLE IN PUMP PLIT OR BOTH INDICATING ABNORMALLY. DIFFERENT THAN P. 1-094; FCV-015 ABLE TO HOLD FLOWRATE SETPONAT FAILURE DETECTION METHODICS) PI-002 READING SIGNIFICANTLY UNUSUALLY LOW INDICATION ON FULLY OPEN; UNUSUALLY SIGN WITHOUT BEING FULLY OPEN WATER VISIBLE IS PIPE | METER INDICATES NINIMAN PRESSURE NO MATTER METER INDICATES MAXIMUM PRESSURE NO MATTER INDICATES BIGH ALARM WHEN LEVEL IS LOW INDICATES NO ALARM UNER LEVEL IS RIGH MINAT ACTUAL PRESSURE IS WHAT ACTING PRESSURE IS FAILURE MORE POT-005 FILTER F-U01 DIFFERENTIAL POY 005 FILTER F-001 DIFFERENTIAL LE -601 MIGH LEVEL ALARM SWITCH 15-601 RIGH LEVEL ALARM SWITCH COMPONENT IDENTIFICATION PRESSURE INDICATION PRESSURE INDICATION 18 6-007 #11 18 G-007 P11 50-855 50-856 50-820 50-821 1158 8

RELIABILITY ANALYSIS - SUPERMATANT PROCESSING - STEADY STATE

DATE 04-0ec-87 PAGE 50-61

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HERENTIAL WITE INDICATES LESS THAN ACTION, PRESURE  HERENTIAL WITE INDICATES HERENTIAL WITE PRESURE  HERENTIAL WITE INDICATES HERE PRESURE  HERENTIAL WITE INDICATES HERE PRESURE  HERENTIAL WITE INDICATES HERE PRESURE  HERENTIAL WITE INDICATES HERENTAL PRESURE  HERENTIAL WITE HERENTAL BENEATH HERENTAL PRESURE  HERENTIAL WITE HERENTAL BENEATH HERENTAL PRESURE  HERENTAL WITE HERENTAL BENEATH HERENTAL BENEATH HERENTAL BENEATH HERENTAL WITE HERENTAL BENEATH HERENTAL BENEATH HERENTAL WITE HER WITE HER	116x 80.	COMPONENT IDENTIFICATION	PALLUME NODE	FAILURE DETECTION METHOD(S)	PASILURE	SEVERITY CATEGORY	PROBABILITY	FAILURE
POT-005 FILTER F-001 DIFFERENTIAL WATER INDICATES MORE THAN ACTINAL PRESSURE   P1-002 CM P1-005 CM BOTT   P1-002	59-65	POY 305 FILTER F-DOT DIFFERENTIAL PRESSURE IMPICATION		P1-002 OR P1-005 OR BOTH INDICATING ABMCHMALLY; P1-002 READING SIGNIFICANTLY DIFFERENT THAN P1-094.	1005 OF ABILITY TO MONITOR F -001 CLOGGING AND BLOADACK IS NOT PREDARM ENDICES. FCV-015 AND OTHER INSTRINGUISTS ARE REQUIRED FOR CLOGGING DETERMINATION.			*
POT 005 RIGH LEWEL ALARM SWITCH RADIA WHEN PRESSURE IS LOW ALARM PORN 005 ANS OCCURRED WORL. ANDITIONAL WORLDOWN, WALL BE WICKSTAMP ID 1902.  THAN THE CAPECISD SEPONS. PROPER THRING OF THE FILTER BLOADACK SEGRENCES.  POT 005 RIGH LEWEL ALARM SWITCH INDICATES NO ALARM WHEN PRESSURE IS RICH ALARM PORN 005 ANS NOT OCCURRED WORL. ANDITIONAL WORLDOWN, WILL BE WICKSTAMP ID 1852.  THAN THE EXPECTED SEPONS! PROPER THRING OF THE FILTER BLOADACK SEGRENCES.	\$6.05	POY-005 FILTER F-001 DIFFERENTIAL, PRESSURE INDICATION	METER INDICATES MORE THAN ACTUAL PRESSURE	PI-002 OR PI-005 OR BOTH INDICATING ABNORMALLY, PI-002 READING SIGNIFICANTLY DIFFERENT THAN PI-094.	POSSIBLE LOSS OF THE ABILITY OF FCH-015 10 CONTROL, THE FLORENCE AT 11% SCHOOLST. GLOMBACK NOME PREGUENC THAN MEEDED.			
POT-005 RIGH LEVEL ALARM SWITCH   NATIONAL WINN PRESSURE IS NICH   ALARM POAN-005 BAS WOT OCCURRED   WOME. ADDITIONAL MONITORING OF THE INDICATED   111   C	50 - 9X	PDY-GIOS RECORT ALARM SWITCH	INDICATES RIOR ALARM WERE PRESSURE IS LOW	ALABM PDAN-005 AAS OCCUREED WHILE POI-005 INDICATES LESS INAM THE EXPECTED SETPOINT.	NOME. AUDITIONAL MONITORING OF THE INDICATED FILLER OF, POI-GOS, WILL BE MECESSARY TO INSUME PROPER TIMING OF THE FILTER REGMENCK SEGRENCES.			
	20.00	POY-005 NIGHTENEL ALARM SALIES	INDICATES NO ALABRE UNITS PRESSURE IS NICH	ALARM POAK-OUS MAS WOT OCCURRED WHILE POI-OUS INDICATES MORE TRAM THE EMPECIED SEIPOINT.	NONE. ADDITIONAL MONITORING OF THE INDICATED FILLER DP. POI ODS, WILL BE NECESSARY TO INSURE PROPER TIACHE OF THE FILLER BLOMBACK SEGRENCES.	1		

ILITY AMALYSIS - SIPERMATANT PROCESSING - SIFARY CTATE

DATE D4-Dec-87 PAGE 50-62

ENGINEZ Libertanier DATE 12-487 MENTERED BY SOULEME DATE 12/4/67

MO: W	COMPONENT IDENTIFICATION	FAILURE	FAILURE DETECTION METHOD(S)	FAILURE	SEVERITY	PROBABILITY	FATTURE
26 82	PRE-FILLER BLOMOOM INSTRINGENT A AS A BLACK BOX	INSTRIBUENT AIR IS AVAILABLE AT TOO LOW A PRESSURE	POI-005 MILL IMPLIATE THE POI-005 MILL IMPLIATE ACMOSS THE FILTER FOLLOWING BLOMBACK ATTEMPTS. IN ADDITION, P1-902 MILL PROVIDE AN INDICATION OF SUMPLY AIR PRESSURE.  PSL-095 AT AIR PRESSURE.	FILTER AND PRECIUDE REQUIRED FLOWS THROUGH THE FILTER.	ļ		-
92.8	PRE-FILTER BLOMPOLM INSTRUMENT AIR,	INSTRUMENT AIR IS AVAILABLE AT TOO HIGH A PRESSURE	P1-P02 IMDICATES PREESSURE IN THE INSTRUMENT AIR L'NE TO THE FILTER		1		-
20 677	PRE-FILTER GLOADOAN INSTRUMENT AIR,	INSCRPTCIONS INSTRUMENT AIR VOLUME IS AYAFLABLE	THE PRINCIPLE INDICATE THE DIFFERENTIAL PRESSURE ACROSS THE FILTER FOLLOWING BLOAGACK ATTEMPTS.  PSI-095, ATR BREAK TANK	LOW AIR FLOW MAY MOT SUCCESSFULLY CLEAR THE FILTER AND PRECLUDE REQUIRED FLOWS THROUGH THE FILTER. SUPERNATART FLOW COALD BE BYPASSED AROMNO THE FILTER. WHEN THE AIR FLOW PROBLEM WAS RESOLVED SUPERNATART WOULD AGAIN BE FILTERED.	<u> </u>		•
95 290	TACK 0-001 DEMINISTRALIZED DILUFION MATER, AS A RIACK BOX	AR INCLIFICIENT VOLUME OF DEMINERALIZED MATER IS AVAILABLE	TES, FE-024 WOLD INDICATE THE LOW DENTH. WATER FLOW. CE-058   PROVIDES AN INDICATION OF THE SUPERNATANT CONDUCTIVITY THAT NOTICE WITH INDADEGUATE DENTH. WATER FLOW.		1		

IABILITY MARYSIS - SUPERMATANT PROCESSING - STEADY STATE

DATE 24-Dec- 87 PAGE 50-63

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CLASS		-		
PROBABILITY	U			
SEVERITY	Ξ	1	<u>a</u>	
FAILURE EHECT	NON.	<b>100</b>	IF STOROXIDE MERE NOT AVAILABLE TO MAINTAIN A RELATIVELY RIGH PR CE-157 REMOVAL EFFICIENCY MAY BE REDUCED.	OF THE TH MERE LONGRED, BUT WERE NOT MECESSARY, CE-157 REMOVAL EFFICIENCY MAY BE REDUCED.
FAILURE DETECTION METHODES)	IF THE WATER ORIGINATES PROM G-015 THE PRESSURE WOULD BE INDICATED ON A LOCAL P.I. 073.	NAY BE DETECTED THROUGH SAMPLING OF 0-001 OR ON CE-056.	AE-00'9 MONID INDICATE PH AS WELL AS S-001 CHEMICAL AMALYSIS AND THE D-001 SAMPLING   PROCEAM.	AE-0019 MOND INDICATE PR AS WELL AS 4-001 CHEMICAL ANALYSIS AND THE D-001 SAMPLING PROCESS.
SALLURE NCDG	DEMESTRALIZED WATER IS AVAILABLE AT TOO STOR A PRESSURE	L.E., IT CONTAINS WANGBOAR TOWLC SPECIES OF 0-001 OR ON CE-056.	COEMICALS ARE NOT AUXILABLE FOR ADDITION WERE WEEDED	CHEMILALS ARE ADDED BUT 307 APEDED
COMPOSED TOTALFICATION	TANK D-DOT DEWINGBALIZED DILUTION WATER, AS A BLACK BOX	TAME D-001 DEMINISMITZED DILUTION WATER, AS A BLACK BOX	TANK 0-001 CHEMICAL ADDITION	TAME D-001 CHEMICAL ADDITION
- 110x	18 3.	2 <b>4</b> 0 05	50 05	8 8

ENGINEER Sibelamin CATE 12-4 8 Tevience or Stable DATE 12/4/87

116M MO.	COMPONENT IDENTIFICATION	FAILURE   MODE		FAILURE   EFFECT	SEVERITY	RELATIVE	FATLURE
50-890	Mx (E-001) SECOMDARY SIDE	1 100 MUCH COOLING IS AVAILABLE 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	PERHAPS DETECTED ON TANK-010.	NONE	111		3
50-891	Hx (E-001) SECONDALY SIDE	100 LITTLE COOLING IS AVAILABLE	YES, ON TANL-010	REDUCED CE-137 REMOVAL EFFICIENCIES AND GREATER THAN EXPECTED RESIN USAGE.	Ib		3
50-892	No. (E-001) SECONDARY SIDE		YES, TANK DIO ANNUNCIATES HIGH TEMPERATURES AT THE MA.	AT A MINIMUM, IN EFFICIENCIES WILL BE REDUCED PEGUIRING MORE FREQUENT RESIN CHANGOUT. IF THE BREECH WERE TO OCCUR, THE PROCESS WOULD BE INTERRUPTED AND THE NA WOLLD REQUIRE REPLACEMENT.  I I I I I I	Ib		1
50-910		ADECHATE ZEOLITE VOLUMES ARE NOT AVAILABLE	YES, ZEOLITE BATCH TANK LEVEL DETECTION.	EMPTIED COLUMN READY FOR ZEOLITE FILL CANNOT OF   REPLENISHED. MAY RESULT IN AN OPERATING OUTAGE   TO FILL COLUMN.	116		3

DATE 04-Dec-87

ENGINEER Ziebestamen 12 4 8 Reviewes or EXURING DATE 12.4-87

PAGE 50-65

			n	-
RELATIVE  PROBABILITY				u
SEVERITY	=	1	£	â
FAILURE	CONCENT BE REFILLED UNTIL THE PLUG LARS REMOVED.	SUPERMATART MONED AND RE PURCED TO SO-2. IT CONLO BE RINSED TO SO-2 WITH A HIGHER RINSE VOLUME GOING TO BO-2. THIS MAS A DENUBRIC IN THE SO-2 TAME INVENTORY WOLD INCREASE.	SUPPERNATARY COULD NOT BE RENSED FROM THE RESIN TO AD-2, NAVING LOW IMPACT. RESIN COULD NOT BE FILIFFED DUBING BACKLASS, RESULTING POSSIBLY IN KEEPING RESIN FROM BEING WASHED FROM THE COLLAM.	EMPTIEG FILTER F-002 READT FOR SAMD SLURRY FILL CANNOT BE REPLENISHED. MAY RESULT IN AN OPERATING OUTAGE TO FILL FILTER.
FAILUME DETECTION METHOD(S)	TES, FILL LINE WOULD PLUG AND LIT OLF ON 0-002 WOULD INDICATE NO LEVEL DECREASE ANEN THE FILL LINE PLUGGEO.	YES, FE-026 WOULD INDICATE LOW FLOW	FI-064 WOULD PROVIDE A LOW FLOW INDICATION. THERE IS NO ALARM.	TES, SAMP BATCH TAMK (D-002) LEVEL DETECTION.
MODE	AROLITE SUPPLY FOR In-D, AS A BLACK BON   TOO MUCH ZEGLITE IS CHERLED INTO THE IX	SUFFICIENT ARE SUPPLY IS NOT AVAILABLE	SUFFICIENT SLUTCE MATER 15 SOT AVAILABLE TO BACKFLUSA OR SLUTCE C-004	SUPPLICITING SAME SLUMMY IS NOT AVAILABLE
COMPONENT IDENTIFICATION	ZEOLITE SUFFLY FOR IN-D, AS & BLACK BOX	INSTRIBUTE ATR SUPPLY FOR 14-0, AS A BLACK BOX	Skulick water surply for Ix-D,	SAND SLUBRY FOR FILTER F-002, AS A REACK BOX
.08	16-95	20 05	20-20	86 33

RELIABILLITY AMALYSIS - SUPERMATANT PROCESSING - STEADY STATE

ENGINEER Darry J Jan Soft 12/10/87 REVIEWED BY TAGETY ONTE 12-10-57

FAILURE	*	~	-	-
PROBABILITY		. (	•	U
CATEGORY	É	4		4
FALURE	O PEGGAM INTERRIPTED O PIGN MATER/CENENT RATIO O UNGALIFIED MIX REGULING MANUAL CORRECTION BY ADDING CENENT AFTER FIXING BIN TO FEED CENENT AGAIN	O COMENT SET-UP IN MINER	BIGH WATER/CEMENT BATIO LUNGUALIFIED MIX IS POSSIBLE MARGAL CORRECTION OF CHRENT ADDITION IS POSSIBLE	SUMP PLANE DISCHARGES TO LUTS. SEZERITY OF LEAK MUST BE DETERMINED FOR POSSIBLE MANNED ENTRY TO CELL
FAILURE DETECTION NETHOD(S)	O ACRISON PANEL ALARN O DAS ALARN O CÉNENT FEEDER TROUBLE ALARN	O ACRESON PAREL ALABN O DAS ALABN O CENENT FEEDER TROUBLE ALABN	O ACRISCM PANEL ALARM O DAS ALARM O CEMENT FEEDER TROUBLE ALARM	0 CELL SLINP ALABMS - LE-2092 0 MDV LEVEL INDICATOR DROPS - LI-2001
FALLURE MEDE	WILL NOT FEED CENENT	PEEDS TOO MICH CENENT	PEEDS LESS THAN NEGATINED ANOUNT OF COMENT	WESSEL LEAKS
COMPONENT IDENTIFICATION	CEMENT DAY BIN 70-V-010-W	CEMENT DAY BIN 70-V-010-W	CENCENT DAY SIN 70-V-010-N	MASTE DISPENSING VESSEL 70-0-001-#
110s   80.	100-00	70-905	ν- 003	70-026

DATE 04 Dec. 87 PAGE 70-2

ENGINEER BONNING LA BANE 12/4/8 THEVIEWED BY SEING MEDICO DATE 12/4/87

FAILURE	~	*		
RELATIVE  PROBABILITY	•			
E B	4	f	Į.	£
FARCT	URABLE TO DEWATER WOV AND UNABLE TO PROCESS RESURS ONE TO RICH WATER COMTENT.  CAN USE UTILITY WATER LINE 070-UM-005 WITH FV-947 AND UBG OFEN, FV-046 CLOSED TO FLUSH SCREEN	PLANT RESIN AND/OR ZEOLITE TO 7015 TANK	NO MIXING OF SOLIDS IN NOV PRIOR TO PARP CIRCULATION.	UNABLE TO ACC LASTE TO REKER UNABLE TO RECERCIANTE LASTE IN LOV
FAILUME DEFECTION METHOD(S)	O MO TLOW ON 15-2036  DURING DEUATERING ATTEMPT  O MOV LEVEL WILL NOT DECREASE	NO DETECTION	NO FLOW INDICATION ON CONTROL PANEL	O HSCSS ALARM PAMEL - FS-2042
PATURE	MOV JUMSON SCREEN PLUCS	MAY JOHNSON SCREEN BREAKS THROUGH	SOUTH SPARCE PLUCS	Asse with sor eas
COMPONENT IDENTIFICATION	MASTE DISPERSING VESSEL 70-0-001-m	MASSE DESPENSING VESSEL 70-0-003-w	MS316 D15PEHS1MG VESSEL. 70-0-001-W	MASTE DISPENSING VESSEL PLANE 70-G-001-8
MD:	750-02	76-028	76-029	78-95 15-95 1-95 1-95 1-95 1-95 1-95 1-95

GREIABILITY AMALYSIS - SUPERMATANT PROCESSING - STEADY STATE

ENGINEER CHALLY SCALLS ONTE 14/15/3 7 REVIEWED BY THE DOLL ONTE 12-10-87

The coll-a	1168 1	COMPONENT IDENTIFICATION	BADLUME	FAILURE DETECTION METHOD(S)	FRIUME	CATEGORY	PROSABILITY	CLASS
TO G-GOL -8  TO G-	1	MASTE DISPENSING VESSEL PLANT 70-6-001-8	PARE VILL NOT STOR	ATTEMPTING TO DE-EMENGIZE:	NO EFFECT ON PROCESS AS FUND IS IN RECIRC UNTIL WASTE IS REQUIRED		•	~
MASTE DISPOSES. PLANS  TO G. COLL SHOW NEEDS AND ALARMS - FAUID  TO G. COLL SHOW NEEDS AND ALARMS - GARREST OF STORMS ALARMS - FAUID  TO G. COLL SHOW NEEDS AND ALARMS - GARREST OF STORMS ALARMS - GARREST OF STORMS AND				- "PUMP ON" LIGHT ON HSCSS PANEL	PLARP COLLD RUN DRY ? - DV IS ESPIT (FAIL PLARP)	<b>a</b>		~
MASTE DISPERSING VESSEL PLANE  PLANE MODELINE  TO 6-001-W  TO 6-00	70-053	WASTE DISPENSING VESSEL PLANT 70-G-001-M	PUMP WILL NOT DEVELOP FLOW	HSCSS PANEL ALARM - FLUID PRESENT SIGNAL PROM FS-2042	O MATO PROCESS WILL WOT RAN	1		•
MASTE DISPENSING VESSEL PLANT  70-G-001-9  170-G-001-9  18 a, b  19 a, c  10 a, c  1					NO SUPPLY DUE TO PLUGGED LINE WITH NO LANY TO FLUDA LINE.	4		-
HIGH SHEAR MYSER AND WOTCH WILL NOT THEN ON O NO NOW INDICATION NECSS PAREL O LANGER ACT CAR CONTINUE PROCESS.  70-4-004-W  OUR TO LOW RPW  OUR TO LOW RPW	±	MASTE DISPENSING VESSEL PLAND 70-G-001-%	PLANT MOUSTING FAILS	o CELL SIMP ALARM.	MASTE DISPENSING VESSEL'S CONTENTS DRAIN TO CELL SUMP.	•	•	
	92-07	#1G# SHEAR MTHER AND MOTOR #1	MOTOR WILL MOT TUBN ON	OUE TO LOW RPM	O UNMABLE TO START OR CONTINUE PROGRAM O MATER ACO MASTE IN MINER	<u> </u>		-

DATE 10-0ec-87

RELIABILITY ANALYSIS - SUPERNATANT PROCESSING - STEADY STATE

ENGINEER PARTY STATE TO TOTAL DAVISED ON MONTHS DATE 12 10-87

SEVERITY | RELATIVE | FASTURE CATEGORY | PROBABILITY | CLASS -#1 \* . -911 : 115 4 O MUST MAMUALLY TRIP BREAKER WHICH INTERRUPTS O SHUTDOWN OCCURS AFTER CENENT DISCHARGE WITH EFFECT OF MOT CONTINUING TO PROCESS WASTE MIXER OVERFLOAS CONTAMINATING CELL · INITIATE EMERGENCY PROCEDURE - MINER EMPTY - STOP PROCESS - MINER FULL - DUMP MINER INITIATE EMERGENCY PROCEDURE CEMENT WILL SET UP IN MINER O PROGRAM INTERRUPT FATLURE DAS ALARM UNER UCT. FXCEEDS FAILURE DETECTION METHOD(S) HIGH LEVEL ALARM ON HSCSS CONTINUED RPM INDICATION C NO WT INCHEASE ON DRUM O NO WT 1.055 ON MINER (ME-2071 AND/OR ME-2072) TIME OUT ALARM ON V-2 O NO RPM INDICATION 100# ABOVE TARE MGT. O BELT BREAK ALARM PAMEL - 15-2048 (ME-2073) DUR TO CEMENT BUILD UP IN DISCHARGE LINE. MINER WILL MOT EMPTY/DRAIN MOTOR WILL 171 TURN OFF MINER OVERFLOWS BELT DRIVE FAILS PAILURE HIGH SHEAR MINER AND MOTOR #1 RIGH SHEAR MINER AND MOTOR #1 HIGH SHEAR MIXER AND MOTOR #1 HIGH SHEAR MINER AND MOTOR #1 COMPONENT IDENTIFICATION #-900-X-02 70 x -004 -# #- 900- X-02 N-700-X-0Z 770-07 70-078 70-07 110s 70-080

PAGE 70-4

RELIABILITY ANALYSIS - SUPERNATANI PROCESSING - STEADY STATE

DATE 04-Dec-87 PAGE 70-5

ENGINEER KAN STUBNICO DATE 12/4/87 REVIEWED OF DESMAN FRANCE 12/4/87

SEVERITY | RELATIVE | FAILURE CATEGORY | PROBABILITY | CLASS \* 110 2 1110 1116 MINER FULL - MINER WILL DIMP AUTOMATICALLY O PROGRAM INTERRIPTED. NYDRALL IC CYLINDER PROGRAM INTERRUPTED, NYDRALLIC CYLINDER STOPS IN POSITION WHEN HYDRAULIC STOPS IN POSITION WHEN HYDRAUS, IC PROGRAM AND PROCESS INTERRUPTS O INITI- 'E EMERGENCY PROCEDUZE MIXER EMPTY - STOP PROCESS O PROGRAM INTERBUPT O REPLACE MIXER MUST DIMP MINER FAILURE OCCURS. FAILURE OCCURS. EFFECT MOTOR CLARKENT STILL REGISTERING O TACHOMETER MEEDLE INDICATOR FAILURE DETECTION METHOD(S) READS ZERO ON CONTROL PANEL. FAST OR SLOW ON CONTROL PANEL. HIGH MOTOR CURRENT ALARM O MINER MOTOR REGISTERS PROGRAM ON HOLD ALARNS. O SEG. NOT VERIFIED AND PROGRAM ON HOLD ALARMS. O BELT BREAK ALARM SEG. NOT VERIFIED AND CHYDRAULICS FAIL 3 (MYDRALLICS FAIL) MALL MOT GO TO "FULLY RETRACT" POSITION RAM VALVE SYDBAIR IC CYLINDER WILL MOT GO TO "MOME" D" -- NEARING FAILURE TACHOMETER FAILS FAILURE 3000 HIGH SHEAR MIXER AND MOTOR #1 HIGH SHEAR MIXER AND MOTOR #1 HIGH SHEAR MIKER AND MOTOR #1 HIGH SHEAR MIXER AND MOTOR #1 COMPONENT IDENTIFICATION # \* 900 ¥ 0Z N- 700- X-02 \*- 700 - \*- 0Z 70 × -004 · N 70-062 70-063 70-064 70 085 1158 9

MELIABILITY AMALYSIS - SUPERMATANT PROCESSING - STEADY STATE

DATE 04-Dec-87 PAGE 70-6

ENGINEER Darn Bankan Jane 12 9/87 NEVICURE OF KANNY MENTAD DATE 12/4/97

SEVERITY | RELATIVE | FAILURE CATEGORY | PROBABILITY | CLASS m u a B qi. IIB 110 O MUST MANUALLY TRIP SREAKER LINION INTERRUPTS o SHITDOWN OCCINES AFTER CENENT DESCRARGE MITS PROGRAM INTERRUPTED, NYDRALK IC CYLINDER EFFECT OF MOT CONTINUENC TO PROCESS WASTE UMABLE TO START OR CONTINUE PROGRAM STOPS IN POSTITOR LINER STERRIGHT MATER AND LASTE IN MINER FAILURE OCCURS. REPLACE MIXER EFFECT PROCRAM O MIKER MOTOR BELT TREAK, ALARM O NO RPM INDICATION HSCSS PANEL FAILURE DETECTION METHODESS O NOTOR CURRENT GOES DOWN CONTINUES RPW INDICATION PROGRAM ON HOLD ALARMS. SEG. NOT VERIFIED AND (HYDRAULICS FAIL) DUE TO LOW RPH DISCAR DETACHES FROM MIXER SHAFT. WILL BUT GO TO "EXTEND" POSITION RAM VALVE STORAGE, 3C CYLINDER MOTOR WILL NOT TURN OFF MOTOR WILL MOT STORY ON FALLUME HIGH SHEAR MIXER AND MOTOR #2 RIGH SHEAR MIXER AND MOTOR #2 HIGH SHEAR MIXER AND MOTOR #1 HIGH SHEAR MIXER AND MOTOR #1 COMPONENT INENTIFICATION 70-K-002-W 70 \* - D02 \* 79 K - 004 - W 70-K-00/-# 70-066 70-087 70-101 70-102 110x

MELINBELLITY AMALYSIS - SUPERMATAMI PROCESSING - STEADY STATE

DATE 10-Dec-87 PAGE 70-7

CHEINERS [ DATE | Set | 1 | 10/8 ] REVIEWED BY JA GARDER DATE 12- 10-87

				-
* *	a	e	<b>a</b>	a
FAILURE I	MINER ONERFLONS CONTANIANTING CELL	O CIMENT WILL SET UP IN MINER O INITIATE EMENGENCY PROCEDURE	O PROGRAM INTERRUPT O INITIATE ALARM PROCEDURE - MINER ENPIT - SIOP PROCESS - NINER FULL - DUNP MINER	Same as 70-002
FAILURE DETECTION METHODGL)	PANEL - 15-2046	O NO INCREASE ON N-15 MEIGHT (ME-2073) O NO DECREASE ON MIXER MEIGHT (ME-2077, ME-2072) O DAS ALARM MIRE MET. EXCIEDS 1000 ABOVE TARE WET.	O NO RPH INDICATION O SELT STEAK ALASSM	Same As 70-982
FARCHE	WINE OFFICES	MINER WILL NOT DEATH, WITY DAR TO CHENT BUILD UP IN DIL CHANGE LINE.	MIT OF INC.	DISCAR BEARING FAILURE
COMPONENT SDEWT193CATSON	NICA SHEAR MINIS AND MOTOR #2	ATCH SHEAR MINES AND NOTON E2	HIGH SHEAR WINER AND MOTOR #2	NICE SECAR PRINTS AND MUTOR #2
	201-05	\$1.00 \$1.00	81-82	70-107

RELIABILITY AMALYSIS - SUPERMATANT PROCESSING - STEADY STATE

DATE D4 Dec- 57 PACE 70-8

CHICKER KING MANNO DATE 12/1/87 MEVICUED OF BROWN DUNG 10/4/87

CATETORY | PROBABILITY | CLASS m 117 1110 e II 1110 4 SAME AS 70 083 SAME AS 70 064 SAME AS 70-065 REPLACE MINER FATEURE CALLURE DETECTION METHODES) O MOTOR CURRENT CORS DOLM. O BELT BREAK ALARM. SAME AS 70-083 SAME AS 70-084 SAME AS 70-085 WILL NOT GO TO "FULLY RETRACTED" POSITION DISCAR DETACHES FROM MINER SHAFT. WILL NOT GO TO "MOME" POSITION RAM VALVE RYDRADALIC CYLINDER RAM VALVE BYDRAILIC CYLINDER TACHOMETER FACES FAILURE HIGH SHEAR MINER AND MOTOR 42 SHEM SHEAR MIKER AND NOTOR SE HIGH SHEAR MINER AND NOTOR #2 HIGH SHEAR MINER AND MOTOR #2 COMPONENT IDENTIFICATION 70-K-002-W 70-K-002-W 70-K-002-W 70-K-002-1 70-109 70-106 70-111 70-110 # G

DATE 04-Dec- 87 PAGE 70-9

LABELLITY ANALYSIS - SUPERNATANT PROCESSING - STEADY STATE

ENG. WEER DONOR TONBORDE 12 4/87 NEVIEWED D. NING HOMOUNE (2/4/87)

I FAILURE I CLASS	2	n	m	-	
PROBABILITY				*	
SEVERITY   CATEGORY	<u>e</u>	<u> </u>	1	3	1
FAILURE EFFECT	INTERNIPTS PROCESSE DYABLE TO REMOVE FILLED DRIM.	UNABLE TO CONTINUE PROCESS AND FILL DRIPS	PROGRAM ON MOLD. CAN CONTINUE BY USING SAME TOP LID AND NOT SATICH LIDS. BUILDOP OF CEMENT ON FACING LID.	DROP'S LID - FOLLOW SOP 70-18-9	UMABLE TO CONTINUE PROGRAM AND PROCESS DRUMS
FAILURE DETECTION METHOD(S)	NO INDICATION OF FILL NEAD RAISED ORTAINED ON PANEL	ND LOWERED INDICATION ON NSCSS PANEL	PAMEL FOR LLS FLEPPED	ALABM MICES PANEL	LOSS OF VACIONS  ALARM MSCSS PANEL
FAILURE	ASSEMBLY WILL NOT BAISE	ASSEMBLY WILL ANY LOADS	MAL WOT PLEP LIB;	1055 OF VACUES AFTER PECKING UP 110	VILL #01 PTCK UP LID
COMPONENT IDENTIFICATION	FILL MEAD ASSEMBLY 70-W-002-W	#111 MEND ASSEMBLY 70-V-002-W	FILL MEAD ASSEMBLY 70-V-002-W	FILL MEAD ASSEMBLY 70-V-002-W	
#0. I	70-126	751.67	70-128	20-129	

DATE 04-Dec- 87 PAGE 70-10

ENGINEER Barney Burdandonce 12/4/87 severas or Kind Hamisare 12/4/87

FAILUS			•	•
RELATIVE		•		•
SEWERITY CATEGORY	<b>4</b>	£	=	1
EARLUMC. EFFEGT	UMABLE TO CONTINUE PROCRAM IF MINER FF.LED, ENIBT REQUIRED TO LAPLUG, FOR MINER EMPITING ENIBT REQUIRED TO REPAIR MAY REQUIRE REMOVAL OF MINER SKID	COCCESS INTERPUPT, CANNOT FILL DRUPS	PROCESS INTERRUPT. UMABLE TO INSTALL LID ON FILLED DRIM, COULD DRIM FILL STATION AND CONLO DRIM FILL STATION AND CONTAMINATE BOTTON OF NEXT DRIM IF DRIM REMOVED.	CARNOT FLIP LIDS, BUT CAN CONTINUE BY USING SAME TOP LID AND NOT SATICH LIDS BUILDUP OF CEMENT ON UP FACING LID
FAILURE DETECTION METHODES)	SIOU DEALUING OF MINER	CTLINDER LIMIT SMITCHES MOT ACTUATED	CTLINDER LIMIT SMITCHES NOT ACTUATED	A. Mice Limit acitos
FALLURE	Plucs artie contait	WILL MOT MOTATE LIDS No. 4 FROM FILL MOZZLE	WILL WOT MOTATE LIDS INNOCK FILL WOZZLE	Will will to 10 "Fight" Mildel
COMPONENT IDENTIFICATION	FILL MEAD ASSEMBLY 70 v-002 -s	FILL MEAD ASSEMBLY 70-V-002 W	FILL READ ASSEMBLY 70-V-002 *	FILL WEAD ASSEMBLY 70-V-002-W
116# #0.	821-95	25 - 55 - 55 - 55 - 55 - 55 - 55 - 55 -	21.12	8 g

CATÉ 10-0ec-87 PAGE 70-11

MELIABILITY MARCSIS - SUPERNATANT PROCESSING - STEADY STA.

ENGINEER 1 01 8. 4. OAT 12 - 10 87 NEW GOLD 1 7 42 1 43 OATE 1 6/10/07

FAILURE CLASS	-		m m	•	•
PROBABILITY	•		<b>.</b>	•	
SEVERITY CATEGORY	I	£	₫ ₫	4	4
FABLURE	PECCHAN.	FROM FILP METGAT: CAN'T P. LIDS ON DRUM OR PLACE LID UNDER FILL ASST.	FROM PICK ACTORT: CARNOT REMOVE LID, LOACE FILL ASST. AND PROCESS DRUMS FROM DAB NETGAT: CARNOT LOACE FILL ASST. AND PROCESS DRUMS	INTERRUPT PROGRAM. CANNOT PICKUP OR *_PLACE	CAMMOT SATING LIGH UNCER FILL ASSEMBLY.
FAILURE DETECTION METHOD(5)	ACTUATOR LIMIT SMITCH	ACTUATOR CIRCL SAFTOR		ACTUATOR LINIT SAFECE	ACTUATOR LINEST SAFFOR
FALUME	WILL NOT GO TO "OAR" METGHT	WILL MOT GO TO "SWING" HEIGHT		WILL FOF 40 TO *PICK* METGAT	WILL MOT LEAVE "PLIP" METCH!
COMPONENT LIDENTIFICATION	FILL MED ASSEMBLY 70-V-902-4	FILL MAY) ASSEMBLY 70-V-002-M		FILL MIND ASSEMBLY 70-V-002-W	FILL MIND ASSEMBLY 70-9-002-#
1168	¥1 &	70-135		81.64 	

DATE 04 Dec 67 PAGE 29-12

ENCINCED BOARD CARE 12/4/87 NEVIEWED ON (MAN DENIE 12/4/87

FAILURE			*5	
RELATIVE				
==	4	4	1	4
FARLUNE	INTERRUPTS PRICERAM. CANNOT LOWER FILL ASSEMBLY AND PACCESS DRUMS	SWIERGUPTS PROCESS. CANNOT PICK UP LID AND PROCESS DRUM	INTERNATS PROCESS. CANNOT RENOWE LED AND PROCESS DRING.	MILL NOT BE ABLE TO DEWATER RESINS AND CAR'T POXCESS RESINS DUE TO RECH LATER CONTEST
FAILURE DETECTION METHODICS)	ACTUATOR LINET SAFECE	ACTUATOR LIMIT SQUICE	ACTUATOR LIMIT SUITOR	o wo level decrease in waste propersing vessel
FAILURE	MILL MOT LEAVE "DAR" REIGHT	MILL NOT LEAVE "SMING" NEIGHT	Will WOT LEAVE "PICK" METGAT	Pare witt, wor euse
COMPONENT IDENTIFICATION	FILL MEAD ASSEMBLY 70-V-002-8	FELL MEND ASSEMBLY 70-V-002-W	FILL MEAD ASSEMBLY 70-V-002-W	DEMICETAGE POPE 70 G-106 W
#0. I	8 8	No. 138	37 - 27	78-151

ENGINEER DOSSO JANTON DATE 14/17/87 NEVIEND BY NOVOY, DATE 12:10-82

FATLORE	-		**	
PROBABILITY			•	1.
SEVERITY	i	<u>f</u>	f	8
FAILURE	BANKGE TO PLAY COLLD OCCUR.	WILL WOT BE ABLE TO DEMATER RESINS AND THEREFORE UNABLE TO PROCESS RESINS DUE TO MIGH WATER CONTERT	O NO FLUEN WATER ADDED TO MINER PROCRAM INTERNATI O POTENTIAL CONCRET BUILDAP	O ENCESSIVE WATER ADDED TO MINER - PROGRAM INTERNATE O INITIATE EMENCINCY PROCEDURE UNITER MUST BE MANUALLY TURNED OFF
FASTURE DETECTION METHOD.S)	O TOW TENET WINDS  O NO FLOW CR FS-2035  AFTER TOW LEVEL MINDS	o sawe as 70-151 o REDUCED FLOW WILL wor as Defected	VERTITIED AND PROGRAM ON MOLE)	O MESSS ALARM (SEGRENCE MOT   VERIFIED AND PROGRAM ON MOLD).
FAILURE	PARP WILL NOT TURN OFF	WILL BOT DEVELOP MEND ON FLOW.	VALVE WILL ANT OPEN -	WHINE WILL WOT CLOSE + "PFE WEN SHOUND ME CLOSED
COAPGRENT SPENTIFICATION	DEMITTERING PUMP 70-G-106-8	DEMIERING PUMP 70-G-106-W	091 - 14	99.14
80.	76-152	η-153	81-61	#1-# #1-#

DATE 10-Dec-87 PAGE 70-14

RELIABILITY AMALYSIS - SUPERMITANT PROCESSING - STEADY STATE

EMENNERS JACOTO, C DATE 12-10-82 MENTEND ON JACUTY STAND DATE 12/10/27

SEVERITY | RELATIVE | FAILURE CATEGORY | PROBABILITY | CLASS m \* qI. IIP 9 911 O EXCESSIVE MATER ADDED TO MIXER -O NO FLUSH WATER ADDED TO MINER -WATER MUST BE MANUALLY TURNED OFF O INITIATE EMERGENCY PROCESSURE O POTENTIAL CEMENT BUILDUP FATLURE SEE 70-178 AMD 187 PROGRAM INTEREUPT PROGRAM INTERRIBPT SEE 70-178 O HSCSS ALARM (SEGRENCE MOT VERIFIED AND PROGRAM ON MOLD) O HSCSS ALARM (SEGRENCE MOT VERTFIED AND PROCRAM ON HOLD) O MSCSS ALARM (SEGRENCE NOT VERTFTED AND PROGRAM ON HOLD) O MSCSS ALARM (SEQUEN . MOT VERTIEE AND PROCREM . MOLD) FAIL. WE DETECTION METHOD(S) FAIL AT SWIERMEDIATE POSITION FASTS AT INTERMEDIATE POSITION VALVE WILL NOT CLOSE . CLOSED WHEN SHOULD BE OPEN VALVE WILL NOT OPEN . -COMPONENT IDENTIFICATION 191-14 FV-161 FV-161 5V-160 #0. #0. 79-186 70-187 70-188

BATE P. Sec. 87 PAGE 70 15

ENCINCENTION OF BELLEVIED ONE 52/4/57 NEVIEWED OF STORAGE PROBLES 144/97

MEX.LABILLITY AMALYSIS - SUPERMATAMI PROFESSING - STEADY STATE

SEVERITY | RELATIVE | FAILURE CLASS M m CATECORY | PROBABILITY | qii 111 III 1 O COULD GET CROSS FEED FROM ZEOLITE/BACKLANSH CHARD GET CROSS FEED FROM ZEOLITE/BACKUASH ON 50-15 19 SMUTHER TRANSFER IS ATTEMPTED NO FEED TRANSFER AND CANCET PROCESS UNSTE ON 50-15 IF AMOTHER TRANSFER IS ATTEMPTED NO FEED TRANSFER AND CANNOT PROCESS MASTE O NO EFFECT 1F TRANSFERS ARE STOPPED NO EFFECT IF TRANS! IS ARE STOPPED EFFECT ONTO WILL FLOW DRAIN TO 35104 O LIMIT SWITCH SMOULD INDICATE LIMIT SMITCH SHOULD INDICATE MATTERIES MINER VALVE, 15 CYCLED FAILURE DETECTION METHOD(S) STEVEL DOES NOT DECREASE IN TANK 35104 (SENSED ON LUIS) CLOSED. NO DROP 19 ZEOLITE OR o LEVEL DOES NOT INCHEASE IN LEVAL DOES NOT INCREASE IN NO CHANGE IN ESTMER LIMIT MHEN TRANSFER STOPS SOME O LIMIT SWITCH SHOULD MASTE DISPENSING VESSEL MASTE DISPENSING VESSEL o 80 FLOW ON 71 2003 0 ND FLOW ON F1 - 2192 BACKWASH IAMK LEVEL IMBICATE CLOSED GREN ON NOT CLOSED o \$1.00 OR \$1,2002 PAILS AT SHIERMEDIATE POSITION WALVE WILL BOT OPEN VALVE WILL MOT CLOSE WALVE WILL MOT OPEN FAILURE 3000 TRANSFER FROM 35104 TO MOV COMPONENT DOENTIFICATION TRANSFER RESIN 250,115 OR FLOW VALVE FV-004 FLOW VALVE FV-006 FLOW MALVE FY-004. FLOW VALVE FV-964 FILTER BACKMASH 70-253 70-251 70-252 70-261 1168 8

ENGINEER AND DATE 12/4/87 NEVIENCE OF BOLL OLD 12/4/87

DATE 04-Dec 87 PAGE 70-16

1108	COMPONENT IDENTIFICATION	FAILUSE ASSE	FAILURE DESECTION METHOD(5)	FAILUME	SEVERITY   CATEGORY	PROBABILITY	FAILURE
79-50	FLOW VALVE FV-1006	SALDE WILL MOT CLOSE	o timil Sulton IMDICATES OPEN OR KAT CLOBED  o 11.0M OR 71.2003	CONED GET CHOSS FEED 35104, OR 50-15 1F ANDTHER TRANSFEER IS ATTENDED NO EFFECT IF TRANSFEERS ARE STOPPED	<u> </u>		
£ 50	FLC. VALUE FV 306	PASSS AT DEPENDENTE POSITION	84 70 253 20 20 20 20 20 20 20 20 20 20 20 20 20 2	ME 70-255	ļ		•
S.	71.00 VALUE FV 90.7	WALNE ACTE ACT OFFICE	0 868 70 251 Mag 70 251	SEE 70-251 and 70-261	<u> </u>		
20-512	FLOW MAN OF TW ODG?	WALVE WILL MOT CLOSE	o 988 75 252 mm 70 262	S68 70-252 aug 70-262	I 		

MRK. LABILLITY AMALTSIS - SUPERMATANT PROXISSING - STEADY STATE

EMERICA KANT A MONDAG DATE 12/4/97 MEDICINE BAS BASSA CLANDADE 12/4/87

PAGE 70-17

DATE OL AC. - 87

SEVERITY | RELATIVE | FAILURE CATEGORY | PROBABILITY | CLASS \* 315 1110 1111 111 200 MASTE DRAINS IN LINE DOMESTREAM OF FV-005 NO MORE IS DRAINED FROM UNY THAN UNS PLANNED AND MORE IS DRAINED FROM UNY THAN LASS PLANNED MANTE DRAINS IN LINE DOLANSIREAR OF FV 065 O MOI ABLE TO FLUSH SCREEN IN MOV SEE 70-253 AMD 70-263 O MOT ABLE TO DESMITER FFECT O LIMIT SMITCH DOESN'T INDICATE. MON LEWEL WILL DROP SLEGHTLY o Ft'sw impicates on \*1-2035 MAN LEWEL WILL DROP SLIGHTLY FAILURE DETECTION METHODICS AMD UMACCONSTABLY (LT-2001) o NO DETECTION WITH PS-2038 SEE 70-253 AND 70-263 O VALVE LIMIT SAITCH 17 FV 046 15 OPER O NO PLOW INDICATED D WRITE LIMIT SMITCH AMD DANCE MEABLY IMDICATES POSITION ON F1-2038 MRICH LABICATES CLUSED OPEN OR 510525 SHUTS PURP OFF FAILS AT SHTERMEDIATE POSITION FAILS AT INTERMEDIATE POSITION WALVE WILL MOT GPEN WALN'S WILL MOT CLOSE -COMPONENT IDENTIFICATION FLOW VALUE BY 007 FLOW VALVE FY-1058 FLOW WREVE FY-088 FLOW WALNE FV-088 70-752 70-273 70-281 70-285 1168 ú

DATE 04 Dec 57 PAGE 70 18

ENCINEER LAND CONTEST 4 9 07 NEVIEWED IN BOLD STANDERS 12 4/87

110s	COMPONENT EDGMITFECATION	1 FALLING	FALLUME DETECTION METHODISS	PALLERS EPIECE	CATEGORY	PEGASILITY	FAILURE CLASS
78-291	FLOW WRINE FW-D&G	WALNE FAILS TO GPER	O LIMIT SAITOR ON VALVE	NOT ABLE TO DEWIER	4		
			o 40 71.00 INDICATED ON 11.2035 UNICA SMUSS PARK DEF				
76-762	FLOW WALNE FW-B6.	WORE FALCE TO CLOSE	I O LIMIT SMITCH ON N. VE INDICATES OFEN	MASTE DRAINS IN LINE DOMESTICING OF PV-DLS 30 MORE IS DRAINED FROM MAY THAN JAS PLANNED	£		
			o FLON INDICATED ON FL. 035 If Plant IS KONKING				
			S WAY LEVEL WILL DROP SCHOOLY				
10 to	FLOW VAN WE FW Shid	COLUMN FASTS AND INTERMEDIANTE POSSTEON	Same as 70-292	262-02 to 3005	f	•	
78-301	STOM SHEW FY-047 (DIAPHRADE UNIVE)	CLEPTED MERN SWIKELD BE OFFIN	so we stew to stadio on we can the second to	DEWATERING PAMP CAN'T DE FLUSMED OR JOHNSON SCREEK CAN'T JE BACK FLUSMED.	f		•
				· · · · · · · · · · · · · · · · · · ·		Survey or or or or	

DATE 04-Dec- 87 PAGE 70-19

ENCINEER KATER WIELE 12/4/97 PETERED BING LAND TON 12/4/87

FAILURE			-	
PROBABILITY	•			•
SEVER-17	1	1	£	<b>f</b>
FALLUME SPRECT	5) NO EFFECT 2 & 3) UNSTR IN UPV IS 1855 CONCENTRATED, CHISTING RECEPT INACCOUNTY	1) WD EFFECT  2 & 3) MASTE IN MAY 15 LESS CONCENTRATED CAUSING RECIPE SAACCOARCY	PROCESS INTERNATION - FOLICIA SOL 70-16-4.	WHILE MOST DAE AGING TO FLIDBW MEVE.
faitume Defection methodocs)	1) o NO DETECTION IF FV-046 AND GROOT OF THE PLAN OF T	13 o NO DETECTION 19  14 OND AND OBS CLOSED.  15 IN NO PLON STIDINFIEM TO DEWATERING POWE THEN PAMP  14 MAN'T TISHS ON & NO DETECTION  23 MON LEVEL INCR. 35 DBE OFFER  33 LINET SMITCH INDICATES PRILUDE.	O LIBETT SMITCH ON VALUE INCICATES OPEN. O PS-2040 INC. "STES FEOM O 400* LEVEL WILL BEGIN TO 540P. S 400* PINLL RECORD LOW FEOM S 400* PINCE ALARIA.	o MOV LEVEL 15'NT DECRESSING.  o MOV LEVEL 15'NT DECRESSING.  o rinal Surfer On, only!
MADE	OPEN WRITE SHOULD BE CLOSED.	Story in settinging Position.	OUTS were Settled ME CLOSED	CLOSED weth Secure at Corpu
COMPOSENT IDENTIFICATION	COLAPSKALE VALVE)	FLOW SHEWE SW-DAY	SO (STATEMENT VALUE)	E (3x tax absented)
# G	205.502	70-303	22.02	223.90

CE-OF SAMPLY SAMPLES ONTO 12/4/87 REVIEWED BY CAMPANA SAMPLE 12/4/17

1118#   	COMPONENT STEWNSTEEN SAME	DESM DESTIFE	FAILURE DETECTI'N METHODISS	FASTUME	SEVEZITY CATEGORY	PROBABILITY	FAILURE
76.523	19.000 SERVICE (19.000)	MACF OPEN	o way save, is decreasing if minimum flow.  If minimum flow.    o 630-001-Jill RECORD tow flow.    way have tow elow alone.	o of tow flow alasm, Process witt Sept Dose	1		*
E &	(briss attended)	GEO COOR SMINITE SMINI	LINIT SAUTONES AND ANY LEVEL LINIT SAUTONES AND ANY LEVEL LINITESSE 15 LATER ON. LINDICATES RIGHER 16.0. LINDICATES RIGHER 16.0. LINDICATES RIGHER 16.0. LINDICATES RIGHER 16.0. LINGINGS CREEK, BY LEVEL	c THE WASTE AND PROCESS LINE.  c THE WASTE MENTINE WILL BE LESS CONCEMIENTED DUE TO THE MODITION OF THE UTILITY WATER.	1	•	
28.66	CDATION ACTIVIDATED TO GAST-ALL	CLOSES avers sacked at carties	CLOSED.  CLOSED.  O MOV LEVEL DOESN'T INCREASE	ACRY OFF WATER TO PLUSH THE PROCESS LINES.	=		•
E &	600 As 800 Mag ( )	MAY 1974	o wells there not flowerse, yallyte   Liest Sulfoles and safe on   incidence of safe on   o wells there elements, 910-001   indicates signer files,   o RECIRC, CPOIS, safe Liest   INCIDENCE   INCI	o union Plane acid minerioni, ufficitiv lantice alita Gonaciata in Process cinel. a reg uniot minimes unit me cess concretanted.	1		•

DATE Discrete PRINT 70-23

commentant Manne con - 14/57 morene or Basaldon bod ne 12/4/87

IMBILITY AMMITSIS - SUPERMINES PROCESSING - STEADY STATE

SEVERITY | RELATIVE | FAILURE CATEGORY | PROBABILITY | CLASS 411 411 110 1110 CATTER TIME DETERMINED BY 11-6258, NIME 212) O FLOW WILL EITHER BE BLOCKED OR BE PARTIAL TO OME SIDE OR THE OTHER BUT NOT TO BUTH. IN MUST ARKE TO CYCLE FROM RECTRC. OR KEEPS RECYCLING WASTE FOR THE TIME DETERMINED BY 17-6248, RIMG 215, THEN SHIFTS DOWN PLANT ON STEAMS. O PROGRAM INTERNIFIED. FOLLOW MOT ABLE TO CYCLE PROM FILL o SHITTS DOWN PLANT ON SIGNAL SMINS DOME PLANT ON SIGMAL SECT. 6.4 OR SECT. 6.5 SOP 70-16-17 19.1188 EFFECT TIME OUT STOAM, ON LIMIT SUTTON! | TIME OUT STOWN, ON LIMIT SAZITOR TIME OUT SIGNAL OR LIMIT SAITCH o units allientits accisocation o 91-2035 140, 910M (PARTIAL) \* #0 110% O# 110-001 (BLOCKED) O LIMIT SWITCH INDICATES UNLY FAILURE DETECTION METRODIS) (18 PARTIAL PLOW IN PECINC.) FOR ETTHER OPEN OR CLOSED MAS CYCLED - MO DETECTION O DAS ALABM - MT INCOMECT SEG. MOT VERIFIED ALABMS. SEG. MOT VERIFIED ALABMS. o units At cited ING BATCS PATLURE - NO IMPETABLE o 10k 710k at 719.001 PROCEASE OR NOLD AND PROCEASE OR NOLD AND PROCESSING TH MINER WALNE WILL MOT CYCLE PRIM "FILL MINER" MOD FROM ACTUATOR TO BACL VALVE BREAKS THE WILL WIT CITLE INCH TRICKET STOP'S IN INTERMEDIATE POSITION TO "FILL MINES" 10 36018" SALLING \* COMPONENT TREATMENTAGE FLOW VALVE FV-662 FLOW VALUE FV-962 FLOW VALVE FV-002 FLOW WALVE TV-002 70-342 25.00 70-341 70-343 110

DATE 04-Dec-87

PAGE 70-22

Commenter Merica consta /4/87 morenes and descent descent 12/4/87

MILIABILITY AMALYSIS - SUPCOMMINAT PACCESSING - STEMBY STATE

SEVERITY | RELATIVE | FAILURE CATEGORY | PROBABILITY | CLASS 95 sh 1113 Ē 110 118 VALVE MONT CPCLE, MENNE MIXER GETS WASTE. PROCESS INTERNATED. FOLICOL SEP 70:18-11, 15, 17 188 CONTINUED AUTOMATICALLY UNITL VALVE CAN CYCLE. ME CONTINUED I "COMMITCALLY SMITL VALV" CAN CYCLE. FIGN WILL EITHER BE RECKED OR LEAK TO OME SIDE OR THE OTHER, MOT TO BOTY. PROGRAM INTERRIPTED, PROCESS WILL MOT CON'T PROGRAM INTERNIPTED, PROCESS WILL MOT PROGRAM INTERRUPTED. PRINCESS USEL MOT AUTOMOTICALLY UNTIL VALVE CAS CYCLE. FOR RECOVERY FAILURE TIME OUT SIGNAL ON LIM. SAFECE - ] \* #0 fills In fl-2035 (IF BLOCKED) PROG. ON MORD & SEO. MOT WERFIED PATLIAME DETEC, FOW METHOD(S) LINIT SWITCH INDICATES VALVE O NO IMOR. IN MI. IN MINES MEDING MINER GETS MASSIE. SEG. NOT VERSITIED, DAS & SECREMENT MON VERTITED SEGRENCE NOT VERIFIED PROS. OR : DLD ALMENS. TIME OUT SIGNAL ON PRINCIPAN ON MOLD & TIME DUT STORM, OR PROGRAM ON HOLD & BAS CYCLED - NO LIMIT SUITCE . DETECTION THERE. LIMIT SWITCH -ALABNS. UNIVE WILL NO! CYCLE TO MIKER 5 VALVE WILL MOT CYCLE TO WIMER 2 STOPS OR DRIEBMEDIATE POSITION. RED FROM ACTUATOR TO BALL VALVE BREAKS -**M** COMPONENT TOENTSFICATION 24-016 5V-014 FY-DIE 24 O.16 70-351 70 335 70-352 70-754 ž s

TEY AMALESTS - SIPSEMATANT PROCESSING - STEADY STATE

ENGINEER DESCRIPTION DATE 14/197 NEWTONE OF DESCRIPTION OF 12-10-87

A   FALURE		~	-	~
PROBABILITY	•		•	•
CATEGORY	4	1		
FABURE	PROGRAM INTERNIPTED AND ACTION TAKEN PER SOP 70-18-17, SECT. 6.11 OR 6.9. CANNOT EMPTY WINER AUTOMATICALLY. CEMENT SETUP MAT OCCUR.	O PROGRAM INTERNAPTED. CANNOT MAINTAIN ALUGO MATER, UMSTE ON CENENT TO MINER. O LUMNINED ON NOT THOROUGHLY MINED MASTE TO DRUM.	PROGRAM INTERNATED AND .CTION TAKEN PER SEP 70-16-17 SECT. 6.19 CANNOT EMPTY MISER AUTOMATICALLY CONSAL CONSAL SETAM MAY OCCUR.	o Pfociale Internatio. Campi Materially Fuchs units, units on cinear to misse. o tamingo on h.: frombaunt misso units to plear.
FAILURE DETECTION METHODOS)	o SEG. MOT VERIFIED & PROC. OR HOLD MIANNES. o NO NY. CHANGE IN MINER. o MAINE LIMIT SALECHES SHOW MAINE POSITION.	SANA VALVE LIM. SAFECHES SANA VALVE POSITION 	o "SEGRENCE NOT VERFEIGHT ALARM O UT DOESN'T CHANCE IN MINER O VALVE LIM. BATTORS SHOW VALVE POSITION.	Securities serfores factor of the serious of the serious serio
PALLUME MODEL	CLOSED WERE SHOULD BE OFFIX.  (ASS SOLEWIDD WALME CAUSES WALME TO FAST CLOSED)	CHES OR PARTIMENT OFFE WATER SHOWER ELECTION.	CLOSED LANES SHOULD BE OPTS.  (ASE DYCEMOTO VALVE CAUSES VALVE TO FAIL, CLOSED.)	OPEN OR FARTINLLY OPEN APEN SARAGO NE CLOSED.
CONFIGNITIONAL LIBERTIFICATION	70-rw-005 (P)MCW-WAS-W)	70-14-005 (P)attr (MLM)	70-ty-10 (P19C0-19ALM)	70-fv-10 (framic swint)
. i	19.50	3 6	5.	28-80

DATE 64- Dec - 87

PRGE 70-75

mines the XMMM one (2/4/97 more of completed on 10/4/87

MELINBELLITY AMALYSIS - SUPERMETANT PROCESSING - STEADY STATE

FAILURE CLASS 91 PROBABILITY | SEMERITY | RELATIVE CATEGORY 118 311 === 1110 PROCESS SWITHWARFIED, FOLICE SOP 70-18-11 & -15 | o PROGRAM INTERNATIO, FOLICIA SOP 70 16-11 OR -15 | NOT ABLE TO FLUSS MOV FOR WASTE CHANCE O DOMESTING WILL RESULT TO FIN WALVE COMPTHATO OPERATION POSSIBLE. SAME AS 70-397 FOR RECOVERY. FOR RECORDERY. FAILURA + 11M. SAITCH OFFRATIONAL AND CLOSED, 249. MOT VERTFIED AND I O 12MIT SAFECE OPTRATIONAL AND PAILUME DETECTION NETWOCKS) PROCESS ON NO.5 AND 250, NOT to \$10-2000 RECOMPT NO \$10M RECORDS NO LEVEL INCREASE o LEVEL TRANSMITTER 2001 PROGRAM ON MOLD ALMOND. IMPLEATES VALVE FALLED. INDICATES MINER 1 STILL VERIFIED ALABRES. SAME AS 70-391 18 100 T. MATER ! WHILE MOT CPCLE PROP MINES 1 TO MINES 2 WHILE MOST CHOLS FROM MERGE 2 TO MOVER 1 UNIVE SAILS AT LATERMEDIATE PUSITION , PARTIALLY OFER TO THE MINER AND CLOSED TO UTAGK WINES I TALLS TO OPEN MREN ACTIVATOR -(TO MASTE DISPERSING MISSES SMLET COMENT DIVERTER VALVE 070-V-017 COMENT DIVERTOR UNLUR GZB-U-017 CHECK WALVE - USF ""Y MATER - 1 CEMENT DIVERTER VALVE 670-V-017 PROCESS LIME, 70-Pt. 1503 COMPOSED IDENTIFICATION \* 70-393 70-381 70 501 70-39 1118

MELIABILLITY AMALYSIS - SUPERMINANT PROCESSING - SIFADY STATE

CHESTER KINDER MAN 12/4/97 HOUSEN DESCRIPTION OF DESCRIPTION 14/87

SEVERITY | RELATIVE | FAILURE CATEGORY | PROBABILITY | CLASS N 1119 110 111 H GGBAR 1971;88;8FTED. FOLLOW 92P 70-18-11 AMD -15] · NO EFFECT IN MECINC. CYCLE - MECINCA, AFFICE . IN FILL CYCLE, MINTIME MAY SETTLE AND O DOMNTONE WILL RESULT TO FIX VALVE PLANT WILL FAIL WITHOUT SEAL WHIER. SHOWLD KEEP MINTURE HOMOGEMEDATS URABLE TO DESARTER ATTHORS PLANT. SECONE MON HONOGENEOUS JOH RECENERY. FALLORE EFFECT 1231443 OM S LIMIT SWITCH OPERATIONAL AND PASSURE DESECTION # 2MODES PROGRAM ON HOLD AND SEG. MOT IMDICATES VALVE PALLED. 41 250 DETECTS NO FLOW TI 250 PETECIS FLOW WERTFIED ALABMS. MD 0616C710M WALNE SALLS WITH WALVE CLOSES 10 BOTS MINERS FAILS TO OFTER 7ATLS 30 OPER PRILS TO CLOSE PATITIBLE CHECK UNLYG - UTILITY WATER : 2 (TO DEWATERING PAMP, 070-6-166) CEMENT DIVENTER JALVE 075-V-017 CHECK VALVE - ATR (TO MASTE OTSPERSTING VALVE MINER) CHECK VALVE - ATR CTO MASTE COMPONENT IDENTIFICATION DISPENSING UNIVE MINERS SEAL MATER 70-411 127-02 73-394 70-422 1118

MELIABILITY AMALYSIS - SUPERMAINET PLACESSING - STEMPT STATE

PAGE 70-25

DATE 10-Dec-87

SEMENTY | RELATIVE | FAILURE CATEGORY | PROBABILITY | CLASS ¥ 90 W. = Ξ 883 # # Ē o bes exame under until to exists to PROGRAM INT. AND ACT. PER SIP 70-10-17, SCI 6.11) o das alaba unes until la minte jo procesar lati. And acti. Mis 50º 70-15-17, St., 6-11) 150P 70-18-17, SECT. 6.5 GR 6.4. 1F ACTURE WEIGHT IS COMMECT AND MEMOTING TOO LOW, NYME WASTP AMD/OR CEMENT ATLE BE ADDED. 17 AC.OR. METGET RICH AND READING ON WILL GET DAS ALABM UNDS MINE" DIRECTO IS COMMECT ANTH READING -110% THE MINGS WILL BE MITH READING + 110% NAMEN, CORE, OF CEMENT MADE SUP 70-18-17, SECT. 6.5 EKS. 17 ACISCO PETENT UMMECESSABILY SUMPLED. 19 ACTUTL WE 15 COMMECT, o PROGRAM INTERNIPTED AND ACTION TAKEN PER o PROCESAR INTERREPTED AND ACTION TAKEN PER NO PRESSURE TO SACIONASE INTO UTILITY MATER STRIEM SMLESS TRIPLE PALLIME: 1) MAY DWERFILLS AND VENT IS PLINGED 2) HIGH LEVEL ALASH DOESN'T SOLMS S) CHECK WALVE FAILS TO CLOSE OF LEWEL TRANSMITTER CONTINUES PUNCOTAG / CRACIMONS READINGS EFFECT CONTROL distr. is data allater dei signis Pradit. MESCHE DOKSM'T MATCH RECIPE to DAS ALARM ON ASCES PAREL MO DETECTION PATLURE DETECTIO LEVEL 18 MOV DG. MEMBING STORES THAN ACTUAL OFF. READING LOADS THAN ACTUAL COUNT OF CALLER. 3 (B) (B) (B) (B) TABLE TO CLOSE **FAILS TO OPEN** CASLIBRE \* (10 MASTE DISPENSING MESSEL 070-5-001) (10 J-070 1302NG MESSES 070-C-001) CHECK WALVE - UTILITY MATER - 3 CHE. R. VALVE - UTIL. TY MATER - 5 COMPONENT IDENTIFICATION ME-2071 CMT. OF MINER #T. FOR TRANSMITTERS FOR IRANSMITTERS ME - 2071 20-02 157 M 70-432 70-481 1 4

ELIABILITY AMALYSIS - SUPERMATANT PROCESSING - STEADY STATE

ENGINEER TOURS ONTE 12-10-67 REVIEWED BY GRANT STATE 14 17/11

PAGE 70-27

DATE 10-Dec-87

!	S
g	
	PROCRAM INTERRUPTED AND ACTION PER SOP 70-18-17 SECT. 6.6, 6.7, 6.11
FAILURE DETECTION METHOD(S)	O DAS USES ACRISON TO DETERMINE ANCURT OF CENEUT (ME2011) AND DAS ALARM
FAILURE	SW-CREAD VIC
COMPONENT IDENTIFICATION	W. 2071
11EN 1	89-62

RELIABILITY AMALYSIS - SUPERNATANT PROCESSING - STEADY STATE

DATE 04-Dec-87 PAGE 70-28

ENCINEER KNING MEDING ONIE 12/4/87 REVIEWED BIRDUNG CONTROL 14/87

FAILURE CLASS	м		•
SEVERITY   RELATIVE   CATEGORY   PROGABILITY		٠	
SEVERITY   RELATIVE   CATEGORY   PROBABILITY	9	<u> </u>	<b>I</b>
FAILURE	PROCRAM INTERRUPTED ALL ACTION TAKEN PER 11D C SOP 70-18-17, SECT. 6.11	PROGRAM INTERRUPTED AND ACTION TACEN PER SOP 70-16-17, SECT. 6-11	PROCESS CONTINUES AS PER SOP 70-16-17, SECT. 6.11
	DRIM > 100% FULL SHOW	DAS - VILL SHOW DRUM TO BE NOT FULL ENOUGH DAS VILL ALARM	DAS ALARM, DRUM LEIGHT NOT SUM OF 015CHARGE LEIGHTS
FAILURE MODE	READING NIGHER INAM ACTUAL (OAT OF CALIB.)	READING LONER THAN ACTUAL (OUT OF CALIB.)	NO NE AD ING
COMPONENT IDENTIFICATION ,	8	ue -2073 (us -2073)	ur-2073 (u1-2073)
. 116w	10-507	78-582	70-503

q II

PROCESS IS STOPPED AS PER SOP 70-18-1

PREMATURE NIGH LEVEL ALARM WHEN FILLING

READS HIGHER THAN ACTUAL

11-2001

70-511

ENGINEER SMIN MONIO DATE 12/4/87 REVIEWED BY Dans Land ONTE 12/4/87

STEM MO.	COMPONENT IDENTIFICATION	FAILURE MODE	FAILURE DETECTION METHOD(S)	FAILURE EFFECT	SEVERITY	RELATIVE	FATLURE
70-512	L1-2001	READS LOWER THAN ACTUAL	LS-2053 CLOSES APPROPRIATE	NO EFFECT - PROCESS CONTINUES AS USUAL	III   	C	3
70-521	ME-2011 (CEMENT MEIGHT DETECTOR)	READING NIGHER INAM ACTUAL	DAS SYSTEM ALARM BECAUSE CAN'T   MATCH MEIGHT IN MIXER, (LOW   MATER/CEMENT RATIO   MITH RECIPE.)	STOP AUTOMATIC PROCESS. PROCESS CONTINUES AS PER SOP 70-18-17, SECTION 6.7	IIb		
70-522	u€-2011	READING LOWER THAN ACTUAL	DAS SYSTEM ALARM BECAUSE CAN'T     MATCH WEIGHT IN MIXER (HIGH     WATER/CEMENT RATIO     WITH RECIPE.)	STOP AUTOMATIC AND PROCEED AS PER SOP 70-18-17, SECTION 6.5	11b		3
70-523	₩-2011	NO READING	DAS ALARM	STOP AUTOMATIC PROCESS AND PROCEED AS PER SOP 70-18-17, SECTION 6.6	1 116		3

ENGINEER Kom & MAMO DATELZ/4/87 REVIEWED BY DATE BY SUPPLY DATE 12/4/87

NO.	COMPONENT IDENTIFICATION	FAILURE   MODE	FAILURE DETECTION METHOD(S)	FAILURE	CATEGORY	RELATIVE    PROBABILITY	CLASS
70-531	FE-001	I INDICATES FLOW WHEN THERE IS NO FLOW  I  I  I  I	O IN RECIRC. CYCLE, PUMP INDICATES OFF. I	MO EFFECT	111	C	3
70-532	fE-001	I ENDICATES NO FLOW WHEN THERE IS FLOW  I  I  I	"SEQUENCE NOT VERIFIED" ALARMS AND MOTOR OF PUMP INDICATES ON	SV 002 WILL NOT OPEN TO MIXERS AND   PROGRAM IS INTERRUPTED	ПЬ	c	3
70-533	FE-Q01	FLOW READING HIGHER THAN ACTUAL	O IN RECIRC. CYCLE, NO INDICATION  O IF IN FILL CYCLE, DAS ALARMS AND "SEQUENCE NOT VERIFIED" ALARM SOUNDS BECAUSE MIXER UEIGHT DOESN'T CORRELATE MITH NECEPE	O RECIRC. CYCLE: NO EFFECT  O FILL CYCLE: PROGRAM INTECRUPTED AND WASTE  IN MIXER IS MORE OR LESS THAN REQUIRED.  IF LESS, WASTE MUST BE ADDED MANUALLY  AND PROCESS CONTINUES. IF MORE WASTE,  PROCESS CONTINUES WITH DRUM AS "SUSPECT."	HÞ		3
70-534	FE-001	FLOW READING LOWER THAN ACTUAL		O RECIRC. CYCLE: PUMP STOPS AND PROG. INTERRUPTED OF FILL CYCLE: 1) MORE WASTE IN MIXER, PROCESS CAN CONTINUE WITH DRUM AS "SUSPECT" OR MAY MANUALLY ADD CEMENT OR DISCHARGE TO FLUSH DRUM 2) IF FLOW IS ACTUALLY 80 GPM AND THE READING IS LESS, THE SYSTEM WILL NOT ALLOW V-002 TO CYCLE TO FILL CYCLE FROM RECIRC	Hb	8   	3   1   1   1   1   1   1   1   1   1

DATE 04-Dec-87 PAGE 70-31

RELIABILITY ANALYSIS - SUPERNATANT PROCESSING - STEADY STATE

ENGINEER KATHEN MIGMO DATE 12/4/87 REVIEWED BY BANGOONTE 12/4/87

SEVERITY | RELATIVE | FAILURE CATEGORY | PROBABILITY | CLASS N 1116 III q E 1116 O PROGRAM INTERRUPTION AND PUMP SHLIDOWN O DOWNTIME WILL RESULT TO CLEAN PROBE LOSS OF REDUNDANCY, HSCSS CONTROL LOSS OF REDUNDANCY, HSCSS CONTROL RECOVERY AS PER SOP 70-18-6 SYSTEM WILL PREVENT OVERFILL SYSTEM WILL PREVENT OVERFILL SAME AS 70-541 FAILURE EFFECT FAILURE DETECTION METHOD(S) HIGH LEVEL ALARM SAME AS 70-541 NO DETECTION NO DETECTION NO RIGH LEVEL READING WHEN FILLED MO BICH LEVEL RI'101MG LOT FILLED TOO MIGH WHEN UNDERFILLED TOO RIGH WHEN UNDERFILLED FAILURE MODE 15-2048 (1EVEL SWITCH [PROBE] LS-2046 (LEVEL SUITCH (PROBE) COMPONENT IDENTIFICATION ONLY A RIGH LEVEL PROBE ONLY A HIGH LEVEL PROBE ON MINER #23 ON MIXER #1) 15-2048 15-2046 70-551 70-552 70-541 110x 70-542

RELIABILLITY ANALYSIS - SUPERNATANT PROCESSING - STEADY STATE

DATE 04-Dec-87 PAGE 70-32

ENCINEER KIND AND CATE (2/9/87 REVIEWS BY BANG BOMBANE 12/0/87

SEVERITY | RELATIVE | FAILURE CLASS M CATEGORY [PROBABILITY | Ξ 9 9 Ξ = I NO INITIAL EFFECT - MAY CAUSE FAILURE OF FV-004 NO EFFECT INITIALLY. LOW LEVEL ALARM MAY ACTIVATE IN UDV 1F NO FLOW TO VESSEL IS COMBINED WITH BATCH PROCESSING INSTEAD OF TURNS OFF. THEREFORE UNABLE TO DEMATER BECAUSE OF PRESSURE BUILD-UP UPSTREAM. ON NO FLOW INDICATION, DEMATERING PUMP AND CAN'T PROCESS RESINS. NO EFFECT - REPAIR FS. PUMP COULD FAIL EFFECT RECIRC. FAILURE DETECTION METHOD(S) O FS-2002 INDICATES NO FLOW PUMP OFF LIGHT FV-046, 047, NOT DETECTED ON CSS SYSTEM USB CLUCED. HAS TO SHOW O NO LEVEL INCREASE IN VOV PUMP GM FV-046, 058 OPEN NOV LEVEL DOESN'T CHANGE FV-046, 068 OPEN. DETECTION IN UNIS LIQUID IN MOV. NO FLOW SHOWS NO FLOW WHEN THERE IS FLOW SHOWS FLOW WHEN THERE IS NO FLOW NO FEED WHEN FEED DESIRED FEED WHEN FEED NOT DESIRED FAILURE MODE Å | FEED FROM 35104 (AS A SUPPORT SYSTEM) FEED FROM 35104 (SUPPORT SYSTEM) COMPONENT IDENTIFICATION FS-2038 FS-2038 70-562 70-556 70-557 70-561 1168

RELIABILITY AMALYSIS - SUPERMATANT PROCESSING - STEADY STATE

DATE 04-Dec-87 PAGE 70-33

ENGINEER KANDSKYAND DATE 12/4/87 REVIEWED BY DANNY FOR BALBATE 14 4/87

SEVERITY | RELATIVE | FAILURE CLASS m CATEGORY PROBABILITY = == Ξ 111 | NO INITIAL EFFECT - NAT CAUSE FAILURE (LEAKAGE) NO INITIAL EFFECT. MAY CAUSE FAILURE OF FV-006 OF FV-DOS SECAUSE OF PRESSURE BUILD-UP BECAUSE OF PRESSURE BUILD-UP UPSTREAM UPSTREAM OF VALVE SEE 70-561 SEE 70-561 EFFECT FAILURE NO DETECTION ON MSCSS CONTROL PANEL - DETECTION IN LUTS O NO FLOW INDICATION ON FS-2004 NOT DETECTED IN CSS SYSTEM O FS-2003 INDICATES NO FLOW FAILURE DETECTION METHOD(S) O NO LEVEL INCREASE ON MASTE O NO LEVEL INCREASE IN MOV DETECTION IN LMTS DISP. WESSEL. FEED WHEN FEED NOT REQUESTED/DESTRED FEED SWEW FEED WOT REQUESTED MO PEED UNEN FEED DESIRED NO FEED WHEN FEED DESIRED FAILURE MODE CONCENTRATE FROM 50-15A-FEED (AS A SUPPORT STSTEM) CONCENTRATE FROM SO-15A-FEED (AS A SUPPORT SYSTEM) COMPONENT IDENTIFICATION RESIN AND ZEOLITE FEED ESIN AND ZEOLITE FEED (AS A SUPPORT SYSTEM) (AS A SUPPORT SYSTEM) 70-566 70-567 70-571 70-572 1168 .08

RELIABILITY MARLYSIS - SUPERMATANT PROCESSING - STEADY STATE

DATE 10-Dec-87 PAGE 70-34

ENCINEER DOTA COTA CONTE 12 - 10 - 62 REVIEWED BY DUCK ANGLIN DATE 1 1 1 1 1 1

T   CLASS		n		
PROBABILITY		·		
CATEGORY	1	<u> </u>	<u>a</u>	_
FAILURE EFFECT	8	UNIME TO FLUSH WASTE DISPENSING VESSEL USING SPRAT. CAN USE UN FROM 070-UM-067 AND 070-UM-011 TO FILL MOV WITH FLUSHMATER	SLUBRY NOT AS CONCENTRATED AS DESTRED.	CEMENT RESIDUE NAY ACCIMULATE AND NARDEN IN THE MINER.
FAILURE DETECTION METHOD(5)	"CELL LOSS OF NEGATIVE PRESSURE"	FV-061 1S CLOSED  (AS IMDICATED 2M MSCSS  GRAPHICS PAMEL)	PV-061 15 OPEN (n. 1801-ALO ON HSCSS GRAPHICS PANEL)	O FV-160 IS CLOFED AS INDICATED ON CRAPHICS PANEL O NO CHANGE IN MEIGHT
FAILURE MXDE	WESSEL WENT OFF	MO MATER TO LINE 070-IAN-068 WHEN MATER REEDED	MATER TO LINE D70-UN-OGS MREC MATER MOT REQUINED	MD LATER TO LEWE 070-UM-090) WHE'D LATER WEEDED
COMPONENT IDENTIFICATION	VESSEL VENT 070-VE-053 (AS A SUPPORT STSTER)	FLUSH KZO TO 70-0-701 (AS A SUPPORT SYSTEM)	FLUSH NZO TO 70-0-001 CAS. A SUPPORT SYSTEM)	FLUSH NZO TO MINER AZ (AS A SUPPORT STSTEM)
116s	70-576	N 581	28.00	86.58

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RELIABILITY ANALYSIS - SUPERNATANT PROCESSING - STEADY STATE

ENCINEER SANDY PLANDED DATE 14 9/87 REVIEWED BY KINNY MADDONIE 12/4/87

SEVERITY | RELATIVE | FAILURE CATEGORY | PROBABILITY | CLASS 111 100 u dii 1116 116 IIb PROCRAM INTERRUPTS (MIXTURE MAY MOT BE IN CORRECT RATIO IN THE MIXER) AS PER 50P 70-18-17, SECT. 6.6 PROCRAM THTERRUPTED SEE 70-596 SEE 70-597 EFFECT O METCHT INCREASE . "SEGRENCE NOT VERTFIED" ALARM "CEMENT FEEDER TROUBLE" ALARM FAILURE DETECTION METHOD(S) INDICATED ON GRAPHICS PANEL O FV-160 IS OPEN AS AND DAS ALARM SEE 70-596 SEE 70-597 NO MATER TO LINE 070-UM-095: WATER TO LINE 070-UN-090 WHEN MATER NOT REQUIRED MATER TO LINE 070-UM-094 WHEN NO WATER REGURED WHEN WATER REGULARED MO CEMENT TO DAY BIN FAILURE 300M COMPONENT IDENTIFICATION CEMENT TO CEMENT DAY 81N (AS A SUPPORT SYSTEM) FLUSH MATER TO MIXER #1 FLUSH WATER TO MINER #1 FLUSB NZO TO MINER #2 (AS A SUPPOPT SYSTEM) (AS A SUPPORT SYSTEM) (AS A SUPPORT SYSTEM, 70-662 70-606 792-07 70-601 1158

DATE 04-Dec-87

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MELIABILITY AMALYSIS - SUPERMAIANT PROCESSING - STEADY STATE

ENCINEER MYTHON MONTH DATE LZ /4/87 REVIEWED OF BUNGORDING 12/4/87

CLASS \* m 1475 SEVERITY | RELATIVE | CATEGORY PROBABILITY 9 u u 110 Ξ 111 = WASTE NOT FLUSHED FROM LINE. EVENTUALLY, WASTE WOT FLUSHED FROM LINE. EVENTUALLY, O CAN'T BACKLASH JOHNSON SCREEN IN UDV O RESIDUALS MAT RESIDE IN THE LINE DIFFERENT MASTES MAY MIX DIFFERENT WASTES HAY MIX PROGRAM INTERRUPTED CAUSING PLUGGAGE EFFECT FAILURE LEGISTER CHANGE ON GRAPHICS PANEL C LID NANDLER UP/DOWN DOESN'T D RAM VALVE BOESH'T REGISTER (MOT DETECTED SPECIFICALLY) O FILL NEAD UP/DOWN DOESN'T FAILURE DETECTION METHOD(S) O SE 1050 INDICATES LOW FLOW CHANGE ON GRAPHICS PANEL. O NO LIDY LEVEL INCREASE IF O NO LEVEL INCREASE IN LIDY O NO DETECTION POSSIBLE o FE 62 INDICATES CLOSED 1F FLUSHING 070-PL-008 INSUFFICIENT FLOW FI - 001 REGISTERS BACK - FLUSHING ON THE PAMEL REGISTER INSUFFICIENT FLUSH MATER AVAILABLE INSUFFICIENT FLUSH WATER AVAILABLE INSUFFICIENT FLUSH WATER AVAILABLE NO FLUID PRESSURE FAILURE MODE NEUSR MATER TO RECTR LIME 070-UM-011 ATDRAIL IC FLUID TO CYLINDER SYSTEMS FLUSH WATER TO SUPPL! NEADER 070-UM-067 (AS A SUPPORT SYSTEM) SUUSH MATER TO DEMATER RETURN COMPONENT IDENTIFICATION CAS A SUPPORT SYSTEM) (AS A SUPPORT SYSTEM) (AS A SUPPORT SYSTEM) LINE 070-UM-005 70-611 20-456 70-621 1168 70-631

RELIABILITY ANALYSIS - SUPERMATANT PROCESSING - STEADY STATE

ENGINEER DOUNG JUNGLED DATE 12/15/97 REVIEWED BY NOUS . DATE 12-10-69

N 9	COMPONENT IDENTIFICATION	FAILURE MODE	FAILURE DETECTION METHOD(S)	FAILURE	2 2	_ 4	CLASS
N9-636	FLUSS WATER DRAIN RETURN TO D-13 TANK 070-DR-2-092 (AS A SUPPORT SYSTEM)	LINE PLUGGED NOT ALLOWING DRAINAGE	O NO FIGUR INDICATED FROM FS-2042 OR FS-2040 OFV-000 INDICATES CLOSED	MASTE NOT -LUSHED FROM LINE	=		-
14	RETURN LINE TO LUTS FROM DELATERING PLANE PLUGGED PREVENTING PLANFING OF FLUID 070-PL-014 (AS A SUPPORT STSTEM)	A SIME PLINGLED PREVENTING PURPING OF FLUID	PS-2038 IMPICATES NO FLOW	PUNP SMUTS OFF. FLUSMING PROCESS CAN'T CONTINUE.	<u></u>		-
38 62	INSCSS CONTROL, STSTEM & DATA ACQUISITION STSTEM (AS A SUPPORT STSTEM)	PLE MOT OPERATIONAL	"SEGUENCES PANCI. "SEGUENCES FAILURE" ALARM "DAS SYSTEM FAILURE" ALARM	PROGRAM INTERNUTION - OPERATION IN MANUAL WODE WOT RECOMMENDED EXCEPT TO STABILIZE SYSTEM. SOP 70-11 SMOULD BE REVISED TO PREVENT CONTINUED OPERATIONS.	<u> </u>	ļ	-
70-651	15.2002	SMITCH SHOWS NO FLOW WHEN THERE IS FLOW	o FE 2080 IS REGISTERING FLOW o FV-804 INDICATES OPEN o L1-2001 INCREASES	IF MOV REACHES RICH LEVEL VALUE, FV 4	E 	ļ.	_

DATE 04-Dec-87

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ENCINEER KAMP MAN ME 12/4/87 REVIEWED BY DAMING BARD SINE 12/9/87

RELIMBILITY ANALYSIS - SUPERNATART PROCESSING - SIFADY STATE

SEVERITY | RELATIVE | FAILURE CLASS m CATEGORY [PROBABILITY | = Ξ 111 NO EFFECT INITIALLY. LOW LEYEL ALARM NAY SOLNO IN "ADV IF INADEQUATE FLOW IS COMBINED W/ BATCH IN UDV IF INADEGUATE FLOW IS COMBINED U/ BATCH NO EFFECT INITIALLY. LOW LEVEL ALARM MAY SOLMS IF NOV REACHES HIGH LEVEL VALUE, FV 7 IF UDV REACHES RIGH LEVEL VALUE, FV 6 PROCESSING INSTEAD OF RECIRCULATION PROCESSING INSTEAD OF RECIRCULATION WILL BE CLOSED WILL BE CLOSED 133443 FATLURE OF FE 2080 NOT REGISTERING FLOW O FE 2080 NOT RECISTERING FLOW o WDV LEVEL (LI-2001) INCREASES o FE 2080 IS REGISTERING FLOW a FE 2050 IS REGISTERING FLOW FAILURE DETECTION METHOD(S) o FV-004 INDICATES CLOSED o FV-007 INDICATES CLOSED o FV-006 INDICATES OPEN o FV-067 INDICATES OPEN O MOV LEVEL INCREASES SWELCH SHOWS FLOW WHEN THERE IS NO FLOW SWETCH SHOWS FLOW WHEN THERE IS NO FLOW SWITCH SHOWS NO FLOW WHEN THERE IS FLOW SWITCH SHOWS NO FLOW WHEN THERE IS FLOW FAILURE MODE COMPONENT IDENTIFICATION FS - 2003 FS-2002 FS-2004 FS-2004 70-652 20-656 70-661 70-657 110

RELIABIL'IT AMALYSIS - SUPERMATANT PROCESSING - STEADY STATE

DATE 04-Dec-87 PAGE 70-39

ENGINEER KNING MANAO DAIE 12/4/47 REVIEWED BY DONN STANDE 12/4/87

SEVERITY | RELATIVE | FAILURE CLASS \* CATEGORY | PROBESILITY | 111 qij 110 111 | FS-2002, -2003, -2004 INDICATE | EVENTUALLY LOW ALARM WILL SOUND IF PROCESS IS NOT | IN MASTE DISPENSING VESSEL IF INADEGIATE FLOW TO I NO EFF. I INITIALLY. LOW LEVEL ALARM MAY SOUND | MANUALLY STOPPED AND PROCESS WILL AUTOMATICALLY IN MOV IF INADEQUATE FLOW IS COMBINED W/ BATCH VESSEL IS COMBINED M/ BATCH PROCESSING INSTEAD OF NO EFFECT INITIALLY. LOW LEVEL ALARM MAY SOUND IS NO MANUALLY STOPPED AND PROCESS WILL ELEMENT SHOWS NO FLOW WHEN THERE IS FLOW | FS-2002, -2005, INDICATE | EVENTUALLY NIGH ALARN WILL SOUND IF PROCESS PROCESSING , NSTEAD OF RECIRCULATION AUTOMATICALLY STOP RECIRCULATION. FAILURE O FE 2080 NOT REGISTERING FLOW FAILURE DETECTION METHOD(S) LOW LEVEL ALARM MAY SOUND O PV-006 INDICATES CLOSED OTHERWISE, NO DETECTION NO FLOW ON PAMEL FLOW ON PANEL ELEMENT SHOWS FLOW WHEN THERE IS NO FLOW SWITCH SHOWS FLOW WHEN THERE IS NO FLOW FLOW READING HIGHER THAN ACTUAL FAILURE 300W COMPONENT IDENTIFICATION FS-2003 FE-2080 FE-2080 FE - 2080 70-666 70-668 70-662 70-667 1158 g

RELIABILITY AMALYSIS - SUPERMATANT PROCESSING - STEADY STATE

DATE 10-Dec-87

PAGE 70-40

ENGINEER Charty Land one '41421 REVIEWED BY 1 000, DATE 12 10 / 72

SEVERITY | RELATIVE | FAILURE CLASS \* m CAT"GORY | PROBABILITY | qii IIP 116 Ξ 004.) BEFORE TIMED SEQUENCE IS COMPLETE IF HIGH APPROPRIATE FLOW VALVE WILL CLOSE (FV-006, 007, PROCESS STOPS BECAUSE PLAP SHUTS OFF. V-602 VALVE CANNOT OPEN. V-002 VALVE CANNOT OPEN LEVEL ALARM SOUNDS NO EFFECT FAILURE EFFECT FAILURE FE-001 INDICATES FLOW, FAILURE DETECTION METHOD(S) WITH PUMP RUNNING AT TIME OF AND "SEQUENCE NOT VERIFIED" HIGH LEVEL ALARM MAY SOUND "FS-2035 LOK FLOW" ALARM OTHERWISE NO DETECTION FG-001 NOT REGISTERING SUFFICIENT FLOW ALARM SOUNDS SWITCH SHOWS NO FLOW WHEN THERE IS FLOW SWITCH SHOWS FLUID PRESENT WHEN FLOW READING LOWER THAN ACTUAL SWITCH SHOWS NO FLUID WHEN THERE IS NO FLOW THERE IS FLOW FAILURE COMPONENT IDENTIFICATION 15-2042 15-2042 FS-2035 70-676 179-671 70-672 70-669 11E8

RELIMBILLITY ANALYSIS - SUPERMITANT PROCESSING - STEADY STATE

ENCINCER ELGAL S. T. E. E. S. DATE 14 C. E.) REVIEND OF THE GATE 12-10-12

1118 8.0	COMPONENT IDENTIFICATION	5A17.38E MODE	-		SEVERITY	SEVERITY   RELATIVE	CLASS
N 677	15-2035	SWITCH SHOWS FLUID WHEN THERE IS NO FLOM	WO DETECTION	** TITE ** 3	1	•	•
N S	LS-2053 ONLY KJGN LEVEL, PNOME	TOO NEED WICK UNDERFILLED	O MOV LEVEL NIGH ALARN DOESN'T CORRELATE AUTH LT-2001 READING O PROGRAM ON HOLD	LT-2001 WILL IMDICATE CORRECT LEVEL WILL SHUT OFF PV-004, 006, 08 007. PROGRAM INTERNUPTED	1	u	•
ğ	18-205	NO RIGH LEVEL READING WHEN OVERFILLED	NOV LEVEL NIGH ALARM	LOSS OF REPROMERT, LT-2001 WILL STOP OVERFILL	8	u	-

APPENDIX C

LIST OF DOCUMENTS

QUA	DOCUMENT #	DOCUMENT TITLE	REV	DATE
	C-10526	Configuration Document - Mycro 352 Single Loop Digital Controller	0	05/87
	SIP-87-18	STS Decontaminated Supernatant Filter (50-F-002)	0	06/87
	SIP-87-23	STS Utilities and Drains Checkout	0	03/87
	SIP-87-24	STS Valve Aisle Operability	0	07/87
	SIP-87-27	Testing and Checkout of the Cesium Removal Columns A, B, C, and D	0	06/87
	SIP-87-28	Testing and Checkout of the Supernatant Feed Tank (50-3-001) and Pump (50-6-002)	0	07/87
	SIP-87-30	Testing and Checkout of the STS (50-V-001) and Supernatant Cooler (50-E-001)	0	06/87
	SIP-87-37	Integrated Checkout of the STS	0	09/87
	SIP-87-43	Permanent Ventilation System Checkout and Startup	0	02/87
11	SIP-87-61	STS Analog Instrument Testing	0	0.057
	SIP-87-62	STS Valve Checkout	0	05/87
	SIP-87-69	Integrated Testing of STS/LWTS/CSS/RTS	0	10/87
	TOP-50-12	Removal of Supernatant from Tank 8D-2 and Pump 50-G-001 Operation	0	10/86
	TOP-50-13	STS Prefilter Operation	0	11/86
13	TOP-50-14	Supernatant Feed Operation	0	11/86
	TOP-50-15	Supernatant Cooler (50-E-001) and Supernatant Chiller (50-V-001) Operation	0	11/86
	TOP-50-16	STS Ion Exchange Operatio.	0	11/86
	TOP-50-17	STS Ion Exchange Column Switchout Operation	0	11/86
	TOP-50-18	STS Ion Exchange Zeolite Discharge	0	12/86
	OP-50-19	STS Zeolite Batch Tank Loading and Fines Removal	0	12/86

## STS

QUA	DOCUMENT #	DOCUMENT TITLE	REV	DATE
	TOP-50-20	STS Ion Exchange Column Loading	0	01/87
	TOP-50-21	Returning Fresh Vessel to STS Process Operation	0	12/86
1	TOP-50-22	STS Final Filtration	0	08/87
	TOP-50-23	Decontaminated Supernatant Collection and Transfer	0	09/87
	TOP-50-29	STS Sampling and Pneumatic Sample Transfer	0	09/87
	TOP-50-33	STS Radiation Monitors	0	10/87
	WVDP-SAR	Sarety Analysis for the STS	1	07/86
	WVNS-DC-013	STS Design Criteria	2	10/87
	Unknown	Material Control Report PR 19-FVV-14554 Ion Exchange Columns	0	unkn
	Video Tape-EN306C	Motive Devices	0	unkn
	Video Tape-EN346C	What Ifs - STS Failure Analysis	0	unkn

A	DOCUMENT #	DOCUMENT TITLE	REV	DATE
	SIP-87-53	Data Acquisition System Checkout	0	08/87
	SIP-87-65 *	HSCSS Control Panel and Data Acquisition System Checkout	n	08/87
	SOP-70-1	Waste Stream Recipe Sheet	2	10/87
	SOP-70-3	Automatic Solidification Operation	2	06/87
	SOP-70-4	CSS Manual Solidification with the Process Logic Controller Operational	2	C = /87
	SOP-70-5	Gravimetric Feeder Operation	1	05/87
	SOP-70-6	Bulk Cement Transfer to Day Bin	2	J5/87
-	SOP-70-9	Automatic Drum Operations for the CSS	2	07/87
	SOP-70-11	CSS Manual Operation with Process Logic Controller Non-operational	2	07/87
1	SOP-70-12	CSS Mixer System Flush Operation	2	07/87
	SOP-70-17	Manual Drum Operations for CSS	2	08/87
	SOP-70-18	Alarm Procedures for CSS	2	08/87
	SOP-70-19	CSS Emergency Procedure - Emergency Shut-Down	1	06/87
	SOP-70-31	CSS Drum Conveyor Alarm Responses	2	09/87
	SOP-70-39	Draining and Flushing the Wastr Dispensing Vessel	0	08/87
	WTSD-TME-081 I WTSD-TME-081 II WTSD-TME-081 III WTSD-TME-081 III	Westinghouse Hi-Shear CSS Operating and Maintenance Manual Mechanical Components Vendor Literature Instrumentation & Controls Vendor Lit.	0	03/85
	WVDP-SAR	Safety Analysis for CSS	1	10/86
	Video Tape-EN400C	System Overview (LP 4 Hour Mode)		
	Video Tape-EN406C	HS CSS System (Tape 1 of 2)	0	Unkn
	Video Tape-EN406C	HS CSS System (Tape 2 of 2)	0	Unkn
	* Includes CSS10097			

## LWTS

QUA	DOCUMENT #	DOCUMENT TITLE	REV	DATE
	SIP-86-18	LWTS Valve Checkout	0	01/87
	SIP-87-01	Testing and Checkout of Tank 35104 (Evaporator Feed Tank) and Feed Pump P-01	0	03/37
	S1P-87-2	Testing and Checkout of Evaporation System Rboiler, Vapor-Body Separator, and Condenser	1	05/87
	SIP-87-2-1	Testing and Checkout of Feed Routes to Evaporator During Cold Testing	0	03/87
	SIP-87-3	Testing and Checkout of Distillate Surge Tank D-005 (Run Side), Pump P-15 and the Distillate Zeolite Ion Exchanger (D-003)	0	03/87
	SIP-87-4	Testing and Checkout Evaporator Concentrate Cooler (E-005) and Concentrate Pump (P-16)	0	04/87
	SIP-87-5	Testing and Checkout of Concentrates Storage Tanks (5D-15A1/A2) and Pumps (P05/06)	0	04/87
	SIP-87-6	Testing and Checkout of Liquid Waste Cell Tanks 78-2, 13D-8, Tanks 5D-15B, 71-D-009, 7D-13 and High TDS Storage Tank Pump 71-P-04	0	04/87
	SIP-87-11	Testing and Checkout for Dewatering and Transfer of Wet Solids from Tanks 71-D-006, 71-D-007, and 71-D-008 to CSS Waste Dispensing Vessel	0	04/87
	SIP-87-19	Checkout of Pump and Valve Interlocks and Sequencing - LWTS Software	0	07/87
	SIP-87-39	LWTS Digital Functional Testing Field and Rack Mounted Switches	0	01/87
	SIP-87-40	LWTS Analog Instrument Testing	0	01/87
	SIP-87-49	Evaporator Overall Integrated Testing with Simulated Supernatant	0	06/87
4	SIP-87-61	STS Analog Instrument Testing	0	05/87
	TOP-71-1	Tank 35104 Evaporator Feed	0	07/86
	TOP-71-2	Process Evaporator (31017) Distillate Zeolite Ion Exchange Column (71-D-003) and Distillate Surge Tank (71-D-005)	0	08/86

## LWTS

QUA	DOCUMENT #	DOCUMENT TITLE	REV	DATE
	TOP-71-3	Resin/Zeolite Hopper (71-D-004) and Loading of Resin Zeolite into Exchange Columns	0	12/86
	TOP-71-4	LWTS Filter System	0	07/86
	TOP-71-5	LWTS Organic (71-D-001) and Zeolite Ion Exchangers (71-D-002)	0	08/86
	TOP-71-7	Unloading Spent Resin/Zeolite from Ion Exchange Columns	0	09/86
	TOP-71-8	Dewatering and Transfer of Wet Solids from Filter Backwash Storage Tank (71-D-008) or Spent Resin Tank (71-D-006) or Spent Zeolite Tank (71-D-007)		
	TOP-71-10	Transfer of LWTS Evaporator Concetrates to the CSS	0	09/86
	TOP-71-14	LWTS Alarm Response Procedure	0	06/87
	TOP-71-15	LWT3 Process Monitoring Procedure	0	06/87
	WVDP-SAR	Safety Analysis Report - LWTS		
7	WVNS-EQ-248	Control Concepts for the LWTS	2	06/87
6	WVNS-EQ-249	Equipment Specification LWTS Control Interlocks	4	08/87
3	WVNS-EQ-250	Fundamental Process Narrative for LWTS	0	01/87
	WVNS-TR-71-004	Test Results Report - Checkout of Pump and Valve Interlocks and Sequencing LWTS Software SIP-87-19	0	10/87

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	00	DRAWING NUMBER	REV	SHT	DRAWING TITLE
	1 ** 1	************	1		
	1 1		1	1	
Retrotech	1 1	010-26-01	10	1 1	Conveyor Schematics
Retrotech	1 1	010-26-01	16	2	Conveyor Schematics
Retrotech		010-26-01	1 0	3	Conveyor Schematics
Retrotech		010-26-01	1 0	1 4	Conveyor Schematics
Retrotech	1	010-26-01	1 0	5	Conveyor Schematics
Retrotech		010-26-01	1 0	6	Conveyor Schematics
Retrotech		010-26-01	10	7	Conveyor Schematics
Retrotech	1	010-26-01	1 0	8	Conveyor Schematics
Retrotech		010-26-01	1 0	9	Conveyor Schematics
Retrotech		010-26-01	1 1	1 10	Conveyor Schematics
Retrotech		010-26-01	1 0	11	Conveyor Schematics
Retrotech		010-26-01	1 1	12	Conveyor Schematics
Retrotech		010-26-01	10	13	Conveyor Schematics
Retrotech		010-26-01	10	14	Conveyor Schematics
Retrutech		010-26-01	10	15	Conveyor Schematics
Retrotech		010-26-01	10	16	Conveyor Schematics
Retrotech		010-26-01	10	17	Conveyor Schematics
Retrotech		010-26-01	1 1	18	Conveyor Schematics
Retrotech	1	010-26-01	1 0	19	Conveyor Schematics
Retrotech	1	010-26-01	1 0	20	Conveyor Schematics
Ketrotech	1	010-26-01	1 0	21	Conveyor Schematics
Retrotech		010-26-01	1 0	22	Conveyor Schematics
Retrotech		010-26-01	1 0	23	Conveyor Schematics
Retrotech		010-26-01	1 0	24	Conveyor Schematics
		172-E2-001	1 5	1 1	Elementary Wiring Diagram Legend
	!	172-62-002	5	1	Empty Drum Room
		172-62-003	1 6	1	Empty Drum to Process Room
		172-E2-004	6	1 1	Crimper, Truck, Hydraulic and Barcode
		172-E2-005	6	1 1	Vacuum Transfer and Alarms
		172-62-008	1 4	1	Wiring Diagram
	3	172-P1-00	1 0	1 1	P&ID STS Legend
Sechtel		15R-A-74	1 9	1 1	P&ID Controlled Ventilation System Below Grade to El 131'
Bechtel	1	15R-A-75	1 9	1 1	P&ID Controlled Ventilation System Above El 131'
Bechtel		15R-M-1	1 1		Key Plan Process Bldg
Bechtel	1	68-0-2	1 1	1 1	Vessel Off-Gas Condensate Catch Tank 60-3
Bechtel		8R-A-1	1 15	1 1	Flow, P&ID Waste Tank Farm Spent Fuel Proc. Plant
Smoot Co.	1 3	7046-1	10	1 1	Flow Diagram
Smoot Co.	3	7046-9	1 0	1 1	Flow Diagram
Smoot Co.	!	7046-11	1 0	! !	Electrical Schematic Main Panel
Smoot Co.	1	7046-11	1 0	5	Conveyor Schematics
Smoot Co.	100	7046-12	10	1 1	Electrical Schematic Main Panel
		900C 539	1 1	1 1	CSS Field Wiring Bldg 01/14
	1	900C 539	1 4	5	CSS Field Wiring Bldg 01/14
	!	9000 539	1 5	1 3	CSS Field Wiring 8ldg 01/14
	!	900C 539	3	1 4	CSS Field Wiring 8ldg 01/14
	1	900C 539	1 5	1 5	CSS Field Wiring 8ldg 01/14
	1	900C 539	1 4	6	CSS field Wiring 81dg 01/14
		9000 539	1 4	1 7	CSS Field Wiring Bldg 01/14
	1	900C 539	4	1 8	CSS Field Wiring 8ldg 01/14
		9000 539	3	9	CSS Field Wiring Bldg 01/14

QU	DRAWING NUMBER	REV	SHT	DRAWING TITLE
**	***********	1 ***		*************************************
	900C 539	1 3	1 10	CSS Field Wiring Bldg 01/14
	900C 539	1 3	1 12	CSS Field Wiring 8ldg 01/14
	900C 539	1 0	13	CSS Field Wiring Bldg 01/14
	900C 539	1 1	1 14	CSS Field Wiring 8ldg 01/14
. 1	900C 539	10	15	CSS Field Wiring Bldg 01/14
	900C 539	1 1	1 16	CSS Field Wiring 8ldg 01/14
	900C 539	1 2	17	CSS Field Wiring Bldg 01/14
	900C 539	1 1	18	CSS Field Wiring Bldg 01/14
	900C 539	1 0	19	CSS Field Wiring 8ldg 01/14
	900C 539	1 1	20	CSS Field Wiring 81dg 01/14
	900C 539	10	21	CSS Field Wiring Bldg 01/14
	9000 1114	1 0	1	CSS Pyrotronics Fire Cont. PNL Schem. Diag. for 01/14 Bldg
2	900C 1116	1 10	1	MSCSS Control Cabinet Elementary Diagram
2	900C 1116	1 6	2	MSCSS Control Cabinet Elementary Diagram
2	900C 1116	1 8	3	MSCSS Control Cabinet Elementary Diagram
2	900C 1116	1 8	4	MSCSS Control Cabinet Elementary Diagram
2	900C 1116	1 9	5	MSCSS Control Cabinet Elementary Diagram
2	900C 1116	1 8	6	MSCSS Control Cabinet Elementary Diagram
2	900C 1116	1 10	7	HSCSS Control Cabinet Elementary Diagram
2	900C 1116	1 7	8	HSCSS Control Cabinet Elementary Diagram
2	9000 1116	1 7	9	HSCSS Control Cabinet Elementary Diagram
2	9000 1176	1 7	10	HSCSS Control Cabinet Elementary Diagram
2	900C 1116	1 6	11	MSCSS Control Cabinet Elementary Diagram
2	900C 1116	1 3	12	HSCSS Control Cabinet Elementary Diagram
2	900C 1116	1 0	13	MSCSS Control Cabinet Elementary Diagram
2	900C 1116	1 0	14	HSCSS Control Cabinet Elementary Diagram
	900C 1122	1 3	1	HSCSS Control Cabinet Thumb Wheel and Proc. Wiring Diagram
. 1	900c 1325	1 1	1	CSS Bldg 01/14 High Shear Mixer-Top Plate
2	9000 108	1 2	1 1	Radwaste Treatment System-Conceptual Process Flow Diagram
5	9000 397	1 7	1	CSS System 070 P&10
5	9000 397	1 6	2	CSS Blug 01-14, P&ID
5	9000 397	1 5	3	CSS 81dg 01-14, P&ID
5	9000 397	1 4	4	CSS 81dg 01-14, P&10
5	9000 397	1 7	5	CSS 81dg 01-14, P&ID
3	9000 436	1 0	1 1	Symbols, Notes, and Legends
3	9000 436	1 0	1 2	Symbols, Notes, and Legends
3	9000 436	1 0	3	Symbols, Notes, and Legends
3	9000 436	1 0	4	Symbols, Notes, and Legends
	9000 807	1.1	1 1	Low Level Waste Evaporator Assembly
" "	9000 807	1 2	2	Low Level Waste Evaporator Reboiler Section Details
	9000 807	1 2	3	Low Level Waste Evaporator Separator Section Details
	9000 807	1 0	4	Low Level Waste Evaporator Support Details
	9000 807	1 2	5	Low Level Waste Evaporator Condenser Section Details
2	9000 1204	1 8	1 1	P&ID LWTS Recycle Water System
2	9000 1204	1 3	2	P&ID LWTS Recycle Water System
	9000 1236	1 3	1 1	CSS Bldg 01/14 High Shear Mixers #1 and #2 Assy
	9000 1236	1 3	1 2	CSS Bldg 01/14 High Shear Mixers #1 and #2 Assy
	9000 1291	1 2	1 1	CSS 8ldg 01/14 High Shear Mixers Frame Weldment
	9000 1292	1 1	1 1	CSS 81dg 01/14 High Shear Mixers #1 and #2 Details
		1 2	1	CSS Bldg 01/14 High Shear Mixers #1 and #2 Details

N I	DRAWING NUMBER	REV	SHT	DRAWING TITLE
-	***********	1	1 ***	
- 1	9000 1324	1 3	1 1	CSS Bldg 01/14 High Shear Mixers Ram Valve Parts
i	9000 1396	1 3	1 1	CSS Fill Head Nozzle Weldment
- i	9000 1413	1 4	1 1	HSCSS Panel Layout
i	9000 1436	1 4	1 1	RTS Drum Cell Loadout Conveyor Plan
3	9000 1481	1 3	1 1	CSS-070-V-050 M37 Hydraulic P&ID
3	9000 1482	1 3	1 1	CSS-070-V-050 M37 Hydraulic P&ID
1	9000 1666	1 0	1 1	P&ID STS Permanent Ventilation System
3 1	9000 1697	1 2	1 1	CSS-070-V-050 Pneumatic Solenoid Pack P&ID
1	9000 1728	10	1 1	CSS-Bldg 01/14 Schematic Diagram Load Out Crane (4 ton)
i	9000 1728	1 0	1 2	CSS-Bldg 01/14 Schemetic Diagram Load Out Crane (4 ton)
1	9000 1832	1 1	1 1	CSS FILL Head Lid Turner Assy
i	9000 1833	1 0	1 1	CSS Fill Head Paddle Assy
- 1	9000 1834	1 0	1 1	CSS Fill Head Lid Turner Details
i	9000 1835	1 1	1.1	CSS Fill Head Mod. Assy
i	9000 1836	1 0	1.1	CSS Fill Head Mod. Frame Weldment
i	9000 1917	1 0	11	Gen Arr CSS Decant System Equipment
i	9000 1917	1 0	1 2	Gen Arr CSS Decent System Equipment
i	9000 1966	1 1	11	CSS Drum Loadout Drum Overpack Details
1	900E 1483	1 3	1 1	HSCSS Graphics Panel
i	900E 1827	1 1	1 1	RTS CSS 01/14 Bldg Plan View El 98'
i	900E 318	1 2	1.1	Gen Arr CTS Pit Area Equipment Plan
2	900E 2005	1 0	1 1	Gen Arr RTS Drum Cell
3	900J 1363	1 8	1 1	External Interface Control Diagram
2	9018 301 701 8	1 1	1 1	CWD LWTS Evaporator Feed Pump 71-P-01
2	9018 301 702 8	12 13	1 1	CWD LWTS Valve 71-H-001
2	9018 301 703 8		1 1	CMD LWTS Valve 71-H-003
2	9018 301 704 8		1 1	CMD LWTS Valve 71-H-006
2	9018 301 705 A		11	CMD LWTS Valve 71-H-014
2	9018 301 706 A		1 1	CMD LWTS Valve 71-H-021
2	9018 301 707 A	5 -	1.1	CMD LWTS Valve 71-H-022
2	9018 301 708 A		1.1	CMD LWTS Heat Tracing Alarms
2	9018 301 710	10	1 1	
2	9018 301 715	1 4	1.1	CMD LWTS Control Panel 1/0 Rack 120V AC Dist.
2	9018 301 717	1 4	1 1	CMD LWTS Instrumentation 15V DC Dist.
2	9018 301 718 8	1 1	1 1	CWD LWTS 24V DC Dist, to Recorders
2	9018 301 719 A		1 :	CWD LWTS Data Liner Message Display
2	9018 301 719	1 5	1.1	CMD LWTS 24V DC Dist. to Annunciator
2	9018 301 720	1 2	11	CMD LWTS Processor 24V DC Dist, for Valves and Pumps
2	9018 301 721 A		1 1	CMD LUTS Valve Control Switches Processor 24V DC Inputs
2	9018 301 722 8		1 2	CMD LWTS Valve Control Switches Processor 24V DC Inputs
2	9018 301 723 A		1 3	CMD LWTS Valve Control Switches Processor 24V DC Inputs
2	9018 301 724 A		1 4	CMD LWTS Valve Control Switches Processor 24V DC Inputs
2	9018 301 725 A		1 5	CMD LWTS Valve Control Switches Processor 24V DC Inputs
2	9018 301 726 8		1 6	CMD LWTS Valve Contro vitches Processor 24V DC Inputs
2	9018 301 727 A	1	1 7	CMD LWTS Valve Control Switches Processor 24V DC Inputs
2	9018 301 728 A		1 8	CMD LWTS Valve Control Switches Processor 24V DC Inputs
2	9018 301 729	1 5	17	CMD LWTS Valve Control Switches Processor 24V DC Inputs
2	9018 301 730	1 4	1 10	CMD LWTS Valve Control Switches Processor 24: DC Inputs
2	9018 301 731 A		1 11	CWD LWTS Valve Control Switches Processor 24V DC Inputs
		1 7	1 12	The same services and services to occasion that he tables

QU	DRAWING NO	UMBER	REV	SHT	DRAWING TITLE
	********		***	1	1
		500		1	
2	9018 301	733	6	13	CMD LMTS Valve Control Switches Processor 24V DC Inputs
2	9018 301	734 A	3	1 14	CMD LWTS Valve Control Switches Processor 24V DC Inputs
2	9018 301	735 A	3	15	CMD LWTS Valve Control Switches Processor 24V DC Inputs
2	9018 301	736 A	3	1 16	CWD LWTS Valve Control Switches Processor 24V DC Inputs
2	9018 301	737 A	3	1 17	CWD LWTS Valve Control Switches Processor 24V DC Inputs
2	9018 301	738 A	3	1 18	CWD LWTS Valve Control Switches Processor 24V DC Inputs
2	9016 301	741 8	2	1 1	CWD LWTS Valve Position and Processor 24V DC Outputs
2	9018 301	742 B	2	1 2	CMD LWTS Valve Position and Processor 24V DC Outputs
2	9018 301	743 8	2	3	CWD LWTS Valve Position and Processor 24V DC Outputs
2	9018 301	744 B	2	1 4	CMD LWTS Valve Position and Processor 24V DC Outputs
2	9018 301	745 8	2	1 5	CWD LWTS Valve Position and Processor 24V DC Outputs
2	9018 301	746 B	2	1 6	CMD LWTS Valve Position and Processor 24V DC Outputs
2	9018 301	747 B	2	1 7	CWD LWTS Valve Position and Processor 24V DC Outputs
2	9018 301	748	3	1 8	CWD LWTS Valve Position and Processor 24V DC Outputs
2	9018 301	749	2	1 9	CWD LWTS Valve Position and Processor 24V DC Outputs
2	9018 301	750	2	1 10	CMD LWTS Valve Position and Processor 24V DC Outputs
2	9018 301	751 8	2	111	CWD LWTS Valve Position and Processor 24V DC Outputs
2	9018 301	752	3	1 12	CWD LWTS Valve Position and Processor 24V DC Outputs
2	9018 301	753 B	2	1 13	CWD LWTS Valve Position and Processor 24V DC Outputs
2	9018 301	754 8	2	1 14	CWD LYTS Valve Position and Processor 24V DC Outputs
2	9018 301	755 8	2	15	CWD LWTS Valve Position and Processor 24V DC Outputs
2	9018 301	756 8	3	1 16	CWD LWTS Valve Position and Processor 24V DC Outputs
2	9018 301	757 B	2	1 17	CWD LWTS Valve Position and Processor 24V DC Outputs
2	9018 301	758 8	3	1 18	CWD LWTS Valve Position and Processor 24V DC Outputs
2	9018 301	760	2	1 1	CWD LWTS Solenoid Valves Processor Outputs
2	9018 301	761	2	1 2	CWD LWTS Solenoid Valves Processor Outputs
2	9018 301	762	2	1 3	CWD LWTS Solenoid Valves Processor Outputs
2	9018 301	763	1 2	1 4	CWD LWTS Solenoid Valves Processor Outputs
2	9018 301	764	2	1 5	CWD LWTS Solenoid Valves Processor Outputs
2	9018 301	765	3	1 6	CMD LWTS Solenoid Valves Processor Outputs
2	9018 301	766	3	1 7	CWO LWTS Solenoid Valves Processor Outputs
2	9018 301	767	3	1 8	CWD LWTS Solenoid Valves Processor Outputs
2	9018 301	768	2	1 9	
-			2		CMD LWTS Solenoid Valves Processor Outputs CMD LWTS Solenoid Valves Processor Outputs
2	9018 301	Table 1		1	
2		770 A	0	1 11	CWD LWTS Solemoid Valves Processor Outputs
	9018 301		3	1 12	CWD LWTS Solenoid Valves Processor Outputs
2	9018 301	711	2	1 1	CWD LWTS Valve Limit Switches Processor Inputs
2	9018 301	772	5	1 5	CWO LWTS Valve Limit Switches Processor Inputs
2	9018 301	773	3	3	CLD LWTS Valve Limit Switches Processor Inputs
2	9018 301	774	1 3	1 4	CWD LWTS Valve Limit Switches Processor Inputs
2	9018 301	775	2	1 5	CWD LWTS Valve Limit Switches Processor Inputs
2	9018 30	776	3	6	CWD LWTS Valve Limit Switches Processor Inputs
2	9018 301	777	1 3	1 7	CMC LWTS Valve Limit Switches Processor Inputs
5	9018 301	778	1 2	8	CMD LWTS Valve Limit Switches Processor Inputs
5	9018 301	779	3	9	CMD LWTS Valve Limit Switches Processor Inputs
5	9018 301	780	1 5	1 10	CMD LWTS Valve Limit Switches Processor Inputs
3	9018 301	781	, 2	1 11	CMD LWTS Valve Limit Switches Processor Inputs
5	9018 301	783	1 7	1 13	CWD LW15 Valve Limit Switches Processor Inputs
2	9018 301	784	3	1 14	CMD LWTS Valve Limit Switches Processor Inputs
2	9018 301	785	1 2	15	CWD LWTS Valve Limit Switches Processor Inputs

au	DRAWING N	LIMBER	REV	SHT	DRAWING TITLE
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2	9018 301	786	2	1 16	CWD LWTS Valve Limit Switches Processor Inputs
2	9018 301	787	2	1 17	CWO LWTS Valve Limit Switches Processor Inputs
2	9018 301	788	2	18	CWO LWTS Valve Limit Switches Processor Inputs
2	9018 301	789	2	1 19	CWO LWTS Valve Limit Switches Processor Inputs
2	9018 301	790	4	1 20	CWO LWTS Valve Limit Switches Processor Inputs
2	9018 301	791	4	1 1	CWD LWTS Pump Control Switches Processor 24V DC Inputs
2	9018 301	792 B	3	1 1	CWD LWTS Pump Control Switches Processor 24V DC Inputs
2	9018 301	792 A	5	1 1	CMD LWTS Pump Control Switches Processor 24V DC Inputs
2	9018 301	792	5	1 2	CWD LWTS Pump Control Switches Processor 24V DC Inputs
1	9018 301	796	3	1 1	CMD LWTS Pump Status Ind. Lights Processor 24V DC Outputs
1	9018 301	797 B	3	1 1	LWTS Valve Position Ind. Processor 24V DC Outputs
	9018 301	797 A	2	1 1	LWTS Valve Position Ind. Processor 24V DC Outputs
	9018 301	797	6	1 2	CMD LWTS Pump Status Ind. Lights Processor 24V DC Outputs
	9018 301	801 8	1	1 1	CWD LWTS Pump 71-P-01
	9018 301	802 8	1	1 1	CWD LWTS Pump 71-P-15
1	9018 301	803 8	2	1 1	CWD LWTS Pump 71-P-16
1	9018 301	805 8	. 1	1 1	CWO LWTS Pump 71-P-02
2	9018 301	806 B	1	1 1	CWO LWTS Pump 71-P-03
1	9018 301	807 8	1	1 1	CWD LWTS Pump 71-P-011
1	9018 301	808 8	5	1 1	CWO LWTS Pump 71-P-04
	9018 301	809 8	1	11	CMD LWTS Pump 71-P-05
1	9018 301	810 8	1	1 1	CWD LWTS Pump 71-P-06
2	9018 301	811	2	1 1	CWO LWTS Pump 71-P-17
	9018 301	812 8	5	1 1	CWD LWTS Pump 71-P-07
2	9018 301	813 8	2	1 1	CWD LWTS Pump 71-P-08
	9018 301	814	2	1 1	C'10 LWTS Pump 71-P-18
2	9018 301	819 A	2	1 1	CMD LWTS Pump 71-P-12 and -13 Acid Metering Pumps
	9018 301	820 A	2	1 1	CWD LWTS Caustic Addition Tanks 140-7 and 140-8 Agitators
	9018 301	821	4	1 1	CWD LWTS Pump Starter Process 120V AC Inputs/Outputs
	9018 301	822	4	2	CMD LWTS Pump Starter Process 120V AC Inputs/Outputs
2	9018 301	823	6	3	CMD LWTS Pur arter Process 120V AC Inputs/Outputs
	9018 301	824	3	18	CMD LWTS Va Limit Switches Processor Inputs
	9018 301	826	6	1 1	CWD LWTS Instrumentation Processor 4-20 MA Inputs
	9018 301	827	3	1 5	CWD LWTS Instrumentation Processor 4-20 MA Inputs
	9018 301	828	3	3	CWD LWTS Instrumentation Processor 4-20 MA Inputs
	9018 301	829	7	1 4	CWD LWTS Instrumentation Processor 4-20 MA Inputs
	9018 301		5	1 5	CWD LWTS Instrumentation Processor 4-20 MA Inputs
	9018 301		3	6A	CWD LWTS Instrumentation Processor 4-20 MA Inputs
	9018 301	831	4	1 6	CWD LWTS Instrumentation Processor 4-20 MA Inputs
	9018 301	832	3	1 7	CMD LWTS Instrumentation Processor 4-20 MA Inputs
	9018 301	838	3	!!	CWD LWTS Controllers 1/0 to Processor
	9018 301		1	!!	CMD LWTS I/P Converter Signal Inputs from PLC
	9018 301	839	2	!!	CWD LWTS I/P Converter Signal Inputs from PLC
	9018 301	840 A	1	1 1	CWD LWTS Processor T/C Inputs
2	9018 301	840	2	1 1	CWD LWTS Processor T/C Inputs
2	9018 301		*	1 1	CMD LWTS Process 4-20 MA Outputs to Recorders
2	9018 301	ACM 20 -	*	1 5	CMD LWTS Process 4-20 MA Outputs to Recorders
2	9018 301		5	1 1	CMD LWTS Process 4-20 MA Outputs to Indicators
2		853 8	3	5	CWD LWTS Process 4-20 MA Outputs to Indicators

QU	DRAWING NUMBER	REV	SHT	DRAWING TITLE
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2	9018 301 855	1 4	4	CWD LWTS Process 4-20 MA Outputs to Indicators
2	9018 301 877	1 3	1	CWD LWTS Annunciators Wiring Connection
2	9018 301 878	1 3	2	CWD LWTS Annunciators Wiring Connection
2	9018 301 879	1 4	3	CWD LWTS Annunciators Wiring Connection
2	9018 301 880	1 4	4	CWD LWTS Annunciators Wiring Connection
2	9018 301 881	1 6	5	CWD LWTS Annunciators Wiring Connection
2	9018 301 886 A	1 2	1	CWD LWTS Solenoid Valve and Rad Alarm Processor Outputs
2	9018 301 886	1 2	1	CWD LWTS Soleroid Valve and Rad Alarm Processor Outputs
2	9018 301 891	1 4	1	CWD LWTS Flow Sws and Va Limit Switches Processor Inputs
2	9018 301 891 A	1 3	1	CWD LWTS Flow Sws and Va Limit Switches Processor Inputs
2	9018 301 892	1 5	2	CWO LWTS Flow Sws and Va Limit Switches Processor Inputs
2	9018 301 893	1 3	3	CWO LWTS Flow Sws and Va Limit Switches Processor Inputs
2	9018 301 894	1 4	4	CWO LWTS Flow Sws and Va Limit Switches Processor Inputs
2	9018 301 896	1 1	1	CWO LWTS Processor and I/O Interconnections
2	9018 301 897	1 3	2	CMD LWTS Processor and 1/0 Interconnections
2	9018 301 897 A	1 1	3	CWD LWTS Processor and I/O Interconnections
2	9018 301 898	3	4	CWD LWTS Processor and I/O Interconnections
2	9018 301 898 A	1 2	5	CMD LWTS Processor and I/O Interconnections
2	9018 301 899	10	1	CMD LWTS IR-017
2	9018 301 900	, 0	1 1	CMD LHT'S Processor 4-20 MA Input
	9010 061	1 4	1 1	LWTS Piping Contruction Isometric XC-3 Lines
5	9010 020	1 1	1	Process Flow Diagram LWTS
	9010 020	1 0	2	Process Flow Diagram LWTS
	9010 020	1 0	3	Process Flow Diagram LWTS
	9010 020	1 0	4	Process Flow Diagram LWTS
4	9010 021	1 0	1 1	P&ID-LWTS-35104
1	9010 021	1 1	2	P&ID LWTS 70-13
3	9010 021	1 0	2	P&10-LWTS-70-13
5	9010 621	1 0	3	P&ID LWTS 70-2
5	9010 021	1 0	4	P&ID-LWTS-70-8
5	9010 021	0	5	P&10-LWTS-40-10
5	9010 021	0	6	P&10-LWTS-30-2
5	9010 021	0	7	P&IO-LWTS-130-8 and 71514
3	9010 022	1 7	1 1	P&ID-LWTS
4	9010 023	7	1 1	PAID-LWTS
3	9010 023	7	2	PAID-LUTS
3	9010 023	1 1	3	P&IO-LWTS
4	9010 024	1 6	1 1	PAID-LWTS
4	9010 026	1 7	1 1	PAID-LWTS
	9010 033	1 0	1	Gen Arr 01/14 8ldg Plan - El 98'
	9010 034	1 0	1 1	Gen Arr 01/14 8ldg Plan - El 116.5'
	9010 035	1 0	1 1	Gen Arr 01/14 Bldg Plan - El 130'and Sections
	9010 036	1 0	1 1	Gen Arr 01/14 Bldg Plan - El 144'and Sections
	9010 037	1 0	1 1	Gen Arr 01/14 Bldg Sections
	9010 038	1 0	1 1	Gen Arr 01/14 Bldg Sections
	9010 041	1 5	1 1	Gen Arr LWTS Plan El 100'
	9010 042	1 0	1 1	Gen Arr LWTS Plan El 114.5'
	9010 043	1 1	1 1	Gon Arr LWTS Plan El 131'
	9015 044	1 0	1 1	Gen Arr LWTS Plan El 144'
	9010 045	1 0	1 1	Gen Arr LWTS Plan El 160'

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DU	DRAWING NUMBER	REV	SHT	DRAWING TITLE
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	9010 046	1 1	1 1	Gen Arr LWTS Section
	9010 047	1 0	1.1	Gen Arr LWTS Section
5	9010 049	1 5	1 1	P&ID LWTS Utility Water System Interface
6	9010 050	1 4	1 1	P&ID LWTS Steam and Condensate Interface
	9010 051	1 3	1 1	P&ID LOTS Instrument and Utility Air System
5	9010 059	1 6	1 1	PAID LUTS
3	9010 1204	1 8	1 1	P&ID-LWTS Recycle Water System
5	9010 1204 '	1 3	1 2	P&ID-LWTS Recycle Water System
5	9010 1340	1 1	1 1	P&ID-LWTS Backflushable Filter
	9020 030	1 1	1 1	Gen Arr CTS Enclosure Plan El 100'
	9020 031	1 1	1 1	Gen Arr CTS Enclosure Plan El 110'
	9020 032	1 1	1 1	Gen Arr CTS Enclosure Plan El 124'
- 1	9020 033	1 1	1 1	Gen Arr CTS Enclosure Plan Section Plan
	9020 034	1 1	1 1	Gen Arr CTS Enclosure Plan El 100'
- 1	9020 041	1 1	1 1	Gen Arr CTS Enclosure Plan Sections
	9038 317 201	1 4	1 1	CMD STS HVAC Alarms
	9038 317 204	1 3	1 1	CMD STS HVAC Air Supply Unit 56-V01
	9038 317 205 C	1 1	1 1	CMD STS HVAC Alarms and Indications
	9038 317 206 8	1 2	1 1	CMD STS HVAC Air Supply Unix 56-V02 Condensers & HVAC Alarm
	9038 317 206 A	1 0	1.1	CWD STS HVAC Heater Unit
	9038 317 207 8	1 1	1 1	Instr. Install, Detail STS HVAC Control Panel Layout
	9038 317 208 \$	1 2	1 1	CWD STS HVAC Diff. Press. Ind. Sws-120V DC Dist.
	9038 317 501 8	1 1	1 1	CMD STS Distripution Panel
	9038 317 502 A		1 1	CWD STs Programmable Controller
	9038 317 503 A	0 0	1 1	CWD STS Annunciator
П	9038 317 511 A	5 5	1 1	CWD STS PLC 1/0 Cabinet and Hand Sws 50-HS-104A, 1048, 105, 104
	9038 317 512 8		1	CWD STS PLC I/O Cabinet and Hand Sws 50-HS-108,118,005
	9038 317 513 A	5 - II.		CMD STS PLC 1/0 Cabinet and Hand Sws 50-HS-204A, 2048, 205, 20
4	9038 317 514 8			CWD STS PLC I/O Cabinet and Hand Sws 50-HS-208,218,077,042
	9038 317 515 A			CWD STS PLC 1/0 Cabinet and Hand Sws 50-HS-304A, 3048, 305, 30
	9038 317 516 A	0 1		CMD STS PLC I/O Cabinet and Hand Sws 50-HS-308,318.031,064
	9038 317 517 A	5 · 1		CMD STS PLC 1/0 Cabinet and Hand Sws 50-HS-404A,404B,405,40
	9038 317 518 A	# F B .	1 1	C-D STS PLC 1/O Cabinet and Hand Sws 50-HS-408,418,067,066
	9038 317 519 A		1 1	CMD STS PLC 1/0 Cabinet and Hand Sws 50-HS-032,038,045
	9038 317 520 A		1	CMD STS Pump G-015
-11	9038 317 521 A		1 1	CMD STS Pump G-005
74	9038 317 522 A	1 2	1 1	CMD STS Pump G-007
	9038 317 523 A	6. 0	1 1	CMD STS PLC 1/0 Cabinet
	9038 317 524 A	3 J	1 1	CMD STS PLC 1/O Cabinet
	9038 317 525 8	1 2	1 1	CMD STS PLC 1/0 Cabinet
13	9038 317 526 A	1 2	1 1	CND STS PLC 1/0 Cabinet
- 1	9038 317 531 A	1	1 1	
	9038 317 532 A	1 2	1 1	CMD STS Valves 50-FV-104A and 104B
	9038 317 533 A		1 1	CMD STS Valves 50-FV-105 and 106 CMD STS Valves 50-FV-108 and 118
			1 1	
	CONTRACTOR	1 -		CMD STS Valves 50-FV-006 and HCV-004
	9038 317 535 A	1 2	1 1	CMD STS Valves 50-FV-204A and 2048
	9038 317 536 A	1 5	1 1	CMD STS Valves 50-FV-205 and 206
	9038 317 537 A	1 5	1 1	CWD STS Valves 50-FV-208 and 218
1	9038 317 538 A	1 2	1 1	CWD STS Valves 50-FV-077 and 007

on 1	DRAWING NUMBER	-	REV	SH	1	DRAWING TITLE
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H	9038 317 340	1	2	1 1		CWD STS Valves 50-FV-101 and 103
	9038 317 541	1	2	1 1	i	CMD STS Valves 50-FV-102A and 1028
- i	9038 317 542	1	2	1 1	i	CWD STS Valves 50-FV-201 and 203
	9038 317 543	i	2	1 1	i	CWD STS Valves 50-FV-202A and 2028
i	9036 317 544	i	2	1 1	i	CND 575 Valves 50-FV-107 and 207
	9038 317 545	i	2	1 1	i	CMD STE Watves 50-FV-304A and 3048
- 1	9038 317 546	1	2	1 1	i	CWD STS Valves 50-FV-305 and 306
Si	9038 317 547	1	2	1 1	i	CMD STS Valves 50-FV-308 and 318
- 1	9038 317 548	1	2	1 1	1	CWD STS Valves 50-FV-031 and 064
- 1	9038 317 549	1	2	1 1	1	CWD STS Valves 50-FV-404A and 4048
1	9038 317 550	1	2	1 1	1	CWD STS Valves 50-FV-405 and 406
. 1	9038 317 551	11	2	1 1	1	CWD STS Valves 50-FV-408 and 418
	9038 317 552	1	2	1 1	1	CWD STS Valves 50-FV-067 and 068
	9038 317 553	1	2	1 1	1	CWD STS Valves 50-FV-301 and 303
- 1	9038 317 554	11	2	1 1	1	CWD STS Valves 50-FV-302A and 3028
- 1	9030 317 555 1	1	2	1 1	1	CWD STS Velves 5C-FV-401 and 403
1	9038 317 556	1	2	1 1	- 1	CWD STS Valves 50-FV-402A and 402B
	9038 317 557	1	2	1	- 1	CWD STS Valves 50-FV-307 and 407
- 1	9038 317 558	1	2	1 1	- 1	CWD STS Valves 50-FV-029 and 030
-	9038 317 559	1	2	1 1	-	CWD STS Valver 50-FV-042 and 092
- 1	9038 317 560 I	1	5	1 1	-	CWD STS Valves 50-FCV-035 and 024
- 1	9038 317 561	1	2	1 1	-1	CWD STS PLC 1/0 Cabinet
- 1	9038 317 562	1	5	1 1	- 1	CWD STS PLC 1/O Cabinet
- 1	9038 317 563	1	2	1 1	-1	CWD STS PLC 1/0 Cabinet
- 1	9038 317 564	1	2	1 1	- 1	CWD STS PLC 1/O Cabinet
. 1	9038 317 565	1	5	1 1	-	CWD STS PLC 1/O Cabinet
- 1	9038 317 566	1	2	1 1	1	CMD STS PLC 1/O Cabinet
	9038 317 567	1	5	1 1	-	CWD STS PLC I/O Cabinet
- 1	9038 317 568	1	5	1 1	- 1	CWD STS PLC I/O Cabinet
	9038 317 569	1	2	1 1	1	CWD STS PLC 1/O Cabinet
	9038 317 570	1	2	1 1	1	CWD STS PLC 1/O Cabinet
- 1	9038 317 571		2	1 1	- 1	CWD STS PLC 1/9 Cabinet
	9038 317 572		S	1 1	1	CLO STS PLC 1/0 Cabinet
	9038 317 573		5	1 1	1	CWO STS PLC I/O Cabinet
	9038 317 574		\$	1 1	1	CWD STS PLC 1/0 Cabinet
	9038 31" 575		2	1 4		CWD STS PLC I/O Cabinet
- 1	9038 317 576	31.51	2	1 1		CWD STS PLC 1/0 Cabinet
	9038 317 577		2	1 1	- 2	CWD STS PLC I/O Cabinet
	9038 317 578		2	1 1		CWD STS PLC I/O Cabinet
	9038 317 579		2	! !	- 3	CMD STS PLC 1/O Cabinet
	9036 317 580		3	! !		CWF STS PLC 1/0 Cabinet
	9038 317 581		2	! !		CWD STS PLC 1/O Cabinet and Solenoid Valves
	9038 317 582	3 2.	2	1 1	- 1	CWD STS PLC 1/O Cabinet and Solenoid Valves
	9038 317 583	. 5	5	1 1	- 3	CWD STS PLC I/O Cabinet and Solenoid Valves
	9038 317 584		3	1 1	. !	CWD STS PLC 1/O Cabinet and Solenoid Valves
	9038 317 585		5	!!	-	CWD STS PLC I/O Cabinet
	9038 317 586		3	! !	3	CWO SYS PLC I/O Cabinet
	9038 317 587		5	1 1		CWD STS PLC 1/0 Cabinet
	9038 317 588		2	1 0		CWD STS PLC I/O Cabinet

QU	DRAWING NO	JMBER	REV	SHT	1	DRAWING TITLE
**	*******		-**	1	1.	
	0070 717	****		! .	!	NO. 070. 010. 170. 011/1-11
	9038 317		1 2	3		SAD STS PLC 1/O Cabinet
	9038 317	591 8	2			NO STS Valves 50-FV-120 and 121
	9038 317	592 8	2			MD STS Valves 50-FV-220 and 221
	9038 317	593 B	1 2			MD STS Valves 50-FV-320 and 321
	9038 317	594 8	1 5	1 1	1	MD STS Valves 50-FV-420 and 421
	9038 317		1 5	2	2.0	MD STS Valves 50-FV-80
	9038 317	596 A	5			ND STS Valves 50-FV-079 and 081
	9038 317	597 A	1 5			MD STS PLC 1/0 Cabinet
	9038 317	598 B	2	A 1		MD SIS Valves 50-FV-059
	9038 317	599 B	1 1			MD STS PLC 1/0 Cabinet
	9038 317	600 A	1 2	2		ND STS Valves 50-FV-520 and 521
	9038 317	601 A	1 1	*		MD STS Instrumentation
	9038 317	602 A	1 1			MD STS Instrumentation
	9038 317	603 B	1 5	3		MD STS Instrumentation
	9038 317	605 B	1 2	4	3.0	MD S7S Instrumentation
	9038 317	606 B	1 3	1 5	200	WD STS Instrumentation
	9038 317	607 B	3	6	10	MD STS Instrumentation
	9038 317	608 8	1 2	7	10	MD STS Instrumentation
	9038 317	609 B	2	8	2.0	MD STS Instrumentation
	9038 317	610 B	5 3	2	10	MD STS Instrumentation
	9038 317	611 8	5 7	*	10	MD STS Instrumentation
	9036 317	612 A			10	MD STS Instrumentation
	9038 317	613 A			10	MD STS Instrumentation
	9038 317	614 8	5 2	4	10	MD STS Instrumentation
	9038 317	616 8	2	1 14	10	MD STS Instrumentation
	9038 317	617 A	1 4	1 15	10	MD STS Instrumentation
	9038 317	618 A	4.	1 16	10	SMD STS Instrumentation
	9038 317	619 A	4	1 17	10	SMD STS Instrumentation
	9038 317	620 B	1 1		10	NO STS Instrumentation
	9038 317	621 B	5	1 19	10	MD STS Instrumentation
	9038 317	622 B	1 4	50	10	SMD STS Instrumentation
	9038 317	623 B	1 4	21	10	NO STS Instrumentation
	9038 317	624 A	1 4	55	10	SMD STS Instrumentation
	9038 317	625	1 4	1 1	1 0	CMD STS Radiation Monitors
	9038 317	626	4	11	10	CMD STS Radiation Monitors
	9038 317	627	1 4	1.1	10	CAD STS Radiation Monitors
	9038 317	628 A	1 2	26	10	NO STS Instrumentation
	9038 317	632 A	1 3	1 1	10	SMD STS PLC 1/0 Cabinet
	9038 317	633 A	1 2	1 1	1 0	CMD STS PLC 1/O Cabinet
	9038 317	634 A	1 5	1 1	10	CND STS PLC 1/0 Cabinet
	9038 317	635 A	1 3	1 1	10	TWD STS Valves 50-SV-120,121,220,221,320,321,420,421
	9038 317	636 A	3	1 1	10	CMD STS Valves 50-SV-520,521
	9038 317	637 A	2	1.1	10	CMD STS Valve Box Interlocks
	9038 31"	640 A	1 1	1 1	10	CMD STS BI 3 Sump Pump WW-G-001
	9038 317	641	1 1	1 1	10	NO STS PL. 1/0 Cebinet
	9038 317	642	1 1	1. 1	10	CMD STS PLIND G-001
	9038 317	643	1 1	1 1	10	CND STS PLINE G-004
	9038 317	644	1 1	1 1	10	CND STS PLC I/O Cabinet
	9038 317	645	1 1	1 1		CMD STS PLC I/O Cabinet
	9038 317		1 4	1 1	20.0	CWD STS Fresh Water Tank D-003 Level Control Wiring

94.0	QU	DRAWING NUMBER	REV	SHT	DRAWING TITLE
		DENGING HUNDER	1	1 ***	
			1		
		9038 317 647	10	1	CWD STS Leak Detectors
Assistant A		9038 317 648	1 1	1	CWD STS Moisture Detector Panel
- 1		9038 317 649	1 1	1	CMD STS Moisture Detector Panel
		9038 317 650	3	1	CWD STS Stack Monitors
		9038 317 651	1 2	1	CWO STS Stack Monitors and Perm. Vent System
1	17.0	9038 317 652	10	1	CMD STS Fines Collection
		9038 317 653	11	1	CWD STS Zeolite Makeup Fan and Shutters
	F. 1	9038 317 654	1 1	1	CWD STS 3rd Sample Leg Perm. Vent System
1		9038 317 655	10	1	CWD STS Control Panel Cage #4
1		9038 317 656	1 0	1	CWD STS Zeolite Loading System (Vacu-Max)
		9038 317 657	10	1	CMD STS Pumps G002 and G003 Interconnection
		9038 317 658	10	1	CWD STS
: The Earl	3	9030 013	1 1	1	P&ID STS Utility Water Systems
44.1	2	9030 014	1 4	1	P&ID STS Utility and Instrument Air
	3	9030 014	1 1	2	P&ID STS Utility and Instrument Air
		9030 015	10	. 1	Process Diegram STS
	2	9030 016	1 4	1	P&ID STS Filtration and Cooling Section
	2	9030 017	3	1	P&ID STS Ion Exchange Section
		9030 018	3	1	P&ID STS Ion Exchange Section
	2	9030 018	3	2	P&IC STS Ion Exchange Section
		9030 019	3	1	P&ID FTS Final Filtration and Storage
34.77	2	9030 020	3	1	P&ID STS Zeolite Fill and Stuice Section
	2	9030 021	3	1	P&ID STS Venting/Chiller Section
		9030 055	2	1	Gen Arr STS 801 Tank Plan 88.5'
		9030 056	2	1	Gen Arr STS 801 Tank Section
		9030 057	1 4	1	Gen Arr STS Bldg and 80-3 & 4 Tanks Plan El 92'
		9030 058	1 4	1	Ger. Arr STS Bldg Plan El 107'
		9030 059	1 4	1	Gen Arr STS Bldg Plan and Sections
		9030 109	3	1	PAID STS Final Filtration and Storage
100		9030 418	2	1	STS Bldg HVAC Floor Plan El 92'
		9050 030	1 0	1	Gen Arr Vitrification Facility Plan El 100'
		9050 031	1 0	1	Gen Arr Vitrification Facility EDT, CPC EL 100'
		9050 032	1 0	'	Gen Arr Vitrification Facility El 110'
		9050 033	1 0	1	Gen Arr Vitrification Facility EDR CPC El 117'
	1	9050 034	1 0	1	Gen Arr Vitrification facility Plan E: 124' and Above
		9050 035	1 0	1	Gen Arr Vitrification Facility EDR CPC Plan El 131'
		9050 036	1 0		Gen Arr Vitrification Facility Sections
S IS CALL		9050 037	1 0	1	Gen Arr Vitrification Facility Sections
**************************************		9050 041	1 0	1	Gen Arr Cold Chemical Bldg Plan El 98'5 and 100'
		9050 042	1 0	1	Gen Arr Cold Chemical Bldg Plan Et 115' and Above
Inner Fun		9050 043	1 0	1	Gen Arr Cold Chemical Bldg Sections
urora Sys		CS-85-6471-60	0	1	Electrical Schematic Truck Panel
oore Prod			0	6	FIC-015 Flow Controller TIC-010
oore Prod		C-10526	1 0	0	FIC-015 Flow Controller
oore Prod	100	C-10526	10	9	FIC-015 Flow Controller LIC-054
oore Prod	77.	C-10526	1 0	7	FIC-U15 Flow Controller HIC-U-9
oore Prod		C-10526	0	5	FIC-015 Flow Controller FIC-05:
oore Prod		C-10526	1 0	8	FIC-015 Flow Controller HIC-027
olcrete		D 1670-M	1 5	1	Gen Arr High Shear Mixer MK. IV

Sechtel	**	GR-A-1 HOHL 01 H-3- 53751 Kranco 81	···   15   0	1 1	1	P&ID Process Off-Gas and Vent, System Spent Fuel Proc Plant
lechtel		HOHL 01 H-3- 53751	10	1 1	1	P&ID Process Off-Gas and Vent. System Spent Fuel Proc Plant
		H-3- 53751		1 1		一大大震声,大大大震声中间,"我们人,"中国的一种"大型","大型"的"大型","大型"的"大型"的"大型","大型"的"大型","大型","大型","大型","大型","大型","大型","大型",
			1 0		1	Module #1 Truck Unload Conv. #60
	į	Vennes 81		1 1	1	Crane Maintenance Room Vit ification Facility Cell SA
		KI BITCU DI	1 0	1 1	i	Bridge Assembly 1-Ton Automated Radwaste Crane
		Kranco 815	1 0	1 1	i	Runway Rails and Conductor System 375' Runway
	i i	Kranco T1	10	1 1	i	Trolley Assembly 1-Ton Automated Radwaste Crane
	i i	SKCEH111386	1 0	1 1	i	RTS-CSS 01/14 Bldg Lower Plan
	i i	SKCEH111386	1 0	1 2	i	RTS-CSS C1/14 Bldg Lower Plan
	i i	SKCEH111386	1 0	3	i	RTS-CSS 01/14 Bldg Upper Plan
	i i	SKCEH111386	10	1 4	i	RTS-CSS 01/14 Bldg Elevation
	i i	SKCEH111386	1 0	5	i	RTS-CSS 01/14 Bldg Elevation
	i i	SKCEH111386	1 0	1 6	i	RTS-CSS 01/14 Bldg Elevation
	i	SKCEH111386	1 0	7	i	RTS-CSS 01/14 Bldg Elevation
	i i	SKCEH111386	1 0	1 8	i	RTS-CSS 01/14 Bldg Section El. Looking South
	i i	SK-DJL-016	1 0	1 1	i	STS Controller Config. Diagram HIC-004
	i i	SK-DJL-016	1 0	1 2	ì	STS Controller Config. Diagram HIC-056
	i	SK-DJL-016	1 0	3	i	STS Controller Config. Diagram FFIC-024
	1	****	1		i	