

UNITED STATES NUCLEAR REGULATORY COMMISSION  
OFFICE OF INSPECTION AND ENFORCEMENT

REGION III

Report of Construction Inspection

IE Inspection Report No. 050-330/77-02

Licensee: Consumers Power Company  
1945 West Parnall Road  
Jackson, MI 49201

Midland Nuclear Power Plant  
Unit 2  
Midland, MI

License No. CPPR-82  
Category: A

Type of Licensee: PWR (B&W) 818 MWe

Type of Inspection: Announced, Special

Dates of Inspection: February 28 - March 1, 1977

Principal Inspector: *I. Yin*  
I. T. Yin

*3/15/77*  
\_\_\_\_\_  
(Date)

Accompanying Inspectors: None

Other Accompanying Personnel: None

Reviewed By: *B. W. Hayes*  
*for* D. W. Hayes, Chief  
Projects Section

*3/15/77*  
\_\_\_\_\_  
(Date)

## SUMMARY OF FINDINGS

### Inspection Summary

Inspection on February 28 and March 1, 1977, (Unit 2, 77-02): Special inspection concerning extensive bulge in the Unit 2 containment liner plate. One noncompliance item was identified relative to failure to report the bulge deficiency pursuant to the requirements of 10 CFR 50.55(e)(2).

### Enforcement Items

#### Deficiency (Unit 2 only)

Contrary to the requirements of 10 CFR Part 50.55(e)(2), the licensee failed to notify the NRC RIII Office of Inspection and Enforcement of the Unit 2 containment liner plate bulge deficiency within 24 hours. (Paragraph 1, Report Details)

#### Licensee Action on Previously Identified Enforcement Items

Not inspected.

#### Other Significant Items

##### A. Systems and Components

The Unit 2 containment liner plate bulge was examined by the inspector. (Paragraph 2, Report Details)

##### B. Facility Items (Plans and Procedures)

The licensee's plans for determining the causes of the Unit 2 containment liner plate bulge, and the procedures for examining, evaluating and repairing the damages had not been formulated at the conclusion of the inspection.

##### C. Managerial Items

None.

##### D. Deviations

None.

E. Status of Previously Identified Unresolved Items

Not inspected.

Management Interview

- A. The following personnel attended the management interview at the conclusion of the inspection:

Consumers Power Company (CP)

D. R. Keating, Quality Assurance Engineer  
R. M. Wheeler, Field Engineer

Bechtel Power Corporation (Bechtel)

A. J. Boos, Project Field Engineer  
J. P. Connolly, Project Field Quality Control Engineer  
G. L. Richardson, Lead Quality Assurance Engineer

- B. Matters discussed were as follows:

1. The inspector stated that it did not appear the licensee had met the requirements of 10 CFR 50.55(e)(2) relative to prompt reporting of the liner bulge deficiency and that this matter would be discussed with RIII management. Subsequent to the inspection the licensee was notified that failure to report the bulge deficiency within 24 hours was considered contrary to the requirements of 10 CFR 50.55(e)(2).
2. The inspector discussed the possible cause of the Unit 2 containment liner plate bulge, the repair procedures, and the QA/QC requirements for the future testing and repair work.

The licensee indicated that they will maintain close communication with RIII relative to the examination and repair work status.

## REPORT DETAILS

### Persons Contacted

In addition to the individuals listed under the Management Interview section of this report, the following persons were contacted:

#### Consumers Power Company (CP)

J. L. Corley, Quality Assurance Superintendent

#### Bechtel Power Corporation (Bechtel)

H. Wahl, Manager of Engineering

T. Johnson, Supervisor of Special Structures Group

R. Castleberry, Project Engineer

T. Thirugavadam, Civil Design Engineer

### Results of Inspection

#### 1. Failure to Promptly Report Liner Bulge Deficiency

10 CFR Part 50.55(e)(1) and (2) states, in part, "If the permit is for construction of a nuclear power plant, the holder of the permit shall notify the Commission of each deficiency found in design and construction, which, were it to have remained uncorrected, could have affected adversely the safety of operations of the nuclear power plant at any time throughout the expected lifetime of the plant, . . . (2) The holder of the construction permit shall within 24 hours notify the appropriate Nuclear Regulatory Commission Inspection and Enforcement Regional Office of each reportable deficiency."

Contrary to the above requirements, the Unit 2 containment liner plate bulge was identified at approximately 11:00 p.m., EST, February 26, 1977, and was not reported to the NRC RIII Office of Inspection and Enforcement until about 2:15 p.m., EST, February 28, 1977.

#### 2. Examination of the Bulge

The RIII inspector was dispatched to the Midland construction site following notification of the Unit 2 liner plate bulge. The purpose



of the site visit was to determine the extent of the damage, and to assess the stability of the liner plate bulge area.

The bulge was first identified during a routine walk through in the Unit 2 containment by the night watchman at about 11:00 p.m., on February 26, 1977. The bulge on the liner plate occurred between columns 250 degrees and 270 degrees, a span of 20 feet and between elevations 593 feet (base mat) and about 700 feet. The liner was anchored to 14-inch wide flange I-beam columns at 250 degrees and 270 degrees by full penetration welds and into the concrete structure by 3-inch x 2-inch x 1/4-inch angle iron welded to the plate and run vertically on 14-inch centers and by 5-inch channel iron welded on edge to the angle iron and run horizontally on 4 foot centers. As a result of the bulge the angle iron, which extended into the concrete 3-inches, broke at the welds to the 5-inch channel tearing the concrete away. The 5-inch channel iron remained firmly embedded in all areas observed through the three 12-inch by 24-inch inspection holes cut into the liner plate following the incident.

Water was pouring from tear holes in the liner plate around the penetrations located approximately 10 to 15 feet about the base mat when the bulge was first discovered. Additional holes (4) were cut into the liner plate to facilitate draining, however, water continued to flow. The source of water, which was valved off to stop the draining, was a 2-inch construction water line embedded in the containment concrete structure about 12-18 inches behind the liner plate. This water is used primarily to wet down the concrete during the curing process. Within a few inches from the water line, there are also a 2-inch compressed air line and a 2-inch grease line. These lines are located at Azimuth 259° at elevation 602'-7" and 261° at elevation 700'-0". For Unit 1 containment, these lines are located at Azimuth 101° at elevation 602'-7" and 99° at elevation 700'-0". The licensee construction contractor, Bechtel Power Corporation, indicated that they will abandon the use of the 2-inch water lines in both Units 1 and 2 containment, however, whether or not to use the air and grease lines during future construction has not yet been determined.

The bulge plate appeared to be in stable condition held by the full penetration welds to the 14-inch wide flange I-beam columns, by the base mat floor plate and by heavier penetration sections near the floor and upper end of the bulge. Tear holes were observed near the columns, adjacent to the penetrations and near a stiffener plate installed at elevation 510 feet to resist wind loads during construction. The lower penetration section was bent and may have to be replaced. The outside of the containment structure was examined and no cracks or other damage was in evidence. Also there was no apparent damage to the tendon sheaths and no unaccounted for water was in the tendon gallery.

At the time of RIII inspection on February 28, 1977, the licensee AE/Constructor had not completed formulating plans to assess the cause and extent of the damage and to develop repair procedures.

Subsequent to the inspection on March 4, 1977, RIII was informed by the licensee by telephone that a section of the liner plate near the bottom of the bulge was cut to remove the concrete debris, and seven additional 12-inch x 24-inch inspection holes have been cut into the liner. After the debris has been removed, the licensee plans to cut out small sections of the liner plant starting at the top of the bulge area and working down to where localized damage, and thus evidence of the cause should be uncovered. This operation is expected to take two to three weeks.

NOTE: ONLY ONE PENETRATION IS SHOWN, SECOND PENETRATION IS AT AZIMUTH 77°. ROUTING OF TENDONS IS APPROX SYMMETRICAL ABOUT AZIMUTH 90°

APPROX SYMM ABOUT  $\phi 2$

120°

90°

103°

EL 711'-5"

EL 710'-4"

H32-038 EL 709'-6"

H13-038 EL 708'-6"

H32-037 EL 706'-6"

H13-037 EL 705'-6"

H32-036 EL 703'-6"

H13-036 EL 702'-6"

CONCRETE PLACED TO EL. 703'-7"

EL 707'-0"

EL 703'-8"

EL 702'-7"

NOT INSTALLED

EL 701'-9"

EL 701'-3"

SHEATHING AS INSTALLED

ORIGINAL ALIGNMENT OF TENDONS AROUND MAIN STEAM PENETRATION

SHEET #1

MIDLAND

PRESENTATION BY NRC 3/17/64 113  
(SHUMAKER) AT 205TH "CRS  
6 MAR 77. (11:00am)

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"A" SIZE

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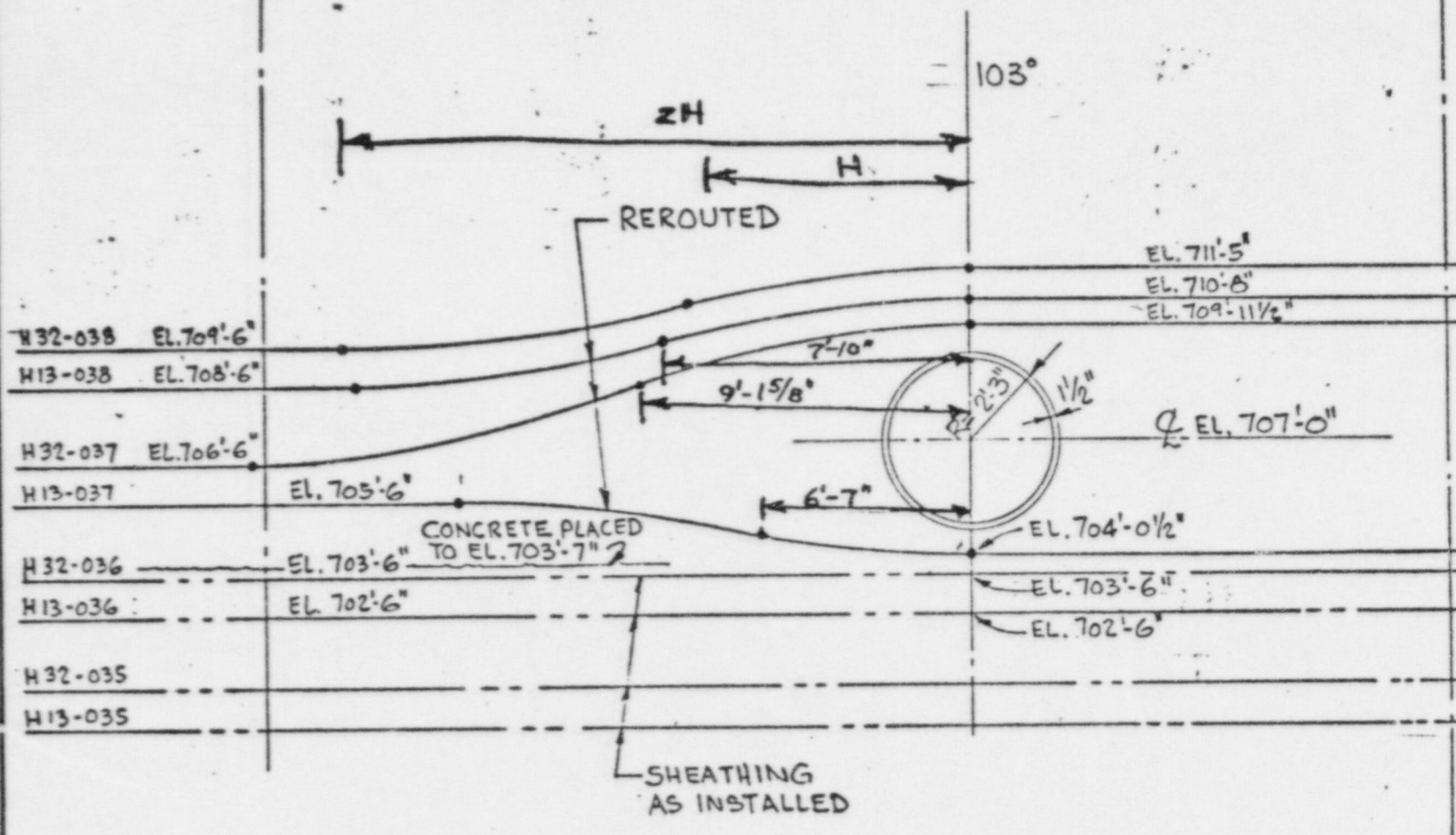
NOTE:-

ONLY 1 PENETRATION IS SHOWN;  
SECOND PENETRATION IS AT AZIMUTH 77°;  
ROUTING OF TENDONS IS APPROX.  
SYMMETRICAL ABOUT AZIMUTH 90°.

APPROX. SYMM.  
ABOUT  $\angle$  90°

120°

103°



REVISD ALIGNMENT OF TENDONS  
AROUND MAIN STEAM PENETRATION

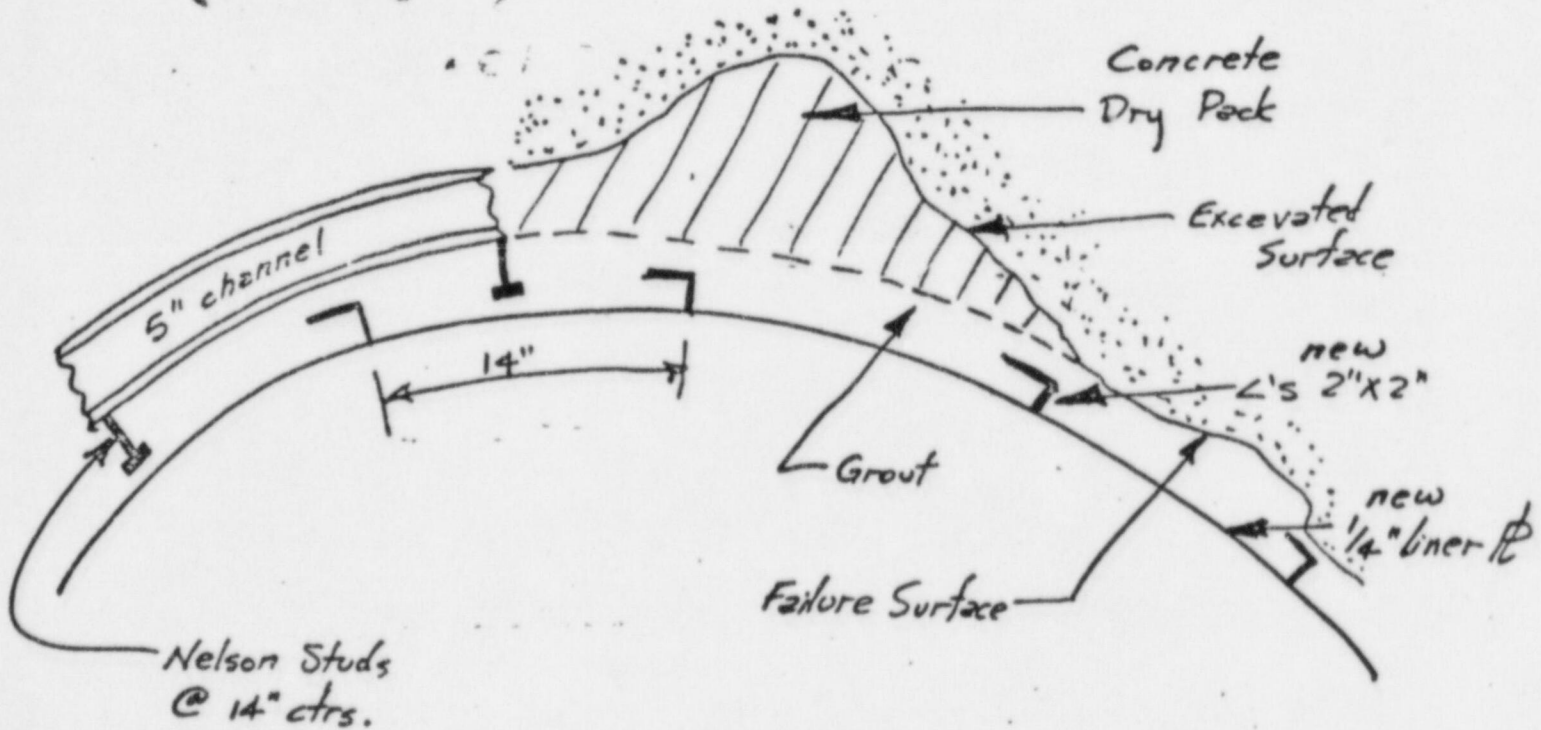
SHEET #2



IC 319165  
PRESENTATION BY NRC 114  
(SM-MAKER) AT 205th ACRS  
6 MAY 77 (10:45am)



Failure Mode on Bulged  
Liner Plate  
N.T.S.

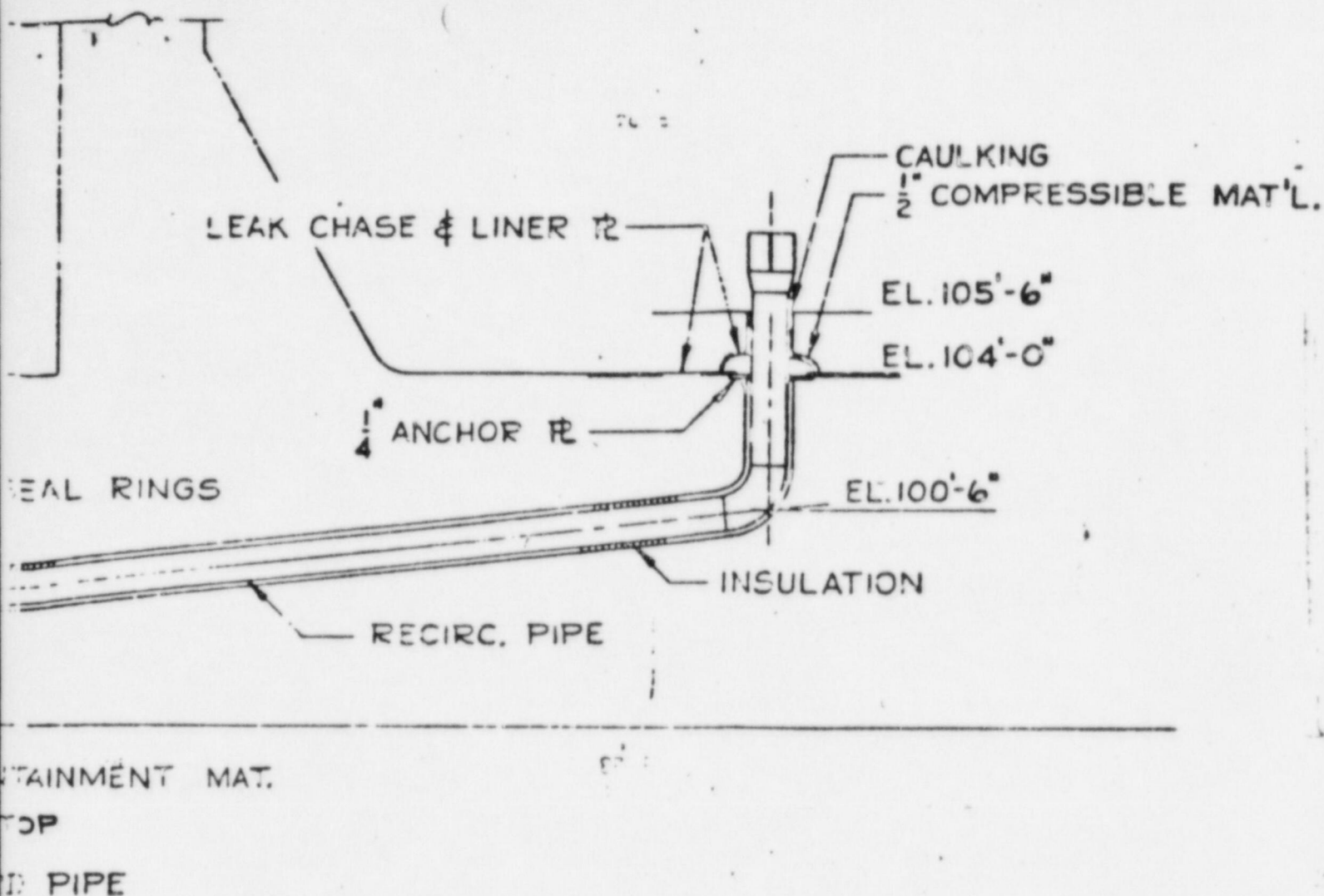


Proposed Repaired  
Section  
N.T.S.

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MIDLAND, UNIT 2

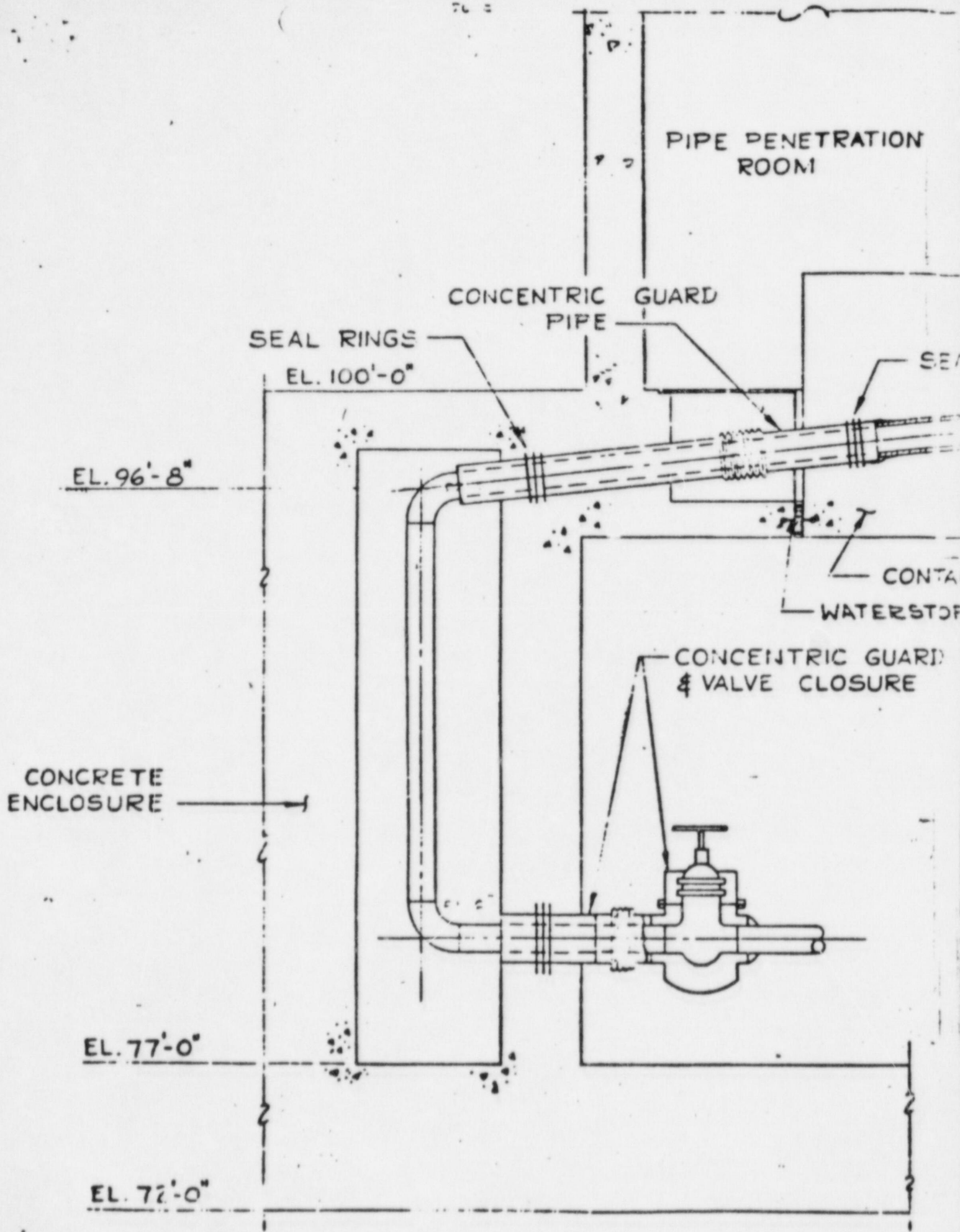


AMEND. 92 2/4/77

ALABAMA POWER COMPANY  
JOSEPH M. FARLEY NUCLEAR PLANT  
FINAL SAFETY ANALYSIS REPORT

TYPICAL ARRANGEMENT OF CONTAINMENT  
SUMP SUCTION LINE

FIGURE 6C-1





Excerpt from  
Minutes of 205th ACRS Meeting

May 5-6, 1977

C. Midland 2: Liner Plate Repair

R. Shewmaker, NRC Staff, discussed proposed repairs to the liner plate of the containment building from the bulge reported at the 204th ACRS Meeting (see Appendix XXII). He noted that pipe penetrations and stiffening columns had arrested the extent of the bulge and there was no tearing of the metal. It is believed that freezing was the cause of the failure of a pipe used to supply concrete curing water. The section of the failed pipe was removed, as well as the bulged section of the liner. It is proposed to re-erect the liner plate with two-inch steel angles similar to the original construction. The concrete that was damaged will be removed and replaced with dry-pack concrete. Nelson studs will be placed between the angles. The three-inch void between the liner plate and the concrete wall will be filled with grout. The liner plate will be retested to develop the liner design criteria. NRC Staff believes that the proposed repairs are reasonable, but may require some additional rock anchors where the five-inch channels are not adequately embedded in concrete.

Mr. Okrent, noting the number of problems that have occurred relating to containment liners during construction, and the fact that these liners are not tested under accident conditions, suggested that the reliability of containment liners might be reevaluated.

[Note: This matter, along with the reliability of other engineered safety features, will be considered at a joint meeting of the Siting Evaluation Subcommittee and the Reactor Safety Study Working Group.]

D. Midland 1: Misplaced Tendons

R. Shewmaker said that a problem had developed during the construction of the containment structure at the Midland 1 plant. Two tendons were misplaced and others had to be relocated to correct the deficiency. The NRC Staff agrees with the fix that was made. All of the modifications have been documented.

R. Shewmaker noted that this was a quality control breakdown which occurred when the chief surveyor was on vacation. The error was found before the next higher pour was made. (For diagrams of the error and the fix see Appendix XXIII.)

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B/46

Midland

EXCERPT FROM  
MINUTES OF 212TH ACRS MEETING  
DECEMBER 8-10, 1977

D. Aeschliman v. NRC

The Chairman informed the Committee that the appeal of the verdict of the Aeschliman v. NRC case, regarding the licensing of the Midland Nuclear Power Plant, Units 1 and 2, has been argued before the U.S. Supreme Court. Involved in this decision, is the requirement for the ACRS to be informing the public as well as the Commission. A decision is expected from the Supreme Court in three to four months.

FOIA-85-602

B/47

MIDLAND 14

EXCERPT FROM  
MINUTES OF 215TH ACRS MEETING  
MARCH 9-10, 1978

D. Midland, Units 1 and 2: Radiation Monitoring of  
Process Steam

[Note: Mr. Kerr did not participate in this discussion.]

D. Hood, NRC Staff, noted that the Consumers Power Company, applicant for Midland Nuclear Power Plant, Units 1 and 2, has requested elimination of a research and development program to assure the adequacy and feasibility of the radiation monitoring system for the process steam to be supplied to the Dow Chemical Company. This program was proposed in Amendment 8, to the PSAR for Midland dated February 9, 1970. In the original design of Midland, secondary steam was to be sold to Dow for process purposes. Since that time, and following Congressional passage of the Dulaney Amendment, which prohibits delivery of potential carcinogens, the steam delivery system was modified to provide for a set of reboilers, and delivery to Dow of tertiary steam instead of secondary steam. This tertiary steam will be essentially nonradioactive, and the Applicant believes that this modification obviates the need for the R&D program in question. Radiation monitors will be installed on each of the steam lines, both high pressure and low pressure. In addition, blowdown from each evaporator will be monitored. He also noted that in its 1968 report, the Committee requested that it be kept informed of matters regarding monitoring of the process steam deliveries.

C. Burke, NRC Staff, noted that this report is a status report, that the NRC Staff is reviewing the matter, and as of this time has made no decision.

Mr. Siess noted that, unless open steam is used in some of the Dow products, there is a fourth barrier to the transmission of radioactive material, in the form of Dow's heat exchangers. (For the chronological history of this research project, and for the original and modified designs of the process steam systems, see Appendix XIX.)

Mr. Ebersole requested that the NRC Staff inform the Committee whether the safety analyses for the main steam line isolation valves in the Midland Nuclear Power Plant, Units 1 and 2, have been updated to conform with the current NRC rules and criteria.

T. Sullivan, Consumers Power Company, said that with the original design of the process steam supply system, there was concern that the limits set by 10 CFR 20 would have to be met with regard to the steam supplied. However, with tertiary heat exchangers, the steam supply system would not be a significant release path for radioactive materials. The existence of three barriers to the passage of radioactive materials, and the huge mass of water involved in the evaporation in the tertiary system, will prevent the transfer of significant concentrations of radioactive materials.

midland 1/2

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B/48



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CHRONOLOGY

MAR 11 1978

PROCESS STEAM RADIATION MONITORING

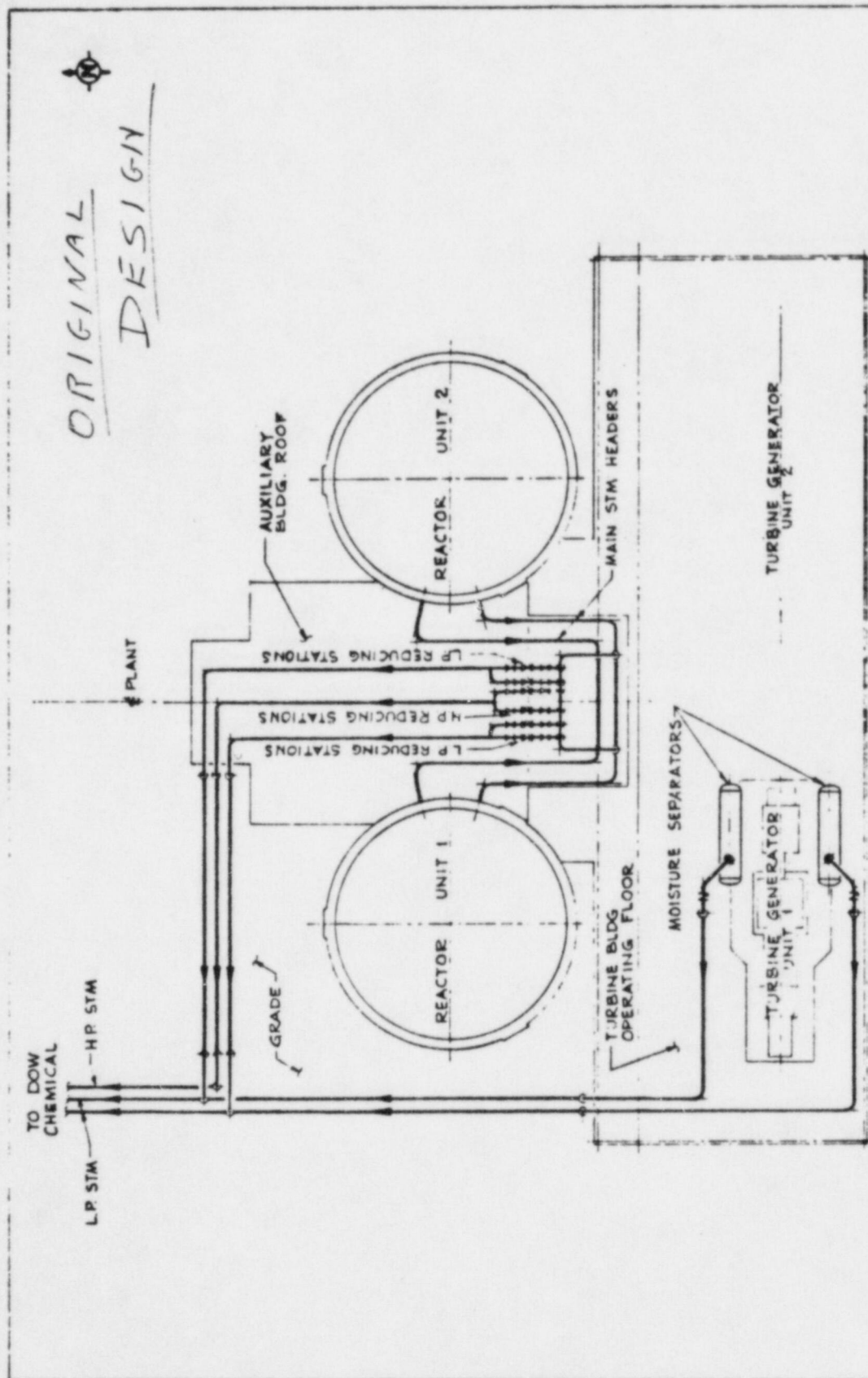
AM 7 8 9 10 11 12 1 2 3 4 5 6 PM

OCT. 30, 1968	PSAR SUBMITTED. PROCESS STEAM SYSTEM DESIGN BASED UPON DIRECT EXPORT OF SECONDARY STEAM TO DOW.
FEB. 9, 1970	PSAR AMEND. 8 PROPOSES R&D TO RESOLVE FEASIBILITY AND ADEQUACY OF RADIOACTIVITY MEASUREMENT CONCEPT.
JUNE 18, 1970	ACRS REPORT ISSUED BASED ON DIRECT EXPORT OF SECONDARY STEAM AND DESCRIBING DEVELOPMENT PROGRAM.
AUG. 14, 1970	PSAR AMEND. 15 INTRODUCES TERTIARY HEAT EXCHANGERS.
SEPT. 14, 1970 SEPT. 17-19, 1970 SEPT. 23, 1970	ACRS SUBCOMMITTEE MEETING ACRS MEETING ON REBOILERS ACRS SUPPLEMENTAL REPORT ISSUED. DETAILED PROCEDURES FOR MONITORING AND CONTROL TO BE DEVELOPED DURING CONSTRUCTION. ACRS TO BE KEPT INFORMED.
Nov. 12, 1970	SER ISSUED. REFERS TO R&D PROGRAM TO VERIFY SENSITIVITY OF GROSS GAMMA MONITOR.
MAY 3, 1977	STAFF MEETING WITH APPLICANT. APPLICANT STATES R&D NOT NEEDED.
AUG. 29, 1977	FSAR TENDERED.
SEPT. 1, 1977	APPLICANT LETTER REQUESTS ELEMINATION OF R&D COMMITMENT.
MARCH 1, 1978	FSAR SECTION 11.6 SUBMITTED DESCRIBING PROCESS STEAM RADIATION MONITORING PROGRAM.

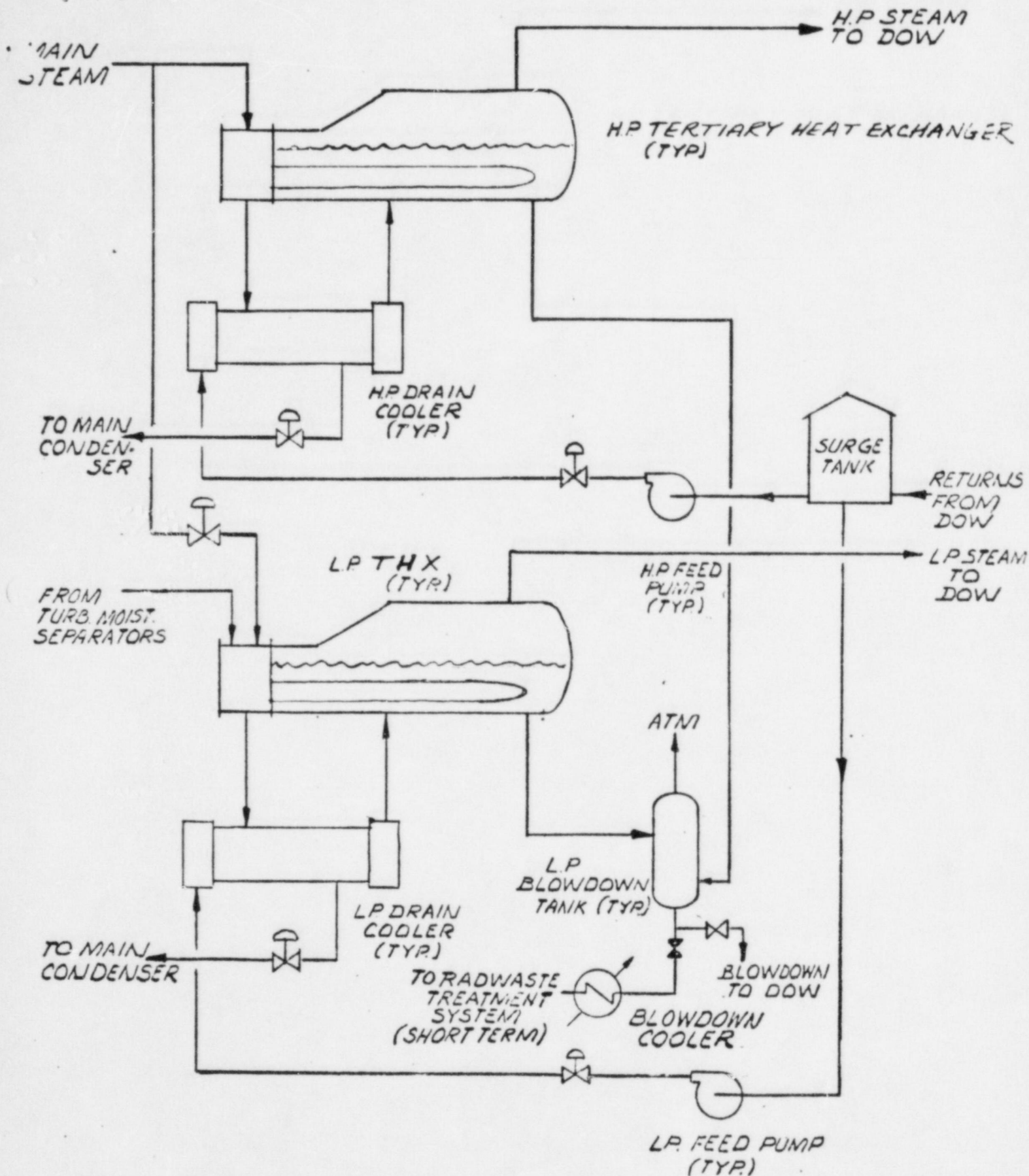
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Midland



**FIG. 10.1-3**  
ISOLATION AND REDUCING VALVES IN  
PROCESS STEAM SYSTEM TO DOW CHEMICAL



Preliminary Tertiary Heat Exchanger System Fig. 11.00-1

Amendment No. 17

9/11/70



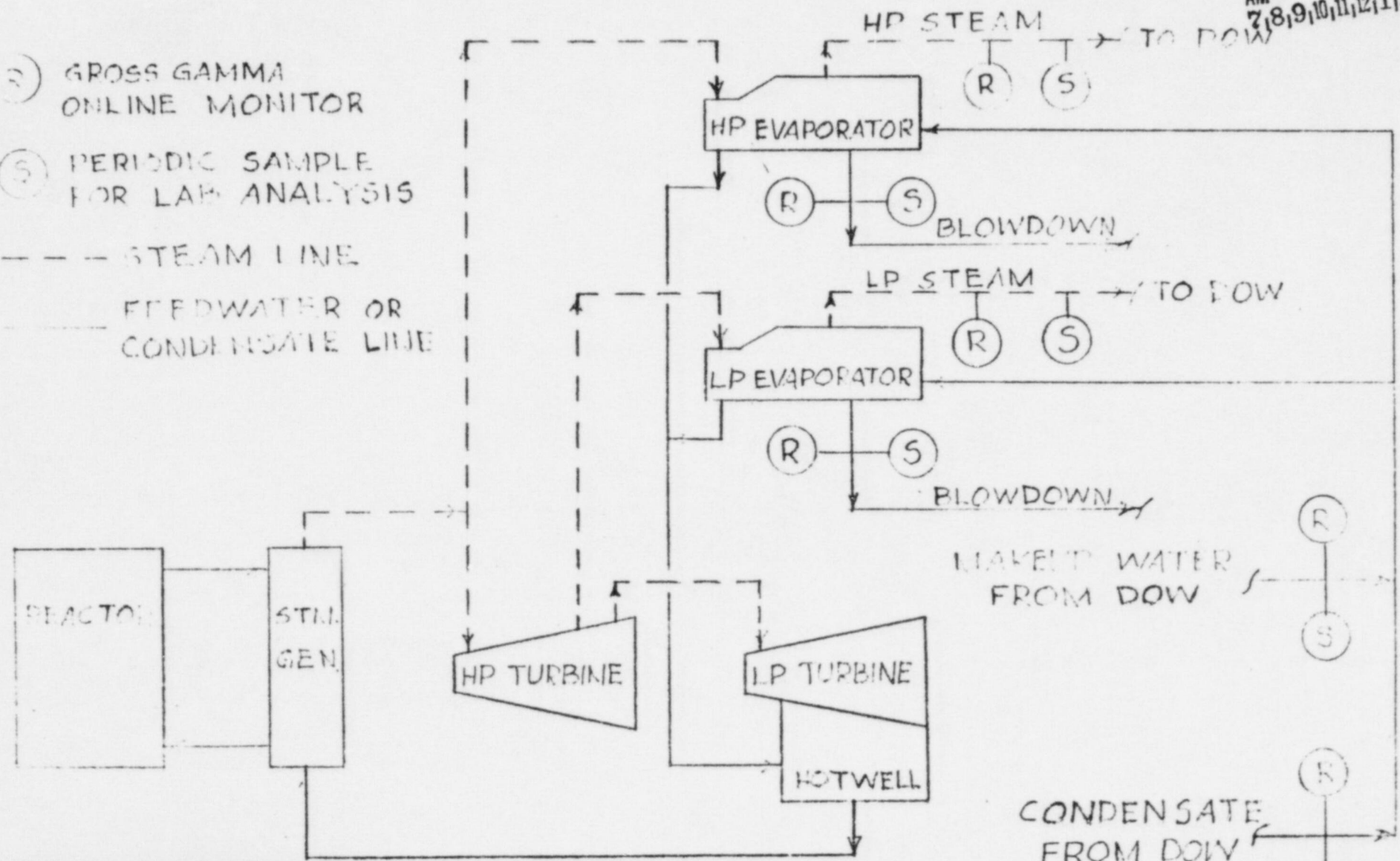
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# MIDLAND PROCESS STEAM SYSTEM

- (R) GROSS GAMMA ONLINE MONITOR
- (S) PERIODIC SAMPLE FOR LAB ANALYSIS

--- STEAM LINE  
— FEEDWATER OR CONDENSATE LINE



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