



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

May 11, 1977

DOCKET NOS. 50-329/330  
FACILITY: Midland Plant, Units 1 and 2  
SUBJECT: SUMMARY OF MEETING WITH CONSUMERS POWER COMPANY REGARDING DESIGN CRITERIA FOR THE PROCESS STEAM RADIATION MONITORING SYSTEM

Summary

On May 3, 1977, the NRC staff met with representatives of Consumers Power Company (CPC), Dow Chemical, and CPC's consultant, NUS Corporation to discuss the status, commitments, and proposed design of the process steam radiation monitoring system.

The list of attendees is enclosed.

THIS DOCUMENT CONTAINS  
POOR QUALITY PAGES

DISCUSSION

The licensee presented a summary of the history and status of significant commitments and comments regarding the process steam radiation monitoring system design. A copy of this summary is enclosed as Enclosure A for future reference. In the staff's Safety Evaluation Report issued November 12, 1970, in Section 15.6 Process Steam Monitoring, we indicated the applicant would conduct a research and development program to verify the required sensitivity of the process steam radiation monitoring system. It was indicated that tests would be performed at the Palisades plant and all tests would be completed prior to submittal of the Final Safety Analysis Report (FSAR). CPC indicated that these commitments were made when the process steam transported to Dow was Secondary steam from the Midland Plant. They indicated that after that issuance date the process steam design was changed to use a tertiary heat exchanger to generate the process steam transported to Dow. CPC indicated that because of this change to the tertiary heat exchange design, the need for the research and development commitment in the Section 15.6 of the SER is not necessary.

We indicated that CPC should submit a letter to the NRC providing the justification for eliminating the PSAR commitment with a description of the proposed program and criteria for developing the process steam radiation monitoring system.

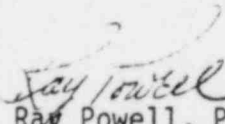
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CPC provided and discussed the Midland Plant Process Steam Radiation Monitoring System Design Criteria, which is contained in Enclosure B for future reference. The finalized design and initiation of procurement of the necessary instrumentation will not be completed until April 1978. Background monitoring to establish the base line radiation levels of the process steam feedwater is continuing.

Action

Consumers Power Company will be submitting to the NRC for review and approval, a letter with justification and a request to eliminate the research and development program committed to in the PSAR Section 15.6.

  
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PROCESS STEAM MONITORING

MEETING WITH CONSUMERS POWER COMPANY - May 3, 1977

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## ENCLOSURE A

### SUMMARY OF SIGNIFICANT COMMITMENTS AND COMMENTS

| <u>Date</u> | <u>Group/Agency</u> | <u>Document/Source</u>        | <u>Commitment/Comment</u>  |
|-------------|---------------------|-------------------------------|--|
| 10/30/68    | CPCo                | Midland PSAR                  | PSAR submittal   |
| 1/22/69     | ACRS, AEC           | ACRS Subcommittee Meeting     | Staff notes FDA concern  |
| 11/3/69     | CPCo                | Midland PSAR Amendment No. 5  | Gross gamma limit of $3 \times 10^{-6}$ $\mu$ Ci/ml identified   |
| 3/24/70     | ACRS, AEC, FDA      | ACRS Subcommittee Meeting     | DRL notes 10CFR20 limits suitable for steam; however, FDA acceptance will be on open market                  |
| 4/24/70     | ACRS, AEC, FDA, Dow | ACRS Subcommittee Meeting     | License or exemption suggested for Dow; 10CFR20 and ALAP both apply; FDA will not support a quality standard |
| 5/1/70      | CPCo                | Midland PSAR Amendment No. 11 | Grab sampling introduced   |
| 5/28/70     | CPCo                | Midland PSAR Amendment No. 12 | Yearly beta radioactivity limit 0.1 MPC, short-term limit up to MPC  |

SUMMARY OF SIGNIFICANT COMMITMENTS AND COMMENTS

| <u>Date</u> | <u>Group/Agency</u> | <u>Document/Source</u>        | <u>Commitment/Comment</u>   |
|-------------|---------------------|-------------------------------|---|
| 6/10/70     | Dow                 | ACRS Subcommittee Meeting     | No use of process steam in direct contact with products   |
| 8/14/70     | CPCo                | Midland PSAR Amendment No. 15 | THX system introduced; on-line limit of $3 \times 10^{-6}$ $\mu\text{Ci/ml}$ for gamma; off-line limits of $3 \times 10^{-8}$ $\mu\text{Ci/ml}$ for beta and $1 \times 10^{-5}$ $\mu\text{Ci/ml}$ for tritium                   |
| 9/4/70      | CPCo                | Midland PSAR Amendment No. 16 | Except for tritium, limits proposed to be essentially background within detection and turn-around capability  |
| 9/14/70     | ACRS, AEC, FDA      | ACRS Subcommittee Meeting     | Specific numerical limits dropped, possible tritium concentration was noted, limits essentially background, no reason for Dow to have license, Dow will use direct contact of steam with products; FDA relaxed about low levels |
| 9/15/70     | CPCo                | Midland PSAR Amendment No. 18 | Allowance must be made for possible concentration effects, grab samples will distinguish significant changes  |

SUMMARY OF SIGNIFICANT COMMITMENTS AND COMMENTS

| <u>Date</u> | <u>Group/Agency</u> | <u>Document/Source</u>   | <u>Commitment/Comment</u>                                    |
|-------------|---------------------|--------------------------|--|
| 6/25/71     | AEC                 | Licensing Hearing        | Concerned about timing between detection and steam transport |
| 3/3/72      | EPA, CPCo           | Response to EPA Comments | Background variations will be accounted for                  |



CONSULTING DIVISION

| PROJECT NO.   | REVISION | EFF. DATE | PAGE    |
|---|----------|-----------|---------|
| 1885  | 0        | 3-28-77   | 1 OF 11 |
| PROJECT Midland Process Steam<br>Radiation Monitoring |          |           |         |
| CLIENT<br>Consumers Power Company                     |          |           |         |

MIDLAND PLANT  
PROCESS STEAM RADIATION MONITORING SYSTEM  
DESIGN CRITERIA

### 1.0 INTRODUCTION

An integral part of the Midland Nuclear Power Plant is the tertiary process steam system designed to supply four million pounds per hour of process steam to the Dow Chemical Company. The process steam is separated from the reactor primary system by two stages of heat exchangers. However, if the secondary system should become contaminated, subsequent secondary-to tertiary system leaks or tube ruptures could allow small quantities of radioactive material to escape into the steam of the tertiary system. In order to detect any such radioactivity which may be present at a statistically significant level above background, a process steam radiation monitoring system is being developed. The overall objective of the process steam radiation monitoring system is to avoid introducing radioactive material into the process steam and to provide detection of any such additions to allow timely corrective action.

The detection of radioactivity in the process steam has been of prime consideration as the design of the tertiary heat exchanger (THX) system has evolved to its present state. A review of the evolution of the system design, including commitments made by Consumers Power Company (CPCo) and concerns expressed by the AEC (now the NRC) and other regulatory advisory groups, has been presented in "Summary of Prior Licensing Action, Midland Process Steam Monitoring" (NUS-1869, March 1977).



CONSULTING DIVISION

| PROJECT NO. | REVISION                                      | EFF. DATE | PAGE    |
|-------------|---|-----------|---------|
| 1885        | 0   | 3-28-77   | 2 OF 11 |
| PROJECT     | Midland Process Steam<br>Radiation Monitoring |           |         |

Based in part on that review, this report sets forth the preliminary design criteria for the monitoring system. Neither the process steam supply system nor the monitoring system is classified as safety-related as defined in 10CFR50, Appendix B. Additional, more specific, criteria or guidelines are anticipated as the bases for such are developed.

## 2.0 DESIGN PERFORMANCE CRITERIA

### 2.1 General Criteria

In order to provide a process steam radiation monitoring program compatible with commitments made by Consumers Power Company and requirements and concerns expressed by regulatory agencies, design criteria have been defined to the extent possible at this time. The program shall be consistent with the following basic criteria:

- Provide a reliable monitoring and sampling program to assure that the steam delivered to Dow is at background radioactivity levels within reasonable limits of detection.
- Provide assurance of timely detection of any radioactive contamination exceeding determined limits, so that corrective action can be taken.
- Provide assurance to the NRC that any release of radioactive material to the environment will meet the intent of 10CFR50, Appendix I.
- Provide Consumers Power Company with adequate records and independent verification of analytical measurements to document compliance with the objective of the process steam radiation monitoring program.
- Consistent with the criteria above, provide assurance that the expected number of spurious alarms due to the normal variation in low-level counting statistics is within acceptable limits.

The program shall be based upon an on-line monitoring system, an off-line monitoring program, and administrative procedures and controls to assure compliance with the criteria given above.

## 2.2 On-Line Monitoring System Functional Criteria

The objective of the on-line monitoring system is to provide prompt detection of gross leakage of radioactivity to the process steam. The performance of the on-line monitoring system shall, as a minimum, be consistent with the criteria listed below.

- Provide a measure of gross gamma activity in the process steam by continuously monitoring appropriate samples by suitably sensitive instrument(s) of sufficient number and selected location to promptly and reliably identify radioactivity levels in the process steam which exceed determined levels.
- Provide an alarm function in the main control room when the on-line monitoring system indicates gross gamma activity levels in excess of determined limits. Multiple alarm levels will be considered, ranging from warning levels indicating the need for pre-determined action, e.g., increased off-line surveillance, to higher levels indicating the need for prompt corrective action. Warning levels will be set at determined multiples above background with due consideration to fluctuations in background and statistical uncertainties in the measurements themselves to assure that alarm signals are valid and that spurious alarms are minimized. Appropriate consideration will also be given to expected isotopic mixtures and maximum

permissible concentrations or other established limits in order to provide necessary warning or action alarms prior to exceeding permissible limits. As a guideline, a gross gamma activity of  $3 \times 10^{-6}$   $\mu$ Ci/ml of condensed steam is anticipated as a level requiring prompt corrective action, but the applicability of this or other values will be within the considerations noted above.

- Provide the capability to store and retrieve measurement data, in order to document system operation.
- Specify administrative controls to properly follow up alarms and for such activities as operation, testing, calibration, and maintenance, to assure that the on-line monitoring system performs its intended functions.

### 2.3 Off-Line Monitoring Program Functional Criteria

The off-line monitoring program is the principal method for assuring that the steam delivered to Dow is at background radioactivity levels within reasonable limits of detection. The performance of the off-line monitoring program shall, as a minimum, be consistent with the following criteria.

- Define suitable points and methods to collect samples for off-line analysis.
- Define a program for off-line analysis of samples for gross beta and tritium activity to determine the radioactive content of process steam. Define analysis frequencies and specify instrument sensitivities.

- Establish approximate background activity levels for both gross beta and tritium and determine limits below which the measured activity can be reasonably considered as indicating the absence of addition of radioactivity above background. Limits shall give due consideration to fluctuations in background, low-level counting statistics, limits of detection, reproducibility, and sample turnaround time. (As a guideline, limits and detection levels presented in EPA Drinking Water Regulations\* shall be considered, consistent with the above considerations.)
- Specify a system for measuring gross beta activity (excluding that from tritium, noble gases, and those radionuclides with half-lives of less than twelve hours) in condensed tertiary steam samples. The capabilities of the system shall be consistent with the requirement to measure activities within the established limits of detection, such that levels which exceed the limits discussed above can be reliably considered to indicate the presence of radioactivity above background.
- Specify a system for measuring tritium activity in condensed tertiary steam samples. The capabilities of the system shall be consistent with the requirement to measure activities within the established limits of detection, such that levels which exceed the limits discussed above can be readily considered to indicate the presence of tritium content above background.
- Specify administrative controls to insure that radioactivity levels above determined limits are properly reported to allow prompt corrective actions.

\* Environmental Protection Agency; Drinking Water Regulations, Radionuclides 40CFR141 (41FR 28402, July 9, 1976).

- Specify administrative controls for such activities as operation, testing, calibration, and maintenance, to assure that the off-line monitoring program fulfills its intended function.

In addition to the items given above, the requirement for additional administrative controls to assure proper program performance consistent with the basic criteria shall be defined.

#### 2.4 General Design Considerations

The overall process steam radiation monitoring program shall be capable of meeting performance criteria compatible with the operating conditions of the process steam system. More specifically, the following items shall be considered.

- Environmental conditions affecting operation, such as pressure, temperature, ionizing and non-ionizing radiation, shall be considered.
- Operational requirements for the monitoring system shall be considered under various conditions such as plant start-up, normal plant operation, plant shutdown, plant emergency operation, special or infrequent operation and system abnormal or emergency operation.
- Any special mechanical requirements, such as vibration, stress, shock and reaction forces, as they pertain to the system performance, will be identified.
- Electrical requirements for power and voltages will be identified in the conceptual design.

- Instrumentation and control requirements will be included (instruments, controls and alarms required for operation and testing of the monitoring system).
- Requirements for redundancy and, as necessary, for physical separation of structures, systems and components will be included. There is no general requirement for consideration of diversity, but diversity may be considered for key components or techniques as it may affect reliability.
- Failure effects requirements for structures, systems and components will be included in the system reliability analyses, as they pertain to the process steam monitoring system.
- Test requirements, including calibration method(s), in-plant tests and conditions under which they will be performed, will be identified.
- General requirements will be identified for accessibility for maintenance, repair, and inservice inspection.

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|---|-------------|----------|-----------|---------|
| CONSULTING DIVISION                                   | PROJECT NO. | REVISION | EFF. DATE | PAGE    |
|   | 1885        | 0        | 3-28-77   | 9 OF 11 |
| PROJECT Midland Process Steam<br>Radiation Monitoring |             |          |           |         |

### 3.0 CODES AND STANDARDS

The process steam monitoring program and its associated systems and components shall be designed in accordance with the codes, standards, and regulations applicable to its function and interfaces with plant systems. Since the primary interface is with the process steam system itself, design standards applicable to turbine-generator systems, structures and auxiliaries will apply. The process steam radiation monitoring system may also interface with other plant systems and as the design evolves, standards applicable to those interfaces will be utilized. Possible requirements for such interfaces will be used for guidance as the design evolves.

To the extent that the process steam monitoring system is defined at this time, the applicable codes and standards are noted below.

- Vessels: ASME Boiler and Pressure Vessel Code, Section VIII
- Piping: ANSI B31.1.0, "Piping Code for Power Piping," 1973  
ANSI B16.5, "Steel Pipe Flanges and Flanged Fittings," 1968  
ANSI B16.11, "Forged Steel Fittings, Sockets Welded and Threaded," 1969
- Seismic: None
- Instruments and Sampling: Regulatory Guide 1.105, "Instrument Set Points"  
ASTM D1066-69, "Sampling Steam"  
ASTM D1192-70, "Equipment for Sampling Industrial Water and Steam"



In addition to the specific codes and standards indicated above, standard practices such as those of the Uniform Building Code and National Electrical Code shall be used as applicable.

Other documents, regulations, and guidelines have been reviewed and will continue to be reviewed, not only for regulatory requirements, but for guidelines which could be of value to the process steam monitoring design program and implementation of the design criteria. In some cases, certain portions of documents directly applicable only to safety-related systems may provide guidelines which could be of value. Neither the process steam supply system nor the monitoring system is classified as safety-related and the guidance taken from documents pertaining to safety-related systems should in no way be interpreted as imposing safety-related criteria on the monitoring system design. Of particular significance, certain sections of the "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants" indicate provisions and principles which will be used for design guidance. These include:

- Section 9.3.2 - Process Sampling System
- Section 11.5 - Process and Effluent Radiological Monitoring and Sampling Systems
- Section 12.1 - Assuring that Occupational Radiation Exposures Are As Low As Is Reasonably Achievable
- Section 7.7 - Control Systems Not Required for Safety

Additional documents which have been identified as possible general sources of guidance are given below.

- Regulatory Guide 1.21, "Measuring and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants," Revision 1
- IEEE-279, "Criteria for Protection Systems for Nuclear Power Generating Stations," Section 4.7, Control and Protection System Interaction
- Regulatory Guide 8.8, "Information Relevant to Maintaining Occupational Radiation Exposures As Low As Practicable (Nuclear Reactors)"
- Regulatory Guide 8.10, "Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Practicable"
- Environmental Protection Agency, Drinking Water Regulations (Federal Register, Vol. 41, No. 133).