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November 22, 1985

Office of Inspection and Enforcement
Attn: Dr. T. E. Murley
Regional Administrator
US Nuclear Regulatory Commission
Region I
631 Park Avenue
King of Prussia, PA 19406

Dear Dr. Murley:

Three Mile Island Nuclear Station, Unit 2 (TMI-2)
Operating License No. DPR-73
Docket No. 50-320
Inspection Report 85-20

During the time period of September 30, 1985, through October 2, 1985, the NRC conducted a special inspection into the circumstances associated with an inaccuracy in strontium-90 analyses being performed at TMI-2. The results of this special inspection led to the following correspondence from the NRC:

1. Confirmatory Action Letter 85-16, dated October 2, 1985.
2. Inspection Report 85-20, dated October 7, 1985.
3. Notice of Violation (Inspection Report 85-20), dated November 5, 1985.

The attachments to this letter provide responses to the NRC requests for information as contained in items (1) and (3) above.

Sincerely,

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for F. R. Standerfer
Vice President/Director, TMI-2

FRS/JCA/eml

Attachment

cc: Director - Division of Reactor Safety & Safeguards, T. T. Martin
Acting Director - TMI Program Office, Dr. W. D. Travers

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Response to Notice of Violation

The NRC Notice of Violation, dated November 5, 1985, identified three (3) items of non-compliance. These items are listed below along with the GPU Nuclear response.

VIOLATIONS

1. 10 CFR 20.311(b) requires that each shipment of radioactive waste to a licensed land disposal facility be accompanied by a manifest which indicates, in part, the identity and quantity of the radionuclide

   Contrary to the above, between January 1, 1984, and September 20, 1985, several radioactive waste shipments made to the U.S. Ecology licensed land disposal facility in Hanford, Washington were accompanied by manifests which did not indicate the correct strontium-90 content in accordance with 10 CFR 20.311(b) in that the quantity was understated in each case by a factor of two.

2. 10 CFR 20.311(d)(1) requires that wastes be prepared such that the waste is classified in accordance with 10 CFR 61.55.

   10 CFR 61.55(A)(4)(ii), and Table 2 referenced therein, requires in part, that any radioactive waste that has a strontium-90 content in excess of .04 Ci/mi^3 but less than 150 Ci/mi^3 be classified as Class B waste as defined in 10 CFR 61.55(a)(2)(ii). If the strontium-90 content is less than .04 Ci/mi^3, the waste is classified as Class A waste.

   Contrary to the above, on March 29, 1985, radioactive waste shipment RS-85-025-11 was sent to the U.S. Ecology licensed land disposal facility, and Barrel 85-D-11-39, containing .06 Ci/mi^3 of strontium-90, was incorrectly classified as Class A waste rather than Class B waste.

3. 10 CFR 71.5(a) requires each licensee who delivers licensed material to a carrier for transport to comply with the requirements of the regulations appropriate to the mode of transport of the Department of Transportation in 49 CFR 170 through 189. 49 CFR 172.203(d)(iii) requires that the radioactive activity contained in the shipment to be included on the shipping papers.

   Contrary to the above, between January 1, 1985, several shipments of material (including waste and samples) from the facility were accompanied by shipping papers which did not indicate the correct strontium-90 activity in accordance with 49 CFR 172.203(d)(iii) in that the activity was understated by a factor of two.

These constitute a Severity Level IV problem (10 CFR 2, Supplement V).

GPU Nuclear Response

GPU Nuclear uses a beta spectrometer at TMI-2 to quantify strontium-90 (Sr-90) in various samples. The beta spectrometer makes use of the fact that

Yttrium-90 (Y-90) is in secular equilibrium with the Sr-90 and that the beta particle associated with Y-90 is significantly greater in energy than the beta particles of most other radioactive material encountered at TMI-2 (the maximum beta energy of Y-90 is 2.2 MeV). By adjusting the system to count only those pulses which exceed the ^{137}Cs beta energy, the beta spectrometer is able to discriminate against the pulses associated with lower energy beta emitters. An NBS liquid Sr-90 (Y-90) standard is transferred to a filter paper and then is used to calibrate the beta spectrometer.

The three (3) violations identified were the result of the Sr-90 measurements being in error (low) by a factor of two. This was caused by the failure, on the part of GPU Nuclear personnel, to use the total equilibrium beta disintegration rate for Sr-90 plus Y-90 in their calculations. Instead, the Sr-90 (or Y-90) disintegration rate alone was used in the calculations. This resulted in the factor of two error.

Upon discovery of this error, GPU Nuclear took the following actions: 1) the NRC, the State of Washington, U.S. Ecology at Richland and the State of Pennsylvania were notified of the Sr-90 miscalculations; 2) the procedures for strontium analyses were reviewed to ensure that they were clear and accurate; and 3) changes to these procedures were made where appropriate. GPU Nuclear reviewed all the documentation for radioactive waste shipments containing Sr-90 for the period of July 1981 to the present. These radioactive waste shipments were reviewed from July 1981 to the present to ensure the proper transportation classification (49 CFR 173.400) and also from December 27, 1983 to the present for the proper waste classification (per 10 CFR 20.311). These reviews revealed that there were no instances of improper transportation classification and two (2) instances of improper waste classification. The two (2) incorrect waste classifications were:

1. 1985 shipment RS-85-025II, Container 85-D-II-39 (SDS Trash)
2. 1984 shipment RS-84-033II, Container 83-D-II-128 (Non-compactible Trash)

These containers were classified as Class "A" waste while, in fact, they should have been classified as Class "B" waste.

GPU Nuclear will notify the State of Washington and U.S. Ecology concerning the misclassification of two (2) specific containers by December 6, 1985. With this notification, full compliance will be achieved.

Other actions taken by GPU Nuclear as a result of this event are discussed in Attachment 2.

Response to Confirmatory Action Letter

The NRC issued Confirmatory Action Letter (CAL) 85-16 on October 2, 1985. This letter documented those actions which GPU Nuclear committed to during the exit meeting for Special Inspection 85-20 conducted at TMI on October 2, 1985. The actions identified in CAL 85-16 are listed below along with the GPU Nuclear response to each item.

A. Assure that all procedures used for strontium analyses are clear and accurate. This action is to be taken by October 11, 1985.

GPU Nuclear Response

This action was completed as previously reported to the Director of the TMIPO via GPUN memorandum 4410-85-M-0807, dated October 8, 1985.

B. Provide the Director, TMIPO with the documented results of your assessment of the impact of the inaccurate Sr-90 analyses.

GPU Nuclear Response

GPU Nuclear has reviewed the following areas to determine the impact of the inaccurate Sr-90 analysis. They are:

- Radioactive Shipment
- SER's, TER's, and SD's
- Effluent Monitoring Program
- Personnel Airborne Exposure

The results of the assessment of these areas appear below:

- Radioactive Shipment: GPU Nuclear reviewed all radioactive shipments from July 1981 to the present which were potentially affected by the Sr-90 inaccuracies. For those shipments that were subject to 49 CFR 173 requirements only (pre December 27, 1983), a recalculation of the curie estimates was performed to ensure that the proper transportation classification had been used. For those shipments that were subject to 49 CFR 173 and 10 CFR 20.311 requirements (post December 27, 1983), a recalculation of the curie estimates was performed to ensure that the proper waste classification and transportation classification had been used. As a result of this effort, it was determined that two (2) containers had been misclassified as Class "A" waste. In no case was there an error in the transportation classification. The two (2) containers which were misclassified as Class "A" waste are:

  1. 1985 shipment RS-85-025II, Container 85-D-II-39 (SDS Trash)

  2. 1984 shipment RS-84-033II, Container 83-D-II-128 (Non-compactible Trash)

GPU Nuclear will notify the State of Washington and U.S. Ecology at Richland by December 6, 1985, of these misclassifications.

- SER's, TER's, and SD's: GPU Nuclear has reviewed all appropriate Safety Evaluation Reports (SER's), Technical Evaluation Reports (TER's) and Recovery System Descriptions (SD's) to determine the potential impact of the inaccurate Sr-90 analysis had on their analyses or conclusions. As a result of the review, the following has been determined:

  1. No licensing safety basis provided in the documents reviewed is currently being exceeded due to the incorrect Sr-90 analysis.

  2. Those Recovery Systems Descriptions which were reviewed were not affected by the incorrect Sr-90 analysis.

  3. The impact of the incorrect Sr-90 analysis on all licensing documents reviewed is minor in nature and effect. Even if postulated Sr-90 releases were increased by a factor of two (2), the following would be true: a) Offsite doses due to normal operations would not exceed limits specified in Appendix B to the TMI-2 Technical Specifications, and b) Offsite doses due to hypothetical accidents would not exceed a small fraction of 10 CFR 100 limits.

  4. The incorrect Sr-90 analysis does not change the conclusion in any licensing document as to the acceptability of the activities with respect to posing acceptable risk to the health and safety of the public and TMI workers.

- Effluent Monitoring: Liquid effluent sample results are not affected since such samples are sent to offsite laboratories where wet chemical analytical techniques are used to assess the strontium-90 content. Thus, the TMI-2 beta spectrometer procedures are not used in assessing these samples.

  Airborne particulate filters from the station vent are counted using TMI-2 beta spectrometry procedures. A review of the sample results since July of 1981 has identified only two filters which had strontium-90 concentrations above the lower limit of detection (LLD). Correcting the strontium-90 results had no statistically significant effect on the levels previously reported in the TMI-2 Semi-annual Effluent Monitoring Report.

- Personnel Airborne Exposure: Breathing zone air samples (BZA's) which are analyzed with the beta spectrometer equipment are impacted by the strontium-90 analytical error. However, because of the extremely low airborne levels received by TMI-2 personnel, the impact is minimal. Corrected BZA sample results will not result in any personnel exposures to airborne radioactivity exceeding regulatory limits. Furthermore, it is expected that, with few exceptions, the corrected levels will involve airborne exposures of less than 2 MPC-hrs per day and less than 10 MPC-hrs per week

C. Have an independent assessment conducted of your chemistry Quality Assurance/Quality Control program and procedures, and provide the Director, TMIPO a copy of this assessment.

GPU Nuclear Response

GPU Nuclear contracted with the Oak Ridge National Laboratory (ORNL) in Oak Ridge, Tennessee, to provide a independent assessment of the chemistry Quality Assurance/Quality Control programs and procedures. A copy of the complete assessment has been provided to the Director, TMIPO. Although the audit contains several recommendations, the overall assessment was favorable. The ORNL report states that the current program to verify proper instrument operation and calibration is adequate. There are no systematic errors in the records system that is used to process sample data. ORNL found the radioanalytical procedures to be adequate and that they will yield the expected analytical results. The logic behind each procedure and the validity of the algorithm used in the associated calculations were also found to be correct.

D. Implement a formalized Quality Assurance/Quality Control program for laboratory analyses that includes the provisions of Regulatory Guide 4.15.

GPU Nuclear Response

GPU Nuclear is in the process of implementing a formalized Quality Assurance/Quality Control (QA/QC) program for laboratory analyses. In developing this program, GPU Nuclear used NRC Regulatory Guide 4.15, INPO Good Practice 83-16 and 83-17 as well as information from TMI-1, Oyster Creek and the recent independent assessment performed by ORNL.

As a result, three procedures (4212-CHM-3011.85, Radiochemistry Round Robin; 4212-CHM-3011.86, Radiochemistry Interlaboratory Cross Check, and 4212-CHM-3011.87, Radiochemistry Intralaboratory Cross Check) have been developed to broaden the scope of the TMI-2 laboratory radiochemistry QA/QC program for laboratory analyses. Thse procedures include:

1. Varying methods of cross checking (including intralaboratory and interlaboratory) to assess current procedures, instrumentation, techniques and computer software;

2. An acceptance criteria of either ±10% of "as analyzed" to actual or a graded approach similar to that found in the U.S. NRC Inspection and Enforcement Manual, procedure 84725 dated January 1, 1984; and,

3. Frequencies for performing cross checks which were chosen based on the references used to develop the program, and plant factors such as frequency of use, history of equipment, difficulty of analyses, turn around time, and laboratory/staffing considerations.

These procedures are currently being reviewed within the GPU Nuclear Organization with a target completion date of January 20, 1986. In the interim, GPU Nuclear is continuing the daily quality control regimen discussed in Procedure 4212-CHM-3011.82, Instrument Checks. Additionally, GPU Nuclear has established a contract with an offsite laboratory to analyze 50 filter paper samples, supplied by TMI-2, for Sr-90 content. These samples have already been supplied to the offsite laboratory and the results obtained will be used as a quality control check of our present onsite analysis capability. The sample result will be compared to those performed by TMI-2 on a statistical basis to detect systematic errors in onsite methods.

GPU Nuclear believes that by adding the checks and verifications required by the above referenced procedures, the accuracy and precision of the radiochemical analyses will be better defined. In addition, the mixture of "intra" and "inter" laboratory work will provide both immediate feedback and long term Quality Assurance.

E. Document all computer software used in laboratory analyses and verify that the results generated are accurate.

GPU Nuclear Response

All of the computer software used in the chemistry laboratory in the production of sample analyses has been verified, reviewed and documented (documentation of the software used is maintained by the TMI-2 chemistry section).

The methodology used in the verification of the computer software consisted of determining which equations were being used, verifying

that the equations were correct and comparing the output of the computer program to hand calculations. This verification was independently reviewed by TMI-2 Radiochemical Engineering and found to be accurate and correct.

Additionally, a procedure is being developed to define the controls for laboratory computer software. The procedure will specify:

1. A method for documenting computer programs.

2. A requirement to verify calculations.

3. Frequency of review of computer software.

4. The method for making modifications to computer software.

5. A security statement.

6. The requirement for a sample run of comparison data to check results.

The intent of this procedure is to establish contro's on computer software used in the chemistry laboratory so that any changes to the computer software will be performed in a standardized and controlled manner. This procedure is currently being reviewed within the GPU Nuclear organization with a target completion date of February 4, 1986.