U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-317/86-05, 50-318/86-05

Docket No. 50-317, 50-318

License No. DPR-53, DPR-69 Priority - Category C

Licensee: Baltimore Gas and Electric Company
P. O. Box 1475
Baltimore, Maryland 21203

Facility Name: Calvert Cliffs Nuclear Power Plant

Inspection At: Lusby, Maryland

Inspection Conducted: March 3-7, 1986

Inspectors: J. J. Kottan — 4-9-86
J. J. Kottan, Radiation Laboratory Specialist — date

Marie Miller — April 7, 1986
M. Miller, Radiation Specialist — date

Margaret C. Kramarz — 4/9/86
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Approved by: W. J. Pasciak — 4/15/86
W. J. Pasciak, Chief, Effluent Radiation Protection Section — date

Inspection Summary: Inspection on March 3-7, 1986 (Combined Report Nos. 50-317/86-05, 50-318/86-05)

Areas Inspected: Routine unannounced inspection of the licensee's liquid and gaseous radioactive effluent control programs; radiological measurements program, and bioassay whole body counting program using the NRC:I Mobile Radiological Measurements Laboratory and laboratory assistance provided by DOE Radiological and Environmental Sciences Laboratory. Areas reviewed included: effluent release records, surveillance tests, filter testing, audits, radioactive waste system operations, confirmatory measurements, laboratory QA program, and whole body counting program.

Results: Of the areas inspected, two violations were identified: failure to properly sample charcoal adsorbers and failure to write and implement a procedure for operation of the standup whole body counter.

DETAILS

1. Individuals Contacted

Principal Licensee Employees

*J. Lemons, Manager Nuclear Operations
*L. Smialek, Senior Plant Health Physicist
*W. Cartwright, Senior Chemistry Engineer
*E. Reimer, Plant Health Physicist
*A. Vogel, Chemist
*R. Sprecher, Plant Chemistry Supervisor
*R. Androsik, Surveillance Test Coordinator
E. Roach, Quality Assurance Specialist
P. Crinigan, Chemistry General Supervisor
S. Cherry, Principal Chemistry Technician
T. Williams, Principal Dosimetry Technician
S. Cowne, Licensing Engineer
R. Heibel,General Supervisor Operations

* Denotes those present at the exit interview.

The inspectors also interviewed other licensee employees, including members of the chemistry and health physics staffs.

2. Status of Previously Identified Items

(Open) Follow-up Item (317/84-09-04 and 318/84-09-04): Adequacy of procedures for testing air filtration systems. The licensee had completed some revisions to the surveillance test procedures appropriate to Unit 1 and Unit 2 common air filtration systems (i.e., Penetration Room Exhaust, ECCS Pump Room Exhaust, Containment Iodine Removal, Control Room Post-LOCI, and Spent Fuel Storage Pit). These changes included: requiring visual inspections of the filters, specifying the circumstances when flow distribution tests would be required; and providing instructions for testing the filter train using the fan with greatest flow.

The inspector noted that additional procedure changes were in progress including, indicating whether the test was perform d for a reason other than satisfying TS requirements, and specifying that two carbon samples must be taken to satisfy surveillance requirements.

(Closed) Follow-up Item (317/84-09-05 and 318/84-09-05). Accuracy of radwaste liquid effluent monitor when in high background environment. The inspector noted that count rates up to 19,000 cpm had occurred during liquid radioactive releases, while the average count rate was approximately 8,000 cpm. However, the high background count rate did not affect accuracy and the lower limit of detection was not exceeded during

the releases. Only on one occasion was a liquid release terminated, because the background radiation reading exceeded administrative controls that would ensure 10 CFR 20 concentration limits could be adequately determined. The licensee routinely decontaminates the liquid effluent monitor to prevent this situation.

Effluent Release Records

The inspector reviewed selected radioactive liquid and gaseous discharge permits, as well as associated procedures and calculations for 1985 and 1986 to date. The inspector was told that the licensee's Radiological Effluent Technical Specifications (RETS) were implemented on July 1, 1985; however the procedures governing releases were not fully revised until August 21, 1985. The licensee tracked both total dose and curies per quarter to satisfy the new requirements and previous requirements, respectively.

The inspector determined that no Technical Specification limits for gaseous or liquid effluents had been exceeded in 1985 or the first quarter of 1986. The inspector reviewed the hand calculations that were required prior to the implementation of RETS for determining curies released, as well as, the calculations for determining if RETS dose limits would be exceeded. Some math errors were noted by the inspector. The license stated that a computerized method was being developed to assist in the preparation, calculations and documentation for effluent permits.

The inspector also reviewed the Semiannual Radioactive Effluent reports for 1985, which were required by Technical Specification 5.6.1 b and presently by section 6.9.1.8. The inspector determined there were no abnormal releases and all liquid and gaseous releases were within Technical Specification limits. The inspector noted that the 1985 reports did not include the strontium results and that the liquid release limits for the second half of 1985 were calculated using the simplified ODCM. The detailed calculation will follow in a supplement report.

Chemistry Surveillances

The inspector reviewed licensee documentation and verified sampling locations to determine if liquid and gaseous effluent sampling and analysis was being conducted as required by Technical Specification Tables 4.11-1 and 4.11-2. Routine chemistry surveillances were documented and reviewed weekly to ensure all required sampling and radionuclide analyses were performed. Final review of the completed verification forms included the chemistry manager's approval. The liquid composite sampler was noted not to be operational, but grab samples were being withdrawn.

The inspector reviewed analysis records for completion covering the period January 1985 through February 1986. All required analyses were completed.

Effluent Monitor Calibration and Functional Checks

The inspector examined the liquid and gaseous effluent monitor calibration and functional test records to determine compliance with Technical Specification Table 4.3.11 and 4.3-12. The inspector determined that the monitors were all calibrated and tested in accordance with specifications and related preventative maintenance procedures. However, the inspector noted that these monitors were not calibrated in accordance with surveillance test procedures. The licensee stated that they were drafting these procedures to comply with the RETS, which were effective July, 1985. The licensee further stated that the monitors, which have a calibration frequency of 18 months, have not been required to be calibrated under the surveillance program. The inspector noted that the liquid radwaste effluent line monitor, which was calibrated November, 1985 using the preventative maintenance procedure, should have been tested under the licensee's surveillance program. The inspector noted the licensee's position as a lack of thoroughness in the implementation of the RETS.

Radioactive Waste System Operations

The inspector toured the reactor coolant waste panel located in the auxiliary building and discussed system operation with cognizant licensee personnel. In addition, the following procedures were reviewed:

OI-17B, Revision 16, "Waste Gas System"
OI-17C, Revision 16, "Waste Processing System"
RCP-601, Revision 13, "Radioactive Liquid Waste Permits".

The inspector observed that the waste processing system was generally being maintained and maintenance requests for instrumentation that was out-of-service were typically less than two months. However, the compositor for the liquid effluent line was noted to be out-of-service since November, 1985. The licensee stated that a new compositor had been ordered and grab sampling was being performed in accordance with the required action statement.

The inspector also reviewed the nuclear plant operator and control room operator logs associated with the radwaste processing systems. Personnel received training in the requalification program detailing radioactive waste systems, drawings and procedure changes. The inspector noted there was some confusion concerning what monitor on the Steam Generator Blowdown was designated in the Technical Specification for related surveillances, channel checks and action statements. The licensee stated there was some misunderstanding by some operations personnel because monitor RE-4014 was a recent (October, 1985) change to the ODCM. The inspector also noted that sheet seven of the CR operator log had not been revised to ensure the channel check was being performed for this specific monitor. A general statement concerning operability of the RMS panel monitor was the

mechanism by which the surveillance had been performed. This lack of thoroughness in the implementation of the RETS was also noted in the calibration procedures as discussed in this report.

In-Place Filter Testing

The inspector reviewed the licensee's air filtration system testing with regard to the Technical Specifications requirements. The testing of the air filtration systems was conducted by the Electrical and Controls Department, with the exception of laboratory testing of carbon adsorber filters, which is performed by a contractor. The inspector reviewed the Surveillance Test Procedures (STPs) appropriate to Unit 1, Unit 2, and Common air filtration systems that are required by Technical Specifications (Penetration Room Exhaust, ECCS Pump Room Exhaust, Containment Iodine Removal Control Room Post-LOCI, and Spent Fuel Pool). In addition, the contractor laboratory results were reviewed for 1985.

Within the scope of this review, the following violation was identified:

Technical Specifications 4.6.3.1, 4.6.6.1, 4.7.6.1, 4.7.7.1 and 4.9.12 require, in part, that a laboratory analysis of a carbon sample from either at least one test canister or at least two carbon samples removed from one of the charcoal adsorbers demonstrates a removal efficiency of ≥ 90% for radioactive methyl iodide.

Contrary to the above, laboratory results and completed surveillance procedures for 1984-1985, indicated that only one carbon sample had been removed and tested for demonstration of removal efficiency for radioactive methyl iodine.

The inspector noted that test canisters were not used to perform the carbon sampling. The licensee stated during a telephone conversation on March 11, 1986 that only one carbon sample had been withdrawn for each surveillance since 1980. The licensee initiated a temporary procedure change to ensure two samples would be removed, in accordance with the Technical Speicfications.

Failure to adhere to the sampling methods of the surveillance requirements constitutes an apparent violation of Technical Specifications 4.6.3.1, 4.6.6.1, 4.7.6.1, 4.7.7.1 and 4.9.12. (317/86-05-01; 318/86-05-01)

Audits

The inspector reviewed audits of the licensee's chemistry and radioactive effluents controls area performed by the Quality Assurance Department. Specifically the following audits were reviewed: Audit TS-33-85 dated November 26, 1985 which covered the Technical Specifications including radioactive effluents; Audit 18-10-85 dated April 10, 1985 which covered chemistry; and Audit 3/19-5-85 dated March 6, 1985 which covered radio-

active waste and environmental monitoring. The above reviewed audits were performed by team members with experience commensurate with the scope and complexities of the activities audited. Discussions with QA Department personnel indicated that audits attempt to assess the quality of the programs audited, and the licensee is attempting to strengthen the technical expertise of the audit staff to further assess program quality. The inspector had no further questions in this area. No violations were identified.

Confirmatory Measurements

During the inspection, liquid, particulate filter, charcoal cartridge, and gas samples were split between the licensee and NRC for the purpose of intercomparison. Where possible, the split samples are actual effluent samples, or inplant samples which duplicate counting geometries used by the licensee for effluent sample analyses. The samples were analyzed by the licensee using normal methods and equipment and by the NRC:I Mobile Radiological Measurements Laboratory. Joint analyses of actual effluent samples are used to verify the licensee's capability to measure radioactivity in effluent samples with respect to Technical Specification requirements and other regulatory requirements.

In addition, a liquid effluent sample was sent to the NRC reference laboratory, Department of Energy, Radiological and Environmental Sciences Laboratory (RESL), for analyses requiring wet chemistry. The analyses to be performed on the sample are Sr-89, Sr-90, gross alpha, and tritium. The results will be compared with the licensee's results when received at a later date and will be documented in a subsequent inspection report.

The results of an effluent sample split between the Licensee and NRC Region I during a previous inspection on April 23-27, 1984 (Inspection Reports 50-317/84-09 and 50-318/84-09), were also compared during this inspection. Based on the results of the comparison, it appears that the sample was poorly split causing the results to be of limited value. The cause of the poor sample split could not be unequivocally determined. The inspector discussed the need for more representative sample splits during measurement comparison.
The results of the sample measurements comparison completed during this inspection indicated agreement. The results of the comparisons are listed in Table I and the agreement criteria are included as Attachment I.

The initial main vent gas sample split resulted in disagreement for the Xe-133 value. The disagreement was due to the manner in which the samples were obtained. Initially the technician purged the line, took the licensee's sample and purged the line once again before taking the NRC sample. This delay may have caused a non-uniform split. The inspector stated that a more uniform sample might be obtained if the two containers were placed in series. The technician performed the second split in series and the results of the Xe-133 comparison were in agreement.

Laboratory QA Program

The inspector performed a selected review of the licensee's program for the quality assurance of radioanalytical mesurements made by the Chemistry Department. The review was performed with respect to criteria contained in the following:

- Regulatory Guide 4.15, "Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment."
- Principles of Quality Assurance of Chemical Measurements (National Bureau of Standards).

The inspector reviewed the following procedures:

• RCP-1-1003, Rev. 0	Determination of Reactor Coolant Isotopic Actvitity
• RCP-1-1006	Radiochemical Analysis Determination of Sr Activity
• RCP-1-1007, Rev. 10	Radiochemical Analysis Determination of Tritium Activity
• RCP-1-1008, Rev. 2	Determination of Corrosion Product activity
• RCP-1-1009, Rev. 7	Radiochemical Procedure for Determination of E-Bar
• RCP-1-1010, Rev. 3	Evaluation of Gamma Spectra
• RCP-2-101, Rev. 6	Calibration and Operational Check of Ge (Li)
• RCP-2-102, Rev. 1	Operation of ND 6620 System
• RCP-1-103, Rev. 8	Quality Assurance Program
• RCP-2-302, Rev. 6	Liquid Scintillation Counting System

The inspector also reviewed the following quality control data:

- weekly efficiency check data for ND1 and ND2 for the period January 1985 - December 1985.

- daily energy calibration check data and control charts for the period January 1985 - August 1985, for ND1 and ND2.

- monthly resolution check for ND1 and ND2 for the period January 1985 - December 1985.

- weekly and monthly contamination checks for ND1 and ND2 for the period January 1985 - December 1985.

Within the scope of this review the following concerns were identified:

- The data for the weekly efficiency checks and monthly resolution checks are not plotted on control charts. The licensee appears to be collecting the data but not using the information. For example, the monthly resolution checks indicated that the resolution of the detectors frequently lies outside the specifications set by the licensee. The licensee explained that their limits are based on specifications provided by the manufacturer, which are unrealistic. The manufacturer determines the resolution in an "ideal" environment and the values are not attainable in the licensee's laboratory. Consequently the licensee apparently anticipates resolution values to be outside the limits and takes no corrective action. The inspector discussed with the licensee the value of establishing realistic limits for resolution checks as well as corrective actions for out of specification conditions.

- Presently the licensee does not participate in any interlaboratory comparisons for radioanalytical measurements. The inspector discussed this matter with the licensee, indicating that interlaboratory comparisons are an essential component of a good laboratory quality assurance program. The licensee stated that they are currently reviewing literature from vendors marketing intercomparison programs. The licensee indicated that they will participate in a program, but have not yet determined specifics.

- The licensee does not use a statistical curve fitting method for chemical calibration curves. During calibration the licensee performs several trials to establish each data point. By this method the licensee is able to calculate the uncertainty associated with each data point. As a result the licensee has very good data to use in establishing its calibration curves. However, the inspector stated that the licensee does not make the best use of the data since they do not apply curve fitting. With the data available the licensee could even apply a weighted least squares fit to the curve. The licensee stated that since the data is already generated during the calibration process that they would make better use of it with curve fitting.

The licensee indicated that the Quality Assurance Program procedure (RCP-1-103) is currently under revision. The revision will include improvements in the areas of interlaboratory comparisons, control charts, and the use of statistical curve fitting methods for chemical calibration curves. These areas will be reviewed during a subsequent inspection (317/86-05-02; 318/86-05-02).

Whole Body Counting Program

During this part of the inspection the capability of the licensee to adequately perform radiological bioassay using a whole body counting system was reviewed. A whole body counting phantom containing radioactive sources traceable to the National Bureau of Standards (NBS) was submitted to the licensee for analysis. The phantom duplicated the nuclides and the organ burdens that the licensee might encounter during normal operation. The phantom was analyzed using the licensee's routine methods and equipment.

Results Comparison

The licensee currently has two whole body counting systems: a Helgeson system which uses a stationary bed and a moving detector, and a standup lung counter which was designed and constructed by the licensee. A terminal printer at the whole body counting facility provides an interim output of whole body counting results for the Helgeson system. Whole body counting results of record, using a more complete algorithm, are provided by Helgeson periodically in a written report. The licensee's standup counting system is routinely used for screening purposes; if the presence of radioactivity is indicated using this system, the individual is then counted on the Helgeson system. However, the standup system has been used for measurements when the Helgeson system was inoperable.

The NRC phantom was counted in both systems by the licensee. The results with the sources in the lungs are based on an average of five measurements. Table II contains the results of the intercomparisons. Based on these results, no violations were identified in this area.

Procedures and Data

The inspector reviewed the licensee's procedure for the operation of the Helgeson whole body counting system; RSP 3-302, Whole Body Counter Operations. This procedure also includes the whole body counting QA program for the Helgeson system. The licensee performs a source check once per shift, performs a lung phantom source check once per week, and performs daily backgrounds as part of the QC program on the Helgeson system. The daily backgrounds are plotted, as are the shift source check peak channel (gain), and the daily Am-241 peak channel and gross counts. (The detector contains an Am-241 source.) The inspector reviewed selected QA data for 1985 and 1986 to date. The licensee plots the daily background data, but

uses plus or minus one sigma as the control limits. Therefore, approximately one-third of the background data is outside the control limits, yet the licensee has taken no action to correct these out of control results. The inspector discussed with the licensee the generally accepted practice of using plus or minus two sigma as warning limits and plus or minus three sigma as control limits on control charts. The inspector also reviewed the QA data maintained by Helgeson. This includes Am-241 gain, K-40 gain, Am-241 and K-40 resolution, integral under the Am-241 photo peak, and background, all on control charts.

The inspector noted that the licensee had no written approved procedure for operation of the standup counting system. This counting system had been in service from April, 1985 to the present time. The inspector stated that Section 6.1.8a of the Technical Specifications requires the applicable procedures of Appendix A of Regulatory Guide 1.33, Revision 2, February 1978. Regulatory Guide 1.33, Revision 2, February 1978 requires bioassay procedures. The inspector stated that the failure to have a written approved operating procedure for the standup counter was a violation of the Technical Specification requirements. The QA program for the standup counter which also is not documented consists of daily backgrounds and source checks.

The background results are plotted on control charts with again the one sigma control limits, and the source check data are not plotted. The inspector discussed the value of plotting the daily source check data on control charts with the licensee. The inspectors stated that the use of appropriate warning and control limits on control charts, and the plotting of daily source check results on control charts for the standup counter would be follow-up items. (317/86-05-03; 318/86-05-03).

The calibration of the standup counter is performed using a phantom constructed by the licensee with radioactive sources prepared by the licensee's chemistry department.

The inspector had no further questions in this area.

Exit Interview

The inspector met with the licensee representatives (denoted in Section 1) at the conclusion of the inspection on March 7, 1986. The inspector summarized the purpose, scope and findings of the inspection. At no time during this inspection was written material provided to the licensee by the inspector.

Attachment I

Criteria for Comparing Analytical Measurements - Table I only

This attachment provides criteria for comparing results of capability tests and verification measurements. The criteria are based on an empirical relationship which combines prior experience and the accuracy needs of this program.

In these criteria, the judgment limits are variable in relation to the comparison of the NRC Reference Laboratory's values to its associated uncertainty. As that ratio, referred to in this program as "Resolution", increased the acceptability of a licensee's measurement should be more selective. Conversely, poorer agreement must be considered acceptable as the resolution decreases.

$$\text{Resolution} = \frac{\text{NRC REFERENCE VALUE}}{\text{REFERENCE VALUE UNCERTAINTY}} \qquad \text{RATIO} = \frac{\text{LICENSEE VALUE}}{\text{NRC REFERENCE VALUE}}$$

Resolution	Agreement
<3	0.4 - 2.5
4 - 7	0.5 - 2.0
8 - 15	0.6 - 1.66
16 - 50	0.75 - 1.33
51 - 200	0.80 - 1.25
>200	0.85 - 1.18

TABLE 1

CALVERT CLIFFS VERIFICATION TEST RESULTS

SAMPLE	ISOTOPE	RESULTS IN uCi/cc		COMPARISON
		NRC VALUE	LICENSEE VALUE	
12 WGDT 3/6/86 1130 hrs.	Xe-133	1.704 ± 0.002	1.735 ± 0.003	Agreement
	Xe-131m	(1.6 ± 0.2)E-2	(2.4 ± 0.2)E-2	Agreement
	Xe-133m	(6.6 ± 0.2)E-3	(5.8 ± 0.3)E-3	Agreement
Unit 1 Main Vent 3/6/86 1100 hrs.	Xe-133	(8 ± 3)E-8	(8 ± 2)E-8	Agreement
Unit 1 RCS 3/5/86 1137 hrs.	I-131	(3.69 ± 0.06)E-2	(3.49 ± 0.02)E-2	Agreement
	I-132	(5.82 ± 0.10)E-2	(5.82 ± 0.05)E-2	Agreement
	I-133	(6.37 ± 0.08)E-2	(5.94 ± 0.03)E-2	Agreement
	I-134	(9.0 ± 0.4)E-2	(8.57 ± 0.11)E-2	Agreement
	I-135	(7.8 ± 0.3)E-2	(8.08 ± 0.12)E-2	Agreement
12 RCWMT 3/4/86 1309 hrs.	I-131	(2.69 ± 0.13)E-6	(2.5 ± 0.2)E-6	Agreement
	Co-58	(1.46 ± 0.10)E-6	(1.5 ± 0.2)E-6	Agreement
	Cs-134	(3.62 ± 0.15)E-6	(3.8 ± 0.3)E-6	Agreement
	Cs-137	(8.3 ± 0.2)E-6	(8.1 ± 0.3)E-6	Agreement
	Sb-125	(3.9 ± 0.3)E-6	(3.7 ± 0.5)E-6	Agreement
Unit 2 Maint Vent Charcoal Cartridge 2/27/86 1830 hrs.	I-131	(1.54 ± 0.13)E-11	(1.44 ± 0.02)E-11	Agreement
Unit 1 Main Vent Charcoal Cartridge 2/27/86 2010	I-131	(1.06 ± 0.12)E-11	(8.7 ± 0.2)E-12	Agreement
Crud Filler Unit 1 RCS 3/5/86	Cs-137	(1.1 ± 0.2)E-3	(8.0 ± 0.5)E-4	Agreement
	Co-58	(4.9 ± 0.3)E-3	(4.8 ± 0.1)E-3	Agreement
	Cs-134	(6.2 ± 1.5)E-4	(5.2 ± 0.5)E-4	Agreement

TABLE II

Isotope	Organ	NRC Value	Licensee Value	Licensee Value / NRC Value
		RESULTS IN TOTAL NANOCURIES		
Type of Counting System: Helgeson-Preliminary				
Co-60	Lung	76 ± 9	88.8 ± 1.1	1.17 ± 0.14
Cs-137	Lung	95 ± 9	107 ± 2	1.13 ± 0.11
Type of Counting System: Helgeson-Final				
Co-60	Lung	76 ± 9	84.8 ± 1.1	1.12 ± 0.13
Cs-137	Lung	95 ± 9	104 ± 2	1.09 ± 0.11
Type of Counting System: Standup Counter				
Co-60	Lung	76 ± 9	78 ± 1	1.03 ± 0.12
Cs-137	Lung	95 ± 9	61.2 ± 0.8	0.64 ± 0.06