U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-245/85-23
50-336/85-28
50-423/85-47

Docket No. 50-245
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50-423

License No. DPR-21 - C
DPR-65 - C
CPPR-113 Priority - Category B

Licensee: Northeast Nuclear Energy Company
P.O. Box 270
Hartford, Connecticut 06141-0270

Facility Name: Millstone 1, 2, 3

Inspection At: Waterford, CT and Berlin, CT

Inspection Conducted: August 5-9, 1985

Inspectors: Jean A. Cioffi — 9/9/85
Jean A. Cioffi, Radiation Specialist, PWR Rad Safety Section — date

Jean A. Cioffi for — 9/9/85
Jayon Jang, Radiation Dosimetry Specialist — date

Approved by: M. Shanbaky — 9/11/85
M. Shanbaky, Chief, PWR Radiation Safety Section — date

Inspection Summary: Inspection on August 5-9, 1985 (Combined Report No. 50-245/85-23; 50-336/85-28; 50-423/85-47).

Areas Inspected: Special, unannounced inspection of the licensee's dosimetry program. Areas reviewed included: status of previously identified items, organization, personnel selection, facilities and equipment, calibrations, dose assessment, quality assurance, documentation and recordkeeping, comparison of the licensee's environmental TLDs with NRC, and an independent performance test.

Results: Within the areas inspected, no violations were identified.

DETAILS

1.0 Personnel Contacted

*J. Waters, NNECo Chemistry Supervisor
*E. Laine, NNECo Radiation Protection Supervisor
*W. Romberg, NNECo Station Superintendent
G. Baskette, Dosimetry Laboratory Supervisor
B. Robinson, Assistant Radiation Protection Support Supervisor
*H. Siegrist, Supervisor, Radiological Protection
J. Sullivan, Health Physicist
G. Closius, QA/QC Supervisor

*denotes attendance at exit meeting.

2.0 Status of Previously Identified Items

2.1 (Closed) Follow-up (245/83-04-01). Review TLD/PIC (pocket ion chamber) Discrepancy Reports. The inspector reviewed a sample of TLD/PIC discrepancy reports for 1985, and observed that the cause of the discrepancy and the corrective actions taken were clearly stated on all reports reviewed. This item is closed.

2.2 (Open) Follow-up (423/85-19-04) Status of procedures for start-up surveys. The licensee has identified the following to be incorporated into the start-up survey procedures:

- measure neutron spectrum in various areas of containment to determine neutron spectrum factors;
- evaluate actual instrument response to the expected response for subatmospheric containment conditions;
- develop radiation dose rate data base for pre-determined areas of containment at various power levels. Compare instrument response and TLD response at these areas;
- develop a program for surveying unsealed penetrations in the containment shield wall, and a means to clearly document the survey results;
- evaluate the response of various survey instruments and TLDs to N-16 gammas;
- Perform and document shield surveys at the required power levels;
- Compare response of portable survey instruments to fixed area monitors.

This item remains open pending completion of the start up survey procedures.

2.3 (Open) Follow-up (423/85-19-06). Supplies of alpha count ratemeters. The licensee has submitted a change to the FSAR, Chapter 12.5, and to Tables 12.5-1 and 12.5-2 to more accurately describe the numbers and types of instrumentation available at the Millstone site. This item will remain open pending acceptance of the FSAR amendment by NRR.

2.4 (Open) Follow-up (423/85-19-07). Supplies of PICs per FSAR commitments. As stated above, the licensee has submitted a change to the FSAR to more accurately describe the numbers of equipment available to Unit 3. This item will remain open pending acceptance of the FSAR amendment by NRR.

2.5 (Closed) Follow-up (423/85-19-09). Review procedures 4909 and 4905 for revisions. The inspector reviewed the pertinent sections of both procedures and determined that the procedures had been appropriately revised to address the initial concerns raised. The licensee has addressed beta counting efficiencies for counting swipes in a covered configuration and the calculation to determine alpha activity has been corrected in procedure SHP 4905. Procedure SHP 4909 now specifies which personnel decontamination tasks are to be performed by Health Physics and which tasks should be performed only by medical personnel. Also, the steps to decontaminate individuals has been revised to require medical supervision with more caustic methods.

3.0 Organization

The responsibility for the Millstone dosimetry program is assigned to the Radiation Protection Support Group under the site Health Physics Supervisor. This department provides dosimetry services to support Units 1, 2, and 3. Dosimetry processing is performed by the staff assigned to the Supervisor, Radiological Protection in the Radiological Assessment Branch at the corporate office in Berlin, Connecticut.

4.0 Selection and Qualification of Dosimetry Laboratory Personnel

The inspector reviewed procedure number 1.3, "Dosimetry Laboratory Training and Program," and selected records of dosimetry laboratory personnel. Position description for all personnel were available and clearly defined. All personnel had met the minimum qualification for their positions.

Corporate dosimetry laboratory personnel training and retraining records were reviewed. All personnel had met the initial training and retraining requirements for the department.

5.0 Facilities and Equipment

The inspecto s toured the facility used by the licensee for the processing of personnel dosimetry. The licensee uses three Model 9100 Teledyne readers to process its whole body dosimeters. Information

from the Model 9100 readers is entered directly into an IBM series 1 computer which converts light output to dose via dose conversion factors and individual TLD response factors (similar to element correction factors). The IBM series 1 prints out a hard copy of the TLD processing results, which is reviewed by the staff in the Radiological Assessment Branch. After the data review is completed, the TLD processing results are manually inserted onto an IBM 370 computer into the Helpore system, which provides dosimetry results to the Millstone site for personnel.

The licensee uses the Teledyne calcium sulfate, dysprosium-doped ($CaSO_4$: Dy) TLD for personnel monitoring of beta and gamma doses. The holder of the TLD is designed to provide four individually shielded areas to determine dose. The design is as follows:

Area	Filtration (milligrams per square centimeter)
1	7 (mylar)
2	300 (plastic)
3	>300 (aluminium, copper)
4	>300 (cadmium, copper)

The licensee determines deep dose using areas 3 and 4 of this dosimeter. Areas 1 and 2 are used to assign shallow dose. A cesium-137 calibration source is used to characterize response under each area of filtration. These response factors are evaluated every two years.

The licensee monitors neutron exposures by providing an additional TLD to the badge holder. The additional TLD consists of natural lithium fluoride blended into the $CaSO_4$: Dy phosphor ($^6LiF/CaSO_4$:Dy). The holder is mounted onto a belt for use as an Albedo dosimeter. Areas 3 and 4 of the double card badge are used to measure neutron dose by subtracting the gamma dose from the $CaSO_4$:Dy badge.

The licensee uses lithium fluoride disks mounted in finger rings for extremity monitoring. A Teledyne model 7300 reader is used to read the disks. Information is processed in the same manner as the whole body badges.

Self-reading pocket dosimeters are assigned to workers to use to monitor their doses during work activities. In addition, the data from self-reading dosimeters are recorded on radiation work permits (RWP) and used by the ALARA group to determine the dose received during particular jobs.

The dosimetery laboratory is located away from the Millstone site. This will ensure that dosimetry processing will not be affected in the event of an emergency.

6.0 Calibrations

The licensee performs his own calibrations with a Cs-137 source (J. L. Shepherd Model 89), mounted in a J. L. Shepherd Model 78-2M Calibrator (dimension 16"x 25" x 16"), complete with a Series 154 Attenuator System. The inspector observed licensee representatives performing a calibration and noted that a Victoreen R-chamber was used to measure the delivered exposure. The inspector discussed the calibration of the R-chamber with the licensee and determined that each R-chamber was calibrated as required.

The readout device did not accurately indicate the delivered dose due to a narrow instrument scale covering a wide range of exposure. It appears that the R-chamber readout scale may contribute to additional systematic error during the calibration process. The inspector discussed with licensee representatives the total uncertainty associated with this calibration method. The licensee's cognizant individual was not available during this inspection and the licensee personnel present were unable to retrieve any studies or information clarifying the uncertainties associated with this method. The inspector stated that this matter will be re-examined during a future inspection. (245/85-23-01; 336/85-28-01; 423/85-47-01).

7.0 Quality Assurance/Quality Control

The inspector discussed with the licensee the quality control program for the dosimetry laboratory. The licensee processes two badges pre-irradiated to a known dose for every 50 dosimeters processed, as part of their laboratory QC program. A special review group of the Radiological Assessment Branch reviews all data before it is entered into the Helpore system to check for anomalous data. A computer file is kept of all badges and readings to track faulty TLD performance.

The Radiological Assessment Branch conducts monthly quality assurance audits of the dosimetry processing facility. The inspector reviewed two monthly audits and found that the content of the audits addressed the performance of the readers and the TLDs using the National Voluntary Laboratory Accreditation Program (NVLAP) criteria.

The licensee participates in an interlaboratory comparison program with University of Michigan semi-annually for their neutron dosimetry and annually for accident dosimetry.

A trending program has been established by the corporate analyst for the dosimetry program on a quarterly basis. The inspector reviewed the Dosimetry Laboratory Trends Analysis Report for the first quarter of 1985 and found that it contained extensive trending studies on the dosimetry used at the Millstone site. It appears that this trend analysis program will be a valuable tool for the licensee to use to measure adequate and deficient performance of the dosimetry.

The Millstone site conducts a quality assurance program of dosimetry under station procedure HP 941/2941/3941, "Performance Audits for Personnel Monitoring Equipment." Under this procedure the licensee irradiates 50 dosimeters to known doses and sends these dosimeters with the monthly personnel badges for processing. The inspector examined selected records of these spiked samples and found that for January, 1985 and May, 1985, discrepant data were identified for badges spiked with beta doses. Section 6.4 of this procedure states that "if the reported results are unacceptable, a written investigation shall be completed and filed." Licensee representatives present at the time of the inspection were unable to provide the inspector with copies of the required investigations. This matter will remain unresolved pending further review by the NRC (245/85-23-02; 336/85-28-02; 423/85-47-02).

Section 5.1.2 of the procedure HP 941/2941/3941 describes performance tests for self-reading dosimeters (PICs) in fields of high energy photons and fast neutrons. This data was also not available, and will be reviewed in a future inspection (245/85-23-03; 336/85-28-03; 423/85-47-03).

The licensee sets out extra badges in various areas of the plant to monitor background conditions, especially in badge storage areas, such as the Primary Access Point, and the North Access Point. These badges are sent with the personnel badges and the spiked badges to the Dosimetry Processing laboratory. Site personnel track these blank badges and trend the background readings in these areas. However, this practice is not described and controlled in any procedure. The licensee stated that they will incorporate the use of these blank badges as another quality assurance measurement into Procedure HP 941/2941/3941. This will be reviewed in a future inspection (245/85-23-04; 336/85-28-03; 423/85-47-03).

8. Dose Assessment

8.1 Minimum Reportable Dose

The inspector reviewed the following procedures to identify parameters to calculate the minimum reportable dose (MRD):

4.8 Manual Calculation of Beta-Gamma Dose, Rev. 2, April 1985
4.9 Manual Calculation of Neutron Dose, Rev. 2, April 1985

The inspector noted that the licensee did not apply the necessary confidence levels to the calculation of the MRDs. Due to the absence of the cognizant individual, the inspector was unable to obtain more information. The inspector stated that the accuracy of the statistical determination of the MRDs will be examined during a future inspection (245/85-23-05; 336/85-28-05; 423/85-47-05).

8.2 Dose Assessment

A daily assignment of deep dose is entered into the Helpore system by station health physics prsonnel based on pocket ion chamber (PIC) readings. These dose assignments are replaced monthly by TLD deep dose readings. If the TLD readings and PIC readings differ by more than ±25% on doses greater than 150 millirems, the Helpore system generates an Exception report, flagging any individuals with discrepancies between the TLD and PIC readings. The site dosimetry supervisor investigates all Exception reports. All investigations are filed in the individual's personnel dose file.

Extremity and neutron dosimetry is issued to personnel based on RWP requirements. Any neutron doses measured are added to the whole body dose.

9.0 Documentation and Recordkeeping

The inspector reviewed the licensee's methods for documenting its dosimetry processing, dose assessment, quality control program, and personnel dose histories. Licensee representatives stated that all raw data, dose records of dose assessments and personnel dose histories will be maintained indefinitely.

The inspector reviewed the licensee's program for providing required termination reports for monitored individuals. Selected instances of terminations of contractor and licensee employees were examined and in each instance, the required termination reports had been provided.

No violations were identified.

10.0 Environmental Dosimetery

The U.S. Nuclear Regulatory Commission (NRC) Direct Radiation Monitoring Network is operated by the NRC (Region I) to provide continuous measurement of the ambient radiation levels around nuclear power plants, (70 sites) throughout the United States. Each site is monitored by arranging approximately 30 to 50 thermoluminescent dosimeter (TLD) stations in two concentric rings extending to about five miles from the power plant. The monitoring results are published in NUREG-0837 quarterly.

One of the purposes of this program is to serve as a basis of comparison with similar programs conducted by individual utilities which operate nuclear power plants. Therefore, four NRC TLDs are co-located with each licensee's TLD stations.

During this inspection the monitoring results of co-located TLDs were compared and the results are listed in Table 2. Table 1 describes the NRC TLD location around the Millstone Nuclear Power Plant.

All NRC exposures are normalized to a 90-day quarter and reported in units of milliroentgens (mR), and uncertainties are the total uncertainty (random and systematic uncertainties).

The licensee monitors the environmental radiation levels monthly using the EG&G TLD System (CaF_2:Mn) and reports in units of microroentgen per hour. The inspector converted the results to milliroentgen per 90 days and the results are shown in Table 2.

The NRC's monitoring results of the first quarter of 1984 are lower than the licensee's results. The low results were due to the high transit dose for the NRC dosimeters. It was suspected that the NRC's contractor did not handle control TLDs properly.

The NRC TLDs are placed about 10 ft. above the ground but the licensee's TLDs are placed 4 ft. above the ground. Although there are differences between the NRC and the licensee's programs, results are generally in good agreement.

11.0 Independent Performance Test

The inspector arranged to have 50 of the licensee's personnel dosimeters sent to Idaho National Engineering Laboratory for a test of their performance. The results of this performance test will be provided in a future inspection report.

12.0 Unresolved Item

Unresolved items are matters about which more information is required in order to ascertain whether they are acceptable items, items of noncompliance, or deviations. An unresolved item disclosed during this inspection is discussed in Paragraph 7.

13.0 Exit Interview

The inspector met with licensee representatives (denoted in Section 1) on August 9, 1985. 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.

Table 1. Co-location of the TLD Station

NRC	Millstone	Location	Description
4	11	ENE, 60°, 1.7 mi.	New London Country Club
5	10	E, 85°, 1.3 mi.	Pleasure Beach Fire Station
11	55B	SW, 232°, 2.5 mi.	Old Black Point Road
12	54B	WSW, 256°, 2.4 mi.	Billow Road Black Point

TABLE 2 - ENVIRONMENTAL MONITORING RESULTS (mR/90 days)

TLD Station: NRC Station Number/Millstone Station Number

Monitoring Period		4/11	5/10	11/55B	12/54B
1st QTR 1983	NRC(1)	11.8 ± 1.8	14.0 ± 2.1	13.2 ± 2.0	14.1 ± 2.1
	Millstone (2)	16.6 ± 1.7	18.4 ± 1.8	15.7 ± 1.6	18.2 ± 1.8
2nd QTR 1983	NRC	15.4 ± 3.0	16.4 ± 3.2	14.1 ± 2.9	TLD Missing
	Millstone	16.4 ± 1.6	17.9 ± 1.8	15.8 ± 1.6	18.1 ± 1.8
3rd QTR 1983	NRC	12.5 ± 6.1	13.1 ± 6.2	11.2 ± 5.9	12.8 ± 6.1
	Millstone	17.9 ± 1.8	19.3 ± 1.9	16.6 ± 1.7	19.2 ± 1.9
4th QTR 1983	NRC	16.8 ± 3.8	18.5 ± 4.0	16.1 ± 3.7	18.2 ± 4.0
	Millstone	16.7 ± 1.7	17.9 ± 1.8	15.6 ± 1.6	18.0 ± 1.8
1st QTR 1984	NRC (3)	9.7 ± 4.4	11.0 ± 4.6	9.5 ± 4.4	11.8 ± 4.7
	Millstone	16.7 ± 1.7	18.5 ± 1.9	16.0 ± 1.6	18.4 ± 1.8
2nd QTR 1984	NRC	18.1 ± 2.7	20.5 ± 3.1	18.6 ± 2.8	20.1 ± 3.0
	Millstone	17.2 ± 1.7	18.9 ± 1.9	16.9 ± 1.7	19.1 ± 1.9
3rd QTR 1984	NRC	17.6 ± 3.5	18.0 ± 3.5	16.5 ± 3.3	18.7 ± 3.6
	Millstone	17.5 ± 1.8	18.7 ± 1.9	16.4 ± 1.6	18.7 ± 1.9
4th QTR 1984	NRC	17.0 ± 5.3	18.7 ± 5.5	16.7 ± 5.3	19.5 ± 5.6
	Millstone	19.1 ± 1.9	19.9 ± 2.0	17.7 ± 1.8	20.8 ± 2.1
1st QTR 1985	NRC	18.3 ± 2.7	19.8 ± 3.0	18.1 ± 2.7	20.8 ± 3.1
	Millstone	17.9 ± 1.8	18.9 ± 1.9	16.9 ± 1.7	19.4 ± 1.9

(1) NRC: mR ± total uncertainty, Panasonic TLD System ($CaSO_4$:Tm), Monitoring Quarterly
TLDs are placed about 10 ft. above the ground.

(2) Millstone; mR ± total Uncertainty (Reporting Unit is uR/hr. All results were converted to mR/90 days)., EG&G TLD System (CaF_2:Mn), Monitoring Monthly. TLDs are placed 4 ft. above the ground.

(3) Low results were due to the high transit dose. The transit dose was 11.5 mR/90 days.