U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-219/94-04

Docket No. 50-219

License No. DPR-16

Licensee: GPU Nuclear Corporation
P.O. Box 388
Forked River, New Jersey 08731

Facility Name: Oyster Creek Nuclear Generating Station

Inspection At: Forked River, New Jersey

Inspection Conducted: January 31- February 3, 1994

Inspector: Jason C. Jang 2-9-94
Jason C. Jang, Senior Radiation Specialist Date
Effluents Radiation Protection Section (ERPS)
Facilities Radiological Safety
and Safeguards Branch (FRS&SB)

Approved by: Judith A. Joustra 2/10/94
Judith A. Joustra, Chief, ERPS, FRS&SB, Date
Division of Radiation Safety and Safeguards

Areas Inspected: Announced safety inspection of the projected dose calculation capability from radioactive liquid and gaseous effluent releases.

Results: Within the areas inspected, the licensee implemented a good projected dose calculation. No safety concerns or violations of NRC requirements were identified.

DETAILS

1.0 Individuals Contacted

1.1 Licensee

* P. Cooper, Manager, Plant Chemistry
* W. Cooper, Manager, Radiological Engineering
* B. Demerchant, Licensing Engineer
* S. Levin, Director, Operation and Maintenance
* J. Mockridge, Staff Chemist
* P. Schwartz, Senior Environmental Scientist
* R. Stoudnour, Chemistry Engineer
* J. Vouglitois, Manager, Environmental Controls

1.2 NRC

* L. Briggs, Senior Resident Inspector
* J. Joustra, Section Chief, Effluents Radiation Protection Section, Region I

* Attended the exit meeting on February 3, 1994.

2.0 Purpose

The purpose of this inspection was to verify the licensee's capability to calculate projected offsite radiation doses from radioactive liquid and airborne (noble gases and particulates) effluent releases during normal operation.

3.0 Responsibility and Procedures

The Chemistry Department had the responsibility for calculating projected offsite doses, using its Offsite Dose Calculation Manual (ODCM) methodology, to control actual effluent releases. The ODCM contained many conservative parameters in order to ensure that effluent release limits would not be exceeded.

The inspector reviewed the licensee's procedure, Number 820.1, "ODCM Dose Assessment", as part of the inspection of the implementation of the Technical Specification and the ODCM requirements. The inspector noted that this procedure was well written to allow performance of all necessary steps. The inspector had no further questions in this area.

4.0 PCDOSE Code

The PCDOSE code was developed by Idaho National Engineering Laboratory (EG&G Idaho, Inc.) for the U.S. Nuclear Regulatory Commission. The code was designed to calculate the maximum projected radiation dose to an individual and the average dose to the population due to radionuclides released in radioactive liquid and airborne effluent releases from a nuclear power plant. The code was designed for normal operation rather than for emergency situations. The code was developed from the methodology found in both NUREG-0133 and Regulatory Guide 1.109 (Revision 1). The PCDOSE code serves as a basis for comparison of similar programs conducted by individual utilities which operate nuclear power plants.

5.0 Verification of the Projected Dose Calculation Program

During this inspection, the inspector conducted intercomparisons at the Oyster Creek site. The inspector reviewed the ODCM for site specific parameters. The inspector noted that the licensee used the EFFECTS computer code to calculate the projected dose for radioactive liquid releases and for radioactive noble gas and particulate releases, including iodines and tritium.

The inspector evaluated the licensee's computer code by using site specific parameters and release information. All comparisons were made using simulated radioactive material releases because the licensee's actual releases were insignificant. The intercomparison results for the release pathways for liquids, noble gases, and particulates, are listed in Tables 1, 2, 3, 4, 5, 6, 7, and 8.

The results of the initial radioactive liquid release (using six radioisotopes) pathway intercomparisons were poor, as shown in Table 1. The cause of these poor comparisons might be the sum of errors from six radioisotopes. The inspector, therefore, used only iodine-133 (I-133) for the comparisons. The results of the liquid release pathway, using I-133, were better than using six radioisotopes, as shown in Table 2.

Transit time (time between release and human consumption) for the fish pathway was not defined in the ODCM, therefore, the inspector used a default value of 24 hours. To compensate for this, the inspector used a much longer half-life radioisotope, cesium-137(Cs-137), for performing the comparisons. The results of this intercomparison for adult/bone and fish/shellfish pathway were poor, as listed in Table 3. The NRC's value was 4.97E-3 millirem (mrem) while the licensee's (using the EFFECTS code) was 1.3E-2 mrem. The inspector calculated the projected dose using PCDOSE without the mixing ratio (site specific parameter) and performed a

hand calculation using the licensee's ODCM equation. The results of this intercomparison were good, as illustrated in Table 3. The results from the PCDOSE code and the hand calculation were 3.34E-3 mrem and 3.64E-3 mrem, respectively. The licensee also calculated the projected dose using EFFECTS without the mixing ratio and the result was 3.7E-3 mrem, which was a good comparison. It appeared that the mixing ratio was being used twice in the EFFECTS code. During the inspection members of Plant Chemistry contacted the individual (contractor) who created the EFFECTs code and together they are actively identifying code specific parameters for future use. The results of the last radioactive liquid release pathway intercomparison, between the EFFECTS code without the mixing ratio and the hand calculation, were excellent, as shown in Table 4. It was noted that the licensee did not release radioactive liquids routinely.

The results of particulate release pathway intercomparisons for vents and stack were also excellent, as illustrated in Tables 5 and 6, respectively.

The results of noble gas release pathway (from vents) intercomparisons were excellent, as shown in Table 7. The results of noble gas release pathway (from stack) intercomparisons were also excellent, as shown in Table 8. The intercomparisons for gamma air dose, total skin dose, and total body dose from the stack were not compared due to different computer models and concepts.

The NRC currently does not have specific criteria for comparisons. However, up to about a 50% difference in projected dose values is acceptable as long as the cause of difference can be identified.

Based on the above comparisons, the inspector determined that the licensee conducted an acceptable projected dose calculation program at the Oyster Creek site.

5.0 Exit Interview

The inspector met with the licensee representatives denoted in Section 1.1 of this inspection report at the conclusion of the inspection on February 3, 1994. The inspector summarized the purpose, scope, and findings of the inspection. The licensee acknowledged the inspection findings.

TABLE 1, SIMULATED LIQUID RELEASE
(Co-60, Sr-89, Sr-90, I-131, I-133, Cs-137)
ADULT/BONE, FISH/SHELLFISH PATHWAY
UNIT = mrem/Release

	NRC	GPU	RATIO (GPU/NRC)
BONE	2.86E-2	8.30E-2	2.90
LIVER	7.71E-3	1.99E-2	2.58
TOTAL BODY	1.20E-2	1.78E-2	1.48
THYROID	2.98E-2	7.60E-2	2.55
KIDNEY	2.48E-3	6.30E-3	2.54
LUNG	7.66E-4	1.95E-3	2.55
GI-LLI	1.63E-2	4.20E-2	2.58

TABLE 2, SIMULATED LIQUID RELEASE
(I-133)
ADULT/BONE, FISH/SHELLFISH PATHWAY
UNIT = mrem/Release

	NRC	GPU	RATIO (GPU/NRC)
BONE	2.24E-5	3.3E-5	1.47
LIVER	3.89E-5	5.7E-5	1.47
TOTAL BODY	1.19E-5	1.7E-5	1.43
THYROID	5.72E-3	8.3E-3	1.45
KIDNEY	6.79E-5	9.8E-5	1.44
GI-LLI	3.50E-5	5.0E-5	1.43

TABLE 3, SIMULATED LIQUID RELEASE
(Cs-137)
ADULT/BONE, FISH/SHELLFISH PATHWAY
UNIT = mrem/Release

	DOSE (mrem)
NRC (with Site Specific mixing ratio = 0.3)	4.97E-3
NRC (without mixing ratio)	3.34E-3
NRC Hand Calculation using ODCM Equation	3.64E-3
GPU EFFECTS (with mixing ratio)	1.3E-2
GPU EFFECTS (without mixing ratio)	3.7E-3

TABLE 4, SIMULATED LIQUID RELEASE
(Cs-137)
ADULT/BONE, FISH/SHELLFISH PATHWAY
UNIT = mrem/Release

	EFFECTS * with No Mixing	HC (HAND CALCULATION)	RATIO (EFFCTS/HC)
BONE	3.79E-3	3.64E-3	1.04
LIVER	5.18E-3	4.97E-3	1.04
TOTAL BODY	3.44E-3	3.26E-3	1.06
KIDNEY	1.73E-3	1.69E-3	1.02
LUNG	5.86E-4	5.61E-4	1.04
GI-LLI	1.01E-4	9.63E-5	1.05

TABLE 5, SIMULATED PARTICULATES RELEASE FROM VENTS
ADULT/INHALATION PATHWAY
UNIT = mrem/Release

	NRC	GPU	RATIO (GPU/NRC)
BONE	7.31E-5	7.1E-5	0.97
LIVER	9.65E-5	9.3E-5	0.96
TOTAL BODY	6.67E-5	6.5E-5	0.97
THYROID	6.06E-4	5.9E-4	0.97
KIDNEY	3.75E-5	3.6E-5	0.96
LUNG	6.81E-4	6.6E-4	0.97
GI-LLI	3.41E-5	3.3E-5	0.97

TABLE 6, SIMULATED PARTICULATES RELEASE FROM STACK
ADULT/INHALATION PATHWAY
UNIT = mrem/Release

	NRC	GPU	RATIO (GPU/NRC)
BONE	3.06E-5	3.1E-5	1.01
LIVER	4.05E-5	4.0E-5	0.99
TOTAL BODY	2.80E-5	2.8E-5	1.00
THYROID	2.54E-4	2.5E-4	0.98
KIDNEY	1.58E-5	1.6E-5	1.01
LUNG	2.85E-4	2.8E-4	0.98
GI-LLI	1.44E-5	1.4E-5	0.97

TABLE 7, SIMULATED NOBLE GAS RELEASE FROM VENTS

	Beta Air Dose (mrad)	Gamma Air Dose (mrad)	Total Skin (mrem)	Total Body (mrem)
NRC	4.14E-3	2.75E-3	2.75E-3	9.88E-4
GPU	4.0E-3	2.7E-3	2.7E-3	9.5E-4

TABLE 8, SIMULATED NOBLE GAS RELEASE FROM STACK

	Beta Air Dose (mrad)
NRC	4.14E-3
GPU	4.0E-3