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C321-94-2093
June 21, 1994

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Dear Sir:

Subject: Oyster Creek Nuclear Generating Station (OCNGS)
Operating License No. DPR-16
Docket No. 50-219

Technical Specification Change Request (TSCR) No. 214
MAIN STEAM LINE (MSL) RADIATION MONITOR(s) REACTOR SCRAM AND MSL ISOLATION FUNCTIONS - Request for Additional Information (RAI) TAC No. M89198

Pursuant to your request dated May 18, 1994 which we received May 20,1994 enclosed please find our response to the questions raised in the subject RAI.

Pursuant to 10 CFR 50.91 (b) (1), a copy of our response to this RAI has been sent to the State of New Jersey Department of Environmental Protection.

Sincerely,

for J. J. Barton
Vice President and Director
Oyster Creek

JJB\GMG

Enclosure: GPUN Response to RAI on TSCR No. 214

cc: OCNGS NRC Project Manager
Administrator, Region I
OCNGS NRC Sr. Resident Inspector

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<u>ENCLOSURE</u>

Technical Specification Change Request (TSCR) No. 214
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TAC No. M89198

<u>Question 450.1</u>

Technical Specification change request No. 214 states that "In Topical Report NEDO-31400A, General Electric shows the occurrence of a control rod drive accident (CRDA) with the main steam line (MSL) high radiation isolation removed, results in off-site radiological exposures that are small fractions of 10 CFR Part 100 limits. Furthermore, the assumptions in NEDO-31400A are bounding for OCNGS because the dose rates resulting from the CRDA for OCNGS, with the elimination of the scram and MSIV isolation functions, are smaller fractions of the 10 CFR Part 100 limits."

<u>Response to Question 450.1</u>

The following discussion describes how the NEDO-31400A model envelopes the OCNGS source terms and potential environmental releases (i.e., dose consequences), and clarifies our position that the off-site dose rates resulting from a CRDA at Oyster Creek are smaller than the off-site dose rates for the reference model cited in NEDO-31400A. As shown in Table 1 of TSCR No. 214, some of the Oyster Creek parameters are orders of magnitude smaller than those of the NEDO reference resulting in estimated off-site doses that are also much smaller than the reference model.

In general terms, an off-site dose can be estimated by the equation:

Off-Site Dose = $X/Q \sum_i D_i C_i$

Where: X/Q = Chi/Q, atmospheric dispersion factor
D_i = A concentration to dose conversion factor for the ith isotope.
C_i = Concentration of the ith isotope

The fission process is similar in all BWRs; therefore, the mixture of fission products, that is the ratio of one isotope to another, is also similar. The dose conversion factor, D_i, for each isotope is the same regardless of where the isotope was produced. Given these two facts: the similarity of the isotopic mixtures (C_is), and the corresponding standard D_is, it can be shown that the dose consequences of a given release rate are proportional to the total number of curies in the source term. Therefore for the purpose of the following discussion, the summation term given above $\sum_i D_i C_i$ is proportional to the total number of curies being released and can be replaced with a blanket Source Term for each plant. The Source Term is equal to the quantitative release of fission products from each plant.

Therefore the above equation can be simplified to:

Off-Site Dose = X/Q (Source Term)(K)

Where: X/Q = Chi/Q, atmospheric dispersion factor.
Source Term = Quantitative Release of Fission Products
K = A constant of proportionality. Since this term is present in all the following equations it will be left out for clarity.

Given this equation the Source Term and the X/Q for the NEDO-31400A model and Oyster Creek can be compared in detail using the data presented in TSCR 214 Table 1, to demonstrate that the Oyster Creek Plant has a lower off-site dose than the NEDO-31400A model.

The Source Term is dependent on the number of failed fuel rods; the power level; core average fuel rod power multiplier (peaking factor); and, main condenser leak rate.

Power Level, NEDO-31400A: 0.12 Mwt/rod
OCNGS: 0.0965 Mwt/rod

The power level per rod is lower for OCNGS then for the NEDO model: Ratio 0.804. The NEDO model envelopes OCNGS for this parameter.

Core Average Fuel Rod Power Factor Multiplier (peaking factor)

NEDO-31400A:	1.5
OCNGS:	1.6

The Oyster Creek core was analyzed assuming that highest powered fuel rods were operated at 1.6 times the average fuel rod power. The OCNGS peaking factor exceeds the NEDO value: Ratio 1.07.

Number of Failed Fuel Rods,

NEDO 31400A:	850
OCNGS:	837

The number of failed fuel rods is proportional to the quantity of fission products available for release. The NEDO model envelopes the OCNGS value for this parameter: Ratio 0.985.

Assuming that the highest powered rods fail in a CRDA the quantity of fission products available (Source Term) for release from damaged fuel is proportional to the number of failed rods and the power that they produced:

Source Term = (Ave Power)(Peaking Factor)(Number of Failed Rods)

Based on this the NEDO-31400A Model and OCNGS can be compared using the ratios developed above, as follows:

NEDO Source Term = (1)(1)(1) = 1
OCNGS Source Term = (0.804)(1.07)(0.985) = 0.847

Therefore, the NEDO model Source Term is larger than the OCNGS source term.

Condenser leak rate:

NEDO-31400A:	1%/day
OCNGS:	-

The condenser leak rate determines the percentage of the fission products that escape to the environment through condenser leakage. Conservatively this leak rate can be construed as a ground level release. The condenser leak rate for OCNGS is not defined. Reasonably, it can be assumed to be nearly identical to the NEDO model value of 1 %/day since the characteristics of the secondary plants in BWRs are similar. Physically, it can not be more than 100 %/day. Even if the most conservative value, 100 %/day is assumed the X/Q values for OCNGS are small enough to result in a smaller off-site dose than the NEDO model.

X/Q values for ground level release:

NEDO-31400A:	2.5E-3
OCNGS:	2.15E-5 (maximum, plant boundary)
	1.16E-5 (maximum, individual)

The X/Q values are multipliers for the Source Term to calculate off-site dose. The most conservative (largest) OCNGS X/Q value is 116 times smaller than the NEDO model value, yielding a Ratio of: 0.0086.

Sample Calculation assuming 100% of OCNGS Source Term escapes through the condenser:

Dose = (Source Term)(Condenser Leak %)(X/Q Ratio)

NEDO Dose = (1)(1)(1) = 1
OCNGS Dose = (0.847)(100)(0.0086) = 0.728

Therefore, even if an extremely conservative condenser leak rate of 100%/day is assumed, the off-site dose for OCNGS will be smaller than the NEDO-31400A model. If the OCNGS is credited with a condenser leak rate of 1% then the OCNGS off-site dose is more than two orders of magnitude smaller than the NEDO-31400A model.

Response to Question 450.1 (Continued)

X/Q values for Main stack release point:

NEDO-31400A:	3.0E-4
OCNGS:	3.07E-8 (maximum, plant boundary)
	2.39E-8 (maximum, individual)

The X/Q values are multipliers for the Source Term to calculate off-site dose. The most conservative (largest) OCNGS X/Q value is 9772 times smaller than the NEDO model value, yielding a Ratio of: $1.02E^{4}$.

Sample Calculation assuming 100% of Source Term escapes through stack:

Dose = (Source Term)(X/Q Ratio)

NEDO Dose = (1)(1) = 1
OCNGS Dose = (0.847)($1.02E^{4}$) = $8.81E^{-5}$

Assuming that roughly equivalent delay lines and off-gas processing facilities are in use, the OCNGS off-site dose will be over ten thousand times smaller than the NEDO-31400A model.

Question 450.2, Condition 1

The NRC accepted by letter dated May 15, 1991, from A. Thadani, Director of Systems Technology, Office of Nuclear Reactor Regulation, the reference of the General Electric Topical Report NEDO-31400A "Safety Evaluation for Eliminating The Boiling Water Reactor Main Steam Isolation Valve Closure Function and Scram Function of the main Steam Line Radiation Monitor," issued October 1992. However, the letter stated that the following three conditions must be met.

1. The applicant demonstrates that the assumptions with regard to input values (including power per assembly, Chi/Q, and decay times) that are made in the generic analysis bound those for the plant.

It appears that your ABS addresses condition 1; however, it is not obvious that conditions 2 and 3 are addressed. Specifically describe how conditions 2 and 3 above are to be met.

Response to Question 405.2, Condition 1

GPUN concurs with the NRC that the OCNGS original TSCR 214 submittal addressed Condition 1 satisfactorily.

Question 450.2, Condition 2

2. The applicant includes sufficient evident, (e.g., implemented or proposed operating procedures or equivalent commitment), to provide reasonable assurance that increased significant levels of radioactivity in the main steam lines will be controlled expeditiously to limit both occupational doses and environmental releases.

Response to Question 405.2, Condition 2

A significant increase in the contamination of the Main Steam from a CRDA or other source will be detected by the Steam Jet Air Ejector (SJAE) radiation monitors, prior to release to the hold-up line and the stack. These monitors measure the radioactivity of the SJAE discharge before it enters the 30 minute delay line. The contamination is principally noble gas fission products. The measured radiation level is continuously displayed in the control room.

The SJAE monitors initiate a high-high radiation alarm and initiates a timer to off-gas isolation, at a radiation level that has the potential to cause an instantaneous off-site concentration equal to 10CFR20 Appendix B, Table 11, Col 1 levels (old 10CFR20). The Technical Specification 3.1 Bases states:

> "The setting of ten times the stack release limit for isolation of the air-ejector offgas line is to permit the operator to perform normal, immediate remedial action if the stack limit is exceeded. The time necessary for this action would be extremely short when considering the annual averaging which is allowed under 10CFR 20.106; and, therefore, would produce insignificant effects upon dose to the public."

A high radiation alarm is also provided at approximately 2/3 of the high-high alarm level, to alert operators to elevated condenser off-gas activity. The setpoints will limit off-site doses to small fractions of 10CFR100 maximum dose limits. These setpoints limit off-site whole body dose to less than 10CFR20 limits which have the potential over the course of a year of resulting in a whole body dose of 0.5 Rem. 10CFR100 dose limits are 25 Rem whole body and 300 Rem thyroid.

When the high-high setpoint is reached an alarm is sounded in the main control room and a timer with a maximum duration of 15 minutes is started. If the radiation level has not been reduced and still exceeds the setpoint at the end of the timed interval, the condenser off-gas system is isolated and the discharge to the delay line is also isolated. The delay line (minimum delay of off-gas for at least 30 minutes) has the capacity to contain and isolate all the contaminated off-gas produced during the timer operation (maximum delay 15 minutes). The off-gas may remain in the delay line for as long as necessary for it to decay to activity levels that would permit safe release. The isolation of the off-gas system will then result in a reactor trip due to loss of condenser vacuum.

When a high-high alarm occurs the abnormal operating procedure[1] directs the operator to monitor, assess, and minimize the condition; and, if the alarm has not cleared within 15 minutes to scram the reactor and manually isolate the off-gas system.

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[1] Reference: OCNGS Procedure 2000-ABN-3200.26

Question 450.2, Condition 3

3. The applicant standardizes the MSLRM and off-gas radiation monitor alarm set point at 1.5 times the nominal nitrogen-16 background dose rate at the monitor locations and commits to promptly sample the reactor coolant to determine possible contamination levels in the reactor coolant and the need for additional corrective actions, if the MSLRM or off-gas radiation monitors or both exceed their alarm setpoints.

Response to 450.2 - Condition 3

NEDO-31400A describes a standardized MSLRM setpoint at 1.5 times the N-16 background. The OCNGS MSLRM have an High Alarm setpoint that closely approximates this criterion.

The MSLRM High Alarm setpoint was selected to accommodate the use of hydrogen-water chemistry control to protect the integrity of the reactor vessel and other routine activities without generating nuisance alarms. The injection of hydrogen into the reactor coolant increases the activity of N-16 in the main steam by reducing some of the non volatile $NO_{(x)}$ in the reactor coolant to volatile NH_3. The High Alarm setpoint was selected to be high enough so that it would not be subject to nuisance alarms due to insignificant fluctuations in the hydrogen injection rate, the effects of condenser backwashing, changes in the number of recirculation pumps in use, and any error/uncertainty in the calibration procedure for the MSLRMs. The High Alarm setpoint for the MSLRMs is presently set at 500 mR/hr, based on existing plant conditions.

The MSLRM measurement corresponding to 1.5 times the N-16 background is close to the High Alarm setpoint value. The MSLRM monitors normally measure about 113 mR/hr when no hydrogen addition is being made. It can be estimated that approximately 80% of this dose is from N-16. The quantity of N-16 in the nuclear steam increases when hydrogen is being injected into the primary coolant and contributes significantly to the radiation level. During one month at full power with no fuel damage and hydrogen-water chemistry in use the measurement of the highest reading MSLRM ranged from 233 mR/hr to 357 mR/hr. All of the increase in the dose rate is attributed to N-16.

The estimation of a setpoint 1.5 times the N-16 background starts from the highest MSLRM measurement. From this we estimate that during normal operation with no fuel damage and hydrogen-water chemistry in operation, N-16 contributes about 334 mR/hr to the MSLRM measurement (80% of 113 mR/hr plus 357 -113 mR/hr = 334 mR/hr), 1.5 times this value is 501 mR/hr which is added to the non N-16 dose rate, 27 mR/hr, giving a total dose rate of 528 mR/hr. The OCNGS High setpoint, 500 mR/hr is lower than the 528 mR/hr; and, therefore this satisfies the criterion expressed in the NRC letter, dated: May 15, 1991, as referenced in NEDO-31400A.

Response to 450.2 - Item 3 (Continued)

There is a two minute delay between the reactor and the SJAE-RM and so N-16 is not present at the off-gas radiation monitor. The Technical Specification 3.1 limit for the OCNGS SJAE-RM is 2.1/Ē Ci/sec which corresponds to 2.25 Ci/sec. This value is within the 1 to 10 Ci/sec range described in NEDO-31400A. OCNGS has a comprehensive reactor coolant and SJAE discharge gas sampling program. This program is mandated by the Technical Specification and is based, in part, on incremental changes in SJAE activity but not on radiation monitor setpoints.

The OCNGS sampling programs are described below.

1.) A sample is required to be taken and evaluated each time the radiation level increases a specified amount over the current measured level; and therefore, samples will be taken and evaluated at many levels before the setpoint would be reached, if radiation levels were to rise continuously toward the setpoint level.

2.) The SJAE and reactor coolant sampling program requirements based on SJAE radiation measurements, in accordance with sampling of the off-gas required per Technical Specification, 4.6.E.1.b:

> "The radioactivity in the fission gases discharged from the main condenser air ejector shall be measured by sampling and analyzing the gases. When the reactor is operating at more than 40 percent of rated power, within 4 hours after an increase in the fission gas release via the air ejector of more than 50 percent, as indicated by the Condenser Air Ejector Offgas Radioactivity Monitor after factoring out increase(s) due to change(s) in the thermal power level."

This requirement is implemented in OCNGS Procedure: 829.1 - "Air Ejector Off-Gas: Analysis."

3.) Sampling of the reactor coolant is required per Technical Specification, 3.6.A.4 (which reads in part):

> "With the reactor mode switch in Run or Startup position, with:...
>
> 2. The off-gas level, at the SJAE, increased by more than 10,000 microcuries per second in one hour during steady state operation at release rates less than 75,000 microcuries per second, or
>
> 3. The off-gas level, at the SJAE, increased by more than 15% in one hour during steady state operation at release rates greater than 75,000 microcuries per second,
>
> take sample and analyze at least one sample, between 2 and 6 hours following the change in thermal power or off-gas level and at least once per four hours thereafter, until the specific activity of the primary coolant is restored to within limits."

This requirement is implemented by existing OCNGS Procedures.