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UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PENNSYLVANIA 19406-1415

OCT 10 1991

MEMORANDUM FOR: Jose Calvo, Assistant Director for Region I Reactors
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

FROM: Charles W. Hehl, Director
Division of Reactor Projects
Region I

SUBJECT: PROPOSED TASK INTERFACE AGREEMENT REGARDING THE TECHNICAL ADEQUACY OF RADIATION ACTION LEVELS USED BY SUSQUEHANNA IN IMPLEMENTING THE SECONDARY CONTAINMENT CONTROL EMERGENCY OPERATING PROCEDURE

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Your assistance is requested in determining the technical adequacy of Susquehanna Steam Electric Station's (SSES) methodology for determining maximum normal and maximum safe area radiation levels for use in implementing the Secondary Containment Control Emergency Operating Procedure (EOP). This concern was identified as an unresolved item during an inspection of the SSES EOPs conducted by the region during the week of July 8, 1991 (Inspection Report Nos. 50-387/91-09 and 50-388/91-09, items 387/91-09-02 and 388/91-09-02). The purpose of this inspection was to follow up on issues identified during the EOP team inspection conducted in April 1990 (Inspection Report Nos. 50-387/90-80 and 50-388/90-80).

The BWR Owners' Group (BWROG) Emergency Procedure Guidelines (EPGs) define the maximum normal operating level for any parameter to be the highest value of the parameter expected to occur during normal plant operating conditions with all directly associated support and control systems functioning properly. Any area radiation level above its maximum normal value requires entry into the Secondary Containment Control EOP. The BWROG EPGs specify that the maximum safe operating radiation levels for areas in secondary containment should be based on the radiation levels at which equipment necessary for the safe shutdown of the plant will fail, and permit personnel access necessary for the safe shutdown of the plant. If a primary system is discharging into an area, the reactor must be scrammed prior to any area reaching its maximum safe operating radiation level. Emergency depressurization of the RPV is required if a primary system is discharging into secondary containment and radiation levels in more than one area exceed the maximum safe operating radiation level.

In response to concerns identified during the EOP team inspection, the licensee revised their methodology for determining maximum normal and maximum safe operating radiation levels and calculated new values for the recently revised EOPs. The revised methodology is based on not exceeding Technical Specification limits for offsite radiation doses. The licensee then selected limits based on the calculations that would be easy for the operators to memorize. This methodology has no correlation to the BWROG EPG definitions for maximum normal operating values and for maximum safe radiation levels.

Memo

ADD: Jim Raleigh

Ltr. Encl.
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The maximum safe radiation levels determined using this methodology appear to be unsafe for personnel access and are less conservative than the values in the previous version of the EOPs. Additionally, the values selected for maximum safe radiation levels in the internal rooms (100 R/hr) are not conservative with respect to the calculated limits for the internal rooms (96 R/hr).

In one of the areas, the maximum indicated level on the area radiation monitors (ARMs) is 100 mr/hr which is below the maximum normal level (1R/hr) and the maximum safe level (100 R/hr). In another area, the maximum indicated level on the ARMs is 1R/hr which is at the maximum normal level and below the maximum safe level (100 R/hr). For these two areas it would not be possible to remotely determine if the action levels for the EOPs had been reached.

Part of the licensee's justification for the maximum normal operating radiation level of 1R/hr is that the level is sufficiently above the ARM high alarm setpoint so actions in alarm response procedures can be carried out in advance of entry into Secondary Containment Control. Delaying entry into an EOP to allow use of other procedures is not adequate technical justification for selecting non-conservative entry conditions.

Enclosed are the sections of the licensee's Plant Specific Technical Guidelines (PSTG) that address the maximum normal and maximum safe operating radiation levels for the Secondary Containment Control EOP and the documentation that explains and supports their methodology for determining the radiation action levels. Also enclosed is a table of the plant specific radiation areas, ARM indicators, and radiation action levels.

The current SSES EOPs are based on Revision 3 of the BWROG EPGs. The licensee plans to implement Revision 4 of the BWROG EPGs in January 1993. We would appreciate your prompt attention to this matter and an assessment by March 31, 1992, so that this concern can be resolved prior to the licensee's implementation of Revision 4 to the BWROG EPGs. The Region I point of contact is Tracy Walker, Senior Operations Engineer, Division of Reactor Safety (FTS 346-5381). This TIA proposal has been discussed with George Hubbard of NRR.

Charles W. Hehl, Director
Division of Reactor Projects

Enclosures:
1. Plant Specific Technical Guidelines (SSES-EPG) and Justification
2. SSES Internal Memorandum PLI-67992
3. SSES Internal Memorandum PLI-67754 (Attachment C only)
4. SSES Calculation SE-B-NA-112
5. Additional Justification Provided by SSES to NRC
6. Table SC-3

SSES-EPG

ENTRY CONDITIONS

The entry conditions for this guideline are any of the following secondary containment conditions:

1. Differential pressure above -0.25 in. of water for longer than 4 hours
2. An area high temperature isolation
3. Hi area differential temperature isolation
4. Zone III HVAC exhaust radiation level above 2.5 mr/hr or RB SPING release rates above LCO release rates in Table SC-1:

Nobel Gas	8.5×10^5 μCi/min.
I-131	141 μCi/min.
Particulates	772 μCi/min.

5. An area radiation level equal to or greater than 1 R/hr
6. Zone I HVAC not in service for 4 hours

EPG

ENTRY CONDITIONS

The entry conditions for this guideline are any of the following secondary containment conditions:

1. Differential pressure at or above 0 in. of water
2. An area temperature above the maximum normal operating temperature
3. A HVAC cooler differential temperature above the maximum normal operating differential temperature
4. A HVAC exhaust radiation level above the maximum normal operating radiation level
5. An area radiation level above the maximum normal operating radiation level
6. A floor drain sump water level above the maximum normal operating water level
7. An area water level above the maximum normal operating water level

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DIFFERENCES AND JUSTIFICATION

The entry condition of secondary containment differential pressure was altered to the Technical Specification value. The Technical Specification value is given in source document 1. SSES operating experience indicates that reactor building differential pressure can be lost occasionally due to a spurious trip of an SC HVAC supply or exhaust fan, closure of a damper, or rapid fluctuation in wind conditions outside the reactor building, etc. Reactor building differential pressure can increase to 0 psig immediately. For such

conditions, entry to the Secondary Containment Control Guideline is not necessary because an emergency does not exist. The operator responds by restoring SC HVAC to service and by ensuring reactor building differential pressure is re-established. If SC HVAC cannot be restored to service or reactor building differential pressure cannot be re-established in a timely manner, entry to procedures developed from this guideline is appropriate. Consistent with the bases of source document 1, entry is made no later than 4 hours after reactor building differential pressure increases above the LCO value. The LCO differential pressure entry condition is an easily recognizable limit and provides adequate opportunity to respond to an off-normal loss of reactor building differential pressure event in advance of entry to the emergency operating procedure.

Area differential temperatures at the isolation setpoint are equivalent to the BWR EPG requirement at the maximum normal operating differential temperature.

Adapted the HVAC exhaust radiation level entry condition to SSES, listing only the secondary containment system that isolates on high radiation levels. The maximum normal operating radiation level was set at the Technical Specification value. This value was determined per source document 2.

Maximum normal operating area temperatures are defined to be the area high temperature isolation setpoint in accordance with source document 2.

RB SPING release rates above the Tech Spec LCO limits are indicative of a threat to secondary containment warranting entry to this guideline.

Maximum normal operating area radiation levels are defined to be 1 R/hr in accordance with source document 2. This action level is sufficiently above the ARM high alarm setpoint so actions in alarm response procedures can be carried out in advance of entry to this guideline. Also, this action level has been shown by calculation to be well below the radiation level that could cause exposure to gaseous effluents at the EPG in excess of 5 mR/qt (Tech. Spec. 3.11.2.2.a).

Addition of the "Zone I HVAC not in service" entry condition is discussed under step SC-1.

The secondary containment entry conditions on area or floor drain sump water levels were deleted. Refer to EPG step SC/L for the justification of this deviation.

Maximum normal operating levels for secondary containment parameters are given in source document 2.

SOURCE DOCUMENTS

1. Plant-Specific EPG Data Table, Item 53a
2. Plant-Specific EPG Data Table, Item 52 & 53
3. Memo A.M. Male to W. Barberick July 27, 1987 Re: EWR M70777
4. Offsite Dose Calculation Manual, dated 7/9/84

SSES-EPG:SC/R-2

If a primary system is discharging into an area, before any area radiation level reaches its maximum safe operating radiation level, enter the RPV Control Guideline at Step RC-1 and execute it concurrently with this procedure.

EPG:SC/R-2

If primary system is discharging into an area, then before any area radiation level reaches its maximum safe operating radiation level, enter (procedure developed from the RPV Control Guideline) at (Step RC-1) and execute it concurrently with this procedure.

DIFFERENCES AND JUSTIFICATION

Area radiation Max Safe radiation levels are given in Table SC-3 (source document 1).

The Max Safe radiation levels are based on area radiation values which are the lesser of either:

1. The most limiting radiation level which would not result in exposure at the exclusion boundary in excess of 500 mrem/yr (Tech. Spec. 3.11.2.1.a), or

2. 50% of the FSAR maximum dose rate for environmental conditions.

SOURCE DOCUMENTS

1. Plant-specific EPG Data Table, Item 53

SSES-EPG:SC/R-3

If a primary system is discharging into an area, and an area radiation level exceeds its maximum safe operating radiation level in more than one area, EMERGENCY RPV DEPRESSURIZATION IS REQUIRED.

EPG:SC/R-3

If a primary system is discharging into an area and an area radiation level exceeds its maximum safe operating radiation level in more than one area, EMERGENCY RPV DEPRESSURIZATION IS REQUIRED.

DIFFERENCES AND JUSTIFICATION

Area radiation Max Safe radiation levels are given in Table SC-3 (source document 1).

SOURCE DOCUMENTS

1. Plant-specific EPG Data Table, Item 53

Enclosure 2

PP&L

June 3, 1991

[redacted] SSES

SUSQUEHANNA STEAM ELECTRIC STATION
EVALUATION OF MAXIMUM NORMAL AND
MAXIMUM SAFE RADIATION LEVELS
IN THE REACTOR BUILDING
CCN 743189 001 FILE A30-4; P108-1
PLI- 67992

References: 1) Calculation SE-B-NA-112
2) Matchick, D. A., Microshield Version 3.12

Reference 1 provided one methodology for determining and documenting the maximum normal and maximum safe radiation limits for the reactor building. These limits turned out to be somewhat confusing for the operator, therefore, a slightly different basis was explored and a slightly different calculational methodology was applied to determine the dose rate limits.

Technical Specification Section 3.11.2.2, which limits noble gas effluent air dose to 5 mrads per quarter (actually, 5 mRem for gamma radiation) was used to establish a maximum normal limit. The maximum safe dose rate limit was determined from Technical Specification 3.11.2.1, which limits whole body dose from noble gas effluent to less than 500 mRem/yr. The calculational method described in Reference 2 was used with room volumes as determined in Reference 1.

The results of the Microshield calculation shows a maximum normal for the largest internal reactor building room (RHR Room B) is 11 R/hr and the refueling floor limit is 1.5 R/hr. For the maximum safe limit, the results are 96 R/hr for the internal rooms and 13 R/hr for the refueling floor.

Based on these calculations, it is suggested that the maximum normal dose rate limit be 1 R/hr for all rooms, the maximum safe limit for the refueling floor be set at 10 R/hr and the maximum safe limit in the internal rooms be set at 100 R/hr. These limits would be very easy for the operator to memorize.

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Take Care PP&L

Enclosure 5

PP&L

May 9, 1991

[redacted] SSES

SUSQUEHANNA STEAM ELECTRIC STATION
RESOLUTION OF EPG/EOP OPEN ITEMS
CTN 743189-001 FILE A30-4; P108-2
PLI-67754

Reference: Letter from Robert M. Gallo, NRC-Division of Reactor Safety to H. W. Keiser, "Emergency Operating Procedures Inspection and Requalification Re-Examination - Report Nos. 50-387/90-80 and 50-388/90-80", June 8, 1990.

In the referenced letter report, the NRC detailed a number of discrepancies between the Emergency Procedures Guidelines (BWROG EPG's), the SSES plant specific technical guidance (PSTG's) and the Susquehanna Specific Emergency Operating Procedures (EOP's). Each of these items is carried under an open item tracking process created by an operations Administrative Procedure. The purpose of this memorandum is to provide technical justification to resolve the following open items:

102-046	Justifies a reactor water level of -38" for entry into Reactor Pressure Vessel Control Guidance (Attachment A)
103-069	Justifies a suppression pool bulk temperature of 105°F for entry into Primary Containment Control Guidance (Attachment B)
104-011 104-012 104-018	Establishes radiation dose rate limits and criteria for these limits which define entry conditions into Secondary Containment Control Guidance and RPV depressurization criteria (Attachment C)
104-010	Establishes basis for not including Secondary Containment water level as an entry condition into Secondary Containment Control Guidance (Attachment D)

If you have any questions regarding this information, please feel free to contact me at ETN 220-7900.

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Take Care

Attachment C

EPG/EOP OPEN ITEM RESOLUTION

1.0 Background

As a result of the NRC audit of the SSES Emergency Operating Procedures in April, 1990, the NRC questioned PP&L's radiation limits in the Secondary Containment Control procedure (EO-100/200-104), for both the entry conditions and the Guidance which calls for rapidly reducing pressure in the reactor vessel under high radiation conditions in Secondary Containment. These items are carried as open items 104-011, 104-012 and 104-018 in the SSES Emergency Procedure open item tracking system. The Maximum normal limits are used as an entry condition into the Secondary Containment Control Guidance. The Maximum Safe Dose Rate limits are used to determine when to scram and depressurize the reactor pressure vessel.

Calculation SE-B-NA-112 has been prepared to determine the required radiation limits and to provide a basis for these limits. The limits, as determined by calculation SE-B-NA-112, are reproduced in Table 1.

Operations Staff has reviewed the results presented in Table 1 and found them to be acceptible with the exception of the 0.3 and 0.5 mRem/hr limits imposed on various parts of Secondary Containment for the Maximum Safe condition. These limits appear to be too low and may cause depressurizing the reactor vessel in situations where it may not have been necessary.

2.0 Evaluation

The numbers in Table 1 for the Maximum Safe Dose Rate for the Sample Room, the Recirculation Fan Room, the RWCU Pump Area and the Remote S/D Room were determined using a limit of 100 times the alarm value for the room and not by the off-site dose criteria. Therefore, the dose rate limits for these rooms can be increased to the value of 208.8 Rem/hr based on off-site dose limits, since each of these rooms has the two feet of concrete shielding assumed in the calculation of Maximum Safe Dose Rate limits.

The values given in Table 1 for the Spent Fuel Pool and Refuel Floor Maximum Safe Dose Rate limits are determined from the criterion that the off-site dose limit must be less than 2.852×10^{-4} mRem/hr at the site boundary. This limit assumes that the dose rate in the room will be constant for at least one year and is one-tenth of the 25 mRem/yr prescribed by 40CFR190. This assumption is very conservative and leads to very low values for Maximum Safe Dose Rate limits in the area of Zone III, because only one-quarter inch of steel acts as a radiation shield. Making a less conservative assumption, that once the Maximum Safe Dose Rate limit is reached, operator action prevents further radioactivity release, that the radiation levels decrease as a function of time after the accident, that the time period for which the accident is active is 100 days and that the limit for dose at the boundary is one-half that prescribed by 40CFR190 the Maximum Safe Dose Rate limit becomes

MSDRL = 0.3 Rem/hr x (0.5/0.1) x (365/100) x 4

where 0.5/0.1 converts from one-tenth of the limit to one-half
365/100 converts from one year to 100 days
and 4 factors the drop in radioactivity as a function of time (Figure 18.1-10 of the FSAR shows that radioactivity decreases about two orders of magnitude over 100 days)

Thus, MSDRL = <u>21.9 Rem/hr</u>

3.0 Conclusion

The revised Maximum Safe Dose Rate limits consistant with the new assumptions given above are shown in Table 2. These limits are the prescribed maximum limits for the Maximum Safe Dose Rate parameter. Should these limits exceed other prescribed limits such as Environmental Qualification limits for radiation dose or should these limits produce habitability concerns, the lower limit should be used for the Maximum Safe Dose Rate parameter. In the specific case of Environmental Qualification limits, a limit of 75% of the actual limit should be used to allow for instrumentation and measurement error and to allow for operator response. Note that no changes have been made to the Maximum Normal Dose Rate limits as determined by calculation SE-B-NA-112.

Table 1 - Radiation Limits in the Reactor Building From Calculation SE-B-NA-112

Room	Room Number	Max Normal Dose Rate mRem/hr	Max Safe Dose Rate Rem/hr
Spent Fuel Pool		150	0.3
Refuel Floor	I-500/I-810	50	0.3
Sample Room		50	0.5
Recirc Fan Room		50	0.5
RWCU Pump Area	I-502/I-503	50	0.5
Fuel Pool Pump Area		516	208.8
CRD HCU North		516	208.8
CRD HCU South		516	208.8
Remote S/D Room	I-109	50	0.5
HPCI Room	I- 11/I-106	300	208.8
RCIC Room	I- 12/I-107	300	208.8
RHR Pump Room A	I- 13/I-103	516	208.8
RHR Pump Room B	I- 14/I-104	516	208.8
RB Sump Room		516	208.8

Table 2 - Revised Secondary Containment Radiation Limits

Room	Room Number	Maximum Normal Dose Rate mRem/hr	Maximum Safe Dose Rate Rem/hr
Spent Fuel Pool		150	21.9
Refueling Floor	I-500/I-810	50	21.9
Sample Room		50	208.8
Recirc Fan Room		50	208.8
RWCU Pump Room	I-502/I-503	50	208.8
Fuel Pool Pump Area		516	208.8
CRD HCU North		516	208.8
CRD HCU South		516	208.8
Remote S/D Room	I-109	50	208.8
HPCI Room	I- 11/I-107	300	208.8
RCIC Room	I- 12/I-108	300	208.8
RHR Pump Room A	I- 13/I-103	516	208.8
RHR Pump Room B	I- 14/I-104	516	208.8
RB Sump Room		516	208.8