From: Darl Hood
To: WNP5.JJH, WNP6.JPS1, WNP5.RLE
Date: 5/19/98 2:36pm
Subject: NMP Unit 1 Control Room doses resulting from a Unit 2 FuelHandling Accident. -Forwarded

From: <kulczyckyt@nimo.com>
To: WND2.WNP3(DSH)
Date: 5/19/98 2:29pm
Subject: NMP Unit 1 Control Room doses resulting from a Unit 2 FuelHandling Accident.

Darl,

Attached calculation evaluates doses in the Unit 1 Control Room resulting from a Unit 2 Fuel Handling Accident.

(See attached file: U2FHA-U1.doc)

The document is in WORD for Windows version 7.0 format - if unable to read please call. My number is 315-349-1949 or try my pager 1-800-732-4365, pager # 1072.

Ted Kulczycky

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OBJECTIVE OF CALCULATION

The objective of this calculation is to determine doses in the Unit 1 Control Room resulting from a Unit 2 Fuel Handling Accident (FHA).

Doses calculated will be compared to the 10CFR50 App A GDC19 (REF 1) dose limits to confirm that the Unit 1 Control Room is habitable following a design basis FHA at Unit 2. This calculation adds a case to the analysis performed in calculation PR-C-18-E but does not void or supersede previous calculations or dispositions. The Unit 2 FHA is not a Unit 1 design basis accident. However, it is analyzed here to ensure Unit 1 CR habitability can be maintained during a Unit 2 FHA.

Note, currently NMP-2 plans to use 9x9 fuel rather than 8x8 fuel as has been previously used at NMP-2. This analysis uses 8x8 as it is conservative and will also be useful in determining what doses would have been in the past had a FHA occurred involving 8x8 fuel. Using 8x8 fuel is conservative as the activity in the 124 fuel rods assumed damaged in a 8x8 FHA is more than in the 140 fuel rods assumed damaged in a 9x9 fuel FHA.

METHOD

The fuel handling accident model used is the same as is found in Section 15.7.4 of the Unit 2 USAR (REF 3) as well as earlier revisions of this calculation. The specific changes are the use of Unit 2 Reactor Building/Radwaste Building Vent to the Unit 1 CR fresh air intake atmospheric diffusion factors and the use of the Unit 1 Control Room (CR) ventilation parameters. The accident modeled uses the Standard Review Plan (REF 2) and Safety Guide 25 (REF 5 - also known as Regulatory Guide 1.25). Core activity at end of cycle is decayed for 24 hours per Unit 2 Technical Specification (REF 11) 3.9.4. Using the Safety Guide 25, the gap activity in damaged fuel pins are then released to the fuel pool water. Per the safety guide, the water provides a DF of 100 for halogens and 1 for noble gas. The activity is then released to the Refuel Floor airspace and then to the RB/RW vent. Although it could be argued that above refuel radiation monitors at Unit 2 would alarm and activate the Standby Gas Treatment System (SGTS), no credit for either filtered or elevated release is assumed in this calculation. No credit is taken for the actuation of the Unit 1 CR emergency ventilation system.

The activity release is completed within two hours and CR doses are calculated for 720 hr. The results are then compared to the dose limits given in GDC 19 (REF 1).

DATA / ASSUMPTIONS

Activity released to the Unit 2 fuel pool as a result of the fuel handling accident given Table 1 are taken from Table 15.7-10 of the Unit 2 UFSAR. The activities are also listed in Table 1 of PR-C-18-E-03A (REF 10). These activities were calculated in accordance with the guidance given in Safety Guide 25 (REF 5). That is 10% of

activity in fuel rod is in the gap (except KR-85 which is assumed to be 30%) and all gap activity in the damaged fuel rods is released to the fuel pool. This activity represents a decay time of 24 hours and a radial peaking factor of 1.5 has been applied.

Release parameters as defined in Safety Guide 25 (REF 5)

the fuel pool water has an effective DF of 1 for noble gas and 100 for halogens
radial peaking factor of 1.5 is assumed in the rods that are damaged.
10% of a fuel rods activity is in the gap with the exception of KR-85 which is assumed to be 30%
breathing rate of 3.47E-04 m3/sec. This value is assumed for the duration (0-720 hr) of the accident.
halogens above the water are 75% inorganic (elemental) and 25% organic (methyl)
all activity released from pool released from building in 2 hrs

The free volume of the Unit 1 control room is 1.31E+5 ft^3. (REF 7).

The control room normal intake rate is 2250 cfm ± 10%. 2250 cfm + 10% = 2475 cfm, use 2500 cfm (REF 12).

The doors of the control room are weather-stripped and the penetrations sealed to maintain a positive pressure of approximately one-sixteenth of an inch of water (REF 4, page III-11), however, an unfiltered inleakage of 10 cfm to the control room is assumed per REF 2, Section 6.4.III.3.d.(2).(ii). An additional 20 cfm is assumed to account for an unfiltered inleakage (REF 8) through an unsealed drain. The total inleakage of 30 cfm combined with the normal ventilation flow rate makes the total Unit 1 CR air intake rate 2530 cfm.

Site specific Unit 2 Reactor Building /Radwaste Building (RB/RW) Vent 0-8 hr χ/Q values to the Unit 1 CR intake is 9.09E-5 sec/m3 (REF 6). Note: This is the only atmospheric diffusion factor required as the release is assumed to be complete in 2 hrs. This atmospheric diffusion factor was calculated using the maximum Kc , site-specific wind speeds, and the suggested Murphy and Campe occupancy adjustment factor of 1.0.

GDC 19 (REF 1) dose limit 5 Rem whole body or its equivalent. This equates to 30 Rem Thyroid and 30 Rem Beta (skin) per SRP (REF 2 Section 6.4)

Release rate from the Unit 2 Reactor Building - 890 vol/day per Table 15.7-9 of the Unit 2 UFSAR (REF 3) with a mixing volume above the refuel floor of 1.89E+4 ft3. These values were calculated in Revision 03 of this calculation (REF 10).

TABLE 1 UNIT 2 FHA	
	Act Rlsd to Pool
ISOTOPE	(Ci)
I-129	1.21E-03
I-131	3.40E+04
I-132	4.29E+04
I-133	3.52E+04
I-134	1.92E-03
I-135	5.78E+03
BR-83	4.57E+00
KR-83M	1.82E+01
KR-85M	2.31E+02
KR-85	1.26E+03
KR-87	3.59E-02
KR-88	6.70E+01
KR-89	0.00E+00
XE-131M	2.20E+02
XE-133M	2.90E+03
XE-133	7.41E+04
XE-135M	8.84E+02
XE-135	1.70E+04
XE-137	1.88E-09
XE138	1.78E-09

CALCULATION

The following DRAGON (REF 9) model is used to model the Unit 2 FHA.

The DRAGON model used is as follows:

Activities from Table 1 instantaneously released to Volume 1 (fuel pool). Fraction of activity in elemental form 0.0075 and in methyl form 0.0025. This is actually the fractions above the fuel pool based on the different DFs as described in Reg Guide 1.25. Note that the DF of 100 is applied to the fractions released. This results in an underestimation of the noble gasses by ignoring the decay of halogens retained in the pool. The noble gas only contributes to the γ and β doses. This is discussed in the RESULTS section of this calculation.

Volume 1

Fuel pool water volume - not required due to release is in fractions per day

Release water to RB air space 2.0E+5 fractions per day for the period 0 to 2 hrs. This is the DRAGON recommended value for puff releases.

Volume 2

RB mixing volume 1.89+4 ft3

release rate 890 volumes per day. Note it must be validated that all Ci released from pool (Table 1 above) are either released from RB or on RBEV filter. This is done in Table 2 below.

Unit 1 Control Room

volume - 1.31E+5 cubic ft
intake rate 0 to 720 hrs 2530 cfm
filter efficiencies 0 - 720 hrs 0

Breathing rate 0-720 hrs 3.47E-04 m3/sec

0 - 2 hr RB/RW vent χ/Q is 9.09E-5 sec/m3 No χ/Q is required after 2 hours as all the activity has been released.

As a check of the model to ensure that the total curies released from the fuel pool to the Reactor Building air space are all released to the environment within 2 hours, Table 3 below lists both the curies released from the pool from Table 1 (note halogens reduced by a factor of 100) and also the curies released from DRAGON run #48152 dated 5/15/98. As can be seen from Table 2, all of the activity released is released with any differences explained by decay and round off.

TABLE 2 UNIT 2 FHA		
	act rlsd from pool	act rlsd to environment 0 to 2 hr
ISOTOPE	(Ci)	(Ci)
I-129	1.21E-05	1.21E-05
I-131	3.40E+02	3.40E+02
I-132	4.29E+02	4.35E+02
I-133	3.52E+02	3.52E+02
I-134	1.92E-05	1.88E-05
I-135	5.78E+01	5.76E+01
BR-83	4.57E-02	4.53E-02
KR-83M	1.82E+01	2.06E+01
KR-85M	2.31E+02	2.30E+02
KR-85	1.26E+03	1.26E+03
KR-87	3.59E-02	3.54E-02
KR-88	6.70E+01	6.66E+01
KR-89	0.00E+00	0.00E+00
XE-131M	2.20E+02	2.22E+02
XE-133M	2.90E+03	2.92E+03
XE-133	7.41E+04	7.44E+04
XE-135M	8.84E+02	4.81E+03
XE-135	1.70E+04	1.76E+04
XE-137	1.88E-09	1.45E-09
XE138	1.78E-09	1.65E-09

RESULTS

The dose results of DRAGON run #8152 5/15/98 are given below in Table 3. A copy of the input to this DRAGON run is included in Appendix A.

TABLE 3 - UNIT 1 CR DOSE FROM UNIT 2 FHA NO CR FILTERS NO SGTS FILTERS		
DOSE(REM)		
THYROID	GAMMA	BETA
2.09E+01	9.66E-03	3.29E-01

Note although the contribution from the decay of halogens into noble gas remaining in the pool was ignored in the calculation, by inspection, the addition of that portion of the noble gas contribution would not result in GDC19 gamma and beta doses being exceeded.

CONCLUSIONS

A Unit 2 design basis Fuel Handling Accident (FHA) as described in the Unit 2 FSAR results in doses in the Unit 1 Control room which are less than 10CFR50 Appendix A GDC 19 dose limits without taking credit for Unit 1 CR emergency filters or Unit 2 Standby Gas Treatment System (SGTS) filtration.

COMPUTER RUN LOG

JOB #	DATE	DESCRIPTION OF RUN
8152	5/15/98	DRAGON (REF 9) Unit 2 FHA

Note: Card image of computer run listed above is given in APPENDIX A

REFERENCES

10CFR Part 50, Appendix A, General Design Criteria
NUREG-0800, Standard Review Plan.
Nine Mile Point Unit 2 USAR, Revision 9
Nine Mile Point Unit 1 UFSAR Revision 15
Reg Guide 1.25 (also known as Safety Guide 25), "Assumptions Used for Evaluating the Potential Radiological Consequences of a Fuel Handling Accident in the Fuel Handling and Storage Facility for Boiling Water and Pressurized Water Reactors"
MES Report "Accident χ/Q Values for Nine Mile Point Unit 1 Control Room Air Intake and Emergency Operations Facility for all Nine Mile Point Unit 2 Release-Building Scenarios", May, 1990
Calculation S10-210HV12 and drawings C18810C sheet 1, C18812C sheet 1, C18804C sheet 1 as described in Mechanical Design Input to Design Change N1-98-016 dated 5/17/98.
NMPC calculation S10-CR277.A-U1.210
DRAGON Computer Code, SWEC Number NU-115, Version 5, Level 0
Calculation PR-C-18-E-03, "FSAR Chapter 15.7.4 Design basis Fuel Handling Accident", 2/15/89 and associated dispositions 03A dated 10/27/92 and 03C dated 9/17/97. (note 03B was not issued).
Unit 2 Technical Specifications.
Internal Correspondence, file code M98-014, from T. Mogren to T. Kulczycky dated 5/18/98 "Outside Air Flow Rate for Control Room Ventilation".

APPENDIX A (2 pages total)

CARD IMAGE OF COMPUTER RUNS