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Palisades Nuclear Plant
Operated by Nuclear Management Company, LLC

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Supplement to Generic Letter 2003-01, "Control Room Habitability"

By letter dated August 7, 2003, Nuclear Management Company, LLC (NMC) provided a 60-day response to Generic Letter (GL) 2003-01, for the Palisades Nuclear Plant (PNP), which provided the basis for acceptability, and the schedule for completion of the alternative course of action. By letter dated November 25, 2003, NMC provided specific commitments related to GL 2003-01 and a schedule for completion for the PNP. By letter dated November 23, 2004, NMC provided a revised schedule of commitments for GL 2003-01 for the PNP. By letter dated July 7, 2005, NMC provided a supplemental response to GL 2003-01.

On November 7, 2006, and December 14, 2006, teleconferences with the NRC staff were held to discuss follow up questions on the PNP GL 2003-01 responses. The NRC staff requested supplemental information in regards to the five bulleted items described in the July 7, 2005, GL update. In addition, the NRC staff requested discussion explaining what actions are necessary to retire the operability recommendation, with a schedule of the implementing actions. Enclosure 1 provides this supplemental information.

Summary of Commitments

This letter contains no new commitments and no revisions to existing commitments.

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Enclosure (1)

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ENCLOSURE 1
SUPPLEMENT TO GENERIC LETTER 2003-01
PALISADES NUCLEAR PLANT

By letter dated July 7, 2005, NMC submitted an update to the response to Generic Letter (GL) 2003-01, "Control Room Habitability," which provided responses to three commitments that were made by letter dated November 23, 2004.

Subsequent to this response, teleconferences were held with the Nuclear Regulatory Commission (NRC) staff on November 7, 2006, and December 14, 2006. In the teleconferences, the NRC staff requested discussion describing the operability recommendation that was written in preparation for tracer gas testing; specifically, additional information was requested in regards to the five bulleted items described in the July 7, 2005, GL update. In addition, the NRC staff requested discussion on actions that are necessary to retire the operability recommendation, with a schedule of the implementing actions.

In response to Generic Letter 2003-01, NMC performed a re-analysis of radiological consequences to determine the existing design basis margin with the current plant configuration using conforming methodologies. NMC concluded that a decrease in margin resulted due to the items listed below. The items below contrast the conforming assumptions with the assumptions currently used in the Final Safety Analysis Report (FSAR) analyses. These assumptions are highlighted, as they are not consistent with current interpretations of regulatory requirements and are the primary cause of the increased calculated doses.

The five bulleted items provided in the July 7, 2005, letter are:

- Use of ARCON96 (RG 1.194, "Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants") for control room atmospheric dispersion factors (χ/Q) versus use of FSAR χ/Q derived from site-specific wind tunnel testing
- Use of constant control room breathing rate (RG 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," and RG 1.195, "Methods and Assumptions for Evaluating Radiological Consequences of Design Basis Accidents at Light-Water Nuclear Power Reactors") versus FSAR time-dependent breathing rates comparable to allowed offsite breathing rates
- Use of engineered safeguards (ESF) room emergency core cooling system (ECCS) leakage iodine airborne fraction of 10% (RG 1.183, RG 1.195) when less than 10% of leaked fluid flashes, versus use of FSAR iodine airborne fraction equivalent to leaked fluid flashing fraction
- Consideration of effect of safety injection refueling water tank (SIRWT) pH on iodine re-evolution due to increased iodine re-volatilization versus FSAR consideration only of sump fluid pH
- Consideration of all dose significant nuclides with respect to shine dose from SIRWT versus FSAR consideration of only nuclides that also contribute to inhalation/immersion dose with respect to shine dose from SIRWT

In preparation for tracer gas testing, and due to the items listed above, an operability recommendation was written and a bounding re-analysis was performed, including the maximum hypothetical accident (MHA)/loss-of-coolant accident (LOCA) event. The re-analysis for the operability recommendation utilized the methodologies presented in RG 1.183, along with best-estimate inputs, including a source term equaling 100% cladding failure with no fuel melt. The 100% cladding failure source term bounds the currently approved 10 CFR 50, Appendix K analysis for Palisades Nuclear Plant (PNP), which demonstrates clad temperatures do not exceed 2200°F, and only limited clad bursts occur. The 100% cladding failure assumption is equivalent to approximately 10% core melt. Therefore, the provisions of 10 CFR 50.67 that (1) the assumed fission product release should be based on a major accident that would result in potential hazards not exceeded by those from any accident considered credible, and (2) that such accidents have generally been assumed to result in substantial meltdown of the core with subsequent release of appreciable quantities of fission products, are met by the re-analysis.

The re-analysis supporting the operability recommendation addresses the five items above. Details on each item are provided below.

<u>Wind Tunnel χ/Q</u>

- Use of ARCON96 (RG 1.194) for control room χ/Q versus use of FSAR χ/Q derived from site-specific wind tunnel testing

The use of ARCON96 for control room χ/Q contributed to the decrease in margin mentioned previously, therefore, the current PNP design basis χ/Q values were used in the analysis. These values are derived from wind tunnel measurements designed to determine conservative atmospheric dispersion characteristics of the PNP site. The use of wind tunnel χ/Q is consistent with the guidance in Section 7 of RG 1.194, provided certain conditions are met. The conditions require that data based on wind tunnel tests be accompanied with an evaluation of the representativeness of the experiment results to the particular plant configuration and site meteorological regimes. Also, the conditions define an acceptable experimental program as meeting the following standards:

- The experimental program should be appropriately structured so as to provide data of appropriate quantity and quality to support data analysis and conclusions drawn from that data. The program should be developed by personnel who have educational and work experience credentials in air dispersion meteorology and modeling.

- The experimental program should encompass a sufficient range of meteorological conditions applicable to the particular site so as to ensure that the data obtained address the site-specific meteorological regimes and the site-specific release point/receptor configurations that impact the control room χ/Q values. Meteorological conditions observed at the particular site with a frequency of 5 percent or greater in a year should be addressed. Parameters derived from statistical analyses on the experimental data should represent the 95^{th}-percentile confidence level.

- The experimental program, including data reduction and analysis, should incorporate applicable quality control criteria of Appendix B to 10 CFR Part 50. The products of the experimental program should be verified and validated.

PNP's wind tunnel χ/Q values were developed with a program materially consistent with these conditions. The wind tunnel χ/Q values are a conservative representation of the atmospheric dispersion characteristics at the PNP site. Therefore, there is reasonable assurance that analyses utilizing the wind tunnel χ/Q provide an appropriately conservative evaluation of control room habitability for operability recommendation analyses.

The χ/Q values used are given below:

Table 1: χ/Q Values

	Containment Releases*		SIRWT Releases	
Time Frame	Normal Intake (Unfiltered)	Emergency Intake (Filtered)	Normal Intake (Unfiltered)	Emergency Intake (Filtered)
	[s/m^3]	[s/m^3]	[s/m^3]	[s/m^3]
0-8 hours	7.72E-4	2.56E-4	1.32E-2	6.35E-4
8-24 hours	4.55E-4	1.51E-4	7.78E-3	3.74E-4
1-4 days	2.90E-4	9.60E-5	4.95E-3	2.38E-4
4-30 days	1.27E-4	4.22E-5	2.18E-3	1.05E-4

*also used for ESF room releases

Control Room Breathing Rate

- Use of constant control room breathing rate (RG 1.183, RG 1.195) versus FSAR time-dependent breathing rates comparable to allowed offsite breathing rates

The constant breathing rate for control room occupants specified in Section 4.2.6 of RG 1.183, was used in the analysis. Given that the breathing rate is specified as acceptable for design basis analyses, there is reasonable assurance that analyses utilizing the RG 1.183 control room breathing rate provide an appropriately conservative evaluation of control room habitability for operability recommendation analyses.

The breathing rate value used is 3.5E-4 m^3/s.

ESF Room Iodine Airborne Fraction

- Use of ESF room ECCS leakage iodine airborne fraction of 10% (RG 1.183, RG 1.195) when less than 10% of leaked fluid flashes, versus use of FSAR iodine airborne fraction equivalent to leaked fluid flashing fraction

An iodine airborne fraction equivalent to the bounding fluid flashing fraction was used in the analysis. Section 5.5 of Appendix A to RG 1.183 states: "If the temperature of the leakage is less than 212°F or the calculated flash fraction is less than 10%, the amount of iodine that becomes airborne should be assumed to be 10% of the total iodine activity in the leaked fluid, unless a smaller amount can be justified based on the actual sump pH history and area ventilation rates." In accordance with the current PNP design basis, the minimum sump pH after the start of recirculation is 7. According to Figure 3.1 of NUREG/CR-5950, "Iodine Evolution and pH Control," at a pH of 7 there will be essentially no elemental iodine present in the sump. In addition, ESF room external ventilation is isolated on high ductwork radiation signals. Therefore, there is reasonable assurance that analyses utilizing ESF room iodine airborne fractions equivalent to bounding fluid flashing fractions provide an appropriately conservative evaluation of control room habitability for operability recommendation analyses.

The ESF room iodine airborne fraction value used is 2.953%.

SIRWT pH

- Consideration of effect of SIRWT pH on iodine re-evolution due to increased iodine re-volatilization versus FSAR consideration only of sump fluid pH

SIRWT pH, temperature and iodine concentration were used in the analysis to determine an equivalent iodine airborne fraction for ECCS leakage to SIRWT as a function of time (an equivalent iodine airborne fraction is defined for this discussion as the iodine volatile fraction divided by the iodine partition coefficient). Consideration of the SIRWT pH, temperature and iodine concentration over time is a reasonable and conservative method for determining an equivalent iodine airborne fraction.

The method is consistent with RG 1.183, Appendix A, Section 5.5 based on the following. Sump water leaks back to the SIRWT at a relatively slow rate and passes through a significant length of pipe before entering the SIRWT. Substantial cooling of this fluid occurs. An analysis of the magnitude of this cooling was performed using GOTHIC and resulted in SIRWT leakage entrance temperatures ranging from approximately 90°F to 170°F. Therefore, no flashing of the fluid leaking to the SIRWT is assumed to occur and the flashing fraction is zero. As a result, airborne fractions of less than 10% can be used.

Given the volume of water initially in the SIRWT, the volume of water assumed to leak in over the course of the 30-day accident sequence, and that the tank is not an open tank, but is largely closed (with the exception of a J-vent), evaporation to dryness of the fluid in the SIRWT is not credible. The method used determines the iodine partition coefficient as a function of temperature according to $Log_{10}(PC_{I2}) = 6.29 - 0.0149*T$ (where T is in degrees Kelvin, as indicated in equation 15 of NUREG/CR-5950, "Iodine Evolution and pH Control"). The method used determines the iodine volatile fraction considering iodine concentration and pH according to the curve in Figure 3.1 of NUREG/CR-5950. Therefore, there is reasonable assurance that analyses utilizing equivalent iodine airborne fractions considering SIRWT pH, temperature and iodine concentration as described above provide an appropriately conservative evaluation of control room habitability for operability recommendation analyses.

The SIRWT equivalent iodine airborne fraction values used ranged from 3.6E-4 to 6.5E-4.

Dose Significant Nuclides

- Consideration of all dose significant nuclides with respect to shine dose from SIRWT versus FSAR consideration of only nuclides that also contribute to inhalation/immersion dose with respect to shine dose from SIRWT

The full set of 107 dose significant nuclides consistent with Table 5 of RG 1.183 was used in the analysis. Therefore, there is reasonable assurance that analyses utilizing the full set of 107 nuclides provide an appropriately conservative evaluation of control room habitability for operability recommendation analyses.

The dose significant nuclides used were:

Table 2: Nuclides					
Co-58	Ru-103	Cs-136	I-130	Pd-109	Y-91m
Co-60	Ru-105	Cs-137	Kr-83m	Rh-106	Br-82
Kr-85	Ru-106	Ba-139	Xe-138	Rh-103m	Br-83
Kr-85m	Rh-105	Ba-140	Xe-131m	Tc-101	Br-84
Kr-87	Sb-127	La-140	Xe-133m	Eu-154	Am-242
Kr-88	Sb-129	La-141	Xe-135m	Eu-155	Np-238
Rb-86	Te-127	La-142	Cs-138	Eu-156	Pu-243
Sr-89	Te-127m	Ce-141	Cs-134m	La-143	
Sr-90	Te-129	Ce-143	Rb-88	Nb-97	
Sr-91	Te-129m	Ce-144	Rb-89	Nb-95m	
Sr-92	Te-131m	Pr-143	Sb-124	Pm-147	
Y-90	Te-132	Nd-147	Sb-125	Pm-148	
Y-91	I-131	Np-239	Sb-126	Pm-149	
Y-92	I-132	Pu-238	Te-131	Pm-151	
Y-93	I-133	Pu-239	Te-133	Pm-148m	
Zr-95	I-134	Pu-240	Te-134	Pr-144	
Zr-97	I-135	Pu-241	Te-125m	Pr-144m	
Nb-95	Xe-133	Am-241	Te-133m	Sm-153	
Mo-99	Xe-135	Cm-242	Ba-141	Y-94	
Tc-99m	Cs-134	Cm-244	Ba-137m	Y-95	

Additional Information

In addition to the discussion above, the NRC staff requested discussion on actions that are necessary to retire the operability recommendation, with a schedule of the implementing actions.

The operability recommendation concluded that no operator actions are relied upon to verify that control room habitability systems can accomplish the intended safety functions. That is, the operability recommendation does not rely on actions such as operators ingesting potassium iodide (KI) prophylactic or donning a self contained breathing apparatus.

By letter dated September 25, 2006, NMC submitted a full scope alternative source term (AST) license amendment request for PNP. In addition, modifications intended to minimize control room unfiltered inleakage were committed to and are scheduled to be implemented no later than the fall 2007 refueling outage. In addition to the modifications, PNP committed to conduct post modification testing, including control room tracer gas testing, following the implementation of the modifications to validate that the modified plant configuration supports the assumptions used in the analysis supporting the AST license amendment request.

NMC plans to implement AST during the 2007 fall refueling outage, pending NRC approval. When the AST amendment is implemented, and the modifications are complete, full qualification would be restored to the PNP radiological licensing basis. The FSAR would be updated accordingly. These actions would retire the operability recommendation.