December 12, 2001

Mr. Douglas E. Cooper
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27780 Blue Star Memorial Highway
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SUBJECT: PALISADES PLANT - ENVIRONMENTAL ASSESSMENT AND FINDING OF NO SIGNIFICANT IMPACT (TAC NO. MB1362)

Dear Mr. Cooper:

Enclosed is a copy of the Environmental Assessment and Finding of No Significant Impact related to the application for amendment dated March 2, 2001, as supplemented on March 29 and September 14, 2001. The proposed amendment would change the Technical Specifications to increase the limits on stored fuel enrichments and provide other more flexible fuel loading constraints for the new and spent fuel storage racks.

The assessment is being forwarded to the Office of the Federal Register for publication.

Sincerely,

/RA/

Darl S. Hood, Senior Project Manager, Section 1
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-255

Enclosure: Environmental Assessment

cc w/encl: See next page

Palisades Plant

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UNITED STATES NUCLEAR REGULATORY COMMISSION

NUCLEAR MANAGEMENT COMPANY, LLC

DOCKET NO. 50-255

PALISADES PLANT

ENVIRONMENTAL ASSESSMENT AND FINDING OF

NO SIGNIFICANT IMPACT

The U.S. Nuclear Regulatory Commission (NRC) is considering issuance of an amendment to Facility Operating License No. DPR-20, held by Nuclear Management Company, LLC (NMC or the licensee), for operation of the Palisades Plant, located in Van Buren County, Michigan, and the NRC is issuing this environmental assessment and finding of no significant impact.

ENVIRONMENTAL ASSESSMENT

Identification of the Proposed Action:

The proposed amendment would change the limiting conditions for operation (LCOs), surveillance requirements (SRs), and design features in the Technical Specifications (TSs) to provide more flexible fuel loading constraints for the Palisades fuel storage racks and accommodate future core designs. The changes affect TS Sections 3.7.15, "Spent Fuel Pool (SFP) Boron Concentration," 3.7.16, "Spent Fuel Assembly Storage," and 4.3, "Design Features--Fuel Storage." Allowed uranium enrichments for storage would be increased. Enrichment limits for storage racks for unirradiated fuel (currently limited to fuel assemblies having a maximum average planar uranium-235 (U-235) enrichment of 4.20 weight percent) would be increased to allow storage of 24 unirradiated fuel assemblies having a maximum planar average U-235 enrichment of 4.95 weight percent, subject to proposed loading pattern constraints (e.g., the center row being empty if stored fuel exceeds 4.05 percent

U-235 enrichments). Similarly, the storage racks for unirradiated fuel could contain 36 unirradiated fuel assemblies having a maximum planar average U-235 enrichment of 4.05 weight percent, subject to similar proposed loading pattern constraints not necessarily requiring the center row to be empty. Region I storage racks (currently limited to a maximum enrichment of 4.40 weight percent) would be changed to allow storage of unirradiated or irradiated fuel up to 4.95 weight percent enrichment on the basis of revised criticality analyses that assume no credit for soluble boron in the pool under normal conditions, but which take credit for 1350 ppm of soluble boron under accident conditions. Enrichment requirements for Region II fuel storage racks (currently limited to 3.27 weight percent) would be changed to allow storage of unirradiated fuel up to 1.14 weight percent and irradiated fuel of equivalent reactivity up to 4.6 weight percent initial enrichment on the basis of criticality analyses that take credit for 850 ppm of soluble boron in the pool under normal conditions and 1350 ppm of soluble boron under accident conditions. The TSs (e.g., proposed Table 3.7.16-1) for allowable enrichments for fuel storage in Region II of the SFP or the north tilt pit would continue to be based upon a combination of initial enrichment and burnup, but the proposed change would also add decay time to this combination. The existing limitations that Region I racks may contain only "new or partially spent" fuel assemblies, and that Region II spent fuel racks may contain only "partially spent" fuel assemblies, would be changed to "new or irradiated fuel assemblies which meet the initial enrichment, burnup, and decay time requirements of [the proposed revision to] Table 3.7.16-1." The existing requirements that fuel assemblies in new or Region I fuel storage racks must contain "216 rods which are either UO_2, $Gd_2O_3UO_2$, or solid metal" would be deleted. TS 3.7.15 would continue to require that the SFP boron concentration be equal to or greater than 1720 ppm whenever fuel is stored in the spent fuel pool, and be verified weekly. However, the optional Action Statement A.2.2 to immediately initiate action to perform a SFP verification when the concentration is not within limits would be deleted (as would a related

portion of the applicability statement regarding verification). The licensee also included changes to the associated TS Bases.

The proposed action is in accordance with the application dated March 2, 2001, as supplemented by letters dated March 29 and September 14, 2001. Although the initial application for a license amendment was tendered by Consumers Energy Company (CEC), CEC has subsequently been succeeded by NMC as the licensed operator of Palisades. By letter dated May 17, 2001, NMC requested that the Commission continue to process and disposition licensing actions previously docketed and requested by CEC.

The Need for the Proposed Action:

The proposed action to change the fuel enrichment and burnup combinations acceptable for storage in Region II racks is needed to allow flexibility in fuel placement within the pool. This flexibility is needed because recent fuel assembly enrichments at Palisades have been above the current 3.27 weight percent enrichment limit for Region II racks specified in TS 4.3.1.2. Thus, currently, these assemblies can only be stored in Region I racks that have limited unused storage capacity. This proposed action is also needed to eliminate reliance upon programs (periodic “blackness” testing) designed to detect degradation and ensure the integrity of fixed Boroflex poison material in the Region II fuel racks for reactivity control. Since the licensee’s criticality calculations for this proposed change do not credit the Boroflex material, periodic blackness testing can be discontinued.

The proposed action to increase fuel storage enrichment limits allows the licensee the flexibility to pursue increased reload fuel enrichments needed to optimize fuel cycle costs.

Environmental Impacts of the Proposed Action:

The NRC has completed its evaluation of the potential radiological consequences for both normal and accident conditions associated with the proposed allowed storage of fuel with increased enrichment and SFP criticality calculations supporting the proposed changes. Radiological consequences are only indirectly affected by increasing fuel enrichment. The radiological consequences are primarily a function of operating power and burnup. By increasing fuel enrichment, the same power level can be produced for a longer period of time before refueling. Therefore, the proposed allowed storage of fuel with increased enrichment in the SFP would have no effect on authorized operating power levels, but would result in increasing the burnup levels that can be practically achieved. The proposed license amendment to change the TSs would not affect the allowed maximum burnup for Palisades. The licensee determines this limit using approved fuel assembly and core design methodology stated in the Palisades Final Safety Analysis Report (FSAR), as periodically updated. The evaluation of the radiological consequences resulting from fuel handling accidents (and other accident and transient conditions) would not change since the maximum allowed fuel burnup remains unchanged. The licensee will continue to evaluate reload core designs on a cycle-by-cycle basis as part of its reload safety evaluation process to confirm that the cycle core design adheres to the limits that exist in the accident analyses and TSs and, thus, ensure that each reactor operating cycle will be acceptable.

A. TS Changes Associated with the Fuel Pool in General

The applicability of TS LCO 3.7.15 would be changed from “When fuel assemblies are stored in the SFP and a verification of the stored assemblies has not been performed” to “When fuel assemblies are stored in the Spent Fuel Pool.” The NRC staff finds this to be a more restrictive change with no environmental impact.

Required Action A.2.2 for LCO 3.7.15 would be deleted because verification alone would not restore the plant to analyzed conditions. Required Action A.2.1 would be renumbered as "A.2."

The intent of the existing LCO 3.7.15 is to protect against criticality during a fuel handling accident or misloading event. The licensee's criticality analyses supporting the proposed action credit boron for normal storage as well as for accident scenarios. Therefore, the applicability of LCO 3.7.15 would be extended to all times when fuel assemblies are stored in the Palisades fuel pool and Action A.2.2 would be eliminated.

The change in applicability effectively increases the minimum SRs for spent fuel boron since samples now must be taken even if loading has been verified. Since administrative procedures at Palisades currently require these samples at least weekly, this change would have no effect upon plant operations and would not result in a change to individual or cumulative occupational radiation exposure limits. Similarly, the changed surveillance would not result in a change to radiological or nonradiological effluent releases during normal or accident scenarios.

B. TS Changes Associated with the Storage Racks for Unirradiated Fuel

The enrichment allowed in TS 4.3.1.3.a would be changed from "Fuel assemblies having a maximum average planar U_{235} enrichment of 4.20 weight percent" to "Twenty-four unirradiated fuel assemblies having a maximum planar average U-235 enrichment of 4.95 weight percent, and stored in accordance with the pattern shown in Figure 4.3.-1; or Thirty-six unirradiated fuel assemblies having a maximum planar average U-235 enrichment of 4.05 weight percent, and stored in accordance with the pattern shown in Figure. 4.3.-1." Existing TS 4.3.1.3.c would be deleted and existing TS 4.3.1.3d would be renumbered as 4.3.1.3c.

Since the storage racks for new (unirradiated) fuel are not used to store irradiated fuel, radiological consequences associated with changes in storage limitations are largely limited by the prevention of inadvertent criticality. The licensee's criticality analyses supporting this license amendment request show that the k_{eff} based on a 95-percent probability at a 95-percent confidence level (i.e., the 95/95 k_{eff}) for the new fuel storage rack is less than 0.95 assuming enrichment up to 4.05 weight percent U-235 when fully loaded with 36 unirradiated assemblies. The analyses also show the 95/95 k_{eff} for the new fuel storage rack is less than 0.95 when loaded with only 24 unirradiated assemblies with enrichment up to 4.95 weight percent U-235. The center row of the rack is left empty under this configuration. The licensee provided a graphical description of both loading patterns in Figure 3 of its engineering analysis, EA-SFP-99-03 (Enclosure 2 to the March 2, 2001, supplemental letter), which shows ½ of the new fuel storage rack--the loading pattern continues through the other half of the rack. The design-basis assembly is a 216-pin Palisades assembly. The licensee found earlier assembly types with fewer than 216 pins and guide tubes to be bounded since their enrichment is less than or equal to 3.27 weight percent. The licensee also notes that all assemblies with fewer than 216 pins have been irradiated and, therefore, cannot be stored in the storage racks for new fuel. Any new designs other than those assumed in the licensee's calculation, including but not limited to different numbers of fueled pins, different pellet diameters, and different pellet densities, would first be evaluated by the licensee against the design-basis calculation and in accordance with 10 CFR 50.59, "Changes, Tests and Experiments," before being stored in the racks. Therefore, the NRC staff finds that the proposed TS changes associated with the racks for storage of unirradiated fuel will not have a significant adverse radiological impact.

Storage of higher enriched fresh fuel assemblies in the storage racks for unirradiated fuel, under specific loading patterns, has no effect on nonradiological effluent releases.

C. TS Changes Associated with Region I Fuel Pool Storage

The enrichment allowed in TS 4.3.1.1.a for fuel assemblies in Region I fuel storage racks would be changed from “having a maximum enrichment of 4.40 weight percent” to “having a maximum planar average U-235 enrichment of 4.95 weight percent.” In TS 4.3.1.1.d, the existing requirement that the Region I fuel storage racks be designed and maintained with:

"New or partially spent fuel assemblies. Assemblies with enrichments above 3.27 weight percent U_{235} must contain 216 rods which are either UO_2 , $Gd_2O_3UO_2$, or solid metal."

would be changed to

“New or irradiated fuel assemblies.”

The licensee’s criticality analyses supporting this license amendment request show that the 95/95 k_{eff} for the Region I fuel storage racks is less than 0.95 assuming the enrichment of an assembly is less than or equal to 4.95 weight percent U-235. The design-basis assembly is a 216-pin Palisades assembly. Earlier assembly types with less than 216 pins and guide tubes are bounded since their maximum enrichment is less than or equal to 3.27 weight percent. The licensee states that the calculation bounds all assemblies currently stored at Palisades and those the licensee foresees in the future. Any new designs other than those assumed in the licensee’s calculation, including but not limited to different numbers of fueled pins, different pellet diameters, and different pellet densities, will first be evaluated by the licensee against the design-basis calculation before being stored in the racks. In addition, before being used in the Palisades core, any new fuel design is first evaluated as part of the licensee’s reload safety evaluation to ensure the cycle core design adheres to the limits that exist in the accident analyses and TSs. The licensee performs such analyses using approved methodologies as defined in TS 5.6.5, “Core Operating Limits Report (COLR),” and in accordance with 10 CFR 50.59.

In itself, increasing the enrichment level allowed for storage in the Region I fuel pool racks has no effect on possible radiological or nonradiological effluent releases. Since the licensee's criticality design calculations show that k_{eff} remains below 0.95 in all normal storage and accident scenarios, there is no significant increased threat of radiation exposure due to accidental criticality in the fuel pool. If the licensee should decide to pursue reload enrichments higher than the current storage limit (i.e., greater than 4.40 weight percent), the result would not adversely impact the environmental effects since radiological impacts are only indirectly affected by increasing fuel enrichment. The radiological impacts are primarily a function of operating power and burnup. The purpose of increased fuel enrichment is the ability to produce the same power level for a longer period of time before refueling. Therefore, the proposed allowed storage of fuel with increased enrichment in the SFP would have no effect on authorized operating power levels, but would result in increasing the burnup levels that can be practically achieved. Again, licensees evaluate the use of fuel (at any enrichment and burnup) on a cycle-by-cycle basis to ensure that parameters such as assembly discharge burnups are within limits specified in the FSAR.

Therefore, the proposed TS changes associated with Region I fuel pool storage have no significant adverse radiological impact. These changes also have no adverse nonradiological impact.

D. TS Changes Associated with Region II Fuel Pool Storage

The licensee proposes the following TS changes regarding the storage of fuel assemblies in Region II of the fuel pool:

LCO 3.7.16 currently requires that "The combination of initial enrichment and burnup of each fuel assembly stored in Region II shall be within the requirements of Table 3.7.16-1." This would be changed to require that "The combination of initial enrichment, burnup, and decay time of each irradiated fuel assembly stored in Region II shall be within the requirements of

Table 3.7.16-1." Thus, this change would add the decay time of each assembly as an additional requirement for storage in Region II. Similarly, the associated SR (SR 3.7.16.1) to "Verify by administrative means that the initial enrichment and burnup of each spent fuel assembly stored in Region II is in accordance with Table 3.7.16-1" would be changed to "Verify by administrative means that the combination of initial enrichment, burnup, and decay time of each irradiated fuel assembly stored in Region II is in accordance with Table 3.7.16-1." Existing TS Table 3.7.16-1 would be replaced by Table 4 from the licensee's engineering analysis, EA-SFP-99-03, which specifies Region II burnup requirements after various periods of decay. The existing requirement of TS 4.3.1.2.a that the Region II fuel storage racks are designed and shall be maintained with fuel assemblies "having a maximum enrichment of 3.27 weight percent" would be changed to "having a maximum planar average U-235 enrichment of 4.60 weight percent." A new TS 4.3.1.2.b would be added to require that the Region II fuel storage racks be designed and maintained with "k_{eff} [less than] 1.0 if fully flooded with unborated water, which includes allowances for uncertainties as described in Section 9.11 of the FSAR." Existing TS 4.3.1.2.b would be renumbered as 4.3.1.2.c and revised to require that Region II fuel storage racks be designed and maintained with k_{eff} less than or equal to 0.95 "if fully flooded with water borated to 850 ppm," rather than "if fully flooded with unborated water." Existing TSs 4.3.1.2.c and 4.3.1.2.d would be renumbered 4.3.1.2.d and 4.3.1.2.e, respectively. TS 4.3.1.2.e (former 4.3.1.2.d) would also be changed to require that Region II fuel storage racks be designed and maintained with "[p]artially spent fuel assemblies which meet the initial enrichment and burnup requirements of Table 3.7.16-1," to "[n]ew or irradiated fuel assemblies which meet the initial enrichment, burnup, and decay time requirements of Table 3.7.16-1." A new figure based upon Figure 3 of the licensee's engineering analysis, EA-SFP-99-03, and showing storage rack loading patterns for new fuel would be added as TS Figure 4.3-1.

The licensee's criticality analyses, which are the basis for this license amendment request, show that the 95/95 k_{eff} for the Region II fuel storage racks is less than 0.95 assuming the enrichment of an assembly is less than or equal to 4.60 weight percent U-235 and assuming 850 ppm boron in the pool water. The analyses also ensure that k_{eff} is less than 1.0 assuming no boron. The proposed revision to Table 3.7.16-1 contains the burnup, enrichment, and decay time combinations shown to be acceptable in the licensee's engineering analysis, EA-SFP-99-03.

Boron is already present in the Palisades SFP. Likewise, the fuel stored in the pool is burned to levels dictated by core design constraints. Fuel assemblies experience radioactive decay while they are stored. These characteristics of the fuel would not be changed by the proposed amendment. Therefore, crediting the reactivity effects associated with boron, burnup, and decay in the design-basis criticality calculations has no effect upon possible radiological or nonradiological effluent releases. Since the criticality design calculations show that k_{eff} remains below 0.95 in all normal storage and accident scenarios, there is no increased threat of radiation exposure due to accidental criticality in the fuel pool.

In general, the proposed burnup and enrichment combinations that are acceptable for storage in the Region II racks require higher burnups for a given enrichment than those present in the current TS Table 3.7.16-1. This increase in allowed minimum burnup does not affect radiological consequences since the actual fuel burnup is dictated by core design constraints and may be significantly higher than that required for storage in Region II fuel storage racks (up to 58,900 MWD/MTU assembly average for recent Palisades reload fuel, as discussed in FSAR Section 3.2.3, Nuclear Limits). In general, higher burnup has a limited effect on the short-lived isotope inventory in the fuel due to the development of an equilibrium condition between production and decay. Instead, extended burnups increase the fraction of the short-lived isotopes that migrate into the fuel-clad gap region (see, for example, NUREG/CR-5009,

“Assessment of the Use of Extended Burnup Fuel in Light Water Power Reactors," prepared for the U.S. Nuclear Regulatory Commission by Pacific Northwest). With increasing burnup, there is no decrease in fuel rod integrity or the probability of fuel failures during normal operations, as long as actual burnup does not exceed the vendor-approved values. However, with the increased short-lived activity in the clad-gap region, increased burnup could result in increased activity being released into the reactor coolant under normal operation if fuel failures were to occur. Maximum fuel burnup limits are not being changed by this proposed amendment.

E. Conclusions

On the basis of the above assessment, the NRC staff concludes that the proposed TS changes regarding the storage of new and irradiated fuel, including fuel with increased allowed enrichment (up to 4.95 weight percent), will not have a significant adverse environmental effect.

The proposed action will not significantly increase the probability or consequences of accidents, no changes are being made in the types of effluents that may be released off site, and there is no significant increase in occupational or public radiation exposure. Therefore, there are no significant radiological environmental impacts associated with the proposed action.

With regard to potential nonradiological impacts, the proposed action does not have a potential to affect any historic sites. It does not affect nonradiological plant effluents and has no other environmental impact. Therefore, there are no significant nonradiological environmental impacts associated with the proposed action.

Accordingly, the NRC staff concludes that there are no significant environmental impacts associated with the proposed action.

Environmental Impacts of the Alternatives to the Proposed Action:

As an alternative to the proposed action, the NRC staff considered denial of the proposed action (i.e., the "no-action" alternative). Denial of the application would result in no change in current environmental impacts. The environmental impacts of the proposed action and the alternative action are similar.

Alternative Use of Resources:

The action does not involve the use of any different resource than those previously considered in the Final Environmental Statement for Palisades dated June 1972, as supplemented.

Agencies and Persons Consulted:

On December 12, 2001, the NRC staff consulted with the Michigan State official, Mary Ann Elzerman, regarding the environmental impact of the proposed action. The State official agreed with the NRC staff's proposed issuance of this Environmental Assessment and Finding of No Significant Impact.

FINDING OF NO SIGNIFICANT IMPACT

On the basis of the environmental assessment, the NRC concludes that the proposed action will not have a significant effect on the quality of the human environment. Accordingly, the NRC has determined not to prepare an environmental impact statement for the proposed action.

Further details with respect to the proposed action may be found in the licensee's application dated March 2, 2001, as supplemented by letters dated March 29 and September 14, 2001. Documents may be examined, and/or copied for a fee, at the NRC's Public Document Room (PDR), located at One White Flint North, 11555 Rockville Pike (first floor), Rockville, Maryland. Publicly available records will be accessible electronically from the ADAMS Public Library component on the NRC Web site, http://www.nrc.gov (the Public

Electronic Reading Room). Persons who do not have access to ADAMS or who encounter problems in accessing the documents located in ADAMS should contact the NRC PDR Reference staff by telephone at 1-800-397-4209, or 301-415-4737, or by e-mail at pdr@nrc.gov.

Dated at Rockville, Maryland, this 12th day of December, 2001.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

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Division of Licensing Project Management
Office of Nuclear Reactor Regulation