Consumers Power
POWERING MICHIGAN'S PROGRESS
Palisades Nuclear Plant: 27780 Blue Star Memorial Highway, Covert, MI 49043

Kurt M. Haas
Plant Safety and Licensing Director

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Document Control Desk
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DOCKET 50-255 - LICENSE DPR-20 - PALISADES PLANT
TECHNICAL SPECIFICATIONS CHANGE REQUEST - IODINE REMOVAL SYSTEM - ADDITIONAL INFORMATION

On December 29, 1994, Consumers Power Company requested an amendment to Technical Specifications which would replace the requirements for Sodium Hydroxide (NaOH) addition to the Containment Spray solution with requirements for baskets of Trisodium Phosphate (TSP) to be stored in the containment. In a follow up telephone conversation on April 28, 1995, the NRC requested information on iodine related engineering factors involved in the analyses supporting the proposed installation of TSP baskets for post-accident sump pH control. In addition the NRC asked how the revised coefficients affected the electrical equipment qualification (EEQ). This letter provides the requested information.

The use of NaOH is intended solely to control the pH of the post-accident containment sump solution. Control of pH is intended to prevent the long term revolatilization of iodine from the sump solution. The use of TSP, for sump pH control, serves the same function as NaOH. The TSP baskets will maintain the sump solution in the same pH range as did the NaOH addition system. The difference in the chemical natures of TSP and NaOH has no effect on the revolatilization of the iodine from the sump solution, since this is based primarily on the pH of the sump.

Discussions, similar to those below, of post accident sump pH control and its affect on iodine levels were provided to the NRC in our July 8, 1993 letter supporting a Technical Specifications change removing requirements for hydrazine addition to the containment spray. The Safety Evaluation for the resulting Amendment (Amendment 158 issued on September 9, 1993) discussed the effects of the Palisades post-accident sump pH range on iodine control.

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The engineering factors affecting iodine removal from a post-accident containment atmosphere are: 1) the First Order Removal Coefficients or "iodine removal rates," for Spray Removal and Wall Deposition of Elemental Iodine, and for removal of Particulate Iodine, 2) the Iodine Partition Coefficient, and 3) the Iodine Decontamination Factor. These engineering factors are used to calculate the concentration of iodine which is to be assumed present in the containment atmosphere following an accident and, therefore, in any leakage from the containment.

The guidance provided for calculation of these engineering factors in Standard Review Plan (SRP) Section 6.5.2, "Containment Spray as a Fission Product Cleanup System," has changed significantly over the past 15 years. The changes in the SRP were the result of research by the NRC which supports the conclusion that removal of iodine in the containment atmosphere is more dependent on mechanical (diffusive) properties than on chemical factors.

Each of the engineering factors is discussed below. The Palisades FSAR discusses iodine engineering factors and analyses which were based on Amendment 31 to the Palisades Technical Specifications and on SRP Revision 1. The current analyses, scheduled to be submitted in January 1996, are based on SRP Revision 2. For brevity, those calculational methods and the resultant values of the engineering factors which are associated with the Maximum Hypothetical Accident (MHA) analysis in the FSAR are referred to as "former"; and those associated with SRP Section 6.5.2, Revision 2 methodology are referred to as "revised." The revision of these engineering factors is due to the change in MHA analysis methodology, not due to the proposed change in the sump pH control chemical.

1) Iodine Removal Rates:

The Iodine removal rates, as the name implies, are a measure of the rate at which iodine is removed from the containment atmosphere by surface deposition, or "plate out," and by dissolution in the spray droplets, or "spray washout". Two distinct removal rates are involved; one for particulate iodine, and one for elemental (gaseous) iodine. The former iodine removal rates are identical to those used by the NRC in their analyses associated with Amendment 31 (November 7, 1977) to the Palisades Technical Specifications; the revised rates are calculated in accordance with methodology found in Revision 2 of the SRP, Section 6.5.2.

a) Particulate Iodine Removal Rate:

The former particulate iodine removal rate was 1.0; the revised rate is 4.43. The difference between these rates is due solely to a change in calculational methodology, and not due to the proposed replacement of the NaOH addition system with TSP baskets. Neither former nor revised calculation methodology assigns higher ***particulate*** iodine removal rates due to the presence of either of these chemicals.

b) Elemental Iodine Removal Rates:

Two elemental iodine removal rates were formerly used: a value of 10.0 was used for the period when hydrazine is being added to the containment spray water, and 0.42 for the periods when hydrazine is not being added. The revised elemental iodine removal rate is 21.3 per hour. That rate applies whether hydrazine is being added or not.

This revised rate is unaffected by the proposed replacement of the NaOH system with TSP baskets since neither former, nor revised calculation methodology assigns higher elemental iodine removal rates due to the presence of either of these chemicals.

2) Iodine Partition Coefficient:

The partition coefficient is, basically, the ratio of the concentrations of iodine in the containment sump solution and in the containment atmosphere. The former iodine partition coefficient was 1000: the revised partition coefficient is 1250.

The former partition coefficient value was taken from Figure 6.5.2-1 of SRP 6.5.2 Revision 1, which gives partition coefficients for spray solutions containing NaOH. Palisades' operating procedures direct the addition of NaOH to the ECCS pump suction to maintain the sump solution (and thereby the spray solution) pH between 7 and 8. The use of the TSP basket pH control system will maintain the pH within this range.

The ***text*** in SRP 6.5.2 Revision 1 describes the values in that table as ***instantaneous*** elemental iodine partition coefficients. The references provided in SRP 6.5.2 revision 1 present methods for calculating elemental iodine spray removal rates that use an ***instantaneous*** partition coefficient. The partition coefficient which should be used to calculate the iodine decontamination factor, however, is the ***equilibrium***, rather than the ***instantaneous***, coefficient.

The revised iodine partition coefficient was calculated following the references provided in SRP 6.5.2 Revision 2. This revised value was taken from Figure 6 of NUREG/CR-4697 "Chemistry and Transport of Iodine in Containment" (Reference 15 of SRP 6.5.2 Revision 2) based on the expected containment sump solution temperature, pH, and iodine concentration for the MHA. This revised value of 1250 for the equilibrium partition coefficient is dependant on sump pH, and not the chemical used for sump pH control. Therefore, the revised iodine partition coefficient is unaffected by the replacement of the NaOH system for sump pH control with TSP baskets.

3) Iodine Decontamination Factor:

The iodine decontamination factor (DF) is the maximum amount of iodine that can be credited as removed from the containment atmosphere before an equilibrium is reached. The iodine DF is based on the partition coefficient, the containment air volume and the containment sump volume, with the partition coefficient being the only variable which is not fixed by the plant physical design.

The former iodine DF was 25.57; the revised DF is 32.51.

The former DF was determined using the equation provided in SRP 6.5.2 Revision 1, and the former partition coefficient of 1000. The revised DF was determined using the ***same*** equation, which appears in ***both*** Revision 1 and Revision 2 of the SRP, and the revised partition coefficient of 1250 .

This revised DF of 32.51 is, like the partition coefficient on which it is based, dependant on the sump pH and not on the chemical used for sump pH control.

The conclusions of the Palisades EEQ analyses are still valid with the proposed replacement of the NaOH addition system with TSP baskets since, when using the revised iodine engineering factors, more iodine would be assumed to be washed from the atmosphere thereby reducing the airborne radiation dose to equipment. This difference is due to a change in the calculational methodology promulgated in SRP 6.5.2 Revision 2, and is not a result of replacing the NaOH addition system with the TSP baskets. The chemical resistance of electrical equipment is considered to be unaffected since the pH range of the spray solution will be unaffected by the proposed change.

The table below summarizes the calculated engineering factors for iodine removal for the former and revised MHA analysis. As can be seen from the table, the iodine removal rates, partition coefficient and maximum decontamination factor calculated using the "revised" methodology of the 1988 Revision 2 to SRP 6.5.2 are greater than those used in the "former" MHA analysis of record in the current Palisades FSAR.

Palisades Iodine Engineering Factors

FACTOR	NaOH Sump pH Control	TSP Sump pH Control
Particulate Iodine Removal Rates	Revised: 4.43 Former: 1.0	Revised: 4.43 Former: 1.0
Elemental Iodine Removal Rates	Revised: 21.3 Former: 10.0/0.42	Revised: 21.3 Former: 10.0/0.42
Partition Coefficients	Revised: 1250 Former: 1000	Revised 1250 Former: 1000
Decontamination Factors	Revised: 32.51 Former: 25.57	Revised: 32.51 Former 25.57

As can be seen above, all Palisades Iodine Engineering Factors change in a conservative fashion with relation to the protection of the public and EEQ. This is due to a change in the calculational methodology promulgated in SRP 6.5.2 Revision 2, and is not a result of replacing NaOH system for sump pH control with the passive TSP system.

The chemical effects of the TSP on containment materials (i.e. corrosion of carbon steel, stainless steel, zinc, aluminum, and PVC) have been evaluated and deemed acceptable. In addition, it has been determined that maximum hydrogen concentration remains less than the acceptance criterion of 4.0 volume percent.

Representatives of Consumers Power Company are available to meet with the NRC to provide additional explanation, if such a meeting would assist the reviewers.

SUMMARY OF COMMITMENTS

This letter contains no new commitments or revisions to former commitments.

Kurt M. Haas
Director, Plant Safety & Licensing

CC Administrator, Region III, USNRC
Resident Inspector, Palisades