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Palisades Nuclear Plant
Operated by Nuclear Management Company, LLC

December 27, 2001

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

DOCKET 50-255 - LICENSE DPR-20 - PALISADES NUCLEAR PLANT
SUPPLEMENTAL INFORMATION TO TECHNICAL SPECIFICATION CHANGE REQUEST - SPENT FUEL POOL BORON CONCENTRATION

By letter dated March 2, 2001, Nuclear Management Company, LLC (NMC) submitted the subject Technical Specification Change Request (TSCR). The NRC staff requested supplemental information to facilitate their review during telephone conversations with Palisades staff members on September 12, 2001, and December 4, 2001. Attachment 1 provides this supplemental information. In addition, Attachment 2 provides page corrections to five pages contained in the March 2, 2001, TSCR. These page corrections address typographical errors and provide a more legible figure containing the Palisades spent fuel pool configuration.

SUMMARY OF COMMITMENTS

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

Paul A. Harden
Director, Engineering

CC Regional Administrator, USNRC, Region III
Project Manager, USNRC, NRR
NRC Resident Inspector - Palisades

Attachments

A001

Rec'd 01/30/02

NUCLEAR MANAGEMENT COMPANY, LLC

TECHNICAL SPECIFICATION CHANGE REQUEST
SPENT FUEL POOL BORON CONCENTRATION
SUPPLEMENT

To the best of my knowledge, the content of this supplemental information for the March 2, 2001, Technical Specification Change Request, which will increase the limits on stored fuel enrichment, impose a spent fuel boron concentration requirement whenever fuel is stored in the spent fuel pool, and require that the spent fuel pool boron concentration be verified weekly, is truthful and complete.

By ______________________
Paul A. Harden
Director, Engineering

Sworn and subscribed to before me this 27th day of December 2001.

____
Janice M. Milan, Notary Public
Allegan County, Michigan
(Acting in Van Buren County, Michigan)
My commission expires September 6, 2003

(Seal)

ATTACHMENT 1

NUCLEAR MANAGEMENT COMPANY
PALISADES NUCLEAR PLANT
DOCKET 50-255

December 27, 2001

SUPPLEMENTAL INFORMATION TO TECHNICAL SPECIFICATION CHANGE REQUEST - SPENT FUEL POOL BORON CONCENTRATION

16 Pages

Supplemental Information to Technical Specification Change Request
Spent Fuel Pool Boron Concentration

Answers to NRC Questions of September 12, 2001

Question

1. The spent fuel pool (SFP) cooling system is required to maintain the SFP water temperature less than 150 °F with a minimum of one SFP cooling pump operating. The maximum SFP heat load resulting from off-loaded spent fuel shall be less than 28.64 x 10^6 Btu/hr regardless of whether the heat load is from a one-third core off-load or a full core off load. Will the proposed increase in fuel enrichment to 4.95 wt% U-235 increase the heat load on the SFP? What impact will this increase have on the SFP cooling system and the ability of the system to continue to meet its design bases?

Answer 1

The increase in enrichment to 4.95 wt% U-235 is expected to have minimal impact on the heat load in the SFP. The heat load is typically calculated using NUREG-0800, "Standard Review Plan," Branch Technical Position (BTP) ASB 9-2, "Residual Decay Energy for Light Water Reactors for Long-Term Cooling." The fission product decay heat is not a function of enrichment and depends only upon time at power level. The heavy element decay heat depends upon power level, time and the ratio of the absorption cross section of U-235 to the fission cross section of U-235. The BTP allows a conservative default value of 0.7 to be used for the U-235. With that approximation the heavy element heat is also not a function of enrichment. Therefore, within the limits of accuracy of the commonly used correlation, the heat load is not a function of enrichment. The fact that a higher enrichment might allow a longer operating cycle will slightly increase decay heat and was conservatively and explicitly considered in the criticality analysis.

Question

2. The no significant hazards determination indicated that a boron dilution analysis was performed for 11 scenarios broken down into two different categories of events. Please provide the following information for all scenarios evaluated:

> *Dilution sources (provide a conservative estimate of the potential volume that each of the sources could add to dilute the SFP.)*
>
> *Dilution flow rates for each source (include the flow rates from potential pipe breaks, seismic events, and others).*
>
> *Boration sources (volumes and flow rates)*
>
> *Instrumentation (explain how instrumentation plays a role in assisting in detection of dilution events evaluated)*
>
> *Administrative Procedures (explain how administrative procedures play a role in assisting in detection and mitigation of dilution events e.g., frequency of operator rounds and what actions are taken during rounds that would detect a SFP dilution and what actions would be taken to assist in mitigating the event)*
>
> *Loss of offsite power impact*
>
> *Describe in detail all initiating events*
>
> *Piping*
>
> *Boron dilution times and volumes for all scenarios evaluated*

Answer 2

The question is broken into pieces and the pieces sub numbered in order to simplify answering.

Question 2a

The no significant hazards determination indicated that a boron dilution analysis was performed for 11 scenarios broken down into two different categories of events. Please provide the following information for all scenarios evaluated:

> *Dilution sources (provide a conservative estimate of the potential volume that each of the sources could add to dilute the SFP.*
>
> *Dilution flow rates for each source (include the flow rates from potential pipe breaks, seismic events, and others).*

Answer 2a

The following table provides the sources, flow rates and volumes required to dilute to the proposed Technical Specification minimum concentrations of 850 parts per million (ppm) boron for normal conditions and 1350 ppm for accident (tornado) cases. Due to significant margins in the limits (e.g., $k_{eff} < 0.95$) dilution with the assumed volume of water does not actually lead to criticality.

Summary Table of Analyzed Events For Spent Fuel Pool Dilution Analysis

#	Event and source	Cause of Event	Dilution flowrate	Dilution volume
1	Demineralized water addition via ¾-inch hose. Source = makeup water storage tanks	Operator error during pool boron adjustment	40.7 gpm	123,007 gal
2	Fire water addition via 1-1/2 -inch hose station. Source = Lake Michigan	Misdirected water during fire fighting or operator initiated to refill pool	209.8 gpm	123,007 gal
3	Failure to fully isolate SFP demineralizer before valving in resin sluice water. Source = makeup water storage tank	Operator error during activity	165 gpm	123,007 gal
4	Place unborated demineralizer in-service. Source = unborated resins	Operator error during activity. SFP boron is reduced a total of 22.3 ppm boron	N/A	N/A
5	SFP cooling heat exchanger tube rupture. Source = makeup water storage tanks	Insufficient in-service-inspection or broken inlet flow baffle	83.6 gpm	123,007 gal

#	Event and source	Cause of Event	Dilution flowrate	Dilution volume
6	Misapplication of portable Tri-nuc water cleanup filter system. Source = temporary water source	Radiation Protection Technician error	250 gpm	123,007 gal
7	Normal system dilution due to transfer tube cross-connecting reactor cavity at 1720 ppm boron with SFP at 3000 ppm boron. Source = reactor cavity	Normal refueling outage evolution, caused by diffusion/natural circulation or cooling flow imbalance (this is not a criticality event). Three-days of uncontrolled and slow boron change.	Refer to Cause column	253,000 gal
8	Fire water addition via six-inch swing elbow in cooling system. Source = Lake Michigan	Emergency makeup via approved procedure after major SFP leak interrupts cooling and shielding.	4,500 gpm	123,000 gal
9	South tilt pit gate leak with transfer tube flange installed. Source = makeup water storage tanks	Operator directed emergency makeup. Refill ends at 1422 ppm boron in SFP.	any	34,600 gal
10	Reactor cavity seal leak or steam generator nozzle dam loss. Source = none	Poorly installed seals or mechanical damage to same. No refill assumed since leak is too large. Event stops when SFP empties to level of SFP gate threshold and boil off cooling.	N/A	N/A
11	Tornado removes seven-feet of water from SFP followed by refill with fire water. Source = Lake Michigan	Refill of SFP following tornado event and prior to re-initiating cooling. Refill with unborated water dilutes SFP to 1480 ppm boron.	any rate	Refer to Cause column

The above table, with the exception of the tornado event, is not driven by events beyond procedural errors and postulated human errors. The tornado was included because it was discussed at some length on the docket. The last sentence of question 2a, "Dilution flow rates for each source (include the flow rates from potential pipe breaks, seismic events, and others)," is therefore treated generically. Representative worst cases based on pipe size and available head were analyzed in above 11 postulated events. Due to the design of the SFP system and its isolation from almost all non-borated water sources, pipe breaks and seismic events are not limiting dilution issues. The results are largely dominated by assumptions of fire hose misuse, operator errors, and procedurally condoned attempts to make up for accidental water loss in the SFP.

The SFP cooling system piping is seismically qualified, however, there are possible seismic scenarios that could dilute the SFP. The only piping that exists directly adjacent to, and above, the pool is heating and cooling system piping. This piping is small and non-seismically qualified, but the system's total volume is very small in comparison to the SFP volume, and therefore is not a serious dilution threat.

There is a significant amount of three-inch piping that serves the three miscellaneous waste demineralizers located approximately forty feet north of the SFP. If this should break in an earthquake or tornado the water could run across the floor and enter the SFP through an existing opening in the curb. However, once the SFP fills (approximately two feet) to overflowing, the water will travel on another path toward the auxiliary building basement. There are a number of pipe cuts and a 6 by 6 foot uncurbed hatch in the floor in the direct pathway of the water which should facilitate diversion. Therefore this event is considered a minor dilution of the boron concentration in the SFP.

There are no floor drains in the SFP itself. There are floor drains in the tilt pits. The one in the north tilt pit which contains fuel racks is permanently capped. The one in the south tilt pit is still active and locked closed during normal plant operation. This drain is further isolated by the tilt pit gate which is in place during normal operation. Therefore, broken drain lines cannot cause loss of SFP water which would necessitate dilution to maintain water level over the fuel.

Question 2b

Boration sources (volumes and flow rates)

Answer 2b

The only SFP boration sources normally used are the two six-inch lines from the SIRWT and a ¾-inch hose which is procedurally controlled and is used to add concentrated boric acid directly from the recycled boric acid tank.

The SIRWT contains 250,000 gallons of 1720 ppm (minimum) borated water in order to meet Technical Specifications requirements during normal operation. During refueling most of this water is pumped to the refueling cavity in containment. Four safety injection tanks are available via separate 12-inch lines by gravity to the reactor vessel. This water would enter the SFP by flowing out of the reactor vessel and though the transfer tube.

The plant's chemical volume control system (CVCS) contains three concentrated boric acid storage tanks totaling about 17,000 gallons. The minimum inventory during power operation is slightly less than one 6,500-gallon tank, however, all the tanks are normally kept full. The tanks are presently maintained between 6.25% and 8% boric acid concentration. This acid can be delivered directly to the SFP by a temporary rubber hose or by batching it to the SIRWT and then feeding SIRWT water to the six-inch normal makeup line to the SFP cooling pump suction per plant procedures. Because the CVCS system can also deliver unborated water it was not directly connected to the SFP system as a design objective in the original plant license application.

Question 2c

Instrumentation (explain how instrumentation plays a role in assisting in detection of dilution events evaluated)

Answer 2c

The main dilution sources of concern in this analysis are the plant's large storage tanks for condensate and reactor coolant system makeup. All of these tanks have high and low level alarms and all are located on the 590 ft. elevation outside the plant. The high level alarms do not play any role for detecting SFP dilution events. The low level alarms for all except the Condensate (T-2) and Primary Makeup Water (T-82) are located near the tank bottom and would only play a role in detecting significant dilution events. Therefore, these alarms are not counted upon for dilution event termination.

The other main source of dilution water is the plant fire protection system. The fire system alarms on low pressure and on all main fire pump starts. These alarms are a major factor in limiting the undetected dilution flow-rate from this source to that of the jockey pump. This system would only become a dilution source when it is being purposely employed by the operator for major SFP leakage mitigation, which is allowed by plant procedures. Because the system is so powerful in this capacity it is analyzed as one of the dilution events.

The most likely alarms to alert the operations personnel are the safeguards room sump level alarms in the lowest level of the auxiliary building. There are also alarms in the sumps on the 590 ft. elevation of the auxiliary building, however they are located further away from the typical path water would take from the SFP to the auxiliary building basement.

Observations by operations and radiation protection personnel while moving about the plant on normal business is the most likely source of an early warning of an in-progress SFP dilution since the common water path from the SFP overflow goes through the main stairway in the auxiliary building. The plant is in the process of adding a SFP high level alarm to give an earlier and more consistent warning of SFP level increases and hence dilution event precursors.

Question 2d

Administrative Procedures (explain how administrative procedures play a role in assisting in detection and mitigation of dilution events e.g., frequency of operator rounds and what actions are taken during rounds that would detect a SFP dilution and what actions would be taken to assist in mitigating the event)

Answer 2d

Plant procedures require weekly verification of SFP level and weekly verification of SFP boron concentration. During refueling this increases to daily and further increases to each-shift during actual fuel movement.

Operating practice requires at least one operator round per shift. Several items in the SFP area are read and keyed into hand held computers. Among them are SFP temperature, level, the condition of the tilt pit gate (leakage, seal gas pressure) and ventilation system functions. This allows the opportunity for the operator to periodically observe the general auxiliary building condition.

Question 2e

Loss of offsite power impact

Answer 2e

Since there are no dilution sources connected to the SFP that are capable of gravity transfer of unborated water to the SFP, the loss of offsite power would not cause a dilution event. The main response paths to counter a dilution involve safety related equipment that is powered by onsite diesel power. If a loss of coolant accident (LOCA) is not in progress, the SFP cooling pumps can be easily manually powered from the diesel which insures that adequate mixing exists in the SFP so that any dilution water is well mixed with SFP water. Should restoration of SFP cooling not occur, the heat from the fuel produces sufficient natural circulation to mix the SFP except for the most rapid dilution events (e.g., use of fire water addition via the six-inch swing elbow.) Swinging the elbow is a deliberate time consuming action performed per plant procedures and is not likely to take place if the SFP cooling pumps are not available.

Question 2f

Describe in detail all initiating events

Answer 2f

The initiating events are described in the second and third columns of the table provided in answer to question 2a.

Question 2g

[Describe the] Piping

Answer 2g

Piping can be involved in dilution in two ways, by penetrating the SFP itself or by connecting to the SFP cooling and clean up system piping. The following two tables describe these piping events. The lowest penetration is at elevation 645 ft, which is the fourteen-inch cooling outlet to the SFP cooling pumps. This is just below the assumed normal water level elevation of 647 ft. The leak chase piping at the bottom of the SFP collects leakage past the SFP liner plate welds which have a low leakage rate.

Fuel Pool Fill and Drain Provisions

The SFP contains the following penetrations or available temporary water sources any of which could be a potential dilution source:

#	Size	Elevation Centerline	Use	Normal fluid	Potential Dilution Mechanism
1	36-inch	617'-6"	South tilt pit fuel transfer tube	SFP water and refueling cavity water	dilution of refueling cavity by component cooling water via shutdown cooling heat exchanger tube leak, accidental safety injection actuation during refueling, refueling cavity decontamination efforts
2	14-inch	645'-0"	SFP cooling out of the pool	SFP water	hot spot removal & pipe decontamination activities, fire system elbow installed, heat exchanger tube leak, demineralizer sluice water not isolated
3	12-inch	648'-0"	SFP cooling in to the pool	SFP water	same as Table line 2

#	Size	Elevation Centerline	Use	Normal fluid	Potential Dilution Mechanism
4	6-inch	610'-0"	South tilt pit drain	SFP water	same as Table line 2
5	*6-inch	648'-6"	Northwest overflow	Empty	All four overflows go to Equipment Drain Tank which could backup due to extensive interconnections with many other plant systems. Due to the dominant height of the SFP other systems such as waste gas tend to flood much earlier, however.
6	*6-inch	648'-6"	Southwest overflow	Empty	same as Table line 5
7	*6-inch	648'-6"	North tilt pit overflow.	Empty	same as Table line 5
8	*6-inch	648'-6"	South tilt pit overflow.	Empty	same as Table line 5
9	4-inch	645'-0"	North tilt pit fill	SFP water	See SFP Cooling (Table lines 2,3, & 4)
10	4-inch	645'-0"	South tilt pit fill	SFP water	See SFP Cooling (Table lines 2,3, & 4)
11	2-inch	610, 611	Leak chase drains for main pool and both tilt pits	Empty	there are multiple lines which go to funnels and then to dirty waste tank
12	2-inch	Over top	Fire hose is 1-1/2 inch	Lake Michigan	Emergency pool refill to restore cooling or shielding
13	¾-inch	Over top	Fill pool via red rubber hose	Demineralized water	Decontamination and evaporation makeup from either primary makeup water tank T-90 or utility water tank T-91
14	¾-inch	Over top	Fill SFP via red rubber hose	Concentrated boric acid	Borate the pool above SIRWT levels to facilitate dry cask loading from the recycled boric acid tank T-96 (ReBAT)
15	2-inch or 3-inch	Portable unit sits on SFP floor. (600gpm unit has 3-inch hose)	Filter SFP water for visibility improvement	SFP water	System uses a floating skimmer for suction of the pump which sits in the pool below the float and discharges upward via an optional line of various lengths designed to control the fraction of the pool volume involved in the recirculation path. The hose is occasionally rigged to discharge outside the SFP for temporary water movement or sampling. The suction hose can also be attached to a floor-vacuuming wand.

#	Size	Elevation Centerline	Use	Normal fluid	Potential Dilution Mechanism
16	¾-inch	Hose over top	Dry cask canister fill and pump down skid. 20 gpm @ run out & 100 psi@ shutoff Burks pump	SFP water at 2800 ppm boron or greater	Used to pre-fill liner before it is immersed in SFP and to pump down and then vacuum evacuate the liner after it is seal welded. Flushing and skid checkout could result in some SFP dilution.

* These overflows attach to four-inch pipe and goes to the equipment drain tank (520 gallons rated at 50 psig) located at elevation 579 ft in the east safeguards room which can be aligned to automatically pump to a 50,000 gal. clean waste receiver tank.

Fuel Pool Cooling System Interconnections.

The following table lists lines that penetrate the SFP cooling system at or near elevation 590 ft. The system is pressurized by fifty-seven-feet of water (~25 psig) at that point. Leakage out of the system especially during refueling with the SIRWT nearly empty can cause the need for emergency makeup with non-borated water. The system also contains equipment vent and drain lines that go directly to atmosphere. Leakage from those lines would wet the floors and fill the auxiliary building sump via the floor drains which should be noticed by operators during shift or hourly rounds of plant equipment. These lines are not dilution hazards due to the air gaps in the lines which prevents any backup.

#	Size	Location	Use	Normal Fluid	Potential Dilution Mechanism
1	6-inch	SFP cooling pump suction	Fill SFP from SIRWT	Refueling water 1720 ppm boron minimum	Can dilute pool from 3050 ppm used during dry cask loading. Due to 1720 ppm minimum set by Technical Specifications there is no SFP rack criticality problem. The valve is locked closed.
2	6-inch	SFP cooling pump discharge and refueling cavity fill and recirculation	Return SFP or refueling cavity water to SIRWT	Refueling water 1720 ppm boron minimum	This line also fills SFP by gravity due to being connected to the only tank that is at higher elevation than SFP. This line has caused SFP overflow in the past. The valves are locked closed. Boron at 1720 ppm minimum insures there is no SFP rack criticality hazard.

#	Size	Location	Use	Normal Fluid	Potential Dilution Mechanism
3	8-inch	SFP cooling pump suction	Shutdown cooling system cross-tie	Cold shutdown boron concentration	Drop line to shutdown cooling used as SFP heat exchanger backup. Line is blind flanged with a spool piece and valve is locked closed. Late in core life cold shutdown boron concentration is about 600 ppm. Use only allowed at cold shutdown since shutdown heat exchanger is part of emergency core cooling system (ECCS).
4	8-inch	SFP heat exchanger discharge.	Shutdown cooling system cross-tie	Cold shutdown boron concentration	Return line from shutdown cooling. Line is blind flanged with a spool piece and valve is locked closed. Late in core life cold shutdown boron concentration is about 600 ppm.
5	6-inch	SFP cooling return line	Emergency fill from fire system	Lake Michigan water	Emergency SFP fill line. Line is blind flanged with a swing elbow. Valve is locked closed. Procedure allows use of this line with Shift Supervisor permission.
6	3-inch	SFP demineralizer	Transfer clean resins to SFP deminerlizer	Demineralized water	Resin transfer operator error and line unplugging efforts.
7	3-inch	SFP demineralizer	Transfer spent resin from SFP demineralizer	Demineralized water	Resin transfer operator error and line unplugging efforts.
8	2-inch	SFP demineralizer	Resin bed lifting air for SFP demineralizer	Plant service air	Service air occasionally contains moisture.
9	3-inch	SFP cooling pump discharge	Transfer hose attachment for drainage and hot spot flushing	Hose bib.	Hot spot flushing activity
10	6-inch	Spool piece	Hot spot removal in reactor cavity and tilt pit drain lines	Tri-Nuc filter and flushing water	Spool piece is isolated by normally closed, locked closed valves and is normally kept bolted in place. Used to splice in portable Tri-Nuc unit during draining of the fuel transfer path to avoid hot spots and in conjunction with at least four separate blind flanged tees for hot spot flushing while piping is isolated from the SFP.
11	8-inch	SFP cooling pump suction	Refueling cavity draining or cooling or cleanup	SIRWT water 1720 ppm boron minimum	Flushing and decontamination efforts use limited demineralized water during Cavity drain down. Valves are locked closed as containment isolation valves during normal operation.
12	6-inch	SFP heat exchanger outlet	Refueling cavity fill or cleaning or cooling return	SIRWT water 1720 ppm boron minimum	Used only during refueling. Valves are locked closed as containment isolation valves during normal operation.

Question 2h

Boron dilution times and volumes for all scenarios evaluated

Answer 2h

The table supplied in answer to question 2a provided the dilution volumes in the last column. The dilution times discussed here are the time from initiation of the dilution to the time when the SFP would reach the proposed Technical Specification limiting boron concentration of 850 ppm. In effect it is the time the operators have to discover the dilution and get it stopped while still meeting the licensed criteria and preserving full uncertainty margins.

#	Event	Time to Reach 850 ppm
1	Demineralized water addition via ¾-inch hose	50 hours
2	Fire water addition via 1-1/2-inch hose station	9.8 hours
3	Failure to fully isolate demineralized before valving in resin sluice water	12.4 hours
4	Place unborated demineralizer in-service	SFP boron lowered by 22.3 ppm due to saturation of resin*
5	SFP cooling heat exchanger tube rupture	24.5 hours
6	Misapplication of portable Tri-nuc water cleanup filter system	8.2 hours
7	Normal system dilution due to transfer tube cross-connecting reactor cavity at 1720 ppm boron with SFP at 3000 ppm boron	SFP diluted from 3000 ppm boron to 2246 ppm boron. 3 days* required for SFP ppm change, dilution is difficult to detect.
8	Fire water addition via six-inch swing elbow in cooling system	27.3 minutes
9	South tilt pit gate leak with transfer tube flange installed	Ends at 1422 ppm* boron due to transfer tube cover being in place.
10	Reactor cavity seal leak or steam generator nozzle dam failure	Level goes to gate threshold and can not be recovered.* Cool SFP by boil off and repair seal.
11	Tornado removes seven-feet of water out of SFP followed by refill with fire water	SFP refilled and at 1480 ppm* boron

*Note: In all **but** the asterisked cases the dilution time is arrived at by dividing 123,007 gallons by the calculated 0 ppm dilution water flow rate.

Follow-up Question of December 4, 2001

Per our discussion on December 4, 2001, the licensee in its draft response identified *additional dilution events that are more limiting than the 9.8 hours stated in the application. The licensee needs to provide justification/bases for detecting and mitigating these "new events."*

Answer to 12/4/01 Follow-up

The question refers to the two cases listed in the dilution table with times of 8.2 hours and 27 minutes respectively. These cases are not considered more limiting that the stated 9.8 hours stated in the application. The reason is different for each of the cases.

The original March 2, 2001 submittal (on Enclosure 1, page 11) discussed two categories of events. Category 1 events were generally considered credible dilution accidents and category 2 events were considered incredible events. Category 2 events begin with a loss of water and involve a purposeful attempt to refill the SFP with non-borated water. Then it is assumed that the refill is allowed to proceed to overflow even though it is being done as emergency correction of another problem. The 27 minute case is a category 2 event. The refill starts with the swing elbow from the SFP being unbolted, swung into place on the fire system pipe, and opening two isolation valves. This would start one electric driven fire pump and one diesel driven fire pump. Both starts are alarmed in the control room. The refill is allowed to proceed uncontrolled even though it is performed intentionally and is covered in plant operating procedures. It is not considered credible to unbolt the elbow, rebolt it in the alternate position, open two large locked closed valves, and allow the pool to over fill while ignoring plant procedures.

The 8.2 hour time is the result of assuming that the Tri-nuc filter is misused. These filter systems are portable and normally run in a short recirculating loop in the SFP. In the final analysis this case is enveloped by other cases due to an argument related to lack of supply water. The logic proceeds as follows.

As a general rule the analysis was performed assuming all water sources were infinite and could deliver water indefinitely at the highest rate restricted only by the size of the pipes and pumps in the delivery path to the SFP. Since the tanks are interconnected, termination of the dilution by tank depletion was not used and the table supplied on the March 2, 2001 submittal (Enclosure 1 page 11) in answer to the previous question does assume an infinite source of dilution water.

In the Tri-nuc case, it has no permanently connected pipes or dilution water supply pumps. In normal use the filter and pumps are submerged in the SFP and use the SFP for both suction and discharge volumes. Occasionally the suction hose of filter is removed from the SFP and inserted in a portable tank to provide clean wash water for a cask, the SFP walls, or refueling cavity walls. The calculated dilution requires over 100,000 gallons of water and is beyond the size of any portable tank that is on the site or that could be maneuvered from off site to anywhere near the SFP. The worst real case would be one where a small tank is used and continuously refilled. This event would then be the same as one of the cases that address continuous dilution. For this reason this event is not considered limiting even though it is a category 1 event in that it starts with intention to decontaminate the SFP surfaces rather than to refill it.

Question

3. What is the normal spent fuel pool volume?

Answer 3

The normal volume of the SFP and attached north tilt pit (which also contains fuel racks), when the plant is configured for power operation, is 165,300 gallons. This considers the normal water surface to be at elevation 647 ft. This volume has been corrected to add the volume of the cooling system which is normally in the circulating path and to subtract the volume of the racks and 892 fuel assemblies (full licensed fuel capacity).

Question

4. Are any of the potential dilution sources capable of gravity feeding the spent fuel pool? If [so], provide a brief description why it is unlikely that these sources could not silently gravity feed or otherwise dilute the pool undetected.

Answer 4

The only potential sources of water capable of gravity feeding the SFP are the SIRWT and the four safety injection tanks near the containment roof. These sources all contain, as a matter of Technical Specification compliance, 1720 ppm minimum concentration boric acid. Although the SFP frequently contains higher concentrations than this, these are not considered a dilution source since the concentration exceeds 1350 ppm and could cause neither a violation of the proposed pool limits nor a pool criticality event.

The shield cooling and component cooling water (CCW) system surge tanks are both located on the 649 ft. elevation with water levels about six-to-ten-feet above the SFP. The tanks have automated filling systems that deliver makeup water when activated by level switches in the tanks. The surge tank volumes are relatively small (1030 gal and 660 gal respectively). These tanks are not directly connected to the SFP. The CCW surge tank and makeup path would be a dilution source when there is a leak in the SFP cooling heat exchanger and this is considered in the dilution analysis. The shield cooling system services two sets of coils embedded in the biological shield concrete and a pair of floor cooling coils in the sump below the reactor vessel. There is no common wall between the shield cooling system and the SFP during normal plant operation. The automatic shield cooling makeup function is automatically isolated by a containment isolation signal. Therefore, under non-faulted conditions, there is no flow path from either the shield cooling or CCW surge tanks.

All other permanently placed sources require an operating pump with an appropriate valve alignment to both its suction and discharge in order to deliver water into the SFP.

Upon occasion, portable drums of non-borated decontamination solution are placed on the 649 ft. elevation deck and a Tri-nuc filter suction hose is placed in them or some other portable pump suction hose is used to decontaminate the reactor cavity and tilt pits. After flow is started it would be theoretically possible to empty the container by siphon action without power. These small portable tank quantities are not a serious dilution hazard and are always controlled by a procedure. The procedure requires approval by the shift supervisor and the decontaminating party's supervisor. A dilution calculation for the volume in question is performed and device usage time is limited to insure undue dilution does not take place.

Question

5. The staff finds insufficient support for your statement of negative declaration regarding the environmental consideration by letter dated March 29, 2001. Provide an environmental assessment for the proposed amendment.

Answer 5

Submitted separately to NRC on March 29, 2001.

ATTACHMENT 2

NUCLEAR MANAGEMENT COMPANY
PALISADES NUCLEAR PLANT
DOCKET 50-255

December 27, 2001

PAGE CORRECTIONS TO THE MARCH 2, 2001
TECHNICAL SPECIFICATION CHANGE REQUEST

All pages contained herein should replace those previously provided.

6 Pages

3. Change the allowed enrichment in Specification 4.3.1.2.a from:

   "having a maximum enrichment of 3.27 weight percent"

   to:

   "having a maximum planar average U-235 *enrichment of 4.60 weight percent."*

4. Add a new specification 4.3.1.2.b that states:

   "k_{eff} < 1.0 if fully flooded with unborated water, which includes allowances for uncertainties as described in Section 9.11 of the FSAR."

5. Renumber existing specification 4.3.1.2.b to 4.3.1.2.c and revise the leading phrase from:

   "$k_{eff} \leq$ 0.95 if fully flooded with unborated water,"

   to:

   "$k_{eff} \leq$ 0.95 if fully flooded with water borated to 850 ppm,"

6. Renumber Specifications 4.3.1.2.c and 4.3.1.2.d. Change Specification 4.3.1.2.e (former 4.3.1.2.d) from:

   "*Partially spent fuel assemblies which meet the discharge burnup requirements of Table 3.7.16-1.*"

   to:

   "*New or irradiated fuel assemblies which meet the initial enrichment, burnup, and decay time requirements of Table 3.7.16-1.*"

   The criticality analyses which are the basis for this license amendment 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 wt% U-235 and assuming 850 ppm boron in the pool water. The analyses also ensure k_{eff} < 1.0 assuming 0.0 ppm boron. Table 3.7.16--1 as revised in this amendment contains the burnup, enrichment and decay time combinations shown acceptable in EA-SFP-99-03.

7. Change the allowed enrichment in 4.3.1.3.a 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.*"

4.0 DESIGN FEATURES

4.3 Fuel Storage

4.3.1 Criticality (continued)

b. $K_{eff} \leq 0.95$ if fully flooded with unborated water, which includes allowances for uncertainties as described in Section 9.11 of the FSAR.

c. A nominal 10.25 inch center to center distance between fuel assemblies with the exception of the single Type E rack which has a nominal 11.25 inch center to center distance between fuel assemblies; and

d. New or irradiated fuel assemblies.

4.3.1.2 The Region II fuel storage racks (See Figure B 3.7.16-1) are designed and shall be maintained with;

a. Fuel assemblies having maximum planar average U-235 enrichment of 4.60 weight percent;

b. Keff < 1.0 if fully flooded with unborated water, which includes allowances for uncertainties as described in Section 9.11 of the FSAR.

c. $K_{eff} \leq 0.95$ if fully flooded with water borated to 850 ppm, which includes allowance for uncertainties as described in Section 9.11 of the FSAR.

d. A nominal 9.17 inch center to center distance between fuel assemblies; and

e. New or irradiated fuel assemblies which meet the initial enrichment, burnup, and decay time requirements of Table 3.7.16-1.

4.3.1.3 The new fuel storage racks are designed and shall be maintained with:

a. 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;

b. $K_{eff} \leq 0.95$ when flooded with either full density or low density (optimum moderation) water including allowances for uncertainties as described in Section 9.11 of the FSAR.

BASES

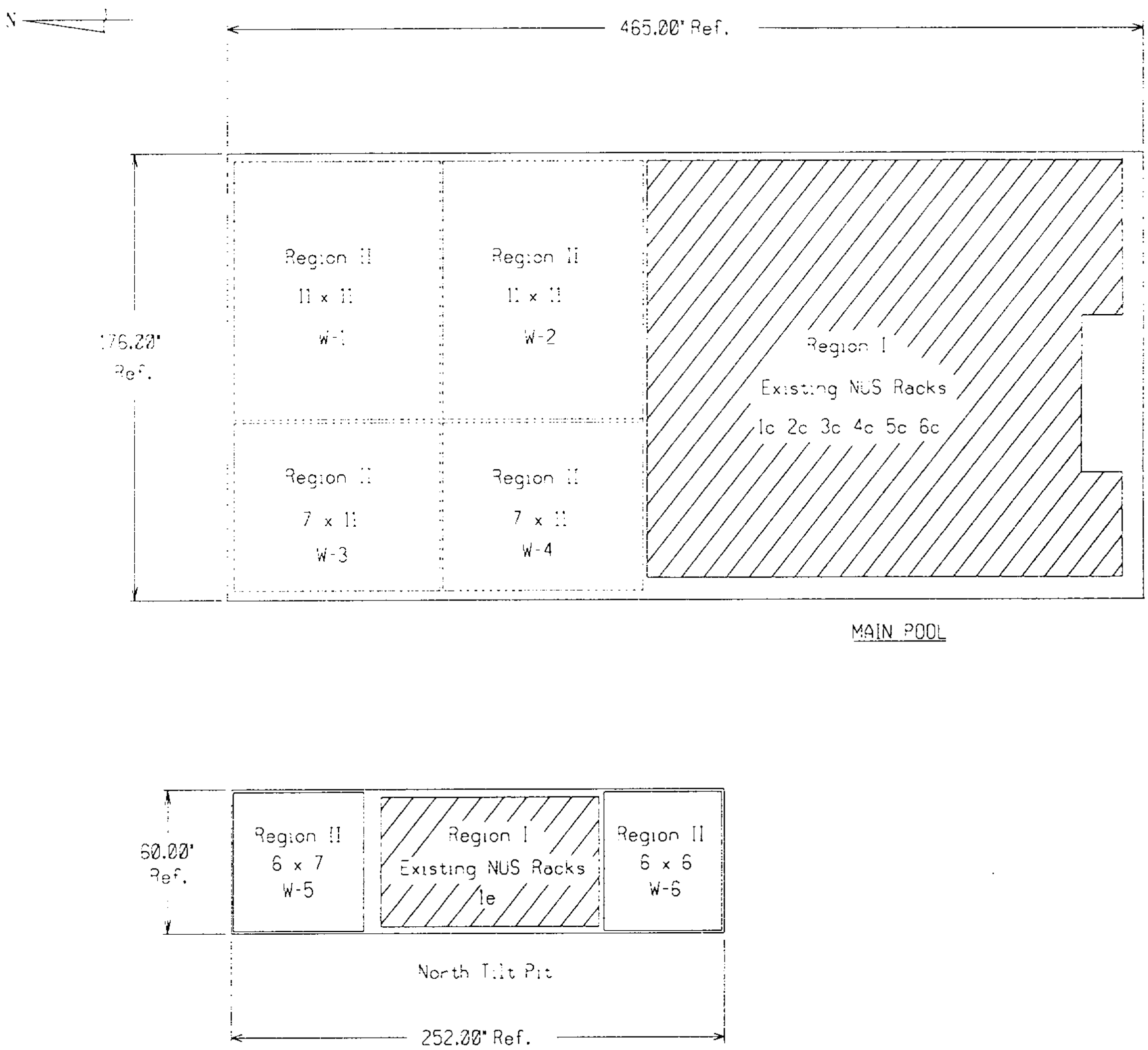

Figure B 3.7.16-1 (page 1 of 1)
Spent Fuel Pool Arrangement

TABLE 3.7.16-1 (page 1 of 1)

Spent Fuel Minimum Burnup and Decay Requirements
for Storage in Region II of the Spent Fuel Pool and North Tilt Pit

Initial Enrichment (Wt%)	Burnup (GWD/MTU) No Decay	Burnup (GWD/MTU) 1 Year Decay	Burnup (GWD/MTU) 3 Year Decay	Burnup (GWD/MTU) 5 Year Decay	Burnup (GWD/MTU) 8 Year Decay
≤ 1.14	0	0	0	0	0
>1.14	3.477	3.477	3.477	3.477	3.477
1.20	3.477	3.477	3.477	3.477	3.477
1.40	7.951	7.844	7.464	7.178	6.857
1.60	11.615	11.354	10.768	10.319	9.847
1.80	14.936	14.535	13.767	13.187	12.570
2.00	18.021	17.502	16.561	15.875	15.117
2.20	21.002	20.417	19.313	18.499	17.611
2.40	23.900	23.201	21.953	21.034	20.050
2.60	26.680	25.905	24.497	23.487	22.378
2.80	29.388	28.528	27.006	25.879	24.678
3.00	32.044	31.114	29.457	28.243	26.942
3.20	34.468	33.457	31.698	30.397	29.008
3.40	36.848	35.783	33.920	32.544	31.079
3.60	39.152	38.026	36.059	34.615	33.077
3.80	41.419	40.226	38.163	36.650	35.049
4.00	43.661	42.422	40.257	38.673	37.007
4.20	45.987	44.684	42.415	40.778	39.028
4.40	48.322	46.950	44.588	42.877	41.041
4.60	50.580	49.158	46.690	44.911	43.003

(a) Linear interpolation between two consecutive points will yield acceptable results.

(b) Comparison of nominal assembly average burnup numbers to these in the table is acceptable if measurement uncertainty is ≤ 10%.

4.0 DESIGN FEATURES

4.3 Fuel Storage

4.3.1 Criticality (continued)

b. $K_{eff} \leq 0.95$ if fully flooded with unborated water, which includes allowances for uncertainties as described in Section 9.11 of the FSAR.

c. A nominal 10.25 inch center to center distance between fuel assemblies with the exception of the single Type E rack which has a nominal 11.25 inch center to center distance between fuel assemblies; and

d. New or ~~partially spent~~ irradiated fuel assemblies. ~~Assemblies with enrichments above 3.27 weight percent U_{235} must contain 216 rods which are either UO_2, Gd_2O_3-UO_2 or solid metal.~~

4.3.1.2 The Region II fuel storage racks (See Figure B 3.7.16-1) are designed and shall be maintained with;

a. Fuel assemblies having maximum planar average U-235 enrichment of ~~3.27~~ 4.60 weight percent;

b. Keff < 1.0 if fully flooded with unborated water, which includes allowances for uncertainties as described in Section 9.11 of the FSAR.

~~b~~c. $K_{eff} \leq 0.95$ if fully flooded with ~~unborated~~ water borated to 850 ppm, which includes allowance for uncertainties as described in Section 9.11 of the FSAR.

~~c~~d. A nominal 9.17 inch center to center distance between fuel assemblies; and

~~d~~e. ~~Partially spent~~ New or irradiated fuel assemblies which meet the initial enrichment, ~~discharge~~ burnup, and decay time requirements of Table 3.7.16-1.

4.3.1.3 The new fuel storage racks are designed and shall be maintained with:

a. ~~Fuel~~ Twenty four unirradiated fuel assemblies having a maximum ~~average planar U_{235}~~ planar average U-235 enrichment of ~~4.20~~ 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;

b. $K_{eff} \leq 0.95$ when flooded with either full density or low density (optimum moderation) water including allowances for uncertainties as described in Section 9.11 of the FSAR.