



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 14, 2013

Mr. Kevin Davison
Site Vice President
Northern States Power Company - Minnesota
Prairie Island Nuclear Generating Plant
1717 Wakonade Drive East
Welch, MN 55089-9642

SUBJECT: PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNITS 1 AND 2 - INTERIM STAFF EVALUATION AND REQUEST FOR ADDITIONAL INFORMATION REGARDING THE OVERALL INTEGRATED PLAN FOR IMPLEMENTATION OF ORDER EA-12-051, RELIABLE SPENT FUEL POOL INSTRUMENTATION (TAC NOS. MF0832 AND MF0833)

Dear Mr. Davison:

On March 12, 2012, the U.S. Nuclear Regulatory Commission (NRC) issued Order EA-12-051, "Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation" (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12054A679), to all power reactor licensees and holders of construction permits in active or deferred status. This order requires the licensee to have a reliable indication of the water level in associated spent fuel storage pools capable of supporting identification of the following pool water level conditions by trained personnel: (1) level that is adequate to support operation of the normal fuel pool cooling system, (2) level that is adequate to provide substantial radiation shielding for a person standing on the spent fuel pool operating deck, and (3) level where fuel remains covered and actions to implement make-up water addition should no longer be deferred.

By letter dated February 26, 2013 (ADAMS Accession No. ML13060A363), Northern States Power Company (the licensee), a Minnesota corporation, doing business as Xcel Energy, provided the Overall Integrated Plan (OIP) for Prairie Island Nuclear Generating Plant, describing how it will achieve compliance with Attachment 2 of Order EA-12-051 by the fall of 2015. By e-mail dated July 11, 2013 (ADAMS Accession No. ML13205A355), the NRC staff sent a request for additional information (RAI) to the licensee. The licensee provided supplemental information by letters dated August 6, 2013, (ADAMS Accession ML13219A859), and August 26, 2013 (ADAMS Accession No. ML13239A093).

The NRC staff has reviewed these submittals with the understanding that the licensee will update its OIP as implementation of the Order progresses. With this in mind, the staff has included an interim staff evaluation with this letter to provide feedback on the OIP. The staff's findings in the interim staff evaluation are considered preliminary and will be revised as the OIP is updated. As such, none of the staff's conclusions are to be considered final. A final NRC staff evaluation will be issued after the licensee has provided the information requested.

K. Davison

- 2 -

The interim staff evaluation also includes RAIs, response to which the NRC staff needs to complete its review. The licensee should provide the information requested in the 6-month status updates, as the information becomes available. However, the staff requests that all information be provided by March 31, 2015, to ensure that any issues are resolved prior to the date by which the licensee must complete full implementation of Order EA-12-051. The licensee should adjust its schedule for providing information to ensure that all this information is provided by the requested date.

If you have any questions regarding this letter, please contact me at 301-415-2855 or via e-mail at scott.wall@nrc.gov.

Sincerely,



Scott P. Wall, Senior Project Manager
Plant Licensing Branch III-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-282 and 50-306

Enclosure:
Interim Staff Evaluation and
Request for Additional Information

cc w/encl: Distribution via Listserv

INTERIM STAFF EVALUATION AND REQUEST FOR ADDITIONAL INFORMATION
BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO THE OVERALL INTEGRATED PLAN IN RESPONSE TO
ORDER EA-12-051, RELIABLE SPENT FUEL POOL INSTRUMENTATION
NORTHERN STATES POWER COMPANY - MINNESOTA
PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNITS 1 AND 2
DOCKET NOS. 50-282 AND 50-306

1.0 INTRODUCTION

On March 12, 2012, the U.S. Nuclear Regulatory Commission (NRC) issued Order EA-12-051, "Issuance of Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation" (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12054A679), to all power reactor licensees and holders of construction permits in active or deferred status. This order requires, in part, that all operating reactor sites have a reliable means of remotely monitoring wide-range spent fuel pool (SFP) levels to support effective prioritization of event mitigation and recovery actions in the event of a beyond-design-basis (BDB) external event. The order required all holders of operating licenses issued under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," to submit to the NRC an Overall Integrated Plan (OIP) by February 28, 2013.

By letter dated February 26, 2013 (ADAMS Accession No. ML13060A363), Northern States Power Company (NSPM), doing business as Xcel Energy (the licensee) provided the OIP for Prairie Island Nuclear Generating Plant (PINGP), Units 1 and 2, describing how it will achieve compliance with Attachment 2 of Order EA-12-51 by the fall of 2015, for Units 1 and 2. By email dated July 11, 2013 (ADAMS Accession No. ML13205A355), the NRC staff sent a request for additional information (RAI) to the licensee. The licensee provided supplemental information by letters dated August 6, 2013 (ADAMS Accession No. ML13219A859) and August 26, 2013 (ADAMS Accession No. ML13239A093).

2.0 REGULATORY EVALUATION

Order EA-12-051 requires all holders of operating licenses issued under 10 CFR Part 50, notwithstanding the provisions of any Commission regulation or license to the contrary, to comply with the requirements described in Attachment 2 to this Order except to the extent that a more stringent requirement is set forth in the license. Licensees shall promptly start implementation of the requirements in Attachment 2 to the order and shall complete full implementation no later than two refueling cycles after submittal of the OIP or December 31, 2016, whichever comes first.

Order EA-12-051 required the licensee, by February 28, 2013, to submit to the Commission an OIP, including a description of how compliance with the requirements described in Attachment 2 of the Order will be achieved.

Enclosure

Attachment 2 of Order EA-12-051 requires the licensee to have a reliable indication of the water level in associated spent fuel storage pools capable of supporting identification of the following pool water level conditions by trained personnel: (1) level that is adequate to support operation of the normal fuel pool cooling system, (2) level that is adequate to provide substantial radiation shielding for a person standing on the SFP operating deck, and (3) level where fuel remains covered and actions to implement make-up water addition should no longer be deferred.

Attachment 2 of Order EA-12-051, states that the SFP level instrumentation shall include the following design features:

- 1.1 Instruments: The instrumentation shall consist of a permanent, fixed primary instrument channel and a backup instrument channel. The backup instrument channel may be fixed or portable. Portable instruments shall have capabilities that enhance the ability of trained personnel to monitor spent fuel pool water level under conditions that restrict direct personnel access to the pool, such as partial structural damage, high radiation levels, or heat and humidity from a boiling pool.
- 1.2 Arrangement: The spent fuel pool level instrument channels shall be arranged in a manner that provides reasonable protection of the level indication function against missiles that may result from damage to the structure over the spent fuel pool. This protection may be provided by locating the primary instrument channel and fixed portions of the backup instrument channel, if applicable, to maintain instrument channel separation within the spent fuel pool area, and to utilize inherent shielding from missiles provided by existing recesses and corners in the spent fuel pool structure.
- 1.3 Mounting: Installed instrument channel equipment within the spent fuel pool shall be mounted to retain its design configuration during and following the maximum seismic ground motion considered in the design of the spent fuel pool structure.
- 1.4 Qualification: The primary and backup instrument channels shall be reliable at temperature, humidity, and radiation levels consistent with the spent fuel pool water at saturation conditions for an extended period. This reliability shall be established through use of an augmented quality assurance process (e.g., a process similar to that applied to the site fire protection program).
- 1.5 Independence: The primary instrument channel shall be independent of the backup instrument channel.
- 1.6 Power supplies: Permanently installed instrumentation channels shall each be powered by a separate power supply. Permanently installed and portable instrumentation channels shall provide for power connections from sources independent of the plant [alternating current (ac)] and [direct current (dc)] power distribution systems, such as portable generators or

replaceable batteries. Onsite generators used as an alternate power source and replaceable batteries used for instrument channel power shall have sufficient capacity to maintain the level indication function until offsite resource availability is reasonably assured.

- 1.7 Accuracy: The instrument channels shall maintain their designed accuracy following a power interruption or change in power source without recalibration.
- 1.8 Testing: The instrument channel design shall provide for routine testing and calibration.
- 1.9 Display: Trained personnel shall be able to monitor the spent fuel pool water level from the control room, alternate shutdown panel, or other appropriate and accessible location. The display shall provide on-demand or continuous indication of spent fuel pool water level.

Attachment 2 of Order EA-12-051, states that the SFP instrumentation shall be maintained available and reliable through appropriate development and implementation of the following programs:

- 2.1 Training: Personnel shall be trained in the use and the provision of alternate power to the primary and backup instrument channels.
- 2.2 Procedures: Procedures shall be established and maintained for the testing, calibration, and use of the primary and backup spent fuel pool instrument channels.
- 2.3 Testing and Calibration: Processes shall be established and maintained for scheduling and implementing necessary testing and calibration of the primary and backup spent fuel pool level instrument channels to maintain the instrument channels at the design accuracy.

On August 29, 2012, the NRC issued an Interim Staff Guidance document (the ISG), JLD-ISG-2012-03, "Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation" (ADAMS Accession No. ML12221A339), to describe methods acceptable to the NRC staff for complying with Order EA-12-051. The ISG endorses, with exceptions and clarifications, the methods described in the Nuclear Energy Institute (NEI) guidance document NEI 12-02, Revision 1, "Industry Guidance for Compliance with NRC Order EA-12-051, 'to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation,'" dated August 2012 (ADAMS Accession No. ML12240A307). Specifically, the ISG states:

The NRC staff considers that the methodologies and guidance in conformance with the guidelines provided in NEI 12-02, Revision 1, subject to the clarifications and exceptions in Attachment 1 to this ISG, are an acceptable means of meeting the requirements of Order EA-12-051.

3.0 TECHNICAL EVALUATION

3.1 Background and Schedule

Prairie Island Nuclear Generating Plant (PINGP) maintains a common, compartmentalized, SFP for both Units 1 and 2.

The licensee submitted its OIP on February 26, 2013. The OIP states that installation of the SFP level instrumentation at PINGP will be completed by the fall of 2015 based on the end of the second refueling outage for each unit following submittal of its OIP.

The NRC staff has reviewed the licensee's schedule for implementation of SFP level instrumentation provided in its OIP. If the licensee completes implementation in accordance with this schedule, it would appear to achieve compliance with Order EA-12-051 within two refueling cycles after submittal of the OIP and before December 31, 2016.

3.2 Spent Fuel Pool Water Levels

Attachment 2 of Order EA-12-051 states, in part, that

All licensees identified in Attachment 1 to this Order shall have a reliable indication of the water level in associated spent fuel storage pools capable of supporting identification of the following pool water level conditions by trained personnel: (1) level that is adequate to support operation of the normal fuel pool cooling system [Level 1], (2) level that is adequate to provide substantial radiation shielding for a person standing on the SFP operating deck [Level 2], and (3) level where fuel remains covered and actions to implement make-up water addition should no longer be deferred [Level 3].

NEI 12-02 states, in part, that

Level 1 represents the HIGHER of the following two points:

- The level at which reliable suction loss occurs due to uncovering of the coolant inlet pipe, weir or vacuum breaker (depending on the design), or
- The level at which the water height, assuming saturated conditions, above the centerline of the cooling pump suction provides the required net positive suction head specified by the pump manufacturer or engineering analysis.

In its OIP, the licensee stated, in part, that

This level will be based on the top of the cooling system suction pipe location, which is about four feet below the normal pool water level. The minimum level is 21 feet and 1 ¾ inches above the top of the racks (36 feet and 3 ¾ inches from the bottom of the pool). This level will be adequate to assure the normal fuel

pool cooling system is available for cooling the spent fuel pool (See Figure 2) and will be used for Level 1.

In its letter dated August 6, 2013, the licensee stated, in part, that

NSPM chose Level 1 based on the first bullet in the NEI guidance and expects this value for Level 1 to be limiting based on the configuration of the spent fuel pool cooling system. At PINGP, the spent fuel pool cooling system penetrates the pool near the normal pool water level to prevent excessive loss of pool water upon a breach of the cooling system. Therefore, since the suction is near the normal level, it is anticipated there will be adequate NPSH at the proposed Level 1 (at the top of the cooling suction line). To confirm this, detailed NPSH calculations will be completed as part of the design process. NSPM's current plan is to begin design of the spent fuel pool instrumentation (SFPI) system by the end of September 2013, with design completion expected by the end of January 2015. Any required changes to the proposed Level 1 to support NPSH will be provided with the February 2015 six-month status report.

The NRC staff notes that in its OIP the licensee provided a sketch showing the approximate elevations identified as Levels 1, 2 and 3. In this sketch the licensee identified Level 1 at an elevation of 36 feet (ft.) 3 ¾ inches (in.) from the bottom of the pool. However, as stated in NEI 12-02, Level 1 is to be established at the higher of two SFP elevations. At this time, the elevation necessary to provide the required net positive suction head (NPSH) specified by the pump manufacturer or engineering analysis is not available. The staff plans to review the results of the calculation performed by the licensee to determine that the elevation identified as Level 1 in the licensee's OIP is consistent with the guidance in NEI 12-02. The staff has identified this request as:

RAI# 1

Please provide the results of the calculation used to determine the water elevation necessary for the pump's required NPSH to confirm that Level 1 has been adequately identified.

NEI 12-02 states, in part, that

Level 2 represents the range of water level where any necessary operations in the vicinity of the spent fuel pool can be completed without significant dose consequences from direct gamma radiation from the stored spent fuel. Level 2 is based on either of the following:

- 10 feet (+/- 1 foot) above the highest point of any fuel rack seated in the spent fuel pools, or
- a designated level that provides adequate radiation shielding to maintain personnel radiological dose levels within acceptable limits while performing local operations in the vicinity of the pool. This level shall be based on either plant-specific or appropriate generic shielding

calculations, considering the emergency conditions that may apply at the time and the scope of necessary local operations, including installation of portable SFP instrument channel components.

In its OIP, the licensee stated, in part, that

Based on the guidance in Section 2.3 of NEI 12-02, Level 2 is 10 feet (+/- 1 foot) above the top of the spent fuel rack, which corresponds to 25 feet and 8 inches from the bottom of the PINGP spent fuel pool. Therefore, Level 2 will be 25 feet and 8 inches from the bottom of the spent fuel storage pool. Allowance for instrumentation accuracy will be applied to the setpoint for this level.

In its OIP, the licensee provided a sketch showing the approximate elevations identified as Levels 1, 2 and 3. The NRC staff reviewed this sketch and notes that Level 2 is identified at an elevation of 25 ft. 8 in. from the bottom of the pool. The staff also notes that the licensee designated Level 2 using the first of the two options described in NEI 12-02 for Level 2.

In its OIP, the licensee stated that an evaluation of other hardware stored in the SFP would be conducted to ensure it will not create adverse interaction with the fixed instrument location(s). In its letter dated August 6, 2013, the licensee restated that an evaluation will also be performed to assess the radiological impact from stored equipment in the identified Level 2. In its letter dated August 26, 2013, the licensee stated that the requested information will be provided with the February 2015 six-month status report. The staff identified this request as:

RAI #2

Please provide the results of the evaluation to be performed to determine the projected dose rate impact and the appropriate Level 2 value as a result of other hardware stored in the SFP.

NEI 12-02 states, in part, that

Level 3 corresponds nominally (i.e., +/- 1 foot) to the highest point of any fuel rack seated in the spent fuel pool. Level 3 is defined in this manner to provide the maximum range of information to operators, decision makers and emergency response personnel.

In its OIP, the licensee stated, in part, that

Level 3 will be greater than six inches above the top of the racks or 15 feet and 8 inches above the pool bottom. This level will be adequate to ensure the fuel remains covered (see Figure 2). This level is based on the guidance provided by NEI 12-02 (i.e., +/- one foot of the highest point of the fuel racks in the spent fuel pool). The final setpoint will be established upon installation and will be within one foot of the top of the racks as recommended by NEI 12-02.

In its OIP the licensee provided a sketch showing the elevations identified as Levels 1, 2 and 3. The NRC staff reviewed this sketch and notes that Level 3 is identified at an elevation of 15 ft.

8 in. from the bottom of the pool. The staff also notes that the elevation identified for Level 3 is above the highest point of any spent fuel storage rack seated in the SFP.

The licensee's proposed plan, with respect to the identification of Level 3, appears to be consistent with NEI 12-02, as endorsed by the ISG.

3.3 Design Features: Instruments

Attachment 2 of Order EA-12-051, states, in part, that

The instrumentation shall consist of a permanent, fixed primary instrument channel and a backup instrument channel. The backup instrument channel may be fixed or portable. Portable instruments shall have capabilities that enhance the ability of trained personnel to monitor spent fuel pool water level under conditions that restrict direct personnel access to the pool, such as partial structural damage, high radiation levels, or heat and humidity from a boiling pool.

NEI 12-02 states, in part, that

A spent fuel pool level instrument channel is considered reliable when the instrument channel satisfies the design elements listed in Section 3 [Instrumentation Design Features] of this guidance and the plant operator has fully implemented the programmatic features listed in Section 4 [Program Features].

In its OIP, the licensee stated that the primary instrument channel level sensing component will be a new fixed system and capable of measuring the range of levels discussed in the SFP level section above. The licensee also stated that the backup instrument channel would be identical to and independent from the primary instrument channel and that the backup instrument channel probe will be mounted on the edge of the SFP and will be capable of displaying level from Level 1 to Level 3.

In addition, in its OIP, the licensee provided a drawing showing the general layout of the SFP, with the proposed location for the SFP level instruments, and a sketch showing the levels. This sketch shows that the instrument range would be 24 ft. 3 ³/₄ in.

In its letter dated August 6, 2013, the licensee stated that the proposed level sensor range will indicate from Level 3 up to the normal pool water level. The licensee provided a sketch depicting that the proposed level measurement range is 24 ft. 3 ³/₄ in. from the normal pool level elevation to 6 in. above the top of the spent fuel racks.

The NRC staff notes that the range specified for the licensee's instrumentation will cover Levels 1, 2, and 3 as described in Section 3.2 above. The licensee's proposed plan, with respect to the number of channels and the range of the instrumentation for both of its SFPs, appears to be consistent with NEI 12-02, as endorsed by the ISG.

In its OIP, the licensee stated, in part, that

The spent fuel pool facility at PINGP is a shared pool comprised of two storage pools and a fuel transfer canal. These three compartments are separated by slots in the walls that can be isolated by use of pneumatically sealed gates. The bottom of these slots is located above the top of the active fuel in the fuel assemblies when stored in the racks. However, the bottoms of the slots are below the top of the storage racks. This configuration allows monitoring of pool level from Level 1 through Level 3 in any of the three compartments provided the gates are not in place. The SFP cooling system has a pump suction from both pools that is located approximately 4 feet below the normal water level.

The NRC staff has concerns regarding the effects the installation of the pneumatic sealed gates in the wall slots could have on the reliability of the SFP level instrumentation to meet the requirements of Order EA-12-051 when the gate between the pools is closed. The staff has identified this request as:

RAI #3

Please describe the impact of the installation of the pneumatic sealed gates on the reliability of the SFP level instrumentation for each SFP, and what compensatory measures would be taken to ensure reliable level indication in each SFP when the gate is installed.

3.4 Design Features: Arrangement

Attachment 2 of Order EA-12-051, states, in part, that

The spent fuel pool level instrument channels shall be arranged in a manner that provides reasonable protection of the level indication function against missiles that may result from damage to the structure over the spent fuel pool. This protection may be provided by locating the primary instrument channel and the fixed portions of the backup instrument channel, if applicable, to maintain instrument channel separation within the spent fuel pool area, and to utilize inherent shielding from missiles provided by existing recesses and corners in the spent fuel pool structure.

NEI 12-02 states, in part, that

The intent of the arrangement requirement is to specify reasonable separation and missile protection requirements for permanently installed instrumentation used to meet this order. Although additional missile barriers are not required to be installed, separation and shielding can help minimize the probability that damage due to an explosion or extreme natural phenomena (e.g., falling or wind-driven missiles) will render fixed channels of SFP instrumentation unavailable. Installation of the SFP instrument channels shall be consistent with the plant-specific SFP design requirements and should not impair normal SFP function.

Channel separation should be maintained by locating the installed sensors in different places in the SFP area.

In its OIP, the licensee stated, in part, that

The two level instruments will be installed in separate pools as shown in Figure 1. The probes will be located approximately 45 feet apart. This distance meets the minimum separation requirement from NEI 12-02, as the shortest length of one pool side is 18 feet and 3 inches. These locations will assure that damage due to missiles is minimized since each instrument is located in a separate pool and is also protected in a pool corner by two walls. In addition, the entire spent fuel pool at PINGP is enclosed in a Class 1 structure designed to protect the pool from tornado generated missiles.

All cabling routing for the primary and backup instrument channels will be protected from external events to meet the requirements of NRC JLD-ISG-2012-03 and NEI 12-02. No cabling will be installed outside structures or in areas subject to external event submergence. The conduit and cable routing will be determined during the design process.

In its letter dated August 6, 2013, the licensee provided a sketch depicting SFP dimensions and the proposed locations of the instruments. The sketch also depicts alternate locations for the primary and backup instruments. Additionally, in this letter, the licensee stated, in part, that

The proposed routing of the cables has not been determined. The final component locations and cable routing will be available upon completion of the final design. NSPM's current plan is to begin design of the SFPI system by the end of September 2013, with design completion expected by the end of January 2015. The requested information will be provided with the February 2015 six-month status report.

The NRC staff notes that the information regarding final component locations and cable routing for the SFP level instrumentation is not currently available for review and that in its August 26, 2013 letter, the licensee identified the status of this activity as "Not Started". The licensee indicated that the information will be provided to the staff during the February 2015, six-month status report. The staff has identified these requests as:

RAI #4

Please provide a clearly labeled sketch or marked-up plant drawing of the plan view of the SFP area, depicting the proposed routing of the cables that will extend from the sensors toward the location of the read-out/display device.

RAI #5

Please provide additional information describing how the final arrangement of the SFP instrumentation and routing of the cabling between the level instruments, the electronics and the displays, meets the Order requirement to arrange the SFP level instrument

channels in a manner that provides reasonable protection of the level indication function against missiles that may result from damage to the structure over the SFP.

3.5 Design Features: Mounting

Attachment 2 of Order EA-12-051 states, in part, that

Installed instrument channel equipment within the spent fuel pool shall be mounted to retain its design configuration during and following the maximum seismic ground motion considered in the design of the spent fuel pool structure.

NEI 12-02 states, in part, that

The mounting shall be designed to be consistent with the highest seismic or safety classification of the SFP. An evaluation of other hardware stored in the SFP shall be conducted to ensure it will not create adverse interaction with the fixed instrument location(s).

The basis for the seismic design for mountings in the SFP shall be the plant seismic design basis at the time of submittal of the Integrated Plan for implementing NRC Order EA-12-051.

In its OIP, the licensee stated that both the primary and backup system mounting will be installed as Seismic Category I to meet the NRC JLD-ISG-2012-03 and NEI 12-02 guidance. The licensee also stated that an evaluation of other hardware stored in the SFP will be conducted as part of the detailed design to ensure it will not create adverse interaction with the fixed instrument locations.

In its letter dated August 6, 2013, the licensee stated, in part, that

The requested information is not available at this time. NSPM's current plan is to begin design of the SFPI system by the end of September 2013, with design completion expected by the end of January 2015. The requested information will be provided with the February 2015 six-month status report.

The NRC staff notes that the information regarding the mounting of the SFP level instrumentation and the evaluation of potential interaction of other hardware stored in the SFP with the instrumentation is not currently available for review and that in its August 26, 2013, letter, the licensee identified the status of this activity as "Not Started". The licensee indicated that the information will be provided to the staff during the February 2015, six-month status report. The staff has identified these requests as:

RAI #6

Please provide the following:

- a) **The design criteria that will be used to estimate the total loading on the mounting device(s), including static weight loads and dynamic loads.**

Describe the methodology that will be used to estimate the total loading, inclusive of design basis maximum seismic loads and the hydrodynamic loads that could result from pool sloshing or other effects that could accompany such seismic forces.

- b) A description of the manner in which the level sensor (and stilling well, if appropriate) will be attached to the refueling floor and/or other support structures for each planned point of attachment of the probe assembly. Indicate in a schematic the portions of the level sensor that will serve as points of attachment for mechanical/mounting or electrical connections.**
- c) A description of the manner by which the mechanical connections will attach the level instrument to permanent SFP structures so as to support the level sensor assembly.**
- d) A description of how other material stored in the SFP will not create adverse interaction with the fixed instrument locations(s).**

(This information was previously requested as RAI-3 in the NRC email dated July 11, 2013.)

In addition, the staff plans to verify the results of the licensee's seismic testing and analysis when it is completed based on the licensee's response to the following RAIs.

RAI #7

For RAI 6(a) above, please provide the analyses used to verify the design criteria and methodology for seismic testing of the SFP instrumentation and the electronics units, including, design basis maximum seismic loads and the hydrodynamic loads that could result from pool sloshing or other effects that could accompany such seismic forces.

RAI #8

For each of the mounting attachments required to attach SFP Level equipment to plant structures, please describe the design inputs, and the methodology that was used to qualify the structural integrity of the affected structures/equipment.

3.6 Design Features: Qualification

Attachment 2 of Order EA-12-051 states, in part, that

The primary and backup instrument channels shall be reliable at temperature, humidity, and radiation levels consistent with the spent fuel pool water at saturation conditions for an extended period. This reliability shall be established through use of an augmented quality assurance process (e.g. a process similar to that applied to the site fire protection program).

NEI 12-02 states, in part, that

The instrument channel reliability shall be demonstrated via an appropriate combination of design, analyses, operating experience, and/or testing of channel components for the following sets of parameters, as described in the paragraphs below:

- conditions in the area of instrument channel component use for all instrument components,
- effects of shock and vibration on instrument channel components used during any applicable event for only installed components, and
- seismic effects on instrument channel components used during and following a potential seismic event for only installed components...

The NRC staff assessment of the instrument qualification is discussed in the following subsections below: (3.6.1) Augmented Quality Process and (3.6.2) Qualification and Reliability.

3.6.1 Augmented Quality Process

Appendix A-1 of the guidance in NEI 12-02 describes a quality assurance process for non-safety systems and equipment that is not already covered by existing quality assurance requirements. Within the ISG, the NRC staff found the use of this quality assurance process to be an acceptable means of meeting the augmented quality requirements of Order EA-12-051.

In its OIP, the licensee stated that the primary and backup channels will be qualified through the use of an augmented quality assurance process that meets the requirements of NRC JLD ISG-2012-03 and NEI 12-02.

The licensee's proposed augmented quality assurance process appears to be consistent with NEI 12-02, as endorsed by the ISG.

3.6.2 Qualification and Reliability

NEI 12-02 states, in part, that

The temperature, humidity and radiation levels consistent with conditions in the vicinity of the [SFP] and the area of use considering normal operational, event and post-event conditions for no fewer than seven days post-event or until off-site resources can be deployed by the mitigating strategies resulting from Order EA-12-049 should be considered. Examples of post-event (beyond-design-basis) conditions to be considered are:

- radiological conditions for a normal refueling quantity of freshly discharged (100 hours) fuel with the SFP water level 3 as described in this order,
- temperatures of 212 degrees F and 100% relative humidity environment,

- boiling water and/or steam environment
- a concentrated boric acid water environment, and...

In its OIP, the licensee stated that the primary and backup instrumentation channel equipment installed in the spent fuel pool enclosure and vicinity will be qualified for reliable operation at conditions expected in the SFP enclosure including, consideration of the SFP boiling at saturated conditions and the presence of high levels of boric acid in the vicinity of the pool. The licensee also stated that the equipment installed would also be qualified for reliable operation at radiation levels representative of a normal core offload of freshly discharged fuel as allowed by existing refueling procedures with the SFP water at Level 3. The licensee stated that the applicable components of the primary and backup instrumentation channel required after an event will be rated for anticipated shock and vibration per the recommendations of NRC JLD-ISG-2012-03 and NEI 12-02.

Regarding seismic reliability, in its OIP, the licensee stated that the primary and backup instrument channel components required after a potential seismic event will be qualified for reliable operation following such an event. The licensee also stated that the methods used to qualify components would be consistent with the guidance of NEI 12-02, including the clarifications and exceptions to that guidance provided by the NRC Staff in NRC JLD-ISG-2012-03.

In its letter dated August 6, 2013, the licensee stated, in part, that

The requested information is not available at this time. NSPM's current plan is to begin design of the SFPI system by the end of September 2013, with design completion expected by the end of January 2015. The requested information will be provided with the February 2015 six-month status report.

The NRC staff notes that the information regarding qualification and reliability of the SFP level instrumentation is not currently available for review and that in its August 26, 2013 letter, the licensee identified the status of this activity as "Not Started". The licensee indicated that the information will be provided to the staff during the February 2015, six-month status report. The staff has identified these requests as:

RAI #9

Please provide the following:

- a) A description of the specific method or combination of methods you intend to apply to demonstrate the reliability of the permanently installed equipment under BDB ambient temperature, humidity, shock, vibration, and radiation conditions.**
- b) A description of the testing and/or analyses that will be conducted to provide assurance that the equipment will perform reliably under the worst-case credible design basis loading at the location where the equipment will**

be mounted. Include a discussion of this seismic reliability demonstration as it applies to a) the level sensor mounted in the SFP area, and b) any control boxes, electronics, or read-out and re-transmitting devices that will be employed to convey the level information from the level sensor to the plant operators or emergency responders.

- c) A description of the specific method or combination of methods that will be used to confirm the reliability of the permanently installed equipment such that following a seismic event the instrument will maintain its required accuracy.**

(This information was previously requested as RAI-4 in the NRC email dated July 11, 2013.)

In addition, the staff plans to verify the results of the licensee's testing and analysis used to demonstrate the qualification and reliability of the installed equipment when it is completed based on the licensee's response to the following RAI.

RAI #10

For RAI #9 above, please provide the results for the selected methods, tests and analyses used to demonstrate the qualification and reliability of the installed equipment in accordance with the Order requirements.

3.6.3 Qualification Evaluation Summary

Upon acceptable resolution of the RAIs in Section 3.6, the NRC staff will be able to make a conclusion regarding the instrument qualification.

3.7 Design Features: Independence

Attachment 2 of Order EA-12-051 states, in part, that

The primary instrument channel shall be independent of the backup instrument channel.

NEI 12-02 states, in part, that

Independence of permanently installed instrumentation, and primary and backup channels, is obtained by physical and power separation commensurate with the hazard and electrical isolation needs. If plant AC or DC power sources are used then the power sources shall be from different buses and preferably different divisions/channels depending on available sources of power.

In its OIP, the licensee stated, in part, that

The primary channel will be independent of the backup channel. Both channels will have their own probes located in separate corners of the spent fuel pool, separate cable routes, and separate electronics. In the vicinity of the spent fuel

pool, existing embedded conduit will be used for entry and exit of cables from the spent fuel pool structure. Once outside the pool structure, the primary and backup channel cabling will be routed in separate conduit or cable trays to achieve independence. Power supply independence is addressed in Section 3.6 [Power Supply] of this Enclosure.

In its letter dated August 6, 2013, the licensee stated, in part, that

The requested information is not available at this time. NSPM's current plan is to begin design of the SFPI system by the end of September 2013, with design completion expected by the end of January 2015. The requested information will be provided with the February 2015 six-month status report.

The NRC staff notes that the information regarding the SFP level instrumentation channel independence is not currently available for review and that in its August 26, 2013, letter, the licensee identified the status of this activity as "Not Started". The licensee indicated that the information will be provided to the staff during the February 2015, six-month status report. The staff has identified this request as:

RAI #11

Please provide the following:

- a) A description of how the two channels of the proposed level measurement system meet this requirement so that the potential for a common cause event to adversely affect both channels is minimized to the extent practicable.**
- b) Further information on how each level measurement system, consisting of level sensor electronics, cabling, and readout devices will be designed and installed to address independence through the application and selection of independent power sources, the use of physical and spatial separation, independence of signals sent to the location(s) of the readout devices, and the independence of the displays.**

(This information was previously requested as RAI-5 in the NRC email dated July 11, 2013.)

3.8 Design Features: Power Supplies

Attachment 2 of Order EA-12-051, states in part, that

Permanently installed instrumentation channels shall each be powered by a separate power supply. Permanently installed and portable instrumentation channels shall provide for power connections from sources independent of the plant ac and dc power distribution systems, such as portable generators or replaceable batteries. Onsite generators used as an alternate power source and replaceable batteries used for instrument channel power shall have sufficient

capacity to maintain the level indication function until offsite resource availability is reasonably assured.

NEI 12-02 states, in part, that

The normal electrical power supply for each channel shall be provided by different sources such that the loss of one of the channels' primary power supply will not result in a loss of power supply function to both channels of SFP level instrumentation.

All channels of SFP level instrumentation shall provide the capability of connecting the channel to a source of power (e.g., portable generators or replaceable batteries) independent of the normal plant AC and DC power systems. For fixed channels this alternate capability shall include the ability to isolate the installed channel from its normal power supply or supplies. The portable power sources for the portable and installed channels shall be stored at separate locations, consistent with the reasonable protection requirements associated with NEI 12-06 (Order EA-12-049). The portable generator or replaceable batteries should be accessible and have sufficient capacity to support reliable instrument channel operation until off-site resources can be deployed by the mitigating strategies resulting from Order EA-12-049.

If adequate power supply for either an installed or portable level instrument credits intermittent operation, then provisions shall be made for quickly and reliably taking the channel out of service and restoring it to service. For example, a switch on the power supply to the channel is adequate provided the power can be periodically interrupted without significantly affecting the accuracy and reliability of the instrument reading. Continuous indication of SFP level is acceptable only if the power for such indication is demonstrably adequate for the time duration specified in section 3.1[.]

In its OIP, the licensee stated, in part, that

The instrument channels will each have an independent power supply meeting the recommendations of NRC JLO-ISG-2012-03 and NEI 12-02. Any onsite generators used as an alternate power source and replaceable batteries used for instrument channel function will have sufficient capacity to maintain level indication function until offsite resource availability is reasonably assured. Any portable power supplies used will be stored consistent with the requirements of NRC Order EA-12-049 and NEI 12-06. The design process will determine the normal power source, battery power supply, and any additional power sources required for the instrument channels.

In its letter dated August 6, 2013, the licensee stated, in part, that

The requested information is not available at this time. NSPM's current plan is to begin design of the SFPI system by the end of September 2013, with design

completion expected by the end of January 2015. The requested information will be provided with the February 2015 six-month status report.

The NRC staff notes that the information regarding the power supply for the SFP level instrumentation is not currently available for review and that in its August 26, 2013 letter, the licensee identified the status of this activity as "Not Started". The licensee indicated that the information will be provided to the staff during the February 2015, six-month status report. The staff has identified this request as:

RAI #12

Please provide the following:

- a) A description of the electrical ac power sources and capabilities for the primary and backup channels.**
- b) Please provide the results of the calculation depicting the battery backup duty cycle requirements demonstrating that its capacity is sufficient to maintain the level indication function until offsite resource availability is reasonably assured.**

(This information was previously requested as RAI-6 in the NRC email dated July 11, 2013. However, based on feedback from the licensees, this RAI has been revised as above.)

3.9 Design Features: Accuracy

Attachment 2 of Order EA-12-051 states, in part, that

The instrument channels shall maintain their designed accuracy following a power interruption or change in power source without recalibration.

NEI 12-02 states, in part, that

Accuracy should consider operations while under SFP conditions, e.g., saturated water, steam environment, or concentrated borated water. Additionally, instrument accuracy should be sufficient to allow trained personnel to determine when the actual level exceeds the specified lower level of each indicating range (levels 1, 2 and 3) without conflicting or ambiguous indication.

In its OIP, the licensee stated that the primary and backup instrument channels will maintain their design instrument accuracy without requiring recalibration following power interruptions or changes in power source, as required by NRC Order EA-12-051. The licensee also stated that the total loop accuracy of both instrument channels will be determined for the entire span (Level 1 to 3) during the design process.

In its letter dated August 6, 2013, the licensee stated, in part, that

Setpoints will be determined following Prairie Island procedure EM 3.3.4.1, "Instrument Setpoint/Uncertainty Calculations". Determination of setpoints using this procedure is part of the NSPM design process. NSPM's current plan is to begin design of the SFPI system by the end of September 2013, with design completion expected by the end of January 2015. The requested information will be provided with the February 2015 six-month status report.

The NRC staff notes that the information regarding the accuracy of the SFP level instrumentation is not currently available for review and that in its August 26, 2013, letter, the licensee identified the status of this activity as "Not Started". The licensee indicated that the information will be provided to the staff during the February 2015, six-month status report. The staff has identified this request as:

RAI #13

Please provide the following:

- a) **An estimate of the expected instrument channel accuracy performance under both (a) normal SFP level conditions (approximately Level 1 or higher) and (b) at the BDB conditions (i.e., radiation, temperature, humidity, post-seismic and post-shock conditions) that would be present if the SFP level were at the Level 2 and Level 3 datum points.**
- b) **A description of the methodology that will be used for determining the maximum allowed deviation from the instrument channel design accuracy that will be employed under normal operating conditions as an acceptance criterion for a calibration procedure to flag to operators and to technicians that the channel requires adjustment to within the normal condition design accuracy.**

(This information was previously requested as RAI-7 in the NRC email dated July 11, 2013.)

3.10 Design Features: Testing

Attachment 2 of Order EA-12-051 states, in part, that

The instrument channel design shall provide for routine testing and calibration.

NEI 12-02 states, in part, that

Static or non-active installed (fixed) sensors can be used and should be designed such that testing and/or calibration can be performed in-situ. For microprocessor based channels the instrument channel design shall be capable of testing while mounted in the pool.

In its OIP, the licensee stated that the instrument channel design would provide for routine testing and calibration and that the entire primary and backup instrumentation channel would be capable of in-situ testing and calibration per the requirements of NRC JLD-ISG-2012-03 and NEI 12-02.

In its letter dated August 6, 2013, the licensee stated, in part, that

The requested information is not available at this time. NSPM's current plan is to begin design of the SFPI system by the end of September 2013, with design completion expected by the end of January 2015. The requested information will be provided with the February 2015 six-month status report.

The NRC staff notes that the information regarding the design of SFP level instrumentation to provide for routine testing and calibration is not currently available for review and that in its August 26, 2013, letter, the licensee identified the status of this activity as "Not Started". The licensee indicated that the information will be provided to the staff during the February 2015, six-month status report. The staff has identified this request as:

RAI #14

Please provide the following:

- a) A description of the capability and provisions the proposed level sensing equipment will have to enable periodic testing and calibration, including how this capability enables the equipment to be tested in-situ.**
- b) A description of how such testing and calibration will enable the conduct of regular channel checks of each independent channel against the other, and against any other permanently-installed SFP level instrumentation.**
- c) A description of how functional checks will be performed, and the frequency at which they will be conducted. Describe how calibration tests will be performed, and the frequency at which they will be conducted. Provide a discussion as to how these surveillances will be incorporated into the plant surveillance program.**
- d) A description of what preventive maintenance tasks are required to be performed during normal operation, and the planned maximum surveillance interval that is necessary to ensure that the channels are fully conditioned to accurately and reliably perform their functions when needed.**

(This information was previously requested as RAI-8 in the NRC email dated July 11, 2013.)

3.11 Design Features: Display

Attachment 2 of Order EA-12-051 states, in part, that

Trained personnel shall be able to monitor the spent fuel pool water level from the control room, alternate shutdown panel, or other appropriate and accessible location. The display shall provide on-demand or continuous indication of spent fuel pool water level.

NEI 12-02 states, in part, that

The intent of this guidance is to ensure that information on SFP level is reasonably available to the plant staff and decision makers. Ideally there will be an indication from at least one channel of instrumentation in the control room. While it is generally recognized (as demonstrated by the events at Fukushima Daiichi) that SFP level will not change rapidly during a loss of spent fuel pool cooling scenario more rapid SFP drain down cannot be entirely discounted. Therefore, the fact that plant personnel are able to determine the SFP level will satisfy this requirement, provided the personnel are available and trained in the use of the SFP level instrumentation (see Section 4.1) and that they can accomplish the task when required without unreasonable delay.

SFP level indication from the installed channel shall be displayed in the control room, at the alternate shutdown panel, or another appropriate and accessible location (reference NEI 12-06). An appropriate and accessible location shall have the following characteristics:

- occupied or promptly accessible to the appropriate plant staff giving appropriate consideration to various drain down scenarios,
- outside of the area surrounding the SFP floor, e.g., an appropriate distance from the radiological sources resulting from an event impacting the SFP,
- inside a structure providing protection against adverse weather, and
- outside of any very high radiation areas or LOCKED HIGH RAD AREA during normal operation.

If multiple display locations beyond the required "appropriate and accessible location" are desired, then the instrument channel shall be designed with the capability to drive the multiple display locations without impacting the primary "appropriate and accessible" display.

In its OIP, the licensee stated that the instrument displays for each SFP level instrument would be located in an area which meets the four characteristics defined in NEI 12-02, Section 3.9.

In its letter dated August 6, 2013, the licensee stated, in part, that

The requested information is not available at this time. NSPM's current plan is to begin design of the SFPI system by the end of September 2013, with design completion expected by the end of January 2015. The requested information will be provided with the February 2015 six-month status report.

The NRC staff notes that the information regarding the location of the SFP level instrumentation displays is not currently available for review and that in its August 26, 2013 letter, the licensee identified the status of this activity as "Not Started". The licensee indicated that the information will be provided to the staff during the February 2015, six-month status report. The staff has identified this request as:

RAI #15

Please provide the following:

- a) **The specific location for the primary and backup instrument channel display.**
- b) **For any SFP level instrumentation displays located outside the main control room, please describe the evaluation used to validate that the display location can be accessed without unreasonable delay following a BDB event. Include the time available for personnel to access the display as credited in the evaluation, as well as the actual time (e.g., based on walk-throughs) that it will take for personnel to access the display. Additionally, please include a description of the radiological and environmental conditions on the paths personnel might take. Describe whether the display location remains habitable for radiological, heat and humidity, and other environmental conditions following a BDB event. Describe whether personnel are continuously stationed at the display or monitor the display periodically.**

3.12 Programmatic Controls: Training

Attachment 2 of Order EA-12-051 states, in part, that

Personnel shall be trained in the use and the provision of alternate power to the primary and backup instrument channels.

NEI 12-02 states, in part, that

The personnel performing functions associated with these SFP level instrumentation channels shall be trained to perform the job specific functions necessary for their assigned tasks (maintenance, calibration, surveillance, etc.). SFP instrumentation should be installed via the normal modification processes. In some cases, utilities may choose to utilize portable instrumentation as a portion of their SFP instrumentation response. In either case utilities should use the Systematic Approach to Training (SAT) to identify the population to be

trained. The SAT process should also determine both the initial and continuing elements of the required training.

In its OIP, the licensee stated, in part, that

Training on the new instrumentation will be provided to the necessary personnel, as determined by plant processes and procedures. NSPM's Systematic Approach to Training (SAT) will be used to identify the population to be trained, and the initial and continuing elements of the required training.

The licensee's proposed plan, with respect to the training personnel in the use and the provision of alternate power to the primary and backup instrument channels, including the approach to identifying the population to be trained, appears to be consistent with NEI 12-02, as endorsed by the ISG.

3.13 Programmatic Controls: Procedures

Attachment 2 of Order EA-12-051 states, in part, that

Procedures shall be established and maintained for the testing, calibration, and use of the primary and backup spent fuel pool instrument channels.

NEI 12-02 states, in part, that

Procedures will be developed using guidelines and vendor instructions to address the maintenance, operation and abnormal response issues associated with the new SFP instrumentation.

In its OIP, the licensee stated, in part, that

Procedures will be developed for both the primary and backup instrument channels consistent with the requirements of NRC JLD-ISG-2012-03 and NEI 12-02, Section 4.2. This will include procedures for the maintenance, operation, testing, calibration and normal/abnormal response of the primary and backup instrument channels. As described in Section 3.1.4, the time duration required for both the primary and backup instrument channels to be functional will be coordinated with the strategies developed for NRC Order EA-12-049 and NEI 12-06.

In its letter dated August 6, 2013, the licensee stated, in part, that

The requested information is not available at this time. NSPM's current plan is to begin design of the SFPI system by the end of September 2013, with design completion expected by the end of January 2015. Program and process features will be developed after that date. Therefore, the requested information will be provided with the August 2015 six-month status report.

The NRC staff notes that the information regarding the development and maintenance of procedures for the testing, calibration, and use of the primary and backup SFP instrument channels is not currently available for review and that in its August 26, 2013, letter, the licensee identified the status of this activity as "Not Started". The licensee indicated that the information will be provided to the staff during the February 2015, six-month status report. The staff has identified this request as:

RAI #16

Please provide a list of the procedures addressing operation (both normal and abnormal response), calibration, test, maintenance, and inspection procedures that will be developed for use of the spent SFP instrumentation. The licensee is requested to include a brief description of the specific technical objectives to be achieved within each procedure.

3.14 Programmatic Controls: Testing and Calibration

Attachment 2 of Order EA-12-051 states, in part, that

Processes shall be established and maintained for scheduling and implementing necessary testing and calibration of the primary and backup spent fuel pool level instrument channels to maintain the instrument channels at the design accuracy.

NEI 12-02 states, in part, that

Processes shall be established and maintained for scheduling and implementing necessary testing and calibration of the primary and backup SFP level instrument channels to maintain the instrument channels at the design accuracy. The testing and calibration of the instrumentation shall be consistent with vendor recommendations or other documented basis.

In its OIP, the licensee stated, in part, that

Testing and calibration of the primary and backup instrument channels will be established and implemented by existing PINGP processes, and will be scheduled in intervals such that the design accuracy of the instruments is maintained. Surveillance or testing intervals will be established per the recommendations of NEI 12-02, Section 4.3.

In its letter dated August 6, 2013, the licensee stated, in part, that

The requested information is not available at this time. NSPM's current plan is to begin design of the SFPI system by the end of September 2013, with design completion expected by the end of January 2015. Program and process features will be developed after that date. Therefore, the requested information will be provided with the August 2015 six-month status report.

The NRC staff notes that the information regarding the SFP level instrumentation testing and calibration is not currently available for review and that in its August 26, 2013 letter, the licensee identified the status of this activity as "Not Started". The licensee indicated that the information will be provided to the staff during the February 2015, six-month status report. The staff has identified this request as:

RAI #17

Please provide the following:

- a) Further information describing the maintenance and testing program the licensee will establish and implement to ensure that regular testing and calibration is performed and verified by inspection and audit to demonstrate conformance with design and system readiness requirements. Please include a description of the plans for ensuring that necessary channel checks, functional tests, periodic calibration, and maintenance will be conducted for the level measurement system and its supporting equipment.**
- b) Information describing compensatory actions when both channels are out-of-order, and the implementation procedures.**
- c) Additional information describing expedited and compensatory actions in the maintenance procedure to address when one of the instrument channels cannot be restored to functional status within 90 days.**

(This information was previously requested as RAI-11 in the NRC email dated July 11, 2013. However, based on feedback from the licensees, this RAI has been revised as above.)

3.15 Instrument Reliability

NEI 12-02 states, in part, that

A spent fuel pool level instrument channel is considered reliable when the instrument channel satisfies the design elements listed in Section 3 [Instrument Design Features] of this guidance and the plant operator has fully implemented the programmatic features listed in Section 4 [Program Features].

In its OIP, the licensee stated that reliability of the primary and backup instrument channels would be assured by conformance with the guidelines of NRC JLD-ISG-2012-03 and NEI 12-02.

Upon acceptable resolution of the RAIs noted above, the NRC staff will be able to make a conclusion regarding the reliability of the SFP instrumentation.

4.0 CONCLUSION

The NRC staff is unable to complete its evaluation regarding the acceptability of the licensee's plans for implementing the requirements of Order EA-12-051 due to the need for additional

information as described above. The staff will issue an evaluation with its conclusion after the licensee has provided the requested information.

The interim staff evaluation also includes RAIs, response to which the NRC staff needs to complete its review. The licensee should provide the information requested in the 6-month status updates, as the information becomes available. However, the staff requests that all information be provided by March 31, 2015, to ensure that any issues are resolved prior to the date by which the licensee must complete full implementation of Order EA-12-051. The licensee should adjust its schedule for providing information to ensure that all this information is provided by the requested date.

If you have any questions regarding this letter, please contact me at 301-415-2855 or via e-mail at scott.wall@nrc.gov.

Sincerely,

/RA/

Scott P. Wall, Senior Project Manager
Plant Licensing Branch III-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-282 and 50-306

Enclosure:
Interim Staff Evaluation and
Request for Additional Information

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