



JAPAN LESSONS-LEARNED PROJECT DIRECTORATE

JLD-ISG-2012-03

**Compliance with Order EA-12-051,
Reliable Spent Fuel Pool Instrumentation**

DRAFT Interim Staff Guidance

Revision 0

(DRAFT Issue for Public Comment)



U.S. NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

JAPAN LESSONS-LEARNED PROJECT DIRECTORATE

JLD-ISG-2012-03

Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation

DRAFT Interim Staff Guidance

Revision 0

(DRAFT Issue for Public Comment)

ADAMS Accession No.: ML12144A323

* concurrence by email

OFFICE	NRR/JLD/PMB	NRR/DORL/LA	NRR/DSS/SBPB	NRR/JLD/PMB
NAME	LRegner	BTully	GCasto*	RPascarelli
DATE	05/25/2012	05/24/2012	05/29/2012	05/25/2012
OFFICE	NRR/DE/EICB	NRO/DE/ICE	NRR/JLD	
NAME	JThorp* (BDittman for)	TJackson* (DSpaulding for)	DSkeen	
DATE	05/25/2012	05/25/2012	05/31/2012	

OFFICIAL RECORD COPY

DRAFT
INTERIM STAFF GUIDANCE
JAPAN LESSONS-LEARNED PROJECT DIRECTORATE (JLD)
COMPLIANCE WITH ORDER EA-2012-051,
RELIABLE SPENT FUEL POOL INSTRUMENTATION
JLD-ISG-12-03

PURPOSE

This interim staff guidance (ISG) is being issued to describe to the public methods acceptable to the NRC staff for complying with Order EA-12-051, *Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Effective Immediately)* (Order EA-12-051), issued March 12, 2012. This ISG endorses, with exceptions, the methodologies described in the industry guidance document, Nuclear Energy Institute (NEI) 12-02, *Industry Guidance for Compliance with NRC Order EA-12-051, "To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation"* (NEI 12-02), Revision B dated May 11, 2012 (Agencywide Documents and Management System (ADAMS) Accession No. ML12135A414). This ISG provides one acceptable approach for satisfying the requirements of Order EA-12-051.

The U.S. Nuclear Regulatory Commission (NRC) issued Order EA-12-051 following the NRC staff's evaluation of the earthquake and tsunami, and resulting nuclear accident, at the Fukushima Dai-ichi nuclear power plant in March 2011. Order EA-12-051 requires all licensees and construction permit (CP) holders to provide safety enhancements in the form of reliable spent fuel pool instrumentation for beyond-design-basis external events. Order EA-12-051 also requires the NRC staff to issue final interim staff guidance in August 2012 to provide additional details on an acceptable approach for complying with Order EA-12-051.

BACKGROUND

Following the events at the Fukushima Dai-ichi nuclear power plant, the NRC established a senior-level agency task force referred to as the Near-Term Task Force (NTTF). The NTTF conducted a systematic and methodical review of the NRC regulations and processes and determined if the agency should make additional improvements to these programs in light of the events at Fukushima Dai-ichi.

As a result of this review, the NTTF developed a comprehensive set of recommendations, documented in SECY-11-0093, *Near-Term Report and Recommendations for Agency Actions Following the Events in Japan*, dated July 12, 2011. These recommendations were modified by the NRC staff following interactions with stakeholders. Documentation of the NRC staff's efforts is contained in SECY-11-0124, *Recommended Actions To Be Taken Without Delay From the Near Term Task Force Report*, dated September 9, 2011, and SECY-11-0137, *Prioritization of Recommended Actions To Be Taken in Response to Fukushima Lessons Learned*, dated October 3, 2011. SECY-11-0124 and SECY-11-0137 established the NRC staff's prioritization of the recommendation based upon the potential safety enhancements.

As discussed in the Staff Requirements Memorandum associated with SECY-12-0025, *Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami*, dated March 9, 2012, the Commission determined that the additional requirements in Order EA-12-051 represent "a substantial increase in the protection of public health and safety." Consequently, the Commission decided to administratively exempt this Order from applicable provisions of the Backfit Rule, Title 10 to the *Code of Federal Regulations* (10 CFR), Section 50.109, and the issue finality requirements 10 CFR Part 52.

Numerous public meetings were held to receive stakeholder input on the NTF recommendation associated with enhanced spent fuel pool instrumentation prior to issuance of Order EA-12-051. Following issuance of Order EA-12-051, several more public meetings were held with representatives from the NEI task force to discuss the guidance for compliance with Order EA-12-051. See the References section for a list of the public meetings and the associated meeting summaries.

Following issuance of these orders, the NRC staff prepared a draft ISG to provide staff reviewers with guidance for evaluating licensee submittals which address these orders. This document was used to facilitate discussions during the public meetings. The NEI task force indicated that they planned to develop guidance also, and would submit to the NRC staff for consideration.

By letter dated May 11, 2012, the NEI task force submitted a guidance document for the implementation of Order EA-12-051 and requested NRC endorsement. The NRC staff reviewed this guidance document and endorses NEI 12-02, Revision B, with the exceptions listed in Attachment 1.

As required by Order EA-12-051, the NRC staff is issuing this ISG to provide additional details on an acceptable approach for complying with Order EA-12-051 requirements. The staff intends to issue a final ISG in August 2012.

RATIONALE

Order EA-12-051 requires that licensees install reliable means of remotely monitoring wide-range spent fuel pool levels to support effective prioritization of event mitigation and recovery actions in the event of a beyond-design-basis external event. Spent fuel pool level instrumentation currently at U.S. nuclear power plants is typically narrow range and, therefore, only capable of monitoring normal and slightly off-normal conditions. The staff's review of the events at Fukushima has shown the benefits that can be derived from the availability of more diverse instrumentation. Reliable and available indication is essential to ensure plant personnel can effectively prioritize emergency actions.

APPLICABILITY

This ISG is implemented on the day following its approval. It remains in effect until it has been superseded, withdrawn, or incorporated into a regulatory guide and standard review plan.

PROPOSED GUIDANCE

This ISG is applicable to holders of power reactor operating licenses and combined licenses.

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

NEI 12-02, Revision B, references other documents, but the NRC's endorsement of NEI 12-02, Revision B, in this ISG should not be considered an endorsement of any of the referenced documents.

To meet the requirements of Order EA-12-051, licensees and CP holders may use methods other than those provided in NEI 12-02. The NRC staff will review such methods and determine their acceptability on a case-by-case basis.

IMPLEMENTATION

Except in those cases in which a licensee or CP holder proposes an acceptable alternative method for complying with Order EA-12-051, the NRC staff will use the methods described in this ISG to evaluate licensee and CP holder compliance as presented in submittals required in Order EA-12-051.

BACKFITTING DISCUSSION

Licensees and CP holders may use the guidance in this document to demonstrate compliance with Order EA-12-051. Accordingly, the NRC staff issuance of this ISG is not considered backfitting, as defined in 10 CFR 50.109(a)(1), nor is it deemed to be in conflict with any of the issue finality provisions in 10 CFR Part 52.

FINAL RESOLUTION

The contents of this ISG will subsequently be incorporated into a standard review plan, and/or other guidance documents, as appropriate.

ATTACHMENTS

1. Guidance for Reliable Spent Fuel Pool Instrumentation
2. Template for Integrated Plan

REFERENCES

- A. NRC Order EA-12-051, *Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Effective Immediately)*, issued March 12, 2012 (ML12056A044)

- B. Federal Register, Volume 77, No. 53, *Order Modifying Licenses with Regard to Reliable spent Fuel Pool Instrumentation (Effective Immediately)*, March 19, 2012, (77 FR 16082)
- C. NEI 12-02, *Industry Guidance for Compliance with NRC Order EA-12-051, "To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation*, Revision B, dated May 11, 2012 (ML12135A414)
- D. SECY 11-0093, *Near-Term Report and Recommendations for Agency Actions Following the Events in Japan*, dated July 19, 2011 (ML112310021)
- E. SECY 11-0124, *Recommended Actions To Be Taken Without Delay From the Near Term Task Force Report*, dated September 9, 2011 (ML11245A127)
- F. SECY 11-0137, *Prioritization of Recommended Actions To Be Taken in Response to Fukushima Lessons Learned*, dated October 3, 2011 (ML11269A204)
- G. SECY 12-0025, *Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami*, February 17, 2012 (ML12039A103)
- H. Public Meetings:
 - December 1, 2011 (ML11341A160)
 - December 15, 2011 (ML11356A061)
 - January 13, 2012 (ML11362A202)
 - January 19, 2012 (ML11361A043)
 - March 29, 2012 (ML12073A077)
 - April 10, 2012 (ML12082A028)
 - April 18, 2012 (ML12093A409)
 - May 1, 2012 (ML12142A009)
- I. NRC-Proposed Draft Interim Staff Guidance for Compliance with Order EA-12-051, "Reliable Spent Fuel Pool Instrumentation," April 26, 2012 (ML12144A088)

GUIDANCE FOR RELIABLE SPENT FUEL POOL INSTRUMENTATION

1. Introduction

The U.S. Nuclear Regulatory Commission staff proposes that, with the exceptions listed below, conformance with the guidance in Nuclear Energy Institute (NEI) 12-02, *Industry Guidance for Compliance with NRC Order EA-12-051, "To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation"* (NEI 12-02), Revision B, is an acceptable method for use in satisfying the requirements in Order EA-12-051 regarding reliable spent fuel pool instrumentation. Licensees and construction permit (CP) holders may use methods other than those provided in NEI 12-02 to meet the requirements of Order EA-12-051. The staff will review such methods and determine their acceptability on a case by case basis. Except in those cases in which a licensee or CP holder proposes an acceptable alternative method for complying with Order EA-12-051, the NRC staff will use the methods described in this interim staff guidance (ISG) to evaluate licensee and CP holder compliance as presented in submittals required in Order EA-12-051.

2. Levels of Required Monitoring

Staff Position: NEI 12-02, Revision B, Section 2, provides an acceptable methodology for reliable spent fuel pool instrumentation with the following clarifications and exceptions:

2.3 Wide Range Pool Level Instrumentation

Section 2.3: In addition to the listed characteristics of what are not spent fuel pools, "water-filled structures within primary containments that contain temporary fuel storage locations" apply to BWR-6 and some PWR designs.

Section 2.3: If continuous indication from a single instrument is not able to measure the entire span from level indications 1, 2 and 3, then additional instruments need to be provided. The set of instruments used to measure the full range of indications should be considered to satisfy the requirements for one channel, either primary or back-up.

Section 2.3: Indications may be continuous or discrete (i.e. incremental) over the ranges identified in each subsection of Section 2.3, sufficient to provide at least the minimum resolution specified. The minimum resolution specification applies to the separation distance between discrete point indications. The monitoring requirements pertaining to minimum resolution are distinct from the specified instrument channel system design accuracy discussed in Section 3.7.

Section 2.3.2: EPA-400-R-92-001 Table 2-2, "Guidance on Dose Limits for Workers Performing Emergency Services" apply to the full duration of the emergency. Since workers may be involved in other recovery actions during the emergency, a fraction of the limit (~20%) should be used in establishing a water level where dose considerations may become important to spent fuel pool recovery actions (i.e., Level 2). References found in Regulatory Guide 1.13 and ANSI/ANS-57.2-1983 apply to normal dose rates and not emergency worker exposure considerations, and should not be used solely to establish level criteria for Level 2.

3. Instrumentation Design Features

Staff Position: NEI 12-02, Revision B, Section 3, provides an acceptable methodology for reliable spent fuel pool instrumentation with the following clarifications and exceptions:

3.1 Instruments

Section 3.1: In addition to the specified design and programmatic elements in NEI 12-02, the instrument channels must be designed, procured, and qualified to resist shock, vibration, seismic motion, submergence, and a reasonable spectrum of missiles for reliability following beyond design basis external events. Appropriate quality assurance measures should be applied to the procurement, design and installation of the instrument channels to provide reasonable assurance of functionality following beyond design basis external events. The staff considers application of the following measures to the design and installation acceptable in providing this reliability:

- all components of the instrument channels are protected against shock, vibration, and seismic motion by one of the following methods:
 - commercial design and testing for operation in environments where significant shock and vibration loadings are common, such as for portable hand-held devices or transportation applications
 - substantial history of operational reliability in environments with significant shock and vibration loading, such as transportation applications
 - components inherently resistant to shock and vibration loadings, such as cables
- all components located less than [5 feet] above the design basis flood elevation for the site are commercially designed for submerged operation or located within sealed conduit commercially designed for submergence assuming a water level [5 feet] above the site design basis flood elevation
- all components located outside safety-related structures and away from the spent fuel pool area are protected against missiles and high winds by locating components within trenches or are otherwise protected by location within structures consistent with the site design basis.

3.2 Arrangement

Section 3.2: Installation of additional missile barriers is not required; however, consideration should be given to instrument placement so that an instrument is protected from missiles and the possibility that such missiles could be wind driven, or objects falling over or down onto the instruments (as in Category two-over-one criteria).

3.4 Qualification

Appropriate quality assurance measures should be applied to all instrument channel components to ensure reliability following beyond design basis external events, including seismic events.

The qualification methods, which may include justification based on significant operating history, testing results, or other appropriate means, should apply to the beyond-design-basis initiating event, as well as the potential result of the spent fuel pool remaining at saturation conditions for an extended period.

3.9 Display

Section 3.9: Spent fuel instrumentation readings for SFP level are to be available to appropriate plant staff and decision makers when required. Once required, the location where the display(s) are located should remain occupied or promptly accessible upon demand for reading.

4. Program Features

Staff Position: NEI 12-02, Revision B, Section 4 provides an acceptable methodology for reliable spent fuel pool instrumentation.

Appendix A-1 Quality Assurance

Staff Position: NEI 12-02, Revision B, Appendix A-1 provides an acceptable methodology for reliable spent fuel pool instrumentation.

Appendix A-2 Order Response Template

Staff Position: NEI 12-02, Revision B, Appendix A-2 provides an acceptable methodology for reliable spent fuel pool instrumentation with the following clarifications and exceptions:

A-2 Order Response Template

Section A-2-2 The overall integrated plan is to provide a level of detail sufficient for the staff to provide a safety evaluation and license specific order to the licensee. Each licensee should provide information at a similar level of detail as that provided in Attachment 2 to satisfy the level of detail necessary for the Integrated Plan. Information in brackets is provided as an example only, and is not intended to describe means of complying the requirements of the order.

TEMPLATE FOR INTEGRATED PLAN

Applicability:

This integrated plan applies to [Unit] [and Unit].

Schedule:

The installation of reliable spent fuel pool level instrumentation for the spent fuel pool associated with [Unit] [and Unit] is scheduled for completion prior to [November 30, 2015], based on submittal of this integrated plan on [February 25, 2013], and the end of the following two refueling outages for [Unit] scheduled to be complete by [May 31, 2014], and [November 30, 2015], [which is the earlier outage sequence of the two units discharging to the pool].

Associated Spent Fuel Pool Configuration:

[Unit] [and Unit] discharge irradiated fuel to a [single][shared][set of {2} interconnected] spent fuel storage pool[s]. With the exception of limited time periods for maintenance or non-refueling operations, administrative controls maintain gates between the following pools open: [spent fuel pool {A}], [spent fuel pool {B}], [fuel transfer canal to [Unit]], and [cask loading pit]. Thus, these pools are normally inter-connected and at the same water level when the water level in the spent fuel pool is greater than [1 foot] above the top of stored fuel seated in the storage racks.

Identification of Spent Fuel Pool Water Levels:

Key spent fuel pool water levels will be identified as follows:

- Level adequate to support operation of the normal fuel pool cooling system – Indicated level on either the primary or backup instrument channel of greater than [x feet] above the top of stored fuel seated in the storage racks based on design instrument channel accuracy of [+/- x feet for both the primary and backup instrument channels] and [a calculation demonstrating a water level of x feet] above the top of stored fuel seated in the storage racks is adequate water level for normal fuel pool cooling system operation.
- Level adequate to provide substantial radiation shielding for a person standing on the spent fuel pool operating deck - Indicated level on either the primary or backup instrument channel of greater than [x feet] above the top of stored fuel seated in the storage racks based on design instrument channel accuracy of [≤+/- x feet for both the primary and backup instrument channels for discrete indications and the specified accuracy for the continuous indications] and [the relatively low sensitivity of dose rate to changes in water depth at the Regulatory Guide 1.13 specified depth for shielding of x feet] above the top of stored fuel seated in the storage racks is adequate water level to provide substantial radiation shielding for a person standing on the spent fuel pool operating deck.

- Level where fuel remains covered - Indicated level on either the primary or backup instrument channel of greater than [x foot] above the top of stored fuel seated in the storage racks based on design instrument channel accuracy of [+/- x feet] for both the primary and backup instrument channels and [location of the primary and backup instrument channel sensing components in areas separated from the fuel storage area by weirs no more than x feet] above the top of stored fuel seated in the storage racks is adequate water level to assure the stored fuel is covered.

Instruments:

Primary (fixed) instrument channel: The primary instrument channel level sensing component[s] will be located in [the cask loading pit]. The primary instrument channel will provide [continuous level indication over a range from [x feet] to [x feet]][and][discrete level indications at [x feet and x feet]] above the top of stored fuel seated in the storage racks. The continuous level indication will be provided by a [pressure transmitter] and the discrete level indication will be provided by [level switches].

Backup instrument channel: The backup instrument channel level sensing component[s] consist of [both portable and fixed] components. The portable components will be deployed in [spent fuel pool A], and the fixed components are located in the [transfer canal adjacent to spent fuel pool A]. The backup instrument channel will provide [continuous level indication over a range from [x feet] to [x feet]][and][discrete level indications at [x feet and x feet]] above the top of stored fuel seated in the storage racks. The continuous level indication will be provided by a [portable ultrasonic level detector] and the discrete level indication will be provided by [level switches].

Instrumentation channel independence is achieved in the following manner: [Plant specific response]

Reliability:

Reliability of the primary and backup instrument channels will be assured by conformance with:

- a quality assurance program consistent with the guidance of [Appendix A to NEI 12-02] applied to all instrument channel components to provide reasonable assurance of reliability following postulated beyond design basis external events
- the design and programmatic criteria, including procurement and qualification criteria, described in [NRC ISG]
- the following criteria for reasonable protection against beyond design basis external events:
 - all components of the instrument channels are protected against shock, seismic motion, and vibration by one of the following methods:
 - commercial design and testing for operation in environments where significant shock and vibration loadings are common, such as for portable hand-held devices or transportation applications
 - substantial operational history in environments with significant shock and vibration loading, such as transportation applications

- components inherently resistant to shock and vibration loadings, such as cables
- all components located less than [x feet] above the design basis flood elevation for the site are commercially designed for submerged operation or located within sealed conduit commercially designed for submergence assuming a water level [x feet] above the site design basis flood elevation
- all components located outside safety-related structures and away from the spent fuel pool area are protected against missiles and high winds by locating components within trenches or are otherwise protected consistent with the site design basis

Instrument Channel Design Criteria:

Consistent with the guidelines of NRC ISG and/or NEI 12-02, with the exceptions and clarifications noted below:

Arrangement: *[Plant specific response]*

Mounting: *[Plant specific response]*

Qualification: *[Plant specific response]*

Power Supplies: *[The primary instrument channel normally receives power from plant vital [alternating current] AC power, and this power supply can be separated from the channel with a disconnect switch and replaced by battery power for intermittent monitoring. The backup instrument channel components are all powered by batteries maintained in a charged state by commercial-grade uninterruptible power supplies.]*

Accuracy:

The instrumentation system minimum resolution is as specified in Item 2.3 of the ISG. The channel design accuracy for the instrumentation is as follows: *[Plant specific response]*

[The accuracy of the instrument channel for Level 3 will be maintained less than +/-x feet to avoid ambiguous indication because the sensor is located in the cask loading pit at an elevation x feet above the bottom of the cask pit gate. This configuration assures that the instrument channel indication at Level 3 unambiguously demonstrates the stored fuel is covered with water despite the location of the sensing components in the cask loading pit.]

Testing

Display: *[The primary instrument display will be located in the control room. The backup instrument channel display will use wireless data transmission to a portable, battery-powered display.]*

Instrument Channel Program Criteria:

Training will be consistent with the guidelines of NRC ISG. *[Maintenance staff members will be designated as staff that would install the portable components of one instrument channel and ensure the proper operation of both instrument channels.]*

Procedures will be consistent with the guidelines of NRC ISG with no exceptions.

Testing and Calibration will be consistent with the guidelines of NRC ISG with no exceptions.