September 11, 2002

Mr. John L. Skolds, President
Exelon Nuclear
Exelon Generation Company, LLC
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3 - DRAFT RESPONSE TO TASK INTERFACE AGREEMENT 2001-13 CONCERNING THE REACTOR BUILDING CRANE AND HEAVY LOADS HANDLING (TAC NOS. MB3023 AND MB3024)

Dear Mr. Skolds:

The Nuclear Regulatory Commission (NRC) staff has completed its review of the subject Task Interface Agreement (TIA) request, dated September 28, 2001, from the NRC's Region III office. TIA 2001-13 provided a backfit analysis and requested the Office of Nuclear Reactor Regulation (NRR) staff's assistance in resolving a number of issues concerning the reactor building crane and heavy loads handling at the Dresden Nuclear Power Station, Units 2 and 3. The issues were identified in Dresden Inspection Reports 07200037/2001-01 and 07200037/2001-02.

The purpose of this letter is to (1) inform you that while resolving the issues identified in the inspection reports, the NRC staff has arrived at a preliminary conclusion that could have an adverse impact on the Exelon Generation Company (Exelon) and (2) provide you with the opportunity to identify any technical errors or relevant information that was not considered in the enclosed draft TIA response. The NRC's TIA procedures require that such issues be discussed with the licensee prior to formal issuance of the TIA response to ensure that the NRR staff has considered all relevant information in arriving at its conclusion and to assure that the licensee is aware of the situation.

The preliminary conclusion we want to inform you of is that moving loads heavier than 100 tons in the reactor building could create the possibility for an accident of a different type than any previously evaluated in the updated final safety analysis report. While you are not required to respond to this letter, if you do identify any technical errors, we ask that you provide the basis for your finding or reference the basis if it has been previously submitted to the NRC. We also ask that you specifically describe where we can find the correct information in your basis document(s).

If you choose to respond to this letter, we request that your response be provided within 30 days of your receipt of this letter. Please feel free to contact me at (301) 415-2863 if you have any questions.

Sincerely,

/RA by S. Bajwa for/

Lawrence W. Rossbach, Project Manager, Section 2
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-237 and 50-249

Enclosure: Draft TIA 01-13

cc w/encl: See next page

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Attachment

RESPONSE TO
TASK INTERFACE AGREEMENT (TIA) 2001-13
REGARDING BACKFITTING REQUIREMENTS FOR
DRESDEN UNIT 2 AND 3 REACTOR BUILDING CRANE
(TAC NOS. MB3023 AND MB3024)

1.0 INTRODUCTION

By memorandum from Cynthia Pederson to Ledyard Marsh, dated September 28, 2001, Regional TIA 2001-13 requested that NRR review Regulatory Analysis - MC 0514, "Plant Specific Backfitting," - Dresden 2/3 Reactor Building Crane (supplement). Specifically, the TIA requested that NRR review various issues pertaining to Dresden's heavy load handling system that are associated with the proposed backfit and determine whether the backfit should be proposed as described, amended, or abandoned. The proposed backfit would require the licensee to perform and submit specific seismic analyses of the Dresden 2/3 reactor building crane and the reactor building superstructure for operating basis earthquakes (OBE) and safe-shutdown earthquakes (SSE) before the Unit 2/3 reactor building crane is used to load more spent fuel casks.

The specific concerns cited by Region III as the basis for the TIA include the following:

- Dresden 2/3 is in nonconformance with industry codes and standards regarding the control and handling of heavy loads;

- The licensee reconfigured the Dresden 2/3 reactor building crane back to its 1976 licensing basis as a "single-failure-proof" crane to justify the intended use of the crane to handle heavy loads without regard for the operating status of the reactors;

- Discrepancies existed when comparing the configuration established in the 1976 licensing basis to both the criteria for single failure proof cranes which existed at that time and current criteria as follows:

  - The lack of docketed analyses relating to performance of the crane and its supporting reactor building superstructure during design basis seismic events;

  - Some components which support heavy loads during handling of spent fuel casks, such as the lifting yoke and the trolley, have not been analyzed for seismic events;

  - The bridge and building superstructure have been examined in a limited manner in non-docketed analyses that have been done either by the licensee or its consultants at various times over the past 25 years;

- The seismic analyses are non-docketed and incomplete, and planned modifications were not implemented;
- The analyses indicate that during a seismic event with a load on the crane, some building structural members will be subjected to stresses that exceed their yield strength; and
- The consequences (including whether and where the load might ultimately drop) have not been analyzed.

2.0 APPLICABLE REGULATORY GUIDANCE

Branch Technical Position (BTP) APCSB 9-1, “Overhead Handling Systems for Nuclear Power Plants,” dated 1975 (found in the Standard Review Plan [SRP], NUREG-0800), provided guidance for the evaluation of heavy load handling systems in nuclear power plants and was derived due to the lack of industry codes and standards that adequately addressed the design, operation, and testing for single-failure-proof cranes.

NUREG-0554, “Single-Failure-Proof Cranes for Nuclear Power Plants,” dated May 1979, identifies features of the design, fabrication, installation, inspection, testing, and operation of single-failure-proof overhead crane handling systems that are used for handling critical loads. NUREG-0554 superseded Draft Regulatory Guide (RG) 1.104, “Overhead Crane Handling Systems for Nuclear Power Plants,” dated 1976.

NUREG-0612, “Control of Heavy Loads at Nuclear Power Plants,” dated July 1980, provides regulatory guidelines in two phases (Phases I and II) for licensees to assure safe handling of heavy loads in areas where a load drop could impact on stored spent fuel, fuel in the reactor core, or equipment that may be required to achieve safe shutdown or permit continued decay heat removal. Phase I guidelines address measures for reducing the likelihood of dropping heavy loads and provide criteria for establishing safe load paths, procedures for load handling operations, training of crane operators, design, testing, inspection, and maintenance of cranes and lifting devices, and analyses of the impact of heavy load drops. Phase II guidelines address alternatives for mitigating the consequences of heavy load drops, including using either (1) a single-failure-proof crane for increased handling system reliability, or (2) electrical interlocks and mechanical stops for restricting crane travel, or (3) load drops and consequence analyses for assessing the impact of dropped loads on plant safety and operations. NUREG-0612, Appendix C, provides alternative means of upgrading the reliability of the crane to satisfy the requirements of NUREG-0554.

Generic Letter (GL) 85-11, “Completion of Phase II of Control of Heavy Loads at Nuclear Power Plants, NUREG-0612,” dated June 28, 1985, dismissed the need for licensees to implement the guidelines of NUREG-0612, Phase II, based on the improvements obtained from the implementation of NUREG-0612, Phase I. GL 85-11, however, encouraged licensees to implement actions they perceive to be appropriate to provide adequate safety.

In NRC Bulletin (NRCB) 96-02, “Movement of Heavy Loads Over Spent Fuel, Over Fuel in the Reactor Core, or Over Safety-Related Equipment,” dated April 1996, the staff addressed specific instances of heavy load handling concerns and requested licensees to provide specific information detailing their extent of compliance with the guidelines and their licensing basis.

3.0 EVALUATION

3.1 Licensing Basis for Dresden Heavy Load Handling

Dresden, Units 2 and 3, are among the Systematic Evaluation Program (SEP) plants that predate the General Design Criteria (GDC, 10 CFR Part 50 Appendix A), the SRP, NUREG-0554, and NUREG-0612. Accordingly, Dresden’s program for the control and handling of heavy loads was evaluated against criteria provided in BTP APCSB 9-1. Moreover, the licensee made commitments to the guidelines of Section 5.1.1, “General” (Phase I) of NUREG-0612, in their response to Generic Letter 80-113, “Control of Heavy Loads,” which was issued on December 22, 1980. The staff, as part of its Phase I review, did not identify any changes and/or modifications needed to satisfy the guidelines of NUREG-0612, Phase I. Subsequently, the staff issued a SER dated July 11, 1983, that accepted the licensee’s NUREG-0612 Phase I Heavy Loads program.

By letter dated November 8, 1974, the licensee (then Commonwealth Edison Co., now Exelon Generation Company, LLC) submitted Special Report Number 41, “Reactor Building Crane and Cask Yoke Assembly Modifications,” that proposed certain modifications to the handling system to make it “single-failure-proof” for handling loads up to 100 tons.

The staff issued a safety evaluation report (SER) dated June 3, 1976, approving changes to Dresden, Units 2 and 3, technical specifications (TS) governing the operation and surveillance of the upgraded crane with “single-failure-proof” capability. In the SER, the staff stated that the reactor building crane met the intent of the requirements in BTP APCSB 9-1 for handling heavy loads weighing up to 100 tons with three exceptions: (1) the redundant mechanical limit switch in the main hoist power circuit (for two-blocking), (2) an electrical interlock system to prevent crane travel outside its safe load path, and (3) a slow speed drive motor to limit the hoisting speed. As a result, the handling system was to be operated on a temporary basis, until August 29, 1976, without the installed components, provided that handling operations followed the TS as modified. The staff, in its June 1976 SER, stated, “Based on our review of data provided by the licensee, we have concluded that the integrated design of the crane, controls, and cask lifting devices meets the intent of BTP APCSB 9-1 as regards single failure criteria except in the specific areas of the crane reeving system, and protection against ‘two-blocking’**.”** The staff expected the licensee to complete the crane modifications to support continued use of the crane after August 29, 1976, as a single-failure-proof crane.

The staff issued a draft Technical Evaluation Report (TER) dated June 28, 1984, that addressed the staff’s review of Dresden’s implementation of guidelines in NUREG-0612 Phase II. The draft TER concluded that the licensee provided a detailed account of the modifications to the crane and cask yoke assembly to demonstrate compliance with the single-failure-proof criteria. However, the draft TER was not issued as a final product due to the issuance of GL 85-11.

In a 1996 response to NRCB 96-02, the licensee stated that, in the future, prior to moving heavy loads with the reactor in power operation, the licensee would demonstrate the capability of performing actions necessary to achieve safe shutdown following a dropped load inside the facility.

3.2 Specific Concerns in Regulatory Analysis - MC-0514

The Region's concerns, in bold text, and NRR's respective evaluations are provided below.

3.2.1 **The licensee "restored" the Unit 2/3 reactor building crane at the Dresden station to conform to a former licensing basis (circa 1976) and used it as a single failure proof crane to load two spent fuel casks**.

As stated above, the staff's June 1976 SER cited specific modifications that were needed to support the single-failure-proof capability of the crane. The staff accepts any licensee restoration/modifications of the Dresden 2/3 crane whereby the needed modifications as described in the 1976 SER are implemented. Such restorations will enable the licensee to conform to its licensing basis. Following restoration of the reactor building crane to conform to its original licensing basis, the licensee is prohibited from lifting loads exceeding 100 tons as a "single-failure-proof" crane. Any loads lifted above 100 tons should be analyzed following the guidelines of NUREG-0612, Section 5.1.1(2), Reactor Building - BWR, to show that the evaluation criteria of Section 5.1, Recommended Guidelines, are satisfied. In addition, where safe shutdown equipment has a ceiling separating it from the overhead handling system, the licensee should demonstrate that any load exceeding 100 tons which is lifted by the handling system could not penetrate the ceiling or cause spalling that could cause failure of the safe shutdown equipment, as specified in NUREG 0612 section 5.1.5(2).

3.2.2 **The crane was not "single failure proof" for about 20 years. As restored, the crane does not comply with the current standards as a single failure proof crane.**

As stated in Section 3.1 above, the staff originally concluded that the crane satisfied the requirements in BTP APCSB 9-1 as a single-failure-proof crane pending implementation of the modifications as described in the June 1976 SER. If the licensee did not satisfactorily complete and maintain the modifications over the last 20 years then the licensee was operating outside its licensing basis, for every lift of a critical load, over a prolonged period. This circumstance should be corrected, and the licensee should be required to complete the modifications prior to moving casks.

3.2.3 **The crane and the reactor building superstructure are not analyzed to withstand rated load plus design basis earthquakes, Operating-Basis Earthquakes (OBE) and Safe-Shutdown Earthquakes (SSE).**

Scores of dry spent fuel casks, each weighing about 100 tons when loaded with 68 spent fuel assemblies, will be routinely handled with the reactor at power, using a lifting yoke which is not designed or analyzed for seismic events, carried

by an undersized wire rope on a trolley with no seismic qualification which is supported by a non seismic bridge which rests on building superstructure that analyses indicate is not capable of carrying the load in a seismic event. The load will pass above safety-related and safe shutdown equipment at heights of about 100 feet, but the consequences of a load drop for plant safety and safe shutdown have not been analyzed.

In relation to the above statements in the TIA, the Region specific concerns were identified and addressed as follows:

(A) Lifting Yoke - The lifting yoke is not designed or analyzed for seismic events. While the lifting yoke is apparently not designed to withstand horizontal forces such as those which could arise from a seismic event there are no physical locks or latches provided to secure the yoke. Accordingly, there are no existing analyses to address the ability of the yoke to retain the load in the event of lateral forces from an earthquake.

In accordance with BTP APCSB 9-1, Section 3.b, and NUREG-0612, Section 5.1.1(4), "Special Lifting Devices," devices such as the lifting yoke should be designed with increased factors of safety if a dual load path is not provided. To satisfy NUREG-0612 the device has to be either designed with a dual load path or the design safety factor has to be increased by twice that required in ANSI N14.6-1978, "Standard for Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4500 kg) or More for Nuclear Materials." Special lifting devices, such as the lifting yokes, are not required to be analyzed for the loads from a seismic event. The licensee, in Special Report Number 41, "Reactor Building Crane and Cask Yoke Assembly Modifications," provided a lifting yoke that was both redundant and met the increased safety factor design of BTP APCSB 9-1, Section 3.b, to support a static load of three times the weight (3W) without permanent deformation. The increased factors of safety provide reasonable assurance that the yoke will hold the load under these conditions. The lifting yoke described in Special Report Number 41 meets both the static load requirements of BTP APCSB 9-1 and the dual design considerations of NUREG-0612, Section 5.1.6(1)(a). The Dresden 2/3 reactor building crane meets both BTP APCSB 9-1 and NUREG-0612, providing an additional level of assurance.

Inspections by Region III identified that the licensee was using a lifting device other than the one approved in amendments 19 and 22 of June 3, 1976. The staff request for additional information (RAI), dated February 28, 2002, requested the licensee demonstrate how the new lifting device meets certain requirements of ANSI N14.6-1978 and the guidelines of NUREG-0612 for special lifting devices. Specifically, the staff wanted to know if the new special lifting device satisfied the design and critical load lifting requirements of ANSI N14.6-1978, and the stress design factors for redundant or non-redundant components of the lifting device within the guidelines of NUREG-0612.

The licensee stated that its current lifting device is the HI-TRAC 125 ton lifting device and that the special lifting device design included a dynamic load of 15-percent of the total static load that was added to the total static load to determine the design load for the lifting device. Moreover, the stress design factors used in the analysis for non-redundant lifting device components were one-sixth of the yield strength and one-tenth of the ultimate strength; where redundancy was incorporated, the stress design factors were limited to one-third the yield strength and one-fifth of the ultimate strength. The staff found the stress design factors to be consistent with ANSI N14.6-1978 and NUREG-0612. The licensee also provided a list of redundant and non-redundant components that make up the lifting device which are provided below:

- crane hook (redundant) with maximum pin loads of one-fifth of the ultimate strength
- strongbacks (non-redundant) loads are one-tenth of the ultimate strength
- actuation plate and engagement pin loads are one-tenth of the ultimate strength
- lift yoke arm loads are one-tenth of the ultimate strength

The design load criteria and stress design factors for the special lifting device used at Dresden 2/3 satisfy the requirements of ANSI N14.6-1978 and the guidelines of NUREG-0612 for special lifting devices.

(B) Undersized Wire Rope - In 1976, NRC accepted a wire rope with a safety factor of 7.798 to 1 instead of a safety factor of 8 to 1 as specified in BTP 9-1 while the current standard NUREG-0554 specifies a safety factor of 10 to 1. NRC accepted the original wire rope with compensatory actions (mandatory surveillance and replacement)

While a safety factor of 10 to 1 as prescribed in NUREG-0554 offers a higher margin of safety and is preferred, a safety factor of 7.798 to 1 with mandatory commitments to visually inspect and replace the wire rope as necessary, as accepted in the June 1976 SER, provides reasonable assurance of the safety of the hoisting system. Observation of degradation such as abrasion, wear, fatigue, corrosion, improper reeving, and kinking are often of greater significance than are strength factors in determining the useful life of a rope. If the wire rope accepted by the staff in the June 1976 SER becomes degraded, the licensee is not obligated to replace the wire rope with one based on currently acceptable safety factors. In addition, NUREG-0612 states that the wire rope should be in accordance with provisions of Crane Manufacturers Association of America (CMAA)-70, “Specification for Electric Overhead Traveling Cranes.” Accordingly, CMAA-70 and other industry codes (i.e., OSHA) state that the crane manufacturer’s recommendation shall be followed. The wire rope design and construction are specified by the crane manufacturer, and the stresses on the rope shall not exceed 20 percent of the manufacturers’ published breaking strength of the rope. Previous staff reviews, including the June 1976 SER, accepted the wire rope as specified by the crane manufacturer.

(C) Trolley - The trolley has no seismic classification and has not been specifically analyzed under Design Basis Earthquake (DBE) conditions;

(D) Bridge - Analyses of the bridge to OBE and SSE seismic conditions as committed to by the licensee as part of the 1976 licensing action was

communicated to the NRC but not approved by the NRC. Licensee commitment to provide safety lugs on the bridge rails, to retain the bridge during a seismic event, was never implemented; and

(E) All of the equipment which bears loads is to be analyzed and demonstrated to be capable of withstanding design basis earthquakes (both OBE and SSE) with rated load on the crane.

With regard to items (C), (D), and (E), the staff's guidelines state that the equipment which bears load should be capable of withstanding seismic events with rated load on the crane. NUREG-0554 Section 2.5, "Seismic Design," states that, " . . . the crane bridge and trolley should be designed and constructed in accordance with Regulatory Guide 1.29, "Seismic Design Classification," such that the maximum critical load plus operational and seismically induced pendulum and swinging load effects on the crane should be considered in the design of the trolley, and they should be added to the trolley weight for design of the bridge." Accordingly, licensees are expected to design and construct the lifting system so that an SSE and OBE may not result in any failures that could reduce the functioning of the spent fuel pool storage structure to an unacceptable safety level. Dresden is licensed to BTP APCSB 9-1, which has similar expectations.

Specifically, BTP APCSB 9-1 states that, " . . . the crane should be classified as seismic Category I and should be capable of retaining the maximum design load during a safe shutdown earthquake, although the crane may not be operable after the seismic event. The bridge and trolley should be provided with means for preventing them from leaving their runways with or without the design-rated load during operation under seismic loadings. The design-rated load plus operational and seismically-induced pendulum and swinging load effects on the crane should be considered in the design of the trolley, and they should be added to the trolley weight for design of the bridge."

In Special Report 41 (which predated BTP APCSB 9-1), Section 3.2, "Component Failure Analysis," the licensee committed to analyze the crane under the American Institute of Steel Construction (AISC) code requirements for OBE and DBE conditions. In addition, the licensee committed to install lugs or other mechanisms to preclude the trolley and bridge from leaving the runways during a seismic event.

The licensee submitted Supplement A to Special Report 41 by letter dated June 10, 1975, in response to BTP APCSB 9-1. In Supplement A, the licensee stated, "We have reviewed the Branch Position on overhead crane handling systems, dated January 10, 1975, **[BTP APCSB 9-1]** in light of the system proposed for installation by Commonwealth Edison at Dresden . . . . The Dresden and Quad Cities cranes are identified as Safety Class II equipment in the plant operating license. It is not practicable to consider reclassifying the hoist system as Seismic Class I, because this would most probably require a new bridge and extensive modifications to the bridge trackway. The bridge and trolley will be analyzed in a manner consistent with the design codes applicable at the time of original construction, that is, the allowable stress will be limited to 90 percent of yield, with only static lifted loads considered . . . . "

In 1975-1976, the NRC staff reviewed Supplement A to Special Report 41 against the criteria of BTP APCSB 9-1 and concluded that the crane met the intent of BTP APCSB 9-1 with the three exceptions identified in Section 3.1 above, to the General Performance Specifications of the BTP. However, during their review of this issue in 2002, NRR staff were unable to determine if the licensee's commitment to analyze the crane bridge and trolley in accordance with applicable codes at the time of the original crane installation, with only static lifted loads considered, was completed, and if the analysis bounded the seismic criteria. Consequently, the staff issued an RAI to the licensee dated February 26, 2002.

In the RAI, the staff requested the analysis of record that supports the seismic qualification of the bridge and trolley and the load-bearing components of the reactor building crane. The staff was particularly interested in the design codes and standards used in the analysis to address the seismic qualification of the crane as single failure proof. Justification was requested to demonstrate how the crane and supporting structure met the intent of BTP 9-1, including how the analysis addressed SSE plus maximum critical load (lifted load) and how the analysis determined the bridge and trolley would not leave their respective trackways.

The licensee's response to the staff RAI dated April 12, 2002, reported that the presence of safety lugs on the bridge and trolley had been verified during a walk down of the reactor building crane. These safety lugs will ensure the bridge and trolley stay on their respective runways with or without the design load during operation or under seismic loadings. Therefore, the presence of the safety lugs on both the bridge and trolley meet the guidelines of the performance specification in paragraph C. The licensee's response to the staff RAI also included an October 10, 1974, crane bridge calculation that verified that OBE and DBE considerations were included in the design of the crane bridge. This satisfies the guidelines of BTP APCSB 9-1 for the bridge; however, neither a seismic nor a component failure analysis was available for the crane trolley. Therefore, the licensee could not produce the results of any calculations in support of the crane trolley.

Notwithstanding the lack of any crane trolley calculation, the licensee's response to the RAI included a Revision 1 to calculation DRE 98-0020, which analyzed the reactor building (RB) superstructure with the crane loaded, including pendulum effects, for forces imposed from both DBE and SSE. The OBE/SSE analysis, with crane-lifted loads exceeding its current licensing basis of 100 tons, shows that the RB superstructure can support the crane-lifted load with restrictions to the limits of crane travel (i.e., load paths). Since the trolley is located on top of the crane bridge, it will be subjected to similar seismic loading. Because the bridge has been qualified for OBE/SSE conditions, and calculation DRE 98-0020 (revision 1) demonstrates that the RB superstructure will support the crane, with lifted loads exceeding its licensing basis, during an OBE, there is reasonable assurance that the crane trolley has been adequately designed to meet the intent of BTP APCSB 9-1.

Therefore, while the staff was not able to identify the specific technical bases for the NRC conclusion in its 1976 SER that the Dresden crane met the intent of BTP APCSB

9-1, the staff is satisfied that the licensee has now adequately demonstrated through analysis the seismic design qualification of the crane, including lifted loads, as single failure proof, and finds the crane bridge and trolley to be acceptable. Based on this, and on the information provided under sections (A), (B), and (G), the staff concludes that the licensee has demonstrated that the overhead handling system is capable of withstanding seismic events as a 100-ton single-failure-proof crane within the crane travel limits identified in calculation DRE 98-0020 (revision 1).

(F) If the subject equipment is not capable, long term cask handling shall not be allowed unless the entire load path has been analyzed for a load drop and the results show that dropping a loaded spent fuel cask does not create an unacceptable risk.

In light of the NRC staff's conclusion as described in Section E above, the Dresden reactor building crane's current licensing basis allows the handling of loads up to 100 tons as a single-failure-proof crane. Therefore, the licensee is not required to analyze the potential consequences of a drop that is within its current single-failure licensing basis of 100 tons along the load path.

As stated in Sections 3.1 and 3.2.1 above, the single-failure licensing basis for the Dresden reactor building crane requires that the loads be carried within the established controlled area (or a safe load path) and that they do not exceed 100 tons, which includes the weight of the lifting apparatus. It should be noted that the use of a single-failure-proof handling system does not negate the requirement to follow the guidelines of NUREG-0612, Phase I, although, the use of a single-failure-proof handling system further reduces the probability of a load drop that could potentially damage safety-related equipment or irradiated fuel. Therefore, movement of heavy loads should be conducted in accordance with the controlled area and the commitments made in addressing NUREG-0612, Phase I and approved in the July 1983 SER.

(G) Building Superstructure - Dresden 2/3 UFSAR, Section 3.2.1 classifies the reactor building as a Seismic Category 1 structure. UFSAR Section 3.8.4.1.3 defines the load combinations for Class 1 structures with Operational Basis Earthquake (OBE) and Safe Shutdown Earthquake (SSE), respectively as follows:

- **D (dead load + live load) + E (OBE load)**
- **D + E' (SSE load)**

Calculations of record to address OBE and SSE do not consider lifted loads on the crane, and therefore, do not demonstrate that the building superstructure is capable of safely handling a seismic event with a lifted load on the crane.

The licensee has performed additional calculations to evaluate the RB superstructure for several load combinations. The combined effect of the maximum-lifted load with a postulated OBE event was evaluated. The crane lifted load included pendulum effects and the allowable stresses were the same as those specified in the FSAR.

Considering the maximum lifted load (crane capacity) of 125 tons in combination with the applicable loads for the OBE loading condition, the Interaction Coefficients (IC = Applied Stress/Allowable Stress) for the RB superstructure members, connections, and anchorages as well as the runway girders were all determined to be $\leq$1.0 except for the superstructure interior columns (Member size W24) where the interaction coefficient (IC) was determined to be 1.05 and the bearing stress on the interior column base plate where the IC was 1.03.

Additional refined analyses were performed to determine the conditions under which the stresses in the two over stressed elements could be shown to be within allowables and their IC's less than $\leq$1.0.

Several options were explored for this purpose, namely, evaluation of actual loads of the items to be lifted instead of the maximum lift load of 125 tons used in the initial evaluation and/or specifying a travel path for the crane which would limit the crane reach to prescribed limits such that the stresses in the affected members would be reduced to within allowable limits. The additional analyses included the following:

Determination of the allowable lifted load that would limit the IC's for the superstructure interior columns and column base plates to $\leq$1.0.

Determination of the crane hook allowable reach that would limit the IC's for the superstructure interior columns and column base plates to $\leq$1.0 with the maximum lifted load of 125 tons.

Evaluation of the RB superstructure interior columns and column base plates for the actual lifted loads of specific items that exceed the allowable lifted load determined in Item 1 above. The evaluation considered the actual travel path for load movement as documented in Exelon Transmittal of Design Information, TODI No. CC2002-9994, dated 4/22/2002 (Reference 52). The specific items whose lifted load was evaluated included:

– Fuel Cask (103 tons including lifting apparatus; analysis conservatively used 105 tons).

– Reactor Vessel Head (125 tons including lifting apparatus).

– Shield plugs (top, middle, and bottom layers, 113, 108, and 103 tons, respectively, including lifting apparatus).

The calculation results for Item 1 (Allowable Lifted Load in order to remain within stress limits and with no limits on crane movements and allowable reach) showed that the allowable lifted load for the crane should be limited to 93.75 tons or 187.5 Kip, which includes the weight of the lifting apparatus.

The calculation results for Item 2 (Allowable reach of the crane hook) showed that, with the 125 tons lifted load, the crane hook maximum reach to either end of the bridge beams must be limited to a minimum of 25 feet from the runway girder. This is equivalent to 27'-3" from column lines H and N.

The calculation results for Item 3 (Maximum Cask weight of 105 tons or 210 Kip) showed that, for the prescribed travel path and with limits on the hook allowable reach so that the minimum distance of the lifted load from end of crane girder is 23.54 ft, all the members of the RB superstructure are within allowable stress limits and the RB superstructure is structurally adequate to support the cask weight during a postulated OBE event. All IC's were found to be <1.0 for a cask weight of 105 tons including the lifting apparatus.

The calculation for lifting the Reactor Vessel Head (Weight 125 tons or 250 Kip) during a postulated OBE event showed that, for the prescribed travel path and with limits on the crane hook allowable reach so that the minimum distance of lifted load to the end of the crane girder is 32.79 ft, the RB superstructure is structurally adequate to support the Reactor Vessel Head weight, and IC's for all the members are <1.0.

The calculation results showed that the RB superstructure members are all adequate to support the shield plugs weight during a postulated OBE event. All IC's are <1.0 provided that the hook maximum reach while lifting the bottom layer is limited to a minimum of 11'-0" from the runway girder. This is equivalent to 13'-3" from column lines N and H. For the top and middle layers there were no limitations on the hook's maximum reach.

Based on a review of the licensee's analytical methodology, loads and load combinations, and calculation results, the staff finds that for the actual lifted loads within the constraints of the prescribed path and crane allowable reach, as discussed above, all members of the RB superstructure are within the FSAR allowable stress limits during a postulated OBE event.

3.2.4 **The proposed backfit is to apply current regulatory standards as embodied in NUREG-0554 and NUREG-0612 in classifying the Dresden 2/3 reactor building crane. The backfit would bring the Dresden 2/3 reactor building crane up to present day standards for classification as a single-failure-proof crane. Any known vulnerabilities should be eliminated due to the cumulative risk of prolonged use.**

Recognizing that as documented in Dresden's regulatory history, the adequacy of the reactor building with a load on the crane is questionable and potentially unacceptable, would it be a BACKFIT to impose a requirement for the licensee to fully analyze seismic events assuming a load on the crane for the purpose of providing a substantial increase in the overall level of protection?

As stated above, Dresden's licensing basis is the June 1976 SER which is based on the staff's use of criteria in BTP APCSB 9-1. Based on further review of the licensee's seismic analyses and information submitted in response to the 2002 RAI, the proposal to require the licensee to satisfy the current standards for classification as a single-failure-proof crane is unnecessary. If the licensee did not satisfactorily complete and maintain the modifications prescribed in the NRC staff's June 3, 1976, SER over the last 20 years, then the licensee was operating outside its licensing basis, for every lift of a critical load, over a prolonged period. This circumstance should be corrected, and the licensee should be required to complete the modifications prior to moving casks. Accordingly, the licensee should be required to implement and maintain the overhead handling system modifications and re-evaluate its NUREG-0612 commitments to operate the crane within its design and licensing basis.

In addition, the licensee's response to the staff RAI dated April 12, 2002, verified the presence of safety lugs on the crane bridge and trolley which prevent them from leaving their respective runways during operation or under a seismic event and has demonstrated the structural adequacy of the RB superstructure through calculation DRE 98-0020 (revision 1). Also, the licensee's RAI response provided the design requirements for its new lifting device, and outlined how it met the applicable requirements of ANSI N14.6 and guidelines of NUREG-0612 satisfying the staff concerns over using a device different from that approved in amendments 19 and 22.

4.0 CONCLUSION

Based on NRR's review of the licensing basis that qualifies the Dresden 2/3 reactor building crane as single-failure-proof, NRR finds that compliance with the licensing basis will provide an acceptable level of safety. Further, in response to the NRC's RAI, the licensee has now conducted additional analyses and provided sufficient information to adequately demonstrate that the overhead handling system will withstand a seismic event while carrying the rated load. Accordingly, the proposed backfit, that is intended to achieve a substantial increase in the overall level of protection by bringing the Dresden 2/3 reactor building crane up to present day standards, is not necessary based on the concerns raised by the Region. Therefore, NRR recommends that the proposed backfit be abandoned.

Based on the above discussions, the NRR staff finds that there are specific concerns regarding Dresden's heavy load handling system that constitute compliance issues. Region III is encouraged to pursue the licensee's completion of modifications to the crane, as cited in the 1976 SER and subsequent documents, to bring the plants' load handling operation into compliance with its design and licensing basis. This includes verifying that the licensee has implemented sufficient controls to limit crane travel to those restrictions described in section 3.2.3.G of this document and verifying that the licensee is not creating the possibility for an accident of a different type than any previously evaluated in the updated final safety analysis report by lifting loads as a single-failure-proof crane that are heavier than the reactor building crane is qualified to lift as a single-failure-proof crane.