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

April 30, 2009

Mr. David A. Christian
President and Chief Nuclear Officer
Dominion Energy
5000 Dominion Boulevard
Glen Allen, VA 23060-6711

SUBJECT: KEWAUNEE POWER STATION - ISSUANCE OF AMENDMENT RE: SEISMIC ANALYSIS METHODOLOGY FOR THE AUXILIARY BUILDING CRANE (TAC NO. MD9221)

Dear Mr. Christian:

The U.S. Nuclear Regulatory Commission has issued the enclosed Amendment No. 205 to Facility Operating License No. DPR-43 for the Kewaunee Power Station in response to your application dated July 7, 2008, as supplemented on September 19, 2008, and March 17, 2009.

The amendment revises the licensing basis, authorizing the licensee to use the methodology conveyed in the licensee's letters cited above to determine the seismic loads on the recently upgraded Auxiliary Building crane. The authorization is conveyed by addition of a new License Condition 2.C.(11) to Facility Operating License DPR-43.

A copy of the Safety Evaluation is also enclosed. The Notice of Issuance will be included in the Commission's next regular biweekly *Federal Register* notice.

Sincerely,

Peter S. Tam, Senior Project Manager
Plant Licensing Branch III-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-305

Enclosures:
1. Amendment No. 205 to License No. DPR-43
2. Safety Evaluation

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

DOMINION ENERGY KEWAUNEE, INC.

DOCKET NO. 50-305

KEWAUNEE POWER STATION

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 205
License No. DPR-43

1. The U.S. Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Dominion Energy Kewaunee, Inc., dated July 7, 2008, as supplemented on September 19, 2008, and March 17, 2009, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, Facility Operating License DPR-43 is amended by adding a new license condition, 2.C.(11), to read as follows:

   (11) Seismic Analysis Methodology for the Auxiliary Building Crane

   The licensee shall use the seismic analysis methodology submitted by letter dated July 7, 2008, supplemented on September 19, 2008, and March 17, 2009, and approved by the NRC staff in Amendment No. 205, for analysis of the Auxiliary Building crane. The licensee shall update the USAR to reflect this approval and in accordance with the schedule specified by 10 CFR 50.71(e).

3. This license amendment is effective as of its date of issuance and shall be implemented within 30 days of the date of issuance, except for update of the USAR, which shall be done as specified by License Condition 2.C.(11).

FOR THE NUCLEAR REGULATORY COMMISSION

Lois M. James, Chief
Plant Licensing Branch III-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment: Changes to the Facility Operating License

Date of Issuance: April 30, 2009

ATTACHMENT TO LICENSE AMENDMENT NO. 205

FACILITY OPERATING LICENSE NO. DPR-43

DOCKET NO. 50-305

Replace the following page of the Facility Operating License No. DPR-43 with the revised page attached. The changed area is identified by a marginal line.

REMOVE	INSERT
Page 5	Page 5

(11) Seismic Analysis Methodology for Auxiliary Building Crane

The licensee shall use the seismic analysis methodology submitted by letter dated July 7, 2008, supplemented on September 19, 2008, and March 17, 2009, and approved by the NRC staff in Amendment No. 205, for analysis of the Auxiliary Building crane. The licensee shall update the USAR to reflect this approval and in accordance with the schedule specified by 10 CFR 50.71(e).

D. The licensee shall comply with applicable effluent limitations and other limitations and monitoring requirements, if any, specified pursuant to Section 401(d) of the Federal Water Pollution Control Act Amendments of 1972.

E. This license is effective as of the date of issuance, and shall expire at midnight on December 21, 2013.

FOR THE ATOMIC ENERGY COMMISSION

Original Signed by

A. Giambusso, Deputy Director
for Reactor Projects
Directorate of Licensing

Attachment:

Appendices A and B - Technical Specifications

Date of Issuance: December 21, 1973

Amendment No. ~~187,~~ 205
~~Revised by letter dated August 21, 2006~~
~~Revised by letter dated August 2, 2007~~

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATING TO AMENDMENT NO. 205 TO FACILITY OPERATING LICENSE NO. DPR-43

DOMINION ENERGY KEWAUNEE, INC.

KEWAUNEE POWER STATION

DOCKET NO. 50-305

1.0 INTRODUCTION

By application dated July 7, 2008 (Agencywide Documents Management and Access System (ADAMS) Accession No. ML081930317), as supplemented by letters dated September 19, 2008 (Accession No. ML082690386), and March 17, 2009 (Accession No. ML090771152) Dominion Energy Kewaunee, Inc. (DEK, the licensee) requested changes to the licensing basis for the Kewaunee Power Station. The licensee proposed a method for analyzing the recently upgraded Auxiliary Building crane when subjected to seismic loading. DEK will use the Auxiliary Building crane for spent fuel cask loading operation in the spent fuel pool. The proposed method of analysis will demonstrate that the crane will not lower its load uncontrolled and that the trolley and bridge wheels will remain on their respective rails under a seismic event. A summary description of this method was provided in Enclosure 1 to Reference 2, which also included a calculation of the internal forces in the crane using this method. In addition, the licensee provided an independent third party review, conducted for DEK, by Dr. Robert P. Kennedy, of Structural Mechanics Consulting, in Enclosure 2 of Reference 2.

The supplements dated September 19, 2008, and March 17, 2009, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the Nuclear Regulatory Commission (NRC) staff's original proposed no significant hazards consideration determination as published in the *Federal Register* (73 FR 50358).

2.0 REGULATORY EVALUATION

The proposed method of analysis was reviewed pursuant to 10 CFR 50, Appendix A, Criterion 2 (Reference 3), which requires, in part, that structures and components important to safety shall be designed to withstand the effects of natural phenomena, such as earthquakes, without loss of capability to perform their safety functions. This methodology is intended to apply to structures classified in accordance with Regulatory Position C2 of Regulatory Guide (RG) 1.29 (Reference 4), as specified in NUREG-0554 (Reference 5). In accordance with this position, the proposed methodology is intended for the dynamic analysis of the Auxiliary Building crane structure subjected to earthquake loading based on the application of specified artificial seismic acceleration time-histories.

The specified artificial acceleration time-histories were reviewed pursuant to Standard Review Plan (SRP), Section 3.7.1 (Reference 6), which provides criteria for selecting and developing artificial acceleration time-histories for application to design and analysis of safety-related Category I structures.

The analysis methodology, which is based on the commercially available computer program, SAP 2000, Version 11, was reviewed pursuant to SRP Section 3.9.1, "Special Topics for Mechanical Components" (Reference 7), which provides applicable criteria for evaluating computer programs for safety-related mechanical and structural design and analysis. In accordance with the requirements in SRP 3.9.1, DEK's submittal included a description of the non-linear aspects of the program, taken from the User's manual of the program (Reference 8).

The licensee used ASME Standard NOG-1-2004, "Rules for Construction of Overhead and Gantry Cranes," for guidance in its analysis. This Standard was endorsed by the NRC staff in Standard Review Plan 9.1.5, Revision 1.

3.0 TECHNICAL EVALUATION

3.1 Method of Analysis

The crane consists of a bridge frame composed of two girders connected by two end trucks, mounted on wheels which roll in the transverse direction on the building runway girders. A trolley is mounted on this frame on wheels, which rolls in the axial direction of the crane.

The crane is initially assumed to be parked on the Auxiliary Building runway girders. The drive wheels are assumed to be locked in place by a brake torque that is transmitted from the crane brake through the gear box and the drive wheel axles. The crane brakes are preloaded spring brakes that are set when an earthquake occurs or when the crane is not in service, and are rated for certain static torque ratings. Under seismic motion of the building, the crane will move in its transverse direction with the runway girders without rolling or sliding, as long as the drive wheel brake torque is not exceeded, or equivalently, the traction between the drive wheels and the runway rails does not exceed the critical traction corresponding to the brake torque. Once the wheel traction exceeds the critical traction, or equivalently, the torque on the drive wheels exceed the brake torque, the crane is assumed to roll without slipping on the runway girders until a reversal of girder motion occurs. The crane will continue to roll until the girder motion is reversed. At this point the brake torque reverses, and motion in the reverse direction will occur when the critical traction is again exceeded. The same effect occurs when the trolley is parked in place, and the seismic motion occurs in the axial direction of the crane, perpendicular to the runway girders. The analytical description of the sequence of motions under three-dimensional seismic motion is extremely complex, and can be evaluated only on a numerical time-history basis.

The proposed methodology for analyzing the response of the crane under the sequence of motion described above is based on the application of the commercially available finite element analysis computer program, SAP 2000, Version 11.

SAP 2000 has extensive capabilities for linear and non-linear analysis, and has been extensively verified. It is based on the well known SAP IV series of widely used structural analysis programs developed by Professor E. L. Wilson at the University of California at Berkeley. It also has the capability of performing a non-linear modal time-history analysis. This non-linear time history method is described in Attachment N to Enclosure 1 of Reference 2, and was taken from Chapter 24 of the SAP 2000 User's manual, "Non-linear Time-History Analysis"

(Reference 8). It is applicable to linear structures with a small number of known or pre-determined non-linear elements. In the analysis of the crane, the non-linearity is restricted to one-dimensional elements that join one or two nodes. Such elements are called "Link/Support elements." The crane bridge and the trolley are represented by a finite element model, in accordance with the recommendation in ASME NOG-1-2004, Section 4150 (Reference 9).

The non-linear modal time history method is a time-stepping incremental method that uses modal analysis at each increment of time. The approach used is an extension of a method called the "Fast Non-linear Analysis," also developed by Professor E. L. Wilson, and described in Chapter 18 of Reference 10 and in Attachment N to Enclosure 1 of Reference 2. The approach consists of expressing the equations of motion for the dynamic degrees of freedom of the linear elastic structure, using the finite element method. The structure elastic stiffness matrix does not include the stiffness properties of the non-linear elements. The non-linear elements are accounted for by considering the effects of these elements as forces external to the structure. These forces become part of the external time-history loading acting on the structure, which, however, depend on the non-linear characteristics of these elements and the structural displacements of the nodes to which they are attached. However, in this form the structure is free to move as a rigid body under the external loads. To anchor the structure, an effective elastic stiffness matrix multiplied by the displacements is added to both sides of the dynamic equations. With this step, the left-hand-side of the equations of motion reduces to the standard linear formulation while the force side contains the independent external forcing functions, and the non-linear forces and the effective forces, which depend on the instantaneous displacements.

The equations of motion are solved at any instant by applying the modal superposition method and integrating the resulting modal equations of motion incrementally by an exact numerical integration procedure. However, an iteration process is necessary at each time increment to obtain the correct displacements, since some of the loads are displacement-dependent. Although an eigenvalue/eigenvector analysis is ordinarily used to determine the modes and the frequencies, the recommended approach is called the "Load Dependent Ritz-Vector" method of modal analysis. The actual implementation of this method is described in Chapter 24 of Reference 8 and in References 10 and 11.

The staff reviewed the method of analysis and finds it acceptable because this methodology is based on the commercially available computer program, SAP 2000, Version 11. This program has been extensively verified and satisfies the description and verification guidance of SRP Section 3.9.1 for evaluating computer programs for safety-related mechanical and structural design and analysis.

3.2 Link/Support Element

A "Link/Support element" is a one-dimensional element that models bilinear hysteretic behavior using a so-called Wen plasticity model. It is termed a "Link" element when both nodes join other members within a structure, or a "Support" element when one of its nodes is attached to the moving structure and the other is attached to an anchor point. It can represent either elastic-plastic deformation of the material or a force-displacement relation of its end nodes. A description of this element is provided in Attachment O to Enclosure 1 of Reference 2, taken from Reference 8, Chapters 14 and 15. As applied to the crane analysis, a drive wheel is represented by a zero-length Support element with one node anchored to the runway girder and the other node attached to a drive wheel. Under a seismic transient loading, the linear portion represents the part of the motion before the critical traction, or equivalently the brake torque, is reached. The non-linear portion represents a constant traction equivalent to the rolling force between the wheel and the rail. The rolling and non-rolling of the drive wheels are governed by the motion of the building through the runway girders.

For inclusion into the formulation of the "Support" element, Attachment B to Enclosure 1 of Reference 2 describes the calculation of the critical tractions at which the crane and trolley braked drive wheels will start rolling. For the bridge, the critical traction depends on the rated bridge brake torque, the bridge center gear box ratio, the gear boxes at the drive wheels, the overall bridge gear efficiency and the radius of the drive wheels. For the trolley, the critical traction depends on the rated trolley brake torque, the trolley gear box ratio, the overall trolley gear efficiency and the radius of the trolley wheels. In the load-displacement formulation of the Support element, these tractions were assumed to remain constant during the bridge or trolley rolling stages. However, for a vehicle on wheels this assumption is not valid, since for the drive wheels to begin rolling without sliding the traction must exceed the critical traction, or equivalently, the torque on a drive wheel must exceed the critical torque, and does not remain constant, because of drive wheel rotary inertia. To account for uncertainties in the design process, DEK increased the calculated bridge and trolley critical tractions by 25 percent and 100 percent, respectively. Based on a limited evaluation, the staff finds the procedure for calculating the critical tractions acceptable because these increases are conservative bounds for the variable rolling tractions. However, the staff also concludes that the 25 percent increase of the calculated bridge critical traction and the 100 percent increase of the calculated trolley critical traction should be a condition for applicability of the non-linear analysis methodology to the seismic analysis of the Kewaunee crane.

The implementation of the "Support" element model in the non-linear analysis requires the calculation of the element effective elastic stiffness for use in the dynamic analysis, and the estimation of the non-linear elastic stiffness for use with the Wen hysteretic model. The calculation of these parameters is described in Attachment C to Enclosure 1 of Reference 2. The effective elastic stiffnesses for the trolley and crane wheel elements were calculated based on the estimated accelerations of the trolley or crane masses corresponding to the critical tractions, the East-West and North-South 2 percent unbroadened spectra at the crane elevation from Reference 1. These values were rounded up by increasing them by 9 percent for the trolley and 8 percent for the crane. The staff reviewed this approach for estimating the effective elastic stiffnesses and finds it acceptable based on a limited staff evaluation and verification.

The non-linear elastic stiffnesses were calculated based on the frequencies corresponding to five times the frequency of the peak unbroadened 2 percent spectral accelerations in the North-South and East-West directions and the masses of the trolley and the crane, respectively. An examination of the response spectra indicates that these frequencies are essentially the zero peak accelerations of the spectra at the crane elevation. The stiffnesses were calculated from the formula for the natural frequency of a one-dimensional element. These values were rounded up by increasing them by 60 percent for the trolley and 11 percent for the crane. The NRC staff reviewed this approach for calculating the non-linear elastic stiffnesses for the Wen hysteretic model and finds it conservative and acceptable based on a limited staff evaluation and verification.

3.3 Push Test

As part of this request, DEK committed to perform a push test of the Auxiliary Building crane, to verify that the bridge and the trolley will roll through their brakes if sufficient force is applied, and to verify that that the brake forces assumed in the calculations were conservative. Separate push tests were performed on the trolley and the crane. The force required to roll the trolley or bridge drive wheels was measured by applying an external force on the bridge and trolley by means of hydraulic rams until they moved. Tests were performed on the bridge and the trolley until three repeatable measurements were obtained within the uncertainty of the test gauges.

The crane bridge and the trolley were both noted to roll through their brakes, without sliding on the runway girder rails. The force required to initiate rolling of the bridge was measured as about 30 percent less than the brake force used in the analysis, and the force required to initiate rolling of the trolley was measured as 50% less than the brake force used in the analysis.

The staff reviewed the approach and the test procedure for push testing the crane and finds the results of this test acceptable. These results are considered conservative, since the internal forces and moments in the crane vary directly with the magnitude of the forces required to initiate rolling of the crane or trolley.

3.4 Review of Calculations

Four separate dynamic analyses of the crane were run to demonstrate the proposed methodology. The crane and trolley were modeled using the finite element method in accordance with ASME-NOG-1-2004 (Reference 9). The trolley was positioned at the center span, the quarter span and the end span locations along the crane bridge. Other loading conditions, such as dead load and live load were also analyzed, and these were combined with the earthquake loads. The results of these analyses are shown in Attachments D through J of Enclosure 1 of Reference 2. The average of the absolute maximum value obtained for each analysis case was used as the design value from the non-linear time history analysis, in accordance with the recommendations in ASCE 43-05 (Reference 12). The results were plotted as moment, shear torsion and axial force diagrams for the mid-span, quarter span and end-span trolley locations. The NRC staff reviewed these results, and concluded that they are reasonable. A full evaluation would require an independent calculation, which is not feasible for this review. However, the NRC staff verified from the plotted results that the distribution of the bending moment along the bridge, with the trolley located at center span, satisfied the symmetry condition about the center span, which is, therefore, acceptable.

Code stress checks were not performed for these analyses. These will be performed in accordance with acceptance criteria given in the Kewaunee updated safety analysis report for the design basis earthquake load condition.

Attachment M to Enclosure 1 of Reference 2 also shows a parametric for a dynamic case of the effect of halving or doubling the effective elastic stiffness and the non-linear elastic stiffness. The study shows the maximum shears, moments, torque and axial loads for three bridge components, girders, end ties and trucks. Halving or doubling the effective elastic stiffness shows a negligible or zero difference in the results, since in principle this stiffness is on both sides of the equations of motion. Halving or doubling the non-linear elastic stiffness also shows an insignificant difference in the results, indicating that the non-linear elastic stiffness is sufficient to reflect non-rolling before the critical traction is achieved. The NRC staff has reviewed these results and finds them acceptable because variation of these parameters has a minimal effect on the analytical results.

3.5 Artificial Acceleration Time-Histories

As part of the proposed methodology, the licensee generated a number of artificial seismic acceleration time-histories, corresponding to the target 2 percent damped acceleration response spectra (ARS) provided by DEK at the Auxiliary Building crane rail elevation (679' 11"). These curves, consisting of two horizontal (North-South and East-West) and one vertical curve, incorporate the amplification and the filtering effect of the site licensing Design Basis Earthquake through the supporting structures. These time-histories were developed by ABS Consulting, a consultant to DEK, for input to the Auxiliary crane non-linear time history analysis.

The methodology and acceptance criteria used in the generation of the time histories follow the guidance and requirements stated in SRP Section 3.7.1, Option II (Reference 6).

The calculation of the artificial time histories require initial seed time-histories from actual strong earthquakes, obtained from the U.S. Geological Survey located at the University of California in Berkeley, CA. DEK selected earthquakes from recording stations in Kern County (Taft), Borrego Mountain, Landers, Camp Mendocino, Livermore and Morgan Hill, all located in the U.S., and in Kobe, Japan, and in Duzce, Turkey. These are high magnitude, long duration earthquakes, and contain required low and high frequency content characteristics.

The calculation develops five sets of 20-second acceleration time-histories, each set containing two horizontal histories and one vertical history, for a total of fifteen time-histories. Each time-history was base-line corrected, which then permitted the development of associated velocity and displacement time-histories. The three time-histories for each set were shown to be statistically independent. The largest correlation coefficient was shown to be less than 0.16, the criterion for statistical independence.

Average North-South, East-West and Vertical time histories were calculated from the corresponding time-histories in the five sets. A 2 percent damped ARS in each direction were calculated and plotted from the averaged time histories. The ARS curves were calculated using 240 frequencies uniformly spaced on a logarithmic scale between 0.1 Hz and 40 Hz. The spectra were broadened in accordance with the provisions in Regulatory Guide 1.122 (Reference 13). These curves were compared to the plotted design 2 percent damped broadened acceleration response spectra at the crane elevation. The developed acceleration time histories are deemed acceptable if the comparison of the broadened acceleration spectra satisfy certain guidelines listed in SRP 3.7.1.

A visual comparison of the generated ARS spectra with the corresponding target response spectra showed general good agreement. None of the calculated averaged spectral values fall more than 10 percent below target response spectra, or exceeded the target curve, at the peak of the curves, by more than 30 percent. At a few locations to the right of the peak, the calculated average spectral values did exceed the target curve by as much as 40 percent. However, in the frequency region of interest the agreement was deemed acceptable. In addition, no more than nine consecutive points were found in any one average curve where the spectral value fell below the target value. On this basis, the developed acceleration time-histories were deemed to contain enough energy in the frequency region of interest and DEK concluded that the fifteen developed acceleration time-histories meet the intent of SRP 3.7.1.

Based on its review, the NRC staff concludes that the generated artificial acceleration time-histories meet the intent of SRP 3.7.1, and are therefore acceptable. The NRC staff agrees with the limitations set forth in the licensee's application for the proposed non-linear dynamic analysis methodology for the Auxiliary building crane.

3.6 Third Party Review

An independent third party review of the proposed methodology was also performed by a consultant to the licensee and submitted as an enclosure to the licensee's request for approval. This review was performed by Dr. Robert P. Kennedy, of Structural Mechanics Consulting, a recognized authority in the field of structural analysis of nuclear facilities.

Below provides a summary and conclusion of Dr. Kennedy's review. In addition, the NRC staff's assessment of Dr. Kennedy's review is also provided.

(1) The five sets of three-directional orthogonal time-histories used as input to the non-linear analysis meet all the requirements specified in SRP 3.7.1 and ASCE/SEI Standard 43-05, Reference 12, for use in non-linear dynamic analysis. The 2 percent damped composite mean response spectra from the five sets of time-histories closely match the target 2 percent damped response spectra at all frequencies at about 0.8 Hz. Below 0.8 Hz, the horizontal composite mean response spectra overshoot the target response spectrum by a significant amount, which is, however, conservative. Other conservatism also exists, as a result of trying to match the response spectra with the target spectra. The five sets of acceleration time-histories are therefore acceptable for use with the non-linear dynamic analysis of the crane. However, this conservatism is also likely to cause significant over-estimation of the rolling displacements.

(2) The non-linear hysteretic modeling of the rolling of the crane bridge girders on the crane support rails, and the rolling of the trolley on the bridge girders, has been correctly incorporated into the non-linear model. The specified critical wheel traction, which governs when rolling will start and terminate, were found to be conservatively high compared to test data by factors of 1.4 for the bridge drive wheels and 2.0 for the trolley drive wheels. This conservatism will result in an over-estimation of calculated accelerations, member forces and reactions. Conversely, it will also result in an underestimation of the rolling displacements. This underestimation will very likely be compensated by the overestimation of the rolling displacements resulting from the conservatism of the specified acceleration time-histories.

(3) The overall dynamic model of the crane and hung cask mass was judged to be excellent.

(4) The SAP 2000 Non-linear Modal Time History Analysis method that forms the basis of the proposed methodology for performing the non-linear seismic analysis of the crane is appropriate and has been correctly implemented.

(5) The development of the mean peak response quantities based upon the five individual sets of time-history results have been appropriately combined to obtain mean peak response results.

(6) The licensee has performed evaluations of a finite element model of the crane with the proposed methodology and the acceleration time-history inputs. The reported

accelerations, forces and reactions were found to be reasonable. However, in view of the discussion of the effect of the conservatism of the acceleration time-histories discussed above, Dr. Kennedy also indicated that he has no such confidence in the calculated displacements, in the sense that these displacements may be over-conservatively estimated. The NRC staff concurs with this assessment of the calculated displacements and finds it acceptable.

The NRC staff has evaluated the Third Party review and concurs with Dr. Kennedy's conclusions because his assessments are in agreement with the conclusions reached by the NRC staff based on its review of the non-linear analysis methodology and the development of the corresponding artificial time-histories.

3.7 Summary of Technical Evaluation

Based on its review, the NRC staff concludes that the application of the proposed seismic analysis methodology and the associated artificial seismic acceleration time-histories will allow DEK to demonstrate that the Kewaunee Auxiliary Building crane will meet the applicable requirement in Regulatory Position C2 of RG 1.29 and NUREG-0554 to withstand the design-basis earthquake loading.

The NRC staff finds that the intended application of SAP 2000 to the seismic analysis of the Auxiliary Building crane conforms to the applicable requirements for computer programs as stated in SRP 3.9.1. The NRC staff has reviewed the formulation of the Non-linear Modal Time History analysis method and the Support Element, and finds the application to the analysis of the Kewaunee Auxiliary Building crane to be acceptable, because it conforms to the current state-of-the-art methodology in industrial seismic structural analysis. The staff has also evaluated the calculation of the artificial time-histories for use with the proposed methodology and concludes that these time histories conform to the applicable criteria stated in SRP 3.7.1.

Based on its evaluation of the DEK submittals and the Third-Party evaluation, the NRC staff concludes that the methodology proposed by the licensee for analyzing the structural integrity of the Kewanee Auxiliary Building crane under combined normal and seismic loading is acceptable, subject to the limitations set forth in the licensee's application:

1. The calculated critical wheel tractions should be increased by 25 percent for the crane drive wheels and 100 percent for the trolley wheels.

2. The analyses are based on the seismic acceleration time histories described in Reference 1.

The NRC staff is issuing the requested amendment to approve the methodology; however, the methodology is approved for the evaluation of the Kewaunee Auxiliary Building crane only. Application of this methodology to other structures will require a case-by-case NRC evaluation and approval.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Wisconsin State official was notified of the proposed issuance of the amendment. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

This amendment changes a requirement with respect to use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluent that may be released offsite and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that this amendment involves no significant hazards consideration (73 FR 50358) and there has been no public comment on such finding. Accordingly, this amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of this amendment.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

7.0 REFERENCES

1. Letter of July 7, 2008, from G. T. Bischof, Dominion Energy Kewaunee, Inc., to the NRC Document Desk, "License Amendment Request 239 – Request for Review and Approval of Seismic Analysis Methodology for Auxiliary Building Crane," with enclosed calculation "Generation of Artificial Seismic Time Histories for the Fuel Cask Bridge Crane at the Kewaunee Power Station," prepared by ABS Consulting for American Crane and Equipment Corporation, Rev. 1, May 27, 2008.

2. Letter of September 19, 2008, from J. A. Price, Dominion Energy Kewaunee, Inc., to the NRC Document Desk, "License Amendment Request 239, Supplement 1 – Request for Review and Approval of Seismic Analysis Methodology for Auxiliary Building Crane," with Enclosure 1, Calculation "Auxiliary Building Crane Non-linear Seismic Analysis," prepared by American Crane and Equipment Corporation for Dominion Energy Kewaunee, Inc., September 11, 2008, and Enclosure 2, "Third Party Review of Auxiliary Building Crane Non-Linear Seismic Analysis," prepared by R. P. Kennedy, Structural Mechanics Consulting, September 7, 2008.
3. 10 CFR 50, Appendix A, Criterion 2, "Design Bases for Protection Against Natural Phenomena."

4. NRC Regulatory Guide 1.29, "Seismic Design Classification." Rev. 3, September 1978.

5. NUREG-0554, "Single-Failure Proof Cranes for Nuclear Power Plants", May 1979.

6. NRC NUREG-800 Standard Review Plan, Section 3.7.1, "Seismic Design Parameters," Rev. 3, March 2007.

7. NRC NUREG-800 Standard Review Plan, Section 3.9.1, "Special Topics for Mechanical Components," Rev. 3, March 2007.

8. CSI Analysis Reference Manual for SAP 2000, ETABS, and SAFE, January 2007. Computers and Structures, Inc., Berkeley, California.

9. ASME-NOG-1-2004, "Rules for Construction of Overhead and Gantry Cranes," American National Standard Institute, 2002.

10. E. L. Wilson, "Three Dimensional Static and Dynamic Analysis of Structures," 3rd Edition, 2002. Computers and Structures, Inc. Berkeley, California

11. A. K. Chopra, "Dynamics of Structures," 2nd Edition, 2001, Prentice Hall.

12. American Society of Civil Engineers Standard ASCE/SEI 43-05, "Seismic Design Criteria for Structures, Systems, and Components in Nuclear Facilities."

13. NRC Regulatory Guide 1.122, "Development of Floor Design Response Spectra for Seismic Design of Floor-Supported Equipment or Components," Rev. 1, February 1978.

Principal Contributor: Mark Hartzman, NRR

Date: April 30, 2009

April 30, 2009

Mr. David A. Christian
President and Chief Nuclear Officer
Dominion Energy
5000 Dominion Boulevard
Glen Allen, VA 23060-6711

SUBJECT: KEWAUNEE POWER STATION - ISSUANCE OF AMENDMENT RE: SEISMIC ANALYSIS METHODOLOGY FOR THE AUXILIARY BUILDING CRANE (TAC NO. MD9221)

Dear Mr. Christian:

The U.S. Nuclear Regulatory Commission has issued the enclosed Amendment No. 205 to Facility Operating License No. DPR-43 for the Kewaunee Power Station in response to your application dated July 7, 2008, as supplemented on September 19, 2008, and March 17, 2009.

The amendment revises the licensing basis, authorizing the licensee to use the methodology conveyed in the licensee's letters cited above to determine the seismic loads on the recently upgraded Auxiliary Building crane. The authorization is conveyed by addition of a new License Condition 2.C.(11) to Facility Operating License DPR-43.

A copy of the Safety Evaluation is also enclosed. The Notice of Issuance will be included in the Commission's next regular biweekly *Federal Register* notice.

Sincerely,

/RA/

Peter S. Tam, Senior Project Manager
Plant Licensing Branch III-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-305

Enclosures:
1. Amendment No. 205 to License No. DPR-43
2. Safety Evaluation

cc w/encls: Distribution via ListServ

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RidsNrrDirsItsb Resource
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LPL3-1 r/f
RidsOgcRp Resource
MHartzman, NRR
RidsNrrDeEmcb Resource

ADAMS ACCESSION NUMBER: **ML090570710**

OFFICE	LPL3-1/PM	LPL3-1/LA	EMCB/BC	OGC	LPL3-1/BC
NAME	PTam	BTully	MKhanna*	MSmith	LJames
DATE	4/14/09	4/13/09	3/20/09*	4/16/09	04/30/09

*Safety evaluation input transmitted by memo on the date shown.

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