



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
WASHINGTON, D. C. 20555

July 24, 1998

Mr. L. Joseph Callan  
Executive Director for Operations  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

Dear Mr. Callan:

SUBJECT: GENERAL ELECTRIC NUCLEAR ENERGY EXTENDED POWER UPRATE  
PROGRAM AND MONTICELLO NUCLEAR GENERATING PLANT POWER LEVEL  
INCREASE REQUEST

During the 453rd and 454th meetings of the Advisory Committee on Reactor Safeguards, June 3-5 and July 8-10, 1998, we reviewed the General Electric Nuclear Energy (GENE) program associated with extended power uprates for operating boiling water reactors (BWRs), and the application by the Northern States Power Company (NSP) for a power level increase for the Monticello Nuclear Generating Plant. Our Subcommittee on Thermal-Hydraulic Phenomena held a meeting on June 2, 1998, to review this matter. During our review, we had the benefit of discussions with representatives of GENE, NSP, and the NRC staff. We also had the benefit of the documents referenced.

In 1991, GENE initiated a power uprate program to support BWR plant licensees for increasing rated core power by up to 5 percent. In 1992, we reviewed the initial GENE power uprate program and the application by the Detroit Edison Company for a power level increase for the Fermi nuclear power plant, Unit 2. In our September 17, 1992 report, we endorsed the GENE generic program associated with the 5 percent power level uprates and concluded that a 5 percent uprate did not pose a significant increase in risk. It was recognized that any power uprate will in some way erode safety margins and that, although 5 percent uprates were acceptable for all BWRs, any uprates beyond that should be given additional review and justification.

In 1995, GENE initiated the "extended" power uprate program. The word "extended" is used to distinguish this program from the initial power uprate program. The extended uprate program will address additional power uprates greater than 5 percent and up to 20 percent of rated core power. Licensees are to make individual decisions on the magnitude of power uprates.

The Monticello Nuclear Generating Plant is the lead plant for the extended power uprate program. NSP submitted an application for a power level increase of 6.3 percent for the Monticello Plant. This would increase the current core power level of 1670 MWt to 1775 MWt. In its safety

evaluation, NSP performed accident analyses using a core power level of 1880 MWt, which is 12.6 percent above the current core power limit and is double the requested core power level increase. The 6.3 percent power level increase requested and the 12.6 percent power level increase analyzed are achieved with an increase in the steam flow rate but without an increase in maximum allowable core flow or the current maximum operating vessel dome pressure and temperature. The core radial power profile is flattened and the high-pressure turbine is replaced with one that accommodates the increased steam flow.

The application by NSP for the Monticello 6.3 percent power uprate utilized the general guidance developed by GENE (ELTR1) and also referenced the GENE generic evaluations (ELTR2). Therefore, any decision on granting the requested uprate has to be accompanied by a decision on the acceptability of the GENE extended power uprate program and the associated reports.

The extended power uprate program generally has the objectives of ensuring that all the current regulatory requirements will still be met after the uprate and that sufficient safety margins will still exist. The ELTR1 report provides guidance to licensees on the scope and content of information to be submitted as part of a plant-specific power uprate request. The ELTR2 report contains generic bounding analyses and equipment evaluations in support of the uprate program. These reports essentially provide a template for any licensee to follow when applying for a power level increase and provide the opportunity to reference any of the bounding analyses that are applicable to the specific application.

The staff reviewed the extended power uprate program and presented its evaluation results in two "position papers" - one dated February 8, 1996 for ELTR1, and one dated May 18, 1998 for ELTR2. The staff generally endorsed this program, but with qualifications.

We agree with the staff's assessment and its qualifications and believe that, if followed, this program will provide the information necessary as a basis for the staff review of and decision on plant-specific power uprate applications.

We particularly endorse the staff's requirement that "each applicant report the effects of the proposed uprate on its core damage frequency and frequency of large magnitude radioactive release." We believe that the appropriate process for making decisions related to power uprate applications is that outlined in Regulatory Guide (RG) 1.174 related to requests for changes to the licensing basis. With the addition of an analysis for core damage frequency (CDF); large, early release frequency (LERF); and the changes associated with the uprate ( $\Delta$ CDF and  $\Delta$ LERF), the power uprate program will provide the information required to utilize the RG 1.174 process, including that associated with all the deterministic analyses made as part of a safety evaluation report.

In its Safety Evaluation Report (SER), the staff concludes that after the 6.3 percent core power uprate, the Monticello plant meets all the regulatory requirements and preserves appropriate margins. Thus, the submittal meets the requirements for adequate protection.

Although the extended power uprate program and the Monticello application preceded by several years the issuance of RG 1.174, significant risk information was provided by NSP in support of the review. The probabilistic risk assessment (PRA) information submitted was based on the

licensee's individual plant examination (IPE), which included only internal events. Based on the IPE, the current risk status of the Monticello plant is:

$$\begin{aligned}\text{CDF} &= 1.4 \times 10^{-5}/\text{yr, and} \\ \text{LERF} &= 4.5 \times 10^{-7}/\text{yr.}\end{aligned}$$

The results of the analyses of the 12.6 percent core power uprate are:

$$\begin{aligned}\Delta\text{CDF} &= +2.4 \times 10^{-6}/\text{yr, and} \\ \Delta\text{LERF} &= +8.6 \times 10^{-8}/\text{yr.}\end{aligned}$$

These "risk metric" values are within the "allowable change" region specified in the RG 1.174 process. The above CDF and LERF absolute values do not include contributions from shutdown and low-power events or from external events, nor were they accompanied by any uncertainty analysis. The NSP, however, performed a Fire-Induced Vulnerability Evaluation (FIVE) analysis, a seismic margins analysis, and a shutdown risk analysis from which it would be possible to bound the contributions from these missing elements of the PRA. We believe that an estimate of the effects of the missing PRA elements would not place the Monticello plant outside the "allowable change" region. This should be confirmed by the staff.

Provided that the staff confirms that the risk status of Monticello remains in the "allowable change" region specified in RG 1.174, we have the following recommendation:

Based on our evaluation of the application and the SER, we agree with the staff's recommendation that the NSP application for a 6.3 percent power level increase for the Monticello Plant be approved. We believe this change meets the intent of RG 1.174 to preserve acceptable margins and to limit risk increases to acceptable levels.

For future power uprate applications, we have the following recommendations:

- The staff's recommendation for approval of the power level increase for the Monticello plant is based partly on the IPE that "meets the requirements of GL [Generic Letter] 88.20." It is not clear to us that this standard for IPEs is also the appropriate standard for a PRA on which to base power uprate decisions. A justifiable decision is needed from the staff on the quality standard required for PRAs to assist decisionmaking on power uprate requests. Additional guidance for the applicant is also needed.
- In any future power uprate application, the staff should require that bounding estimates be made for the contributions from any missing elements of the PRA, especially for the contributions from shutdown, low power, and external events.
- Finally, we are concerned about the concept that seemed to be implied in the application and the staff's review documents that, because better calculations are now possible, greater margins exist. The margin is inherent in the design and is what it is, regardless of the calculational ability. These margins compensate for aleatory and epistemic uncertainties in the determination of the risk status. We believe that any power uprate has the effect of eroding the margins. This is the reason for our recommendation that the NRC

staff guide its decisions on power uprates by the intent of the RG 1.174 process, which provides the appropriate rationale for justifying decreases in margins.

Sincerely,



R. L. Seale  
Chairman

References:

1. Report dated September 17, 1992, from D.A. Ward, Chairman, ACRS, to James M. Taylor, Executive Director for Operations, NRC, Subject: General Electric Nuclear Energy Power Uprate Program/Fermi, Unit 2 Power Increase Request.
2. Letter dated March 22, 1996, from W. Marquino, GE Nuclear Energy, to U. S. NRC Document Control Desk, transmitting "Generic Evaluations of General Electric Boiling Water Reactor Extended Power Uprate," NEDC-32523P, March 1996, and NEDC-32523P Supplement 1, Volumes I & II, June 1996 (Proprietary).
3. GE Nuclear Energy Report NEDC-32424P, "Generic Guidelines for General Electric Boiling Water Reactor Extended Power Uprate," February 1995 (Proprietary).
4. Letter dated February 8, 1996, from D. Crutchfield, NRC, to G. Sozzi, General Electric Nuclear Energy, transmitting Staff Position Concerning General Electric Boiling-Water Reactor Extended Power Uprate Program.
5. Letter dated December 4, 1997, from M. Hammer, Northern States Power Company, to Nuclear Regulatory Commission, transmitting Revision 1 to License Amendment Request dated July 26, 1996 Supporting the Monticello Nuclear Generating Plant Power Rerate Program (includes Proprietary information).
6. Letter dated July 25, 1997, from T. Kim, Office of Nuclear Reactor Regulation, NRC, to R. Anderson, Northern States Power Company, transmitting Amendment Regarding Updated Analysis of DBA Containment Temperature and Pressure Response and Reliance on Containment Pressure to Compensate for Potential Deficiency in NPSH for ECCS Pumps During DBA.
7. Letter dated July 16, 1997, from W. Hill, Northern States Power Company, to Nuclear Regulatory Commission, transmitting response to Request for Additional Information Regarding Monticello Nuclear Generating Plant License Amendment.
8. Letter dated July 16, 1997, from W. Hill, Northern States Power Company, to Nuclear Regulatory Commission, transmitting response to Request for Additional Information Regarding Revision 2 to Monticello Nuclear Generating Plant License Amendment.

9. Memorandum dated May 18, 1998, from E. Adensam, Nuclear Reactor Regulation, NRC, to J. Larkins, ACRS, transmitting Staff Position Concerning GE Licensing Topical Report NEDC-32523P on Generic Evaluation of Boiling Water Reactor Extended Power Uprate.
10. Memorandum dated May 14, 1998, from E. Adensam, Nuclear Reactor Regulation, NRC, to J. Larkins, ACRS, transmitting Staff Safety Evaluation of the Lead Plant (Monticello) Application.
11. U. S. Nuclear Regulatory Commission, SECY-98-015, "Final General Regulatory Guide and Standard Review Plan for Risk-Informed Regulation of Power Reactors," dated January 30, 1998, transmitting Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Current Licensing Basis."

