

November 21, 2000

Mr. Robert P. Powers, Senior Vice President  
Indiana Michigan Power Company  
Nuclear Generation Group  
500 Circle Drive  
Buchanan, MI 49107

SUBJECT: DONALD C. COOK NUCLEAR PLANT, UNITS 1 AND 2 - ISSUANCE OF  
AMENDMENTS (TAC NOS. MA8893 AND MA8894 )

Dear Mr. Powers:

The U.S. Nuclear Regulatory Commission has issued the enclosed Amendment No. 249 to Facility Operating License No. DPR-58 and Amendment No. 230 to Facility Operating License No. DPR-74 for the Donald C. Cook (D. C. Cook) Nuclear Plant, Units 1 and 2. The amendments consist of changes to the Technical Specifications in response to your application dated April 6, 2000, as supplemented November 13, 2000.

The amendments would approve changes to the Updated Final Safety Analysis Report to incorporate new methodology to be used in the analysis of high-energy line breaks at D. C. Cook, which involve unreviewed safety questions.

This action closes Restart Action Matrix issue 8.8.

A copy of our related safety evaluation is also enclosed. A Notice of Issuance will be included in the Commission's next biweekly *Federal Register* notice.

Sincerely,

**/RA/**

John F. Stang, Senior Project Manager, Section 1  
Project Directorate III  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Docket Nos. 50-315 and 50-316

Enclosures: 1. Amendment No. 249 to DPR-58  
2. Amendment No. 230 to DPR-74  
3. Safety Evaluation

cc w/encls: See next page

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Donald C. Cook Nuclear Plant, Units 1 and 2

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INDIANA MICHIGAN POWER COMPANY

DOCKET NO. 50-315

DONALD C. COOK NUCLEAR PLANT, UNIT 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 249  
License No. DPR-58

1. The U.S. Nuclear Regulatory Commission (the Commission) has found that:
  - A. The application for amendment by Indiana Michigan Power Company (the licensee) dated April 6, 2000, as supplemented November 13, 2000, 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, the license is amended to authorize revision of the Updated Final Safety Analysis Report (UFSAR), as set forth in the application for amendment by the licensee dated April 6, 2000, and as supplemented November 13, 2000, and as evaluated in the NRC staff safety evaluation attached to this amendment. The UFSAR shall be revised to incorporate the following methodologies applicable to the high-energy line break program: 1) NUREG/CR-2913, "Two-Phase Jet Loads," 2) NUREG-0800, "Standard Review Plan (SRP)," Section 3.6.2, "Determination of Rupture Locations and Dynamic Effects Associated with the Postulated Rupture of Piping," and its associated Branch Technical Position (BTP), MEB 3-1, "Postulated Rupture Locations in Fluid System Piping Inside and Outside Containment," Section B.1.b, break exclusion zones, and 3) an SRP 3.6.2, BTP MEB 3-1, Section B.1.e, crack exclusion based on stress analysis, as authorized by this license amendment and in accordance with 10 CFR 50.71(e).
3. This license amendment is effective as of its date of issuance, and the licensee shall update the UFSAR at the next required UFSAR update.

FOR THE NUCLEAR REGULATORY COMMISSION

*/RA/*

Claudia M. Craig, Chief, Section 1  
Project Directorate III  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Date of Issuance: November 21, 2000

INDIANA MICHIGAN POWER COMPANY

DOCKET NO. 50-316

DONALD C. COOK NUCLEAR PLANT, UNIT 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 230

License No. DPR-74

1. The U.S. Nuclear Regulatory Commission (the Commission) has found that:
  - A. The application for amendment by Indiana Michigan Power Company (the licensee) dated April 6, 2000, as supplemented November 13, 2000, 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, the license is amended to authorize revision of the Updated Final Safety Analysis Report (UFSAR), as set forth in the application for amendment by the licensee dated April 6, 2000, and as supplemented November 13, 2000, and as evaluated in the NRC staff safety evaluation attached to this amendment. The UFSAR shall be revised to incorporate the following methodologies applicable to the high-energy line break program: 1) NUREG/CR-2913, "Two-Phase Jet Loads," 2) NUREG-0800, "Standard Review Plan (SRP)," Section 3.6.2, "Determination of Rupture Locations and Dynamic Effects Associated with the Postulated Rupture of Piping," and its associated Branch Technical Position (BTP), MEB 3-1, "Postulated Rupture Locations in Fluid System Piping Inside and Outside Containment," Section B.1.b, break exclusion zones, and 3) an SRP 3.6.2, BTP MEB 3-1, Section B.1.e, crack exclusion based on stress analysis, as authorized by this license amendment and in accordance with 10 CFR 50.71(e).
3. This license amendment is effective as of its date of issuance, and the licensee shall update the UFSAR at the next required UFSAR update.

FOR THE NUCLEAR REGULATORY COMMISSION

*/RA/*

Claudia M. Craig, Chief, Section 1  
Project Directorate III  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Date of Issuance: November 21, 2000

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
RELATED TO AMENDMENT NO. 249 TO FACILITY OPERATING LICENSE NO. DPR-58  
AND AMENDMENT NO. 230 TO FACILITY OPERATING LICENSE NO. DPR-74  
INDIANA MICHIGAN POWER COMPANY  
DONALD C. COOK NUCLEAR PLANT, UNITS 1 AND 2  
DOCKET NOS. 50-315 AND 50-316

## 1.0 INTRODUCTION

By application dated April 6, 2000 as supplemented November 13, 2000, the Indiana Michigan Power Company (I&M) (the licensee) requested amendments to the Technical Specifications (TSs) for the Donald C. Cook Nuclear Plant, Units 1 and 2. The proposed amendments would approve changes to the Updated Final Safety Analysis Report (UFSAR) involving unreviewed safety questions. The amendment would allow incorporation into the UFSAR the following methodologies used in the High Energy Line Break (HELB) program: 1) NUREG/CR-2913, 2) NUREG-0800, "Standard Review Plan (SRP)," Section 3.6.2, "Determination of Rupture Locations and Dynamic Effects Associated with the Postulated Rupture of Piping," and its associated Branch Technical Position (BTP), MEB 3-1, "Postulated Rupture Locations in Fluid System Piping Inside and Outside Containment," Section B.1.b, break exclusion zones, and 3) SRP 3.6.2, BTP MEB 3-1, Section B.1.e, crack exclusion based on stress analysis.

The November 13, 2000, letter, provided clarification on the specific modifications needed for the Unit 1 steam generator blowdown piping located in the normal flash tank room. In the letter the licensee stated that the existing steam generator blowdown piping in the normal flash tank room did not need to be replaced; however, modifications to the piping supports were required. The information contained in the November 13, 2000, letter did not change the scope of the proposed action and did not change the Commission's preliminary no significant hazards consideration determination.

## 2.0 BACKGROUND

In the early 1970s, the Atomic Energy Commission (AEC) took the position that the effects of a postulated pipe failure outside the containment structure, including the break of a main steam or feedwater line, needed to be adequately documented and analyzed by licensees and applicants, and evaluated by the AEC staff. The AEC issued generic correspondence on the consequences of postulated piping failures (the "Giambusso letter") on December 18, 1972, and an errata sheet dated January 31, 1973, reproduced in NUREG-0800, "Standard Review Plan" (SRP) Section 3.6.1 as Branch Technical Position (BTP) ASB 3-1, "General Information Required for Consideration of the Effects of a Piping System Break Outside Containment." In the Giambusso letter, the AEC requested information from licensees and established criteria,

including those used to define high-energy line piping, address physical separation and pipe whip, determine design basis piping break locations, analyze dynamic effects of break jets, demonstrate environmental qualification, and postulate an open critical-sized crack at the worst location. The Giambusso letter guidance to consider the dynamic effects of break jets out to an unspecified distance is conservative. This distance is typically where the resulting pressure profile from the jet returns to atmospheric pressure. As applied inside the plant areas, this distance is from the break location out to the farthest structures, systems, and components (SSCs). The Giambusso letter postulated design basis breaks in piping based on limiting stress criteria for piping designed in compliance with the applicable requirements for materials, design, fabrication, testing and inspection stated in the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (the ASME Code), Section III, Subsections NB, NC, ND. The Giambusso letter also included design criteria for postulating arbitrary breaks at piping system terminal ends, including containment penetrations, which are not based on meeting limiting stress criteria. Additionally, the Giambusso letter included design criteria for postulating a minimum of two breaks at arbitrary intermediate locations, selected as necessary to provide protection to essential structures and components, and an arbitrary critical crack at the most adverse location, which could be anywhere along the pipe. The Giambusso letter did not allow for the postulation of crack location based on piping stress analysis.

At the time of initial licensing for D. C. Cook Units 1 and 2, the licensing basis for the HELB program was based on the intent of the Giambusso letter, as amended by an errata sheet dated January 31, 1973. Appendix O to the D. C. Cook UFSAR contains the licensing commitments related to the implementation of the HELB program, including the specific design criteria used.

In 1998, during extended outages for both Units 1 and 2, the licensee performed a review of the HELB program. The licensee identified nonconformances with regard to the HELB program. Subsequent efforts by the licensee to reconstitute the HELB program identified that the original jet loading calculations and analyses could not be located. Walkdowns of equipment to assess the adequacy of HELB protection identified that protection from an HELB in some cases was inadequate.

To resolve non-conformances in the HELB program, the licensee has proposed to incorporate the following methodologies into the program: 1) NUREG/CR-2913, 2) NUREG-0800, "Standard Review Plan (SRP)," Section 3.6.2, "Determination of Rupture Locations and Dynamic Effects Associated with the Postulated Rupture of Piping," and its associated Branch Technical Position (BTP), MEB 3-1, "Postulated Rupture Locations in Fluid System Piping Inside and Outside Containment," Section B.1.b, break exclusion zones, and 3) an SRP 3.6.2, BTP MEB 3-1, Section B.1.e, crack exclusion based on stress analysis. (The limiting stress criteria represent thresholds, below which no breaks or cracks need be postulated.) In these sections, the limiting stress criteria are stipulated to be used in conjunction with ASME Code Section III piping analysis criteria and requirements. The licensing basis for design of piping at the D. C. Cook plant is based on the USA Standard Code for Pressure Piping, USAS B31.1-1967, "Pressure Piping," which has less stringent design, fabrication and inspection requirements than the ASME Code Section III. The licensee therefore has proposed the postulation of breaks and cracks in piping in containment penetration areas using stress analyses based on USAS B31.1-1967, with the sections of BTP MEB 3-1 pertaining to ASME Section III Class 2 and 3 piping, subject to certain conditions, and the limiting stress criteria of the Giambusso letter. The effect of these provisions is that breaks and cracks need not be postulated (in contradiction to the

Giambusso letter) at the containment penetrations, which represent terminal ends for the attached piping, if the stresses determined from the USAS B31.1- 1967 piping stress analysis are lower than the prescribed break and crack limiting stress criterion. The benefits to the licensee of this relaxation are that, if the limiting stress criteria are satisfied, pipe whip restraints need not be installed at these locations and jet impingement effects on adjacent equipment and components need not be considered.

In reviewing the incorporation of the new methodology into the licensing basis, the licensee identified each of these changes involve unreviewed safety questions (USQs). Therefore, prior NRC review and approval are required in accordance with 10 CFR 50.90. Each of the proposed changes is evaluated below.

### 3.0 EVALUATION

#### 3.1 NUREG/CR-2913 Influence of HELB Break Jets

The licensee proposes to use the NUREG/CR-2913 methodology for determining the distance of influence for jet spray from breaks and critical cracks in high-energy line piping. The implementation of this methodology would be performed in accordance with the assumptions presented in NUREG/CR-2913.

The original design basis for many of the HELB protective features at the D. C. Cook plant is a one-dimensional mathematical model of the jet loading. The Giambusso letter guidance was established based on the one-dimensional modeling of HELB flow.

The jet resulting from an HELB is a two-phase, complicated, multidimensional flow. The use of the one-dimensional model is inappropriate for load calculations on two-phase jets. A multidimensional analysis that is capable of modeling strong shocks within the flow is needed to evaluate the thermodynamic properties downstream of the shocks. This is needed in order to provide realistic zones of influence of the jets and the resulting target loads. NUREG/CR-2913 provides a method for performing such an analysis. The use of the NUREG/CR-2913 methodology provides a more realistic evaluation of target loads following a HELB.

The licensee's implementation of the NUREG/CR-2913 methodology at the D. C. Cook plant would consist of calculating the influence of jets within ten diameters from a postulated break or critical crack. The jet forces within the ten diameters are calculated as done previously in accordance with the original design and licensing basis. This would modify the licensing and design basis to define more accurately the characteristics of HELB jets at D. C. Cook.

NUREG/CR-2913 has been reviewed and approved by the NRC for similar applications at the following nuclear power plants:

Byron Nuclear Power Station

Comanche Peak Steam Electric Station

Crystal River Unit 3

Vogtle Nuclear Power Plant

Watts Bar Nuclear Power Plant

The licensee has performed new calculations (verified by plant walkdowns) to assure proper implementation of NUREG/CR-2913 for the HELB program. Further, the licensee has assured that adequate protection of systems within the zone of influence from an HELB has been implemented in accordance with the original HELB licensing basis for D. C. Cook.

Based on the above, the NRC staff finds the application of NUREG/CR-2913 to eliminate the need for analysis of the effects of jet impingement beyond ten pipe diameters from a postulated break or critical crack is acceptable.

### 3.2 Use of SRP 3.6.2, MEB 3-1, Section B.1.b for the Postulation of Breaks and Cracks in Containment Penetration Areas

The licensee proposes to apply stress analyses based on USAS B31.1.0-1967, "USA Standard for Pressure Piping, Power Piping," the design code of record for piping at the D. C. Cook plant, for use with SRP 3.6.2, BTP MEB 3-1, Section B.1.b, to establish break exclusion zones. The application of SRP break exclusion zones is requested specifically for the steam generator blowdown (SGBD) and chemical volume control system (CVCS) letdown lines outside containment (see Figure 1).

The SRP Section 3.6.2, BTP MEB 3-1, Section B.1.b, provides for an exclusion from break and crack considerations in the containment penetration area for piping exiting penetrations up to the first isolation valve. As set forth in the SRP, such an exclusion is appropriate only if piping stresses are within specified limits and the piping cannot be adversely impacted by breaks or cracks in other parts of the piping. The licensee proposes to change the licensing and design basis of the piping to preclude the consideration of breaks and cracks in the portions of the SGBD and CVCS letdown lines in the containment penetration areas (designed under the provisions of the Giambusso letter) based on acceptable piping analysis in accordance with USAS B31.1.0-1967. The licensee has performed new detailed stress analyses on the piping in question to verify that the stresses in the piping are within the SRP identified limits. The new calculations identified a number of piping supports that required modifications. Modifications to the piping supports in Unit 2 have been completed and modifications for Unit 1 will be completed prior to Unit 1 entering into operational MODE 3 from its current extended outage.

The SGBD and CVCS letdown piping has been analyzed in accordance with USAS B31.1.0-1967, and support modifications have been performed to ensure that the piping stresses meet the Giambusso break limiting stress criterion of  $0.8(S_h + S_a)$ , which is lower than the SRP limiting stress criterion of  $0.8(1.8S_h + S_a)$ . The symbols  $S_h$  and  $S_a$  represent the allowable stress at maximum (hot) temperature and the allowable stress range for thermal expansion, respectively. The use of this approach to account for the differences between the American Society of Mechanical Engineers (ASME) Code stress methodology used in the SRP and the USAS B31.1.0-1967 stress methodology has been previously reviewed and approved by the NRC for use on USAS B31.1.0-1967 piping located inside containment at Crystal River, Unit 3, by letter dated September 28, 1989. Other requirements for the use of USAS B31.1.0-1967 and MEB 3-1 are also specified in this letter. The licensee stated that the revised analyses

conform with these provisions. The licensee has also evaluated the effects of breaks outside of the containment penetration area and determined that they do not have an adverse impact on the piping within the exclusion zone. The use of this methodology and the modification of the piping supports on the SGBD and CVCS letdown lines ensure a sufficient margin to preclude breaks and cracks in this region of piping. The use of lower limiting stress criteria for the postulation of breaks and cracks in the containment penetration areas of the SGBD and CVCS letdown lines will provide the necessary reasonable assurance for protection from HELB events.

Based on the above, the NRC staff finds the application of stresses calculated in accordance with USAS B31.1.0-1967, in conjunction with SRP BTP MEB 3-1, Section B.1.b, to the portions of SGBD and CVCS piping outside containment located between the containment penetration and the first outboard isolation valve is acceptable.

### 3.3 Critical Crack Location With Use of SRP Section 3.6.2

The Giambusso letter requires the arbitrary postulation of a single open crack at the most adverse location(s) in piping carrying high energy fluids which are routed in the vicinity of systems and component required for safe shut down, to provide protection against environmental effects, including jet impingement loading.

The licensee proposes to apply stress analyses based on USAS B31.1.0-1967 for use with SRP 3.6.2, BTP MEB 3-1, Section B.1.e, for the postulation of cracks based on piping stress analysis. Consistent with the methodology reviewed and approved by the NRC in the letter dated September 28, 1989, approving this methodology at Crystal River Unit 3, the licensee proposes the limiting stress criterion used with USAS B31.1.0-1967 stress analysis of piping, in areas other than containment penetration areas, to be one-half of the Giambusso letter limiting stress criterion for ASME Section III Class 2 and 3 piping (i. e.,  $.05(0.8(S_h+S_a))$ ), which is more conservative than the SRP criterion of  $0.4(1.8S_h+S_a)$ . This approach accounts for the differences between the ASME Section III Code for Class 2 and 3 related piping as required by SRP MEB 3-1, and the USAS B31.1.0-1967 code for power piping.

The licensee intends to apply this methodology to a portion of SGBD piping located in the normal flash tank room in Units 1 and 2 (see Figure 2), to eliminate the postulation of a crack in this piping as would be required under the Giambusso letter. This modifies the licensing and design basis for this portion of piping.

The licensee performed new calculations on the piping in question based on USAS B31.1.0-1967 and discovered that approximately 10 feet of piping in Unit 2 needed to be replaced with heavy wall piping, and the piping supports in both Units 1 and 2 needed to be modified, so that the applied stresses met the limiting stress criterion. By letter dated November 13, 2000, the licensee clarified the April 6, 2000, application by indicating that the SRP methodology for crack postulation for the SGBD piping in the normal flash tank room in Unit 1 was required.

The use of piping stresses based on USAS B31.1.0-1967 to predict crack postulation based on the SRP methodology and the limiting stress criterion for cracks stated in the NRC letter September 28, 1989, is acceptable and conservative. This methodology for the postulation of cracks in the SGBD piping in the normal flash tank rooms is conservative and provides the margin to failure, which is inherent in the material properties and allowables of the SGBD piping. The replacement of the normal piping with heavy wall piping in Unit 2, piping support

modifications, in the new stress calculations based on USAS B31.1.0-1967, in conjunction with the conditions and the limiting stress criterion for crack postulation, provides reasonable assurance that the stresses in the SGBD piping are sufficiently low to exclude the SGBD piping from crack formation.

Based on the above, the NRC staff finds the application of stresses calculated in accordance with USAS B31.1.0-1967, in conjunction with SRP BTP MEB 3-1, Section B.1.e, to the portions of the SGBD piping outside containment located in the normal flash tank rooms in Units 1 and 2 is acceptable.

#### 4.0 SUMMARY

Based on the above elevation, the NRC staff finds that the proposed changes in methodology concerning HELB are acceptable. Therefore, the licensee may update the UFSAR for D. C. Cook Units 1 and 2 to incorporate the following specific methodology changes concerning HELB:

- 1) NUREG/CR-2913, "Two-Phase Jet Loads";
- 2) NUREG-0800, "Standard Review Plan (SRP)," Section 3.6.2, "Determination of Rupture Locations and Dynamic Effects Associated with the Postulated Rupture of Piping," and its associated Branch Technical Position (BTP), MEB 3-1, "Postulated Rupture Locations in Fluid System Piping Inside and Outside Containment," Section B.1.b, break exclusion zones; and
- 3) SRP Section 3.6.2, BTP MEB 3-1, Section B.1.e, crack exclusion based on stress analysis.

#### 5.0 STATE CONSULTATION

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

#### 6.0 ENVIRONMENTAL CONSIDERATION

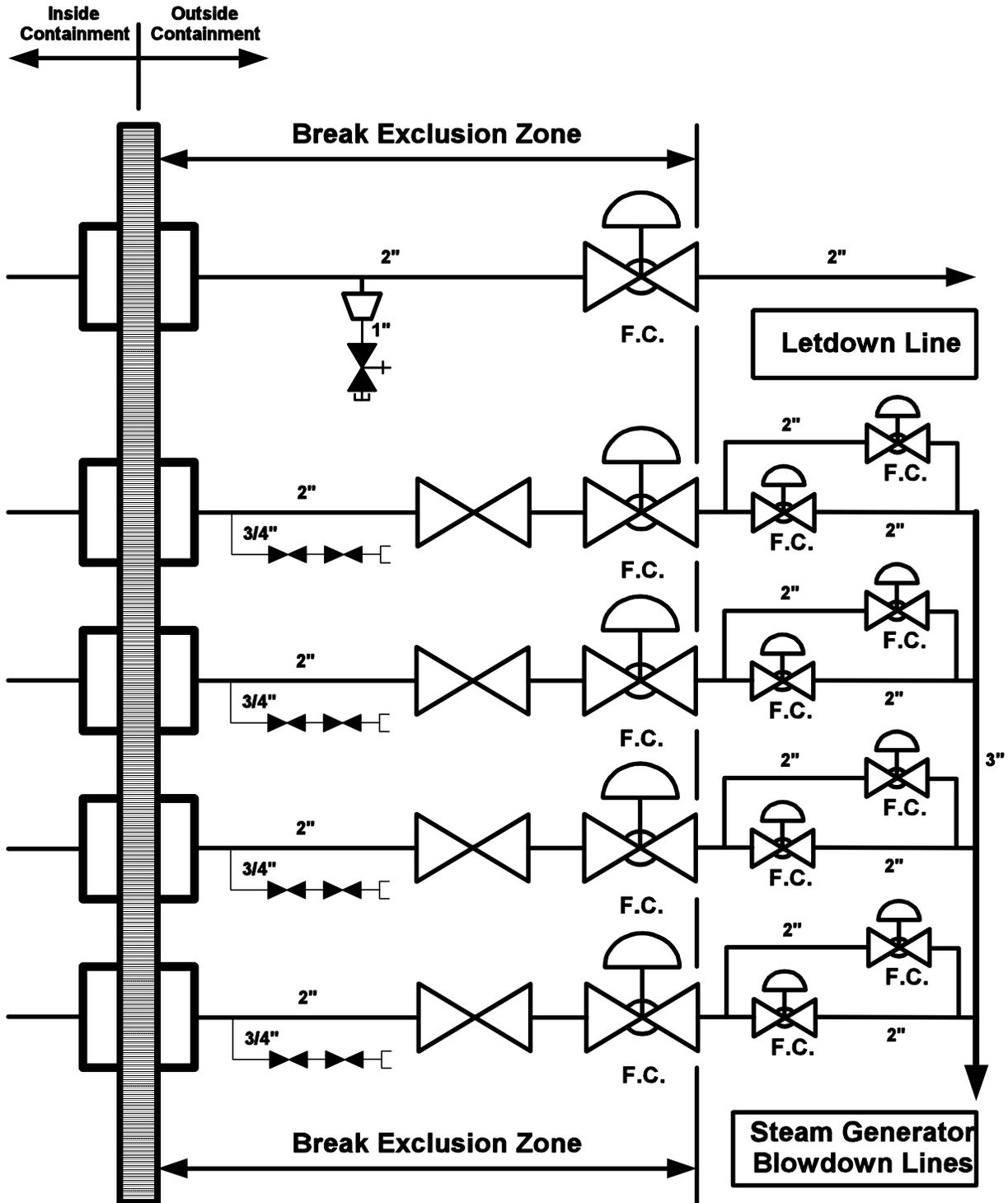
These amendments change the requirements with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents 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 the amendments involve no significant hazards consideration and there has been no public comment on such finding (65 FR 51355 ). Accordingly, the amendments meet 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 the amendments.

## 7.0 CONCLUSION

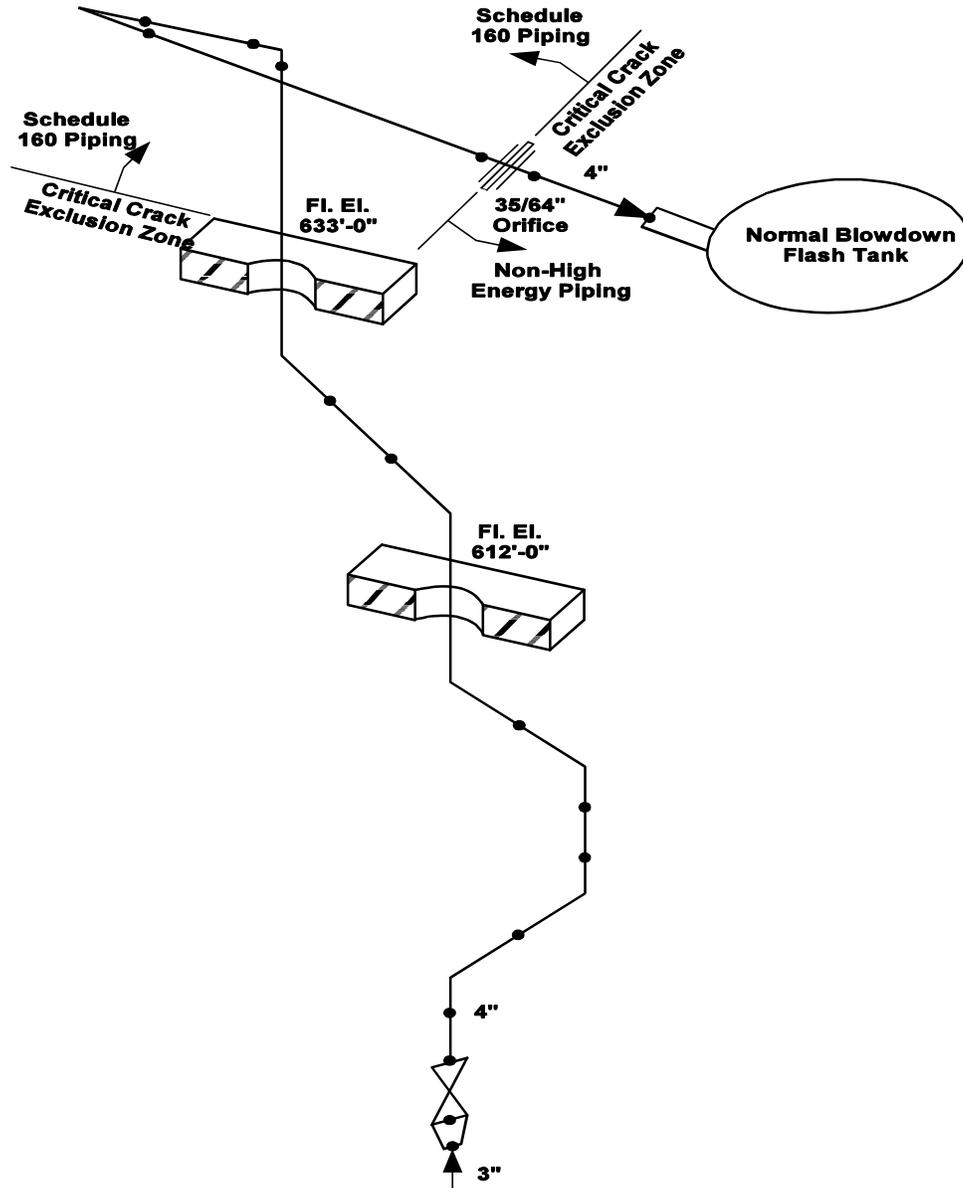
The NRC staff has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations,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

Principal Contributor: MHartzman

Date: November 21, 2000



**Figure 1: Break Exclusion Zones**  
(No Longitudinal or Circumferential Breaks, No Critical Cracks, No Terminal End Breaks)  
Typical for Both Units



**Figure 2: Steam Generator Blowdown Line Crack Exclusion**  
(No Critical Cracks)  
Units 1 & 2