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U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
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References: 1) Fermi 2
NRC Docket No. 50-341
NRC License No. NPF-43

2) "Guidelines for Permanent BWR Hydrogen Water Chemistry Installations - 1987 Revision," EPRI NP-5283-SR-A, September 1987

3) "BWR Water Chemistry Guidelines - 1993 Revision," EPRI TR-103515, February 1994

Subject: Main Steam Line Radiation Monitor Setpoint Changes for Hydrogen Water Chemistry (HWC)

The purpose of this letter is to inform the NRC that Detroit Edison is preparing for the implementation of Hydrogen Water Chemistry (HWC) at Fermi 2 later this year. As part of the preparation Detroit Edison is performing a safety evaluation in accordance with 10 CFR 50.59 and has reviewed the necessity to change the Technical Specifications (TS) for the Main Steam Line Radiation Monitor (MSLRM) trip setpoint. Our conclusion is that the TS do not need to be changed and therefore, the change can be implemented provided that the 50.59 evaluation determines there is no unreviewed safety question. The basis for this preliminary conclusion is discussed in the following paragraphs.

The design, including the location of the hydrogen storage facility, construction and operation of the HWC system will be in accordance with the EPRI guidelines (Reference 2). Any exceptions to or deviations from the guidelines would be evaluated to assure that they will not adversely affect the safety of the plant or the

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public. These guidelines were reviewed by the staff and found acceptable in their safety evaluation of Reference 2.

The Fermi 2 TS state the MSLRM trip setpoint as "$\leq$3.0 x full power background" and the allowable value as "$\leq$3.6 x full power background." The injection of hydrogen will increase the full power background by a factor of approximately five to eight (Reference 3). The monitor trip setpoint can then be adjusted to the factor of three specified in the TS above the new full power background level. The MSLRM trip setpoint would be based upon the background radiation level for 100% power operation with the established hydrogen injection rate. Actual background radiation levels may be less depending on actual power level or hydrogen injection rate. Setpoint adjustment would not be necessary for variations in power or hydrogen injection rate, including interruptions of hydrogen flow.

The current TS, therefore, support the proper setting of the MSLRM trips while allowing flexibility for possible changes in hydrogen injection rates or other potential changes in main steam line radiation levels.

The "dual setpoint approach" described in Section 8 of the EPRI guidelines (enclosed) also changes the trip setting by adjusting for the new background level while retaining the original multiplier. In this approach the trip setpoint remains specified as three times full power background. The background level for full power operation without hydrogen injection is used at less than 20% power. Above 20% power, the setpoint is adjusted based upon the full power background with hydrogen injection. This allows both a lower setpoint to be applied as required by the plant control rod drop analysis (CRDA) at low power and a higher setpoint for hydrogen water chemistry at high power.

The Fermi 2 CRDA assumes that the activity assumed by Standard Review Plan Section 15.4.9 is transferred to the main condenser prior to main steam line isolation. As a result, the radiological consequences of the CRDA remains unchanged even with the new higher trip setpoint and, therefore, the dual setpoint is not needed at Fermi 2. Although it is described in the EPRI guidelines only in the context of a dual setpoint, the approach of applying the current TS factor to a new full power background (with hydrogen injection) is just as valid in establishing a new single trip setting for the MSLRM.

In summary, Detroit Edison believes that the current Fermi 2 TS allow the MSLRM setpoint to be raised to account for the increase in background radiation levels anticipated with hydrogen addition. The new setpoint, as stated in the current TS bases, will continue to be high enough above background to prevent spurious trips yet low enough to promptly detect gross failures in the fuel cladding. Because Reference

2 discussion of MSLRM setpoints does not directly address the circumstances at Fermi 2 and the specific wording in the Fermi 2 TS, Detroit Edison determined that it was appropriate to notify the NRC staff of the status of the HWC modification and our conclusions regarding its implementation via 10 CFR 50.59.

If you have any questions, please call Mr. Glen D. Ohlemacher at (313) 586-4275.

Sincerely,

Enclosure

cc: T. G. Colburn
J. B. Martin
M. P. Phillips
A. Vegel

Section 8

RADIATION MONITORING

8.1 INTRODUCTION

This section reviews the radiological consequence of hydrogen water chemistry (HWC) and presents the basis for increasing the main steam line radiation monitor set point to accommodate HWC. It is concluded that implementation of HWC does not reduce the margin of safety as defined in the basis of the technical specification set point.

During normal operation of a BWR, nitrogen-16 is formed from an oxygen-16 (N-P) reaction. N-16 decays with a half-life of 7.1 sec and emits a high-energy gamma photon (6.1 MeV). Normally, most of the N-16 combines rapidly with oxygen to form water-soluble, nonvolatile nitrates and nitrites. However, because of the lower oxidizing potential present in a hydrogen water chemistry environment, a higher percentage of the N-16 is converted to more volatile species. As a consequence, the steam activity during hydrogen addition can increase up to a factor of approximately five. The dose rates in the turbine building, plant environs, and off-site also increase; however, the magnitude of the increase at any given location depends upon the contribution of the steam activity to the total dose rate at that location. The specific concerns include:

1. The dose to members of the general public (40 CFR 190),
2. The dose to personnel in unrestricted areas (10 CFR 20), and
3. The maintenance of personnel exposure "as low as reasonably achievable" (ALARA).

8.2 MAIN STEAM LINE RADIATION MONITORING

As noted in the previous section, main steam line radiation levels can increase up to approximately fivefold with hydrogen water chemistry. The majority of BWRs have a technical specification requirement for the main steam line radiation monitor (MSLRM) set point that is less than or equal to three (3) times the normal rated full-power background. For these plants an adjustment in the MSLRM set point may be required to allow operation with hydrogen injection. For earlier

BWRs with MSLRM set points of seven (7) to ten (10) times normal full-power background, a set point change may not be required.

8.2.1 Dual MSLRM Set Point Recommendation

For plants at which credit is taken for an MSLRM-initiated isolation in the control rod drop accident (CRDA), a dual set point approach may be utilized. At most plants, the MSLRM set point is specified in the plant Technical Specifications (Tech Specs) as some factor times rated full-power radiation background. With hydrogen addition, the full-power background could increase up to 5 times that without hydrogen addition. Below 20% rated power or the power level required by the FSAR or Tech Specs (see table 2-1), the existing set point is maintained at the Tech Spec factor above normal full-power background, and hydrogen should not be injected. About 20% rated power, the MSLRM set point should be readjusted to the same Tech Spec factor above the rated full-power background with hydrogen addition. This adjustment would be made by the plant personnel during startups and shutdowns. Plant power would remain constant during this adjustment process. Thus, the Tech Spec factor by which the MSLRM set point is adjusted remains the same with and without hydrogen addition, but the background radiation level increases with hydrogen addition. If an unanticipated power reduction event occurs such that the reactor power is below this power level without the required set point change, control rod motion should be suspended until the necessary set point adjustment is made. At newer plants, credit is not taken for an MSLRM-initiated isolation after a CRDA, and a dual set point is not needed at these plants.

Plants that need a dual set point should consider changing their Technical Specifications to increase the factor used to determine the MSLRM set point, if their CRDA analysis will permit this increase. A suggested approach would be to use the Susquehanna Steam Electric Station, unit 1, amendment no. 58 Technical Specification change as a model. Under this approach, the MSLRM set point was raised based on a satisfactory evaluation of the off-site consequences.

8.2.2 MSLRM Safety Design Basis

The only design basis event for which some plants may take credit for main steam isolation valve (MSIV) closure on main steam line high radiation is the design basis control rod drop accident (CRDA). As documented in reference (1), the CRDA is only of concern below 10% of rated power. Above this power level the rod worths and resultant CRDA peak fuel enthalpies are not limiting due to core voids

and faster Doppler feedback. Since the current MSLRM set point will not be changed below 20% rated power, the MSLRM sensitivity to fuel failure is not impacted and the FSAR analysis for the CRDA remains valid.

The licensing basis for the CRDA states that the maximum control rod worth is established by assuming the worst single inadvertent operator error (2). From references (2) and (3), the maximum control rod worth above 20% rated power, assuming a single operator error, is <0.8% $\Delta K/K$. Parametric studies utilizing the conservative GE excursion model (1) indicate that the maximum peak fuel enthalpy for a dropped control rod worth of 0.8% $\Delta K/K$ is less than 120 calories per gram (3). Consequently, the conservatively calculated peak fuel enthalpy for a CRDA above 20% rated power will have significant margin to the fuel cladding failure threshold of 170 calories per gram.

An increase in the MSLRM set point will not impact any other FSAR design basis accident or transient analysis since no credit is taken for this isolation signal. Consequently, a technical specification change which adopts the recommended dual set point approach will not reduce overall plant safety margins.

8.2.3 MSLRM Sensitivity

Conceptually, the sensitivity of the MSLRM to fission products is effectively reduced by the increase in the set point above 20% power. However, it is still functional and capable of initiating a reactor scram. The main function of the instrument is to help maintain off-site releases to within the applicable regulatory limits. The MSLRM is supplemented by the off-gas radiation monitoring system which monitors the gaseous effluent prior to its discharge to the environs. The off-gas radiation monitor set point is established to help ensure that the equivalent stack release limit is not exceeded.

8.2.4 Conclusions

From the above discussion, it can be concluded that an increase in the MSLRM set point above 20% rated power will not reduce the safety margins as defined by Technical Specifications or increase the off-site radiological effects as a consequence of design base accidents. Furthermore, since this change to the MSLRM can be justified independent of HWC, this change does not constitute an unreviewed safety concern.

8.3 EQUIPMENT QUALIFICATION

Outside primary containment the increase in dose rates with HWC is relatively small relative to the integrated dose assumed for equipment qualification (EQ) tests. Furthermore, dose rates inside the drywell near the recirculation piping will decrease because of the increased carry-over of N-16 in the steam. Each utility should review the resultant dose increases to ensure that the doses assumed in the EQ tests required for electrical equipment per 10 CFR Part 50.49 remain bounding.

8.4 ENVIRONMENTAL CONSIDERATIONS

Implementation of an HWC system is unlikely to significantly increase the amounts or significantly change the types of effluents that may be released off-site. Although an increase in individual or cumulative occupational radiation exposure may occur, the guidelines provided in section 6.1.3 of this document will ensure that radiological exposures to both plant personnel and the general public are consistent with ALARA requirements. Since the design objectives and limiting conditions for operation as defind by 10 CFR Part 50, Appendix I, are not impacted, no Appendix I revision is required.

Each plant should examine the environmental effects of an HWC system. However, it is unlikely that environmental impact statements or environmental assessments will be required for HWC systems.

8.5 REFERENCES

1. R. C. Stirn et al. "Rod Drop Analysis for Large Boiling Water Reactors." NEDO-10527. General Electric Company, March 1972.

2. R. C. Stirn et al. "Rod Drop Accident Analysis for Large Boiling Water Reactors Addendum No. 2 Exposed Cores." NEDO-10527, Supplement 2. General Electric Company, January 1973.

3. R. C. Stirn et al. "Rod Drop Accident analysis for Large Boiling Water Reactors Addendum No. 1 Multiple Enrichment Cores With Axial Gadolinium." NEDO-10527, Supplement 1. General Electric Company, July 1972.