UNITED STATES
NUCLEAR REGULATORY COMMISSION
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January 24, 1984

MEMORANDUM FOR: J. Rutberg, Assistant Chief
Hearing Counsel, OELD

FROM: A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing

SUBJECT: REPORT ON HYDROGEN RECOMBINER ISOLATION VALVES

This memorandum presents the NRC staff's report on the containment isolation provisions for hydrogen recombiner lines during the first fuel cycle for Limerick Unit 1 as requested by the Board in its October 28, 1983, Memorandum and Order.

The issue was identified in Section 6.2.4.2 of the Safety Evaluation Report as follows:

> "The second group of lines with only a single containment isolation valve are the lines to and from the recombiners. Because the hydrogen recombiners, to which these lines connect, are not designed to the containment design pressure and temperature, they do not meet the requirements of a closed system. Even if the hydrogen recombiners systems were closed systems, however, maintenance on the recombiners during operation would be prohibited because only a single containment isolation valve would exist for containment isolation.
>
> Therefore, the NRC staff finds that the one containment isolation valve in each line is not acceptable and a second isolation valve will be required. This is an open item and will be addressed in a supplement to this report."

At the time of issuance of the above statements in the SER, the issue was open, therefore, the staff could not make a finding that the recombiner line isolation provision either met, or constituted an acceptable alternative to, the explicit requirements of GDC 56.

This issue was addressed in Supplement No. 1 to the SER (SSER-1) which reported the resolution of the issue. A copy of the applicable SSER-1 pages is attached. In SSER-1, the staff again noted that the proposed design did not meet the explicit requirements of GDC-56 and acknowledged the applicant's arguments that the design did present an acceptable alternative to the explicit requirements of GDC-56.

In the evaluation presented in SSER-1, the staff did not accept the applicant's arguments, namely, that the design constitutes an acceptable alternative to the explicit requirements of GDC-56 for the full life of the plant and therefore requires no further modification. However, the staff did find that, conditioned on the installation of the required redundant isolation valves prior to commencement of the second fuel cycle, the present design provides adequate containment isolation provisions for the first fuel cycle of operation.

These staff findings were based on information provided by the applicant in response to the open issue stated in the SER. As noted in SSER-1, the applicant addressed the staff's SER concern that the presently existing single isolation valve would be the only containment barrier by providing information in support of the capability of the hydrogen recombiner piping and other components outboard of the isolation valve to withstand the postulated accident pressures and temperatures and thus serve as a second barrier. To support reliance on these components as an interim second barrier, the applicant committed to leak test the piping systems including two control valves and four instrument line valves in conjunction with the containment integrated leak rate test.

The applicant addressed the staff's SER concerns on maintenance of the recombiner system components by committing to install a blind flange outboard of the present single isolation valve in each line and to leak test the section of the line between the single isolation valve and the blind flange to demonstrate the integrity of the two isolation barriers (1 isolation valve and the blind flange) during maintenance.

On the basis of these provisions, as summarized below, the staff finds that an exemption from the explicit requirements of GDC-56, for the first fuel cycle of operation of Unit 1, will be appropriate.

1. The period of operation which relies on one isolation valve in conjunction with the recombiner piping and other components to form the second barrier, will be limited to only the first fuel cycle out of the full life of the plant. Thus, the percentage of the plants life that does not contain the redundant isolation valves is not considered to be undue in view of the alternative isolation provisions discussed above.

2. Limiting the alternative provisions to only the first fuel cycle also mitigates the staff's concern regarding degradation of the interim isolation barrier since it is expected that degradation of the recombiner system piping and components beyond the present single isolation valve would be a function of age related processes and not likely to be a significiant leak tightness factor early in the life of the systems. In any event, these systems will be leak tested as noted above.

3. If maintenance is required, a second barrier will be established by blind flanges and also will be leak tested.

4. The only alternate to these interim provisions, which the NRC staff considers acceptable, would be the installation of the second isolation valve prior to fuel loading. The applicant has stated that installation and testing of the second isolation valves in the system, prior to initial fuel loading, would cause undue delay in the initial operation of Unit 1.

This supplementary information on the bases for the granting of a limited one time exemption will be included in a future supplement to the SER. As stated in SSER 1, the NRC staff will require as a license condition that prior to startup following the first refueling outage, the applicant must install redundant isolation valves in the hydrogen recombiner system.

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Attachment:
SSER-1 Section 6.2.4.3

6 ENGINEERED SAFETY FEATURES

6.2 Containment Systems

Professor George Bienkowski of Princeton University, a staff consultant, prepared a draft report on the results of his analyses of the containment load specifications for the chugging phenomenon in Mark II containments. His findings indicated that because of the random selection process for the individual vent chug initiation times, the previously established load specifications for Mark II containments (Limerick has a Mark II containment) may not be sufficiently conservative.

To show that the existing chugging load specifications are still adequately conservative, the Mark II owners used a two-step approach. First, they showed that containment response to the asymmetric chugging load specification was not significantly different from that for the symmetric specification. In fact, the comparison showed them to be remarkably similar. Having established the similarity, they applied the symmetric specification to the JAERI (Japanese Atomic Energy Research Institute) facility with 20 different sets of start times and showed that the calculated wall pressures were for the most part greater than the pressures recorded during some of the biggest chugs in the JAERI facility.

The staff and its consultant concluded that the Mark II Owners Group approach toward resolution of the chug start-time concern was a sound one. Also, there was general accord with the arguments presented, and the staff concluded that this is no longer an outstanding issue and that no modification to the load specifications (generic and plant unique) is required. Appendix I of this report documents the work done by Professor Biewkowski on the effects of desynchronization on the Mark II chugging load specifications and the work done by the Mark II owners to alleviate Professor Bienkowski's concern.

6.2.4 Containment Isolation System

6.2.4.2 General Design Criterion 56

SER Section 6.2.4.2 identifies the containment isolation provisions for the hydrogen recombiner system as an outstanding issue. Each of the two redundant hydrogen recombiner trains for post-accident hydrogen control has one automatic containment isolation valve in the line from the drywell to the reaction chamber and one automatic containment isolation valve in the line from the reaction chamber to the wetwell. The second isolation barrier for each line penetrating containment is considered by the applicant to be the closed piping system of the hydrogen recombiner trains. This represents a deviation from the explicit requirements of GDC 56 for penetrations of the primary containment that connect directly to the containment atmosphere. GDC 56 explicitly requires two isolation valves in each line penetrating reactor containment; however, GDC 56 does allow deviations if acceptably justified.

In a meeting held between the staff and the applicant on September 8, 1983, the applicant provided the following justification to allow a deviation from the explicit requirements of GDC 56:

(1) Although the rated design pressure and temperature of the hydrogen recombiner piping are less than the containment peak pressure and temperature following a LOCA, the piping has been reanalyzed to demonstrate that it meets ASME Code requirements for pressure and temperature values greater than the LOCA values. The carbon steel portion of the recombiner system is now code stamped for 55 psig and 340°F, and the stainless steel portion is now code stamped for 30 psig and 1400°F. The gas temperature leaving the reaction chamber during recombiner operation is 1400°F. In this regard, it is noted that the recombiner system is not needed until approximately 39 hours following a postulated LOCA; pressure and temperature at this time are expected to be below 30 psig and 340°F.

(2) The hydrogen recombiner system is primarily of welded construction, and the blower is enclosed in a vessel. Potential leakage can occur only through two control valves, four instrument line root valves, and five flanged connections. The system is leak tested in conjunction with the (Appendix J) containment integrated leak rate test. If maintenance requiring removal of a component is needed on one of the two redundant trains, a blind flange shall be installed outboard of the containment isolation valve in each line and the segment of line between the isolation valve and flange will be leak tested to demonstrate the existence of two isolation barriers during maintenance.

The staff has indicated that the justification provided in SRP 6.2.4 for accepting a closed system outside containment to serve as the second isolation barrier was developed for those engineered safety feature systems that are required to recirculate cooling water during a loss-of-coolant accident. The justification was intended to apply only to emergency core cooling (ECC) system suction lines that penetrate containment and not to other penetrations of the containment boundary. The staff also stated that these ECC systems rely on the single valve plus the closed system for isolation of the suction penetrations only; the discharge penetrations of the ECC system have two isolation valves. The applicant's proposed arrangement relies on the closed system as the second barrier for both the suction and discharge penetrations.

The staff also stated that the very limited reduction in equipment availability that may be attributable to the addition of a second isolation valve does not warrant the proposed deviation from the requirements of GDC 56. It is noted that the recombiner system is not needed until about 39 hours into the transient; the ECC systems are needed immediately following the onset of the accident.

The staff concluded, however, that the applicant's rationale provided an adequate basis for justifying operation of Limerick Unit 1 through the first cycle. Implementation of the staff position requiring the addition of an automatic isolation valve in each of the hydrogen recombiner lines penetrating the containment should be completed before startup after the first refueling outage.

Based on the applicant's commitment by letter dated September 22, 1983, to install the additional valves before startup after the first refueling outage,

the staff concludes that this issue is now closed. However, the staff will condition the Limerick Unit 1 operating license to require the applicant to install the additional valves before startup after the first refueling outage. The staff will prepare a separate report providing the basis for and the granting of this exemption from GDC 56.

6.5 Engineered Safety Feature Atmospheric Cleanup System

6.5.5 Evaluation Findings

The SER indicated that the conclusions stated therein were subject to the minimum provisions of Table 6.5.1-1 of SRP 6.5.1 that recorded indications be provided in the control room showing the pressure drop across the first high efficiency particulate air (HEPA) filter of each of the three engineered safety features (ESF) filter systems: the control room emergency fresh air (CREFA) filter units, the standby gas treatment system (SGTS) filter units, and the reactor enclosure recirculation system (RERS) filter units.

The applicant's position has been that the RG 1.52, Position C.2.g, has been met because alternative system features have been provided in the Limerick design to accomplish the aim of the SRP guidelines to mitigate a postulated malfunction of the first HEPA filter in the ESF filter systems. The alternate features provide for an automatic changeover to the standby filter train whenever the system flow reduces to about 80% of design flow as a result of high HEPA filter pressure drop. In addition, each filter train is provided with local pressure drop indication and an overall filter train high pressure drop computer alarm. In this context, the applicant's position has been that potential dust loadings on the first HEPA filter are not sufficient to cause rapid over-pressurization leading to a filter failure that the alternative instrumentation included in the present Limerick design would fail to respond to.

Since the issuance of the SER, the staff has reviewed additional, more detailed information provided by the applicant in letters dated July 25 and October 3, 1983. This information consisted of an analysis of the worst case dust loadings on the first HEPA filters and an analysis of the postulated failures of the first HEPA filters and consequences of the failures.

On the basis of this review, the staff has found that the present Limerick system design is adequate to mitigate the postulated malfunction of the first HEPA filters as a result of high HEPA filter pressure drop. This system design is, therefore, acceptable. This closes outstanding issue 6.