The Dow Chemical Company
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May 5, 1994

Director, Office of Nuclear Reactor Regulation
Attn: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555

DOW TRIGA RESEARCH REACTOR, DOCKET 50-264

Sir:

The Dow Chemical Company requests an amendment to the Technical Specifications, part of Operating License R-108, governing the operation of the TRIGA Mark I Nuclear Research Reactor installed at this facility. The requested amendment consists of five parts:

1. Addition of a definition of a surveillance interval

2. Changes of language intended to clarify some points and bring others up to date (11)

3. Change of the specification concerning the minimum period setpoint

4. Change of the specification for examination of the fuel elements

5. Change of the schematic chart of the administration and the specification of these functions where changes of personnel should be reported to the US NRC.

The changes are described in the enclosed document along with justifications and data, where useful, to support the request for the changes.

This application consists of this cover letter, a discussion of all of the proposed changes, a copy of the current Technical Specifications (Amendment 6) with the changes entered as strikeouts (for deletions) and as bold italic letters (for additions), and a full copy of the proposed Technical Specifications if such proposed changes are accepted.

Very truly yours,

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Proposed Amendment 7 of the Technical Specifications - License R-108

1. Addition of a surveillance interval - The Technical Specifications require certain actions on a quarterly basis (meetings of the Reactor Operations Committee) and the Requalification Program requires actions on a quarterly basis, but there is no definition of a quarterly surveillance interval. We propose to add the definition given (in italic bold letters) on page 22 of the appended Technical Specifications under Section 4 - SURVEILLANCE REQUIREMENTS:

   quarterly - not to exceed four months

   In the paragraph following the list of definitions in Section 4 the comment concerning maintenance of established intervals applies to the quarterly intervals as it does to the monthly intervals: the quarterly tasks shall be performed at least four times during a calendar year of normal operation.

2. Changes of language intended to clarify some points and bring others up to date (12) - These items are listed here in order; each deletion is indicated by a strikeout and each addition is indicated by bold italic letters:

   this is an addition

   ~~this is a deletion~~

   a. Page 1: Definition 1.9 (Experimental facilities) - The present wording "vertical tubes" does not adequately define the experimental facility as intended; the reference is to holders which replace a fuel element or a dummy fuel element in one of the 85 core positions now available, so that a sample in such a holder can be irradiated at higher neutron fluxes than are available in the lazy susan and for times that may be greater than available in the pneumatic transport terminus. We propose to delete the reference to vertical tubes and to add a reference to sample containers replacing fuel elements or dummy fuel elements in the core. This is not a change in the materials which can be placed in the core; it is a clarification of the definition of such a facility.

   b. Page 2: Definition 1.17 (Radiation Safety Committee) - The definition as it now stands does not reflect the full scope of the responsibilities of the Radiation Safety Committee. The replacement definition is proposed after consultation with the Radiation Safety Committee and reflects the responsibilities of the Radiation Safety Committee as listed in the Part 30 (broadscope) license.

c. Page 12: Table 3.3A - Minimum Reactor Safety Circuits, Interlocks, and Set Points - (Scram Channel) - We propose to delete the references to "~~Wide Range Linear Channel~~" and to "~~Wide Range Log Channel~~", which refer more to a general type of instrumentation, and replace them with "***NPP1000*** Detector ***High-Voltage***" and "***NM1000 Detector High-Voltage Power Supply***", respectively, which specifically refer to the instrumentation now in place.

d. Page 13: Table 3.3A - Bases for Reactor Safety Channels and Interlocks - (Scram Channel) - We propose to delete the references to "~~wide range linear power channel and the wide range log power channel~~" and replace this with "***NPP1000 and NM1000 power channels***" to be more specific about the instrumentation now in place.

e. Page 14: Table 3.3B - Measuring Channels - We propose to add the designations of the instrumentation in both the listing and in the bases for this table, as given, in order to be more specific about this instrumentation.

f. Page 15: Bases - We propose to eliminate the reference to a specific number of years of experience and to refer instead to the initial date of operation of this facility in order to convey the extent of our experience. Six years have passed since this item was written and there is no indication that this will not continue.

g. Page 17: Confinement (Specification) - We propose to add the words "***Door 10***" to the mention of the external door of the reactor room in order to be more specific about the building.

h. Page 18: Radiation Monitoring Systems (Specifications) - We propose to add words to more completely describe the intended function of the Continuous Air Monitor. This monitor is intended to measure the radioactivity on particles separated from the air on a filter.

i. Page 24: Reactor Control and Safety Systems (Specifications - 2) - We propose to delete the reference to "~~wide range linear power channel~~" and add a reference to "***NM1000 percent power channel***" in order to be more specific about the channel which is being calibrated.

j. Page 25: Reactor Control and Safety Systems (Bases - 4) - We propose to change the reference to the number of years that have passed, just as in "f." above.

k. Page 39: Required Actions (In Case of Safety Limit Violation) - we propose to add conjunctions to indicate that all of the actions must be taken in case of this violation.

3. Change of the specification for the minimum period setpoint - The minimum period setpoint of 7 seconds was established for this facility in the original Safety Analysis Report (1967) and was repeated in the Safety Analysis Report of 1986 during the licensing of the reactor with a power upgrade to 300 kilowatts from 100 kilowatts.

Experience with this and other TRIGA-fueled reactors, some of which are licensed to pulse, indicates that this specification is extremely conservative and that the TRIGA-fueled reactors may be safely operated at periods considerably less than 7 seconds. This experience is summarized and analyzed in the report CREDIBLE ACCIDENT ANALYSES FOR TRIGA AND TRIGA-FUELED REACTORS, S. C. Hawley and R. L. Kathren, NUREG/CR-2387 (PNL-4028), 1982.

Our major concern with minimum period is that the fuel not be allowed to approach the Safety Limit, which in the case of the Dow TRIGA Research Reactor, with its one aluminum-clad (U-Zr)$H_{1.1}$ fuel element in the E or F ring, is 500 C. Considering the number of fuel elements (78) and the maximum core excess ($3.00) the safety limit cannot be approached in normal steady-state operation even if the full core excess should be inserted (400-500 kilowatts).

Even in the case of an inadvertent transient involving full insertion of the maximum core excess Kathren and Hawley conclude that TRIGA-fueled reactors would not endanger the public welfare. They considered the General Atomic Torrey Pines TRIGA Safety Analysis Report ($2.00, aluminum-clad fuel), the Reed College TRIGA Safety Analysis Report ($3.00, aluminum-clad fuel), the Washington State University MTR-TRIGA conversion Safety Analysis Report ($3.75, stainless steel-clad fuel), the Advanced TRIGA Prototype Reactor, and destructive tests with SNAPTRAN reactors.

There is seen to be no credible way that the Dow TRIGA Research Reactor could approach the Safety Limit under current loading conditions (77 stainless steel-clad fuel elements, one aluminum-clad fuel element, $3.00 maximum core excess (in the present configuration the core excess is $2.25)); indeed, similar reactors are licensed to pulse, with periods of the order of milliseconds.

However, the Dow TRIGA Research Reactor is not presently licensed to pulse and the research program does not now include applications requiring pulsing. The research program does require steady-state operation in the 240- to 300-kilowatt range and for purposes of control a limit on the minimum period would seem to be advisable. In particular the minimum period should be such that the rise to steady-state power should be controllable to prevent overshoots and possible activation of the Limiting Safety System Setting on power level, which must not exceed 300 kilowatts.

A thoughtful reduction of the minimum period setpoint would allow operation in a regime where an overshoot and subsequent activation of the power-level safety system setting would not be likely to occur, would allow attainment of steady-state power levels more quickly than is now the case, and would help to reduce the number of inadvertent shutdowns caused by random electronic noise at low power levels in the period-measuring circuit.

We propose to delete the specification of a scram at some limiting period and substitute an interlock which would prevent control rod withdrawal when the period is less than three seconds.

Such a period interlock system has been evaluated at other TRIGA reactors and is in use specifically at the General Atomics 250 kilowatt TRIGA Mark I reactor. For this reason the capability already exists in the software for the console now operating at the Dow facility. There would be no need to make any changes in the software; the change would consist of physically bypassing the period scram and of configuring the console to give a warning at the three-second period time. This warning automatically inhibits control rod withdrawal until the period becomes greater than the setpoint.

This interlock would prevent any operation which might exceed the Safety Limit, since periods of the order of milliseconds must be used to pulse this or similar reactors to such power levels. When the reactor power level is approaching the Limiting Safety System Setpoint the rate of change of the fuel/moderator temperature is such as to prevent inadvertent overrun of the maximum desired power level.

4. Change of the specification for examination of the fuel elements (4.5 Facility Specific Surveillance (page 28)) - This specification was originally framed in the 1967 Technical Specifications and was continued through the 1986 - 1989 relicensing process.

Experience with this reactor and with other TRIGA-fueled reactors indicates the fuel elements in non-pulsed reactors are dimensionally stable over long periods of time (see the Hawley and Kathren report cited above). No damage to fuel elements has been detected at this facility since shortly after the initial fuel loading when one of the original (used) fuel elements was found to leak radioactive fission products when the reactor was operating in the 100-kilowatt region.

Inspection of the fuel elements involves physical removal of each element and inspection for length and straightness at a position near the surface (but still under about three feet) of the water. Exposure of operators to radiation from the radioactive fuel elements is very low - it has not been detected at this facility - but under the policy of As Low As Reasonable Achievable (ALARA) such operations are routinely reviewed. Furthermore, such handling and gauging involves risks of damaging the fuel, such as by dropping an element from the insertion tool, and always involves bumping the fuel element during removal and replacement.

In order to meet the goals of the ALARA policy and to reduce the risk of fuel damage, and in light of the years of experience with inspection of TRIGA fuel elements, we propose to reduce the frequency of handling of fuel elements by a factor of five. We propose to inspect the fuel on a five-year basis rather than annually, inspecting each fuel element at least once each five years, with at least 20% of the fuel elements examined annually.

The present procedure (4.3.4, Annual Fuel Inventory) calls for inspecting all of the fuel elements visually and placing up to 25% of the fuel elements (different ones each year) in a go-nogo gauge which is intended to detect growth in length and either bend or growth in girth. This gauging process has been in effect for three years now and 59 fuel

elements have been gauged and found satisfactory. The procedure further requires that if any fuel elements fail the gauge test then all of the remaining fuel elements shall be subjected to the gauge test. Any fuel element which fails this test will be removed from the core of the reactor.

5. Change of the schematic chart of the administration (page 35) and specification of those functions where changes of personnel should be reported to the U. S. NRC (page 41) - The chart showing line management responsibilities and reporting functions involving the Dow TRIGA Research Reactor is modified to reflect present structure and nomenclature. The line management responsibility charts are presented for both the reactor staff and the health physics persons, showing the separation of authority between these two functions through three levels of management. The reporting functions are shown for health physics staff and reactor staff with respect to the two oversight committees.

The current Technical Specifications (Amendment 6) refer to "level 1 or level 2 personnel" for whom permanent changes in staff must be reported to the U. S. NRC, but "level 1" and "level 2" are not further defined in the Specifications.

We propose to modify Specification 6.6.2 (Special Reports, Page 41) to define those functions in which permanent changes must be reported to the U. S. NRC to include those persons who have the most control over the operation and the oversight function of the reactor: the reactor supervisor and the chair of the Reactor Operations Committee, respectively.

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