HAZARDS ANALYSIS BY THE TEST & POWER REACTOR SAFETY BRANCH

DIVISION OF REACTOR LICENSING

LOCKHEED AIRCRAFT CORPORATION

DOCKET NO. 50-172

TECHNICAL SPECIFICATIONS CHANGE NO. 2

By letter dated January 28, 1964, Lockheed Aircraft Corporation requested authorization to utilize a lithium hydride shield in conjunction with operation of the Radiation Effects Reactor (RER). Additional information in support of this request was submitted by letter dated March 13, 1964 and further clarified by a telegram dated March 26, 1964, later confirmed and amplified by a letter dated March 27, 1964. Lockheed's initial request sought authorization to use the proposed shield at reactor power levels up to 3 Mwt. However, the application did not discuss plans for controlling hazards due to tritium that would be produced in the shield during the course of its use at such power levels. Pending development of this information Lockheed has requested authorization use the shield in connection with experiments to be performed at a maximum reactor power level of 200 watts thermal for an exposure at this power level equivalent to no more than 60 hours. During such limited use, the amount of tritium produced in the shield would be negligible with respect to creating a potential hazard to operating personnel or the public. The following discussion pertains to use of the shield only at the 200 watt level and the attached Technical Specifications, in which Lockheed concurs, cover this limited use.

The proposed lithium hydride shield will be interposed between the reactor and experiments which are to be irradiated. The lithium hydride will be contained in a stainless steel container in the shape of a 75° annular sector of a cylinder having a curvature such that when it is positioned for a test, its entire inner surface will be approximately equidistant from the reactor vessel. The shield will be approximately 48 in. high and 16.5 in. thick. The shield will be mounted on a support structure which spans the reactor pool. The support structure is designed to move the shield in the vertical direction so that during the course of the experiment the shield may be remotely raised or lowered. This feature also permits the shield to be elevated for storage when it is not in use.

The principal concern with the use of lithium hydride is its chemical reactivity. The chemical reaction of lithium hydride with water is fairly vigorous, releasing large quantities of gaseous hydrogen which in turn could present a potential explosion hazard. In contact with air, lithium hydride may ignite spontaneously. However, the specific shield design proposed by Lockheed takes both of these possibilites into account.

When the shield is installed it will be supported in a position where it could conceivably be dropped into the pool along side the reactor if the support structure were to fail. We have reviewed the support structure in detail, and have found it to be conservatively designed with respect to all anticipated normal and abnormal loads. A minimum of two inches clearance is provided between the reactor structure and the shield support structure except on the

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bottom of the shield support structure where an interlock is provided which will deactivate the reactor lift 2 inches prior to contact. Clearances are thus ample to prevent contact between the shield and the reactor while the reactor is being raised or lowered. The shield will be moved vertically by an electric hoist. Failure of the hoist or hoist cable would not endanger the shield, however, since the shield is also supported by two other cables attached to a counter weight. This counter weight would limit the impact loading on the stops of the support structure to a safe value so that we do not consider it likely that the shield can fall into the pool. The support structure itself appears to be adequately anchored and braced to withstand any lateral loadings that can be anticipated.

There is a remote possibility that the shield support structure could be knocked into the reactor pool by runaway of the locomotive which is used to bring test cars to the reactor building since the railroad tracks extend to the edge of the reactor pool. However during use of the locomotive in the vicinity of the reactor building, the reactor is required to be shutdown and lowered into the pool. Such an incident under these conditions could lead to extensive damage to the reactor building if the hydrogen released from reaction of the hydride with water should detonate. However it is considered highly unlikely that any significant amount of fission product activity would be released from the reactor in such an event. As mentioned above there would be no significant hazard from tritium from this event due to the restriction on power level during use of the shield.

The shield container is in essence a pressure vessel designed for a positive pressure of 5 psig. In order to establish the integrity of the shield, leak tests at 50°C and design pressure have been performed and the results of the testing indicate that leakage should be negligible for the anticipated mode of operation. Overpressure protection is provided by a safety valve set to relieve at approximately 5 psig. Provisions have been made to keep the shield container filled with helium at all times to prevent air from reacting with the hydride. The possibility that a shield leak could lead to a fire is extremely remote when the shield is used at a reactor power level of 200 watts. Heat generation in the shield will be extremely small and the hydride will not reach a temperature high enough to ignite even if it were in contact with air. Furthermore, provisions have been made to bleed helium into the shield to exclude air in the event of a leak so that the possibility of a fire would be virtually eliminated.

It is our opinion that the lithium hydride shield can be utilized as proposed up to a reactor power level of 200 watts thermal subject to the limitations set forth in the proposed technical specifications without introducing significant hazards considerations not described or implicit in the Hazards Summary Report and there is reasonable assurance that operation of the reactor in accordance with these specifications will not endanger the health and safety of the public.

FOR THE ATOMIC ENERGY COMMISSION

Original Signed by

Saul Levine, Chief S. Levine
Test & Power Reactor Safety Branch
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Date: April 1, 1964