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INTRODUCTION

This report describes a portable shield which may be used to transport the HRT antimony-beryllium source from the LITR to the HRT reactor site, and to store the source during critical experiments preliminary to bringing the reactor to power. The shield consists of a 16 in. dia lead pig (the existing HRT fluid sample carrier) centered in a 50 in. dia x 42 in. deep steel tank filled with borated water.

DISCUSSION

For purposes of economy, since the shield is intended to be used for this one job only, the existing HRT sample carrier¹ and a salvaged 300 gal tank were used as the basis of design. This combination provides 7 in. of lead gamma shielding and 17 in. of borated water for neutron attenuation. A new plug for the sample carrier was designed to permit raising or lowering of the source during critical experiments without opening the top of the carrier; attached to the plug is a simple locking device, similar to that on a venetian blind, which permits positioning of the source at intermediate levels. The bottom of the carrier is shielded by a sliding lead block which may be withdrawn in order to lower the source from the carrier. The carrier is centered within the tank by means of a spider and platform welded to the tank. The total weight of tank, water, and carrier is approximately 4800 lbs. Although not shown on the drawings, an inexpensive fishing reel, welded to a C-clamp, may be used to hold the excess cable attached to the source.

Gamma activity of the HRT source, which has been irradiated in the LITR since May 25, 1956, will probably be in the order of 160 Curies; the neutron emission rate is estimated at 8×10^8 n/cm²-sec.² The dose

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rate at one meter from the unshielded source will therefore be about 210 r/hr. Assuming a point source at the inside wall of the lead carrier, and that all neutrons are absorbed in the water, the dose rate at the surface of the lead carrier was calculated to be 5.4 r/hr; the dose rate at the surface of the water tank was found to be 56 mr/hr.³

USE OF THE SHIELD

The source will be removed from the stainless steel "shim" used for positioning in the LITR by LITR personnel. LITR personnel will also attach the stainless steel cable to the source and position the source in its portable shield. During transport and storage the total shielding of both lead and water will be employed. During critical experiments, however, it will be necessary to remove the lead sample-carrier from the water in order to permit lowering of the source from the carrier into the thimble of the reactor vessel. Because of the high radiation level at the boundary of the carrier (5.4 r/hr) personnel will be required to remain at least 20 ft from it (assuming that a full days radiation dose is to be absorbed in a twenty minute period, i.e., a rate of 180 mr/hr for a 20 min period), thus necessitating remote handling of the carrier. After positioning of the lead carrier over the reactor vessel, the source may be positioned at intermediate levels within the thimble with the aid of the locking device on the plug of the carrier. The cable attached to the source may be marked at one foot intervals to indicate the position of the source.

A steel plate will be placed over the opening in the roof plug over the reactor vessel thimble, and the lead carrier placed over this. The source will be lowered through a 4 in. hole in the plate coinciding with

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the bore of the thimble. The bottom of the bore of the carrier is shielded with a sliding lead block which must be withdrawn before the source may be lowered. An extension of the thimble, fitted with a funnel at the top, is provided to compensate for misalignment of the thimble and carrier during the remote positioning operation.

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REFERENCES

1. ORNL Drawing D-21590.
2. T. C. Weeks, verbal memo to C. A. Burchsted, September 7, 1956.
3. G. W. Rivenbark, memo to S. E. Beall, HRT Source Shield, October 29, 1956.

PORTABLE SHIELD
FOR HRT SOURCE

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