UNIVERSITY OF MISSOURI

Office of Research Safety
518 Clark Hall
Columbia, Missouri 65211
Telephone: (314) 882-3721

August 4, 1986

FEE EXEMPT
170.11(a)(8) - State

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Materials Licensing Branch
Region III, US NRC
799 Roosevelt Road
Glen Ellyn, Illinois 60137

Attn: William J. Adam, Ph.D.
Ref : License 24-00513-32

Gentlemen:

A group of investigators wish to perform Mössbauer scattering experiments with an intense beam of low-energy gamma radiation. Four radionuclides have been selected as suitable sources: samarium-153, gadolinium-153, dysprosium-159, and thulium-170. The sources will be prepared at our Research Reactor Facility as ≤ 100 curie, sealed sources in quartz ampoules of 8 mm diameter, 13 mm high cylinders having a 1 mm wall thickness. Authorization for a total activity of 200 curies for all sources in use is requested. The sources will be prepared from high-purity enriched material to prevent any significant radionuclide contamination being included during the activation process. The description of the procedure for preparing the source within the quartz ampoules was described in our letter to you dated May 8, 1984, in reference to the preparation of Dy-159 sources. A copy of the sketch of the source capsule is enclosed. The same procedures will be used to prepare sources of the four radionuclides specified in this amendment request.

In addition, the following radiation protection requirements have been stipulated for these sources: each sealed quartz ampoule will be placed in a tungsten shield/collimator (see Figure 1) having a minimum thickness of one inch of tungsten surrounding the source; the source will be loaded into the tungsten container at the Research Reactor Facility and the dose rate outside of the shield/collimator will not exceed 10 mrem/h; the source will not be removed from the tungsten container until the end of its useful life; the tungsten container will have an identification label affixed that will include the radionuclide, activity, and date the activity was determined; the label will include the wording and color requirements of 10 CFR 20.203(f); the source will be transported from the Research Reactor Facility to the Physics Building in a GE 8500 shipping cask; after delivery to the Physics Building, the tungsten shield/collimator will be removed from the shipping cask and securely fastened in a dewar can and the can will be securely fastened in a stainless steel jacket (see Figure 2); the outer jacket will also have a radioactive material label affixed; and health physics personnel will be present during the transportation of any source and during the time the source container is removed from the shipping cask and placed in the dewar.

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The source will be used in room 332 of the Physics Building. The room will be posted in accordance with 10 CFR 20. Not more than two sources will be in the Physics Building at any given time. The room will be locked and access will be limited. The beam from the source will be highly collimated. The shield/collimator with the enclosed source will be loaded into the dewar, then the collimator pin will be removed from the shield/collimator and the dewar placed into the stainless steel jacket. The beam will be blocked from exiting the dewar by a tungsten beam block attached to the stainless steel jacket (see Figure 2). When the scattering experiments are being conducted, the beam stop will be removed to permit the gamma beam to strike a target and be scattered. A block of lead about 3/8 inch thick, 4 inches high, and 14 inches wide will be permanently mounted behind the experimental apparatus to fully intercept the direct and scattered beam (see Figure 3). In addition, a red light will be activated by a microswitch when the beam stop has been removed from the dewar. Semi-annual wipe tests will be accomplished and recorded. A logbook will be maintained, listing: radionuclide, initial activity, and the dates of installation and removal of sources.

Theft of the source is unlikely due to the security and posting of the room, the massive weight (over 150 pounds) and labeling of the apparatus, the complex and redundant units bolted together, and the lack of value of the material. The likelihood of contamination is remote due to the fusing of the source to the quartz rod, the encapsulation within the quartz, the aluminum window between the encapsulated source and the tungsten blocking pin, and the tight-fitting, precision-ground connection between the two parts of the shield/collimator. The pin has a machined offset to physically prevent the pin from touching the aluminum window.

When the source activity is depleted, the dewar with the shield/collimator containing the source will be removed from the stainless steel jacket. The collimator pin and protective shipping cover will be replaced on the shield/collimator, which will then be removed from the dewar. The unit will be placed in a GE 8500 shipping cask for the unit to be returned to the Research Reactor Facility for removal and disposal of the source.

Please let me know if additional information is required. Because the primary investigator for this project will be in residence here for just a short time, your indulgence is urgently solicited to expedite this request for an amendment.

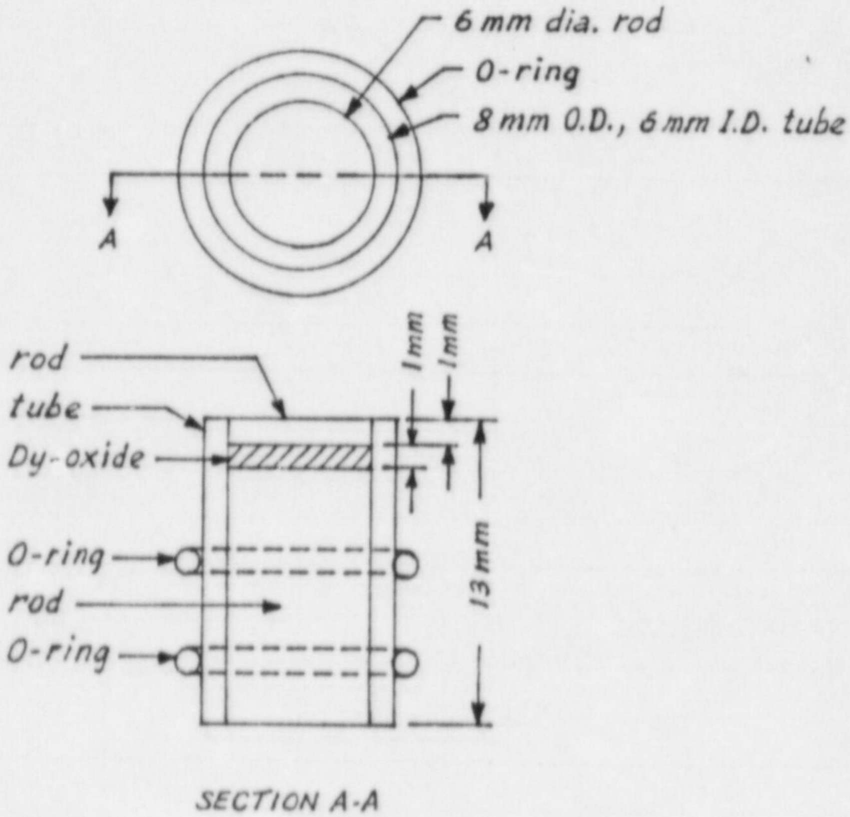
Sincerely,

John H. Tolan

John H. Tolan
Radiation Safety Officer

JHT:mh
Enclosures

cy James G. Mullen, Ph.D.
Wynn A. Volkert, Ph.D.
Philip K. Lee, Ph.D.
Robert M. Brugger, Ph.D.
Edward King



Sketch of Source Capsule

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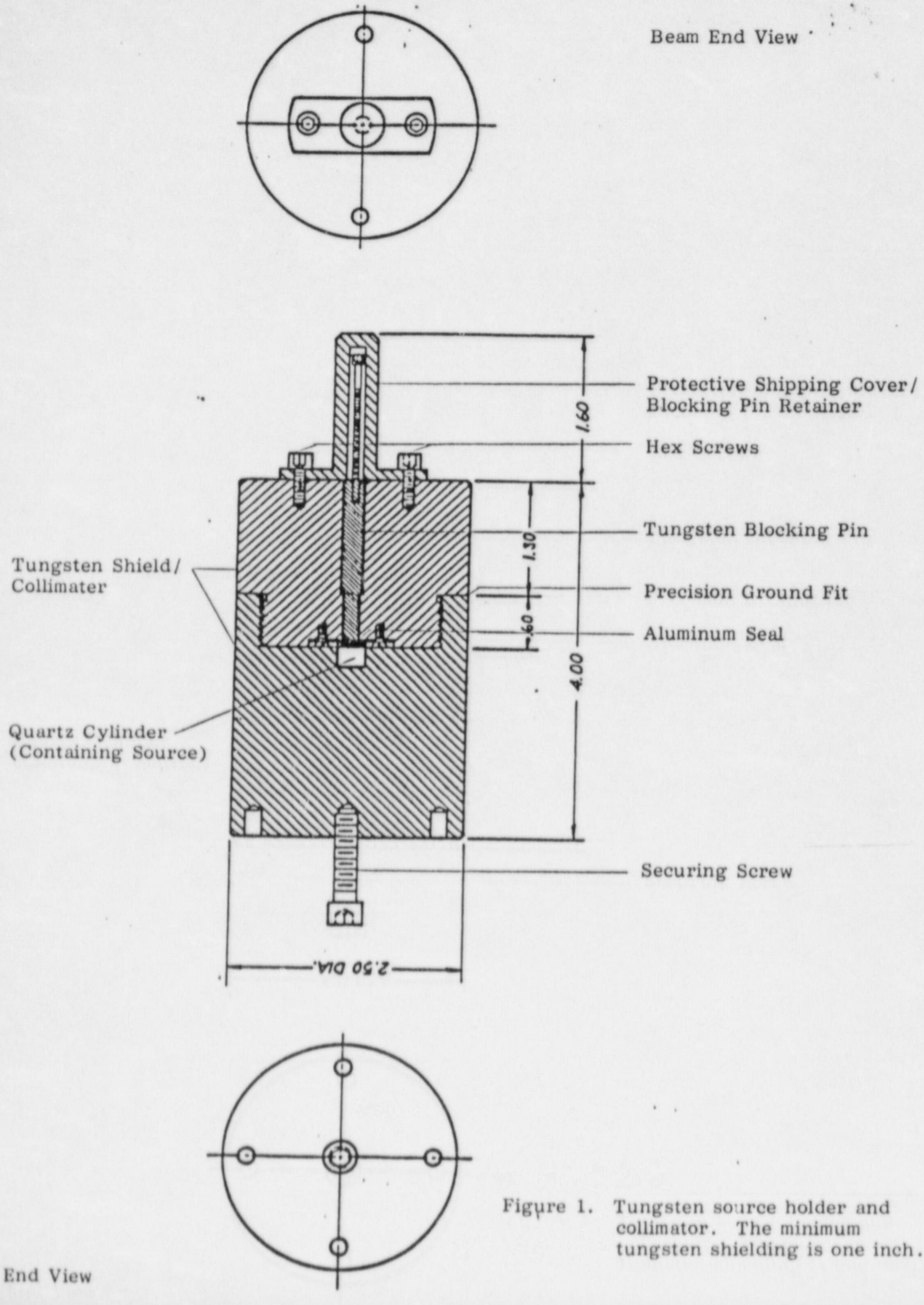

Figure 1. Tungsten source holder and collimator. The minimum tungsten shielding is one inch.

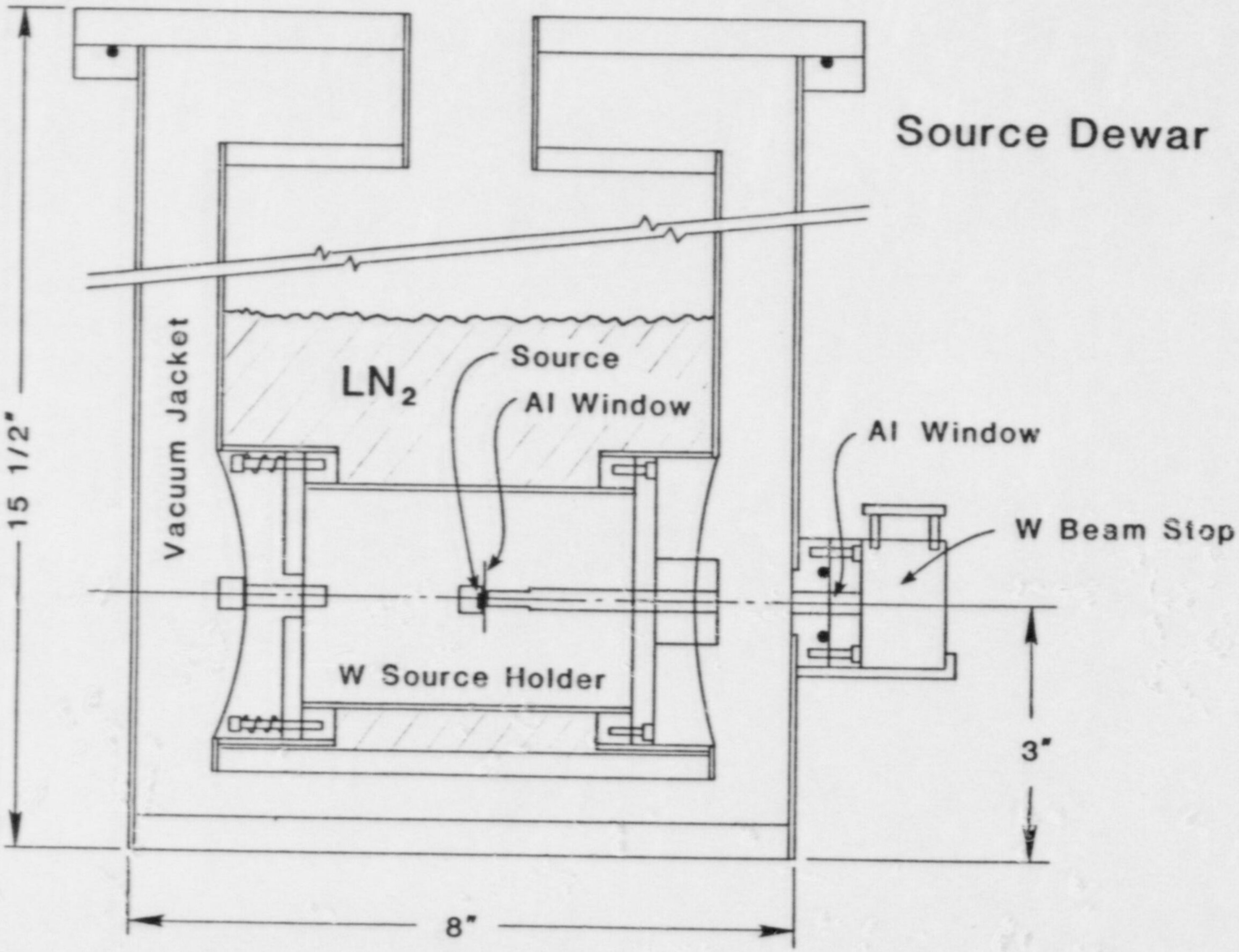

Figure 2. Source liquid nitrogen dewar can which contains source and tungsten holder. The beam stop is shown at the front of dewar.

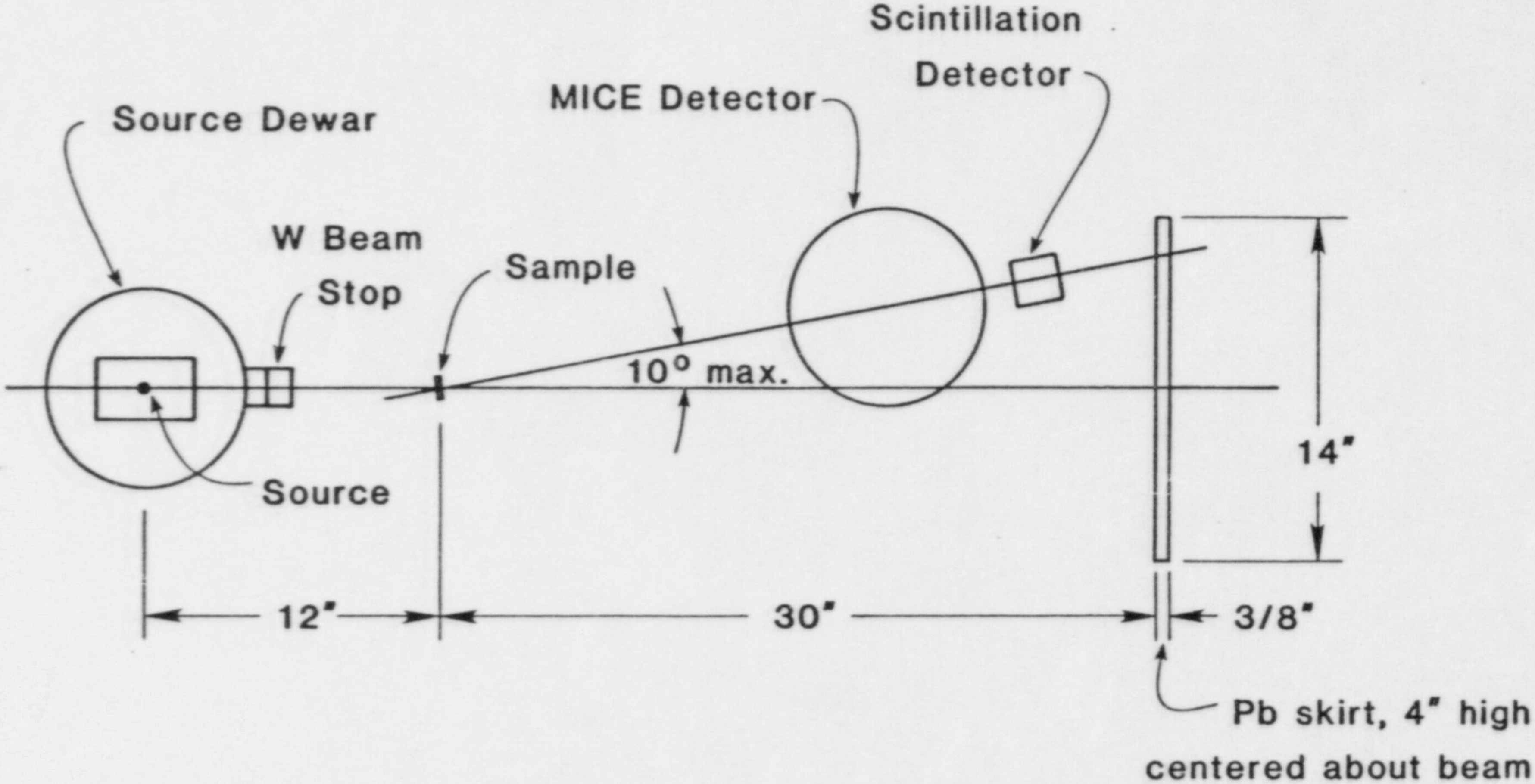

Figure 3. Schematic drawing of source can scattering crystal and MICE detectors. Lead fence at back edge of apparatus table serves as a beam stop when dewar beam stop is taken out.