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INSPECTION OF A FIRE-DAMAGED RADIATION SOURCE

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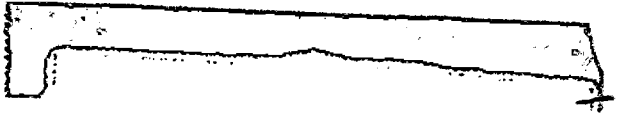

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Patrick W. Howe, Joseph E. Rainey, and Harvey F. Soule

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Abstract

A commercially manufactured cesium-137 radiation density gauge was inspected after a severe fire. The primary container was found to have come through with no spread of radioactivity.

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Introduction

On the night of October 17, 1959, fire broke out in the Booth Company cannery in Fremont, California. The fire was far advanced before an alarm was turned in and the cannery was totally destroyed. The magnitude of the fire is indicated in Fig. 1; the Fremont fire chief estimated a fire temperature of 2500°F.

The owner was licensed by the Atomic Energy Commission (License 4-2743-1) to use a commercial radiation density gauge containing cesium-137. The position of the gauge is shown in Figs. 2 and 3. A private consultant to the owner made a radiation survey of the ruins and found no contamination. The San Francisco Operations Office, USAEC, requested the Health Chemistry Department, Lawrence Radiation Laboratory, to dismantle the device as necessary to determine if the activity was still confined to the primary container.

Investigation Procedure

The radiation gauge at time of removal to the Radiation Laboratory on October 30 is shown in Fig. 4. Swipes of the outside showed no contamination detectable on conventional portable beta-gamma detection instruments. Dose-rate measurements were not significant except on the bottom of the device at the axis.

The radiation gauge was assembled in three main parts: (a) an offset section of process piping inside a split housing; (b) a detector housing bolted to the top flange of the split housing; (c) a source housing bolted to the bottom flange of the split housing.

The detector housing was unbolted, and when a thin aluminum cover plate was removed from the bottom a mass of lead was revealed (Fig. 5). Discussion with the manufacturer confirmed that this lead was not an intentional absorber for the detector head, but rather solidified lead from a melted collimator around the detector head.

The split housing was then opened. About one to two pounds of loose lead scrap was found inside.

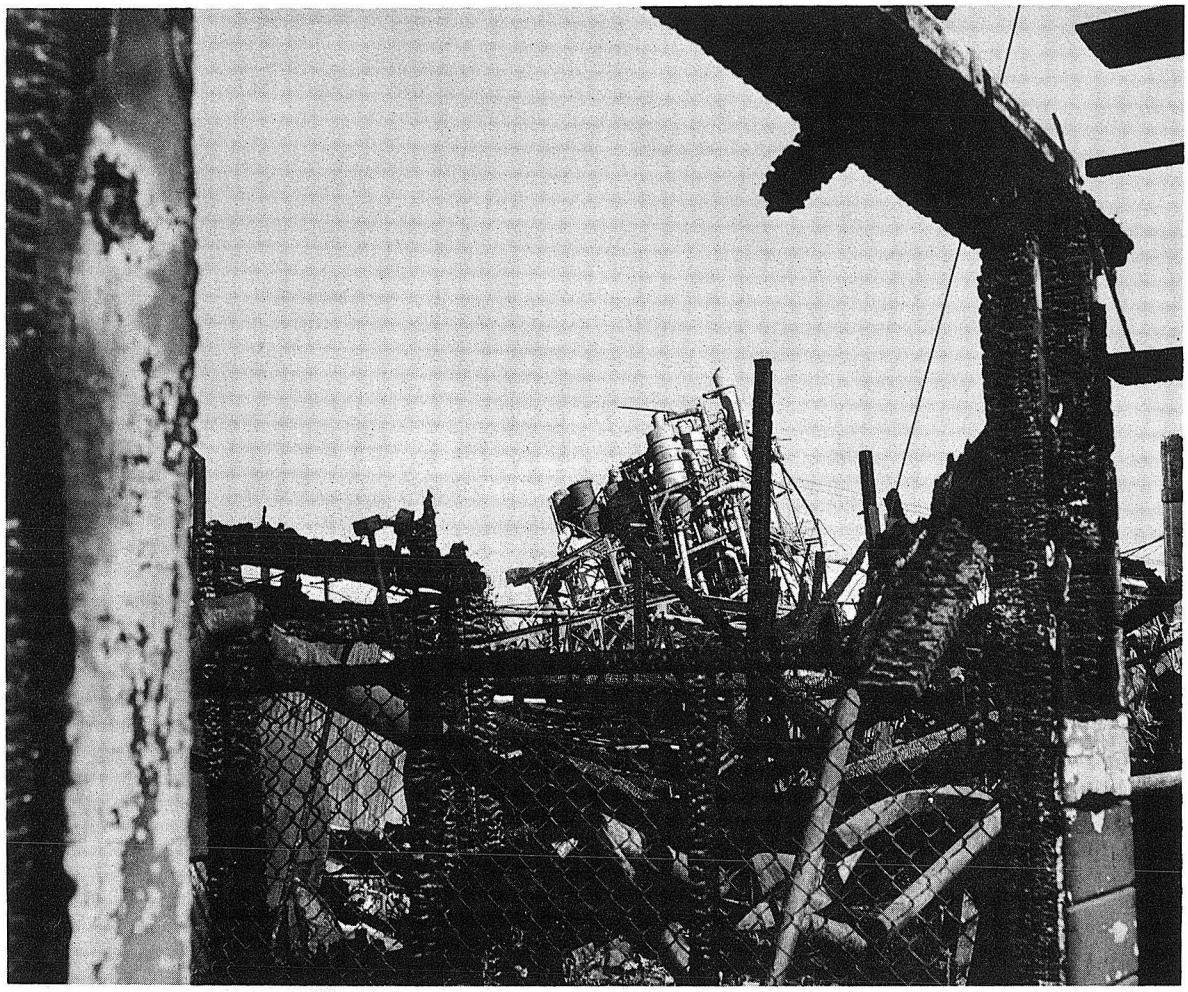

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Fig. 1. General view of ruins.

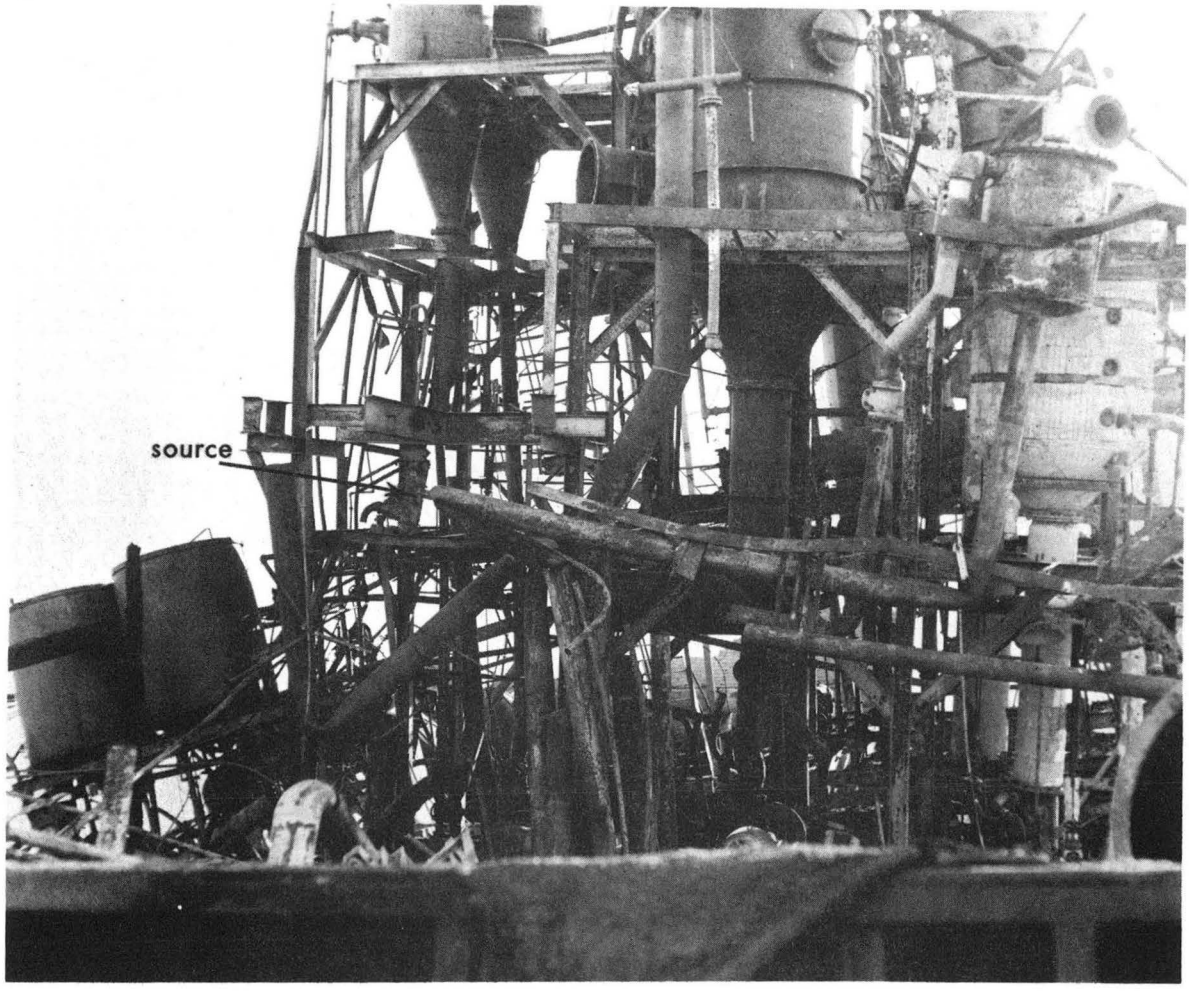

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Fig. 2. Process area, showing position of source.

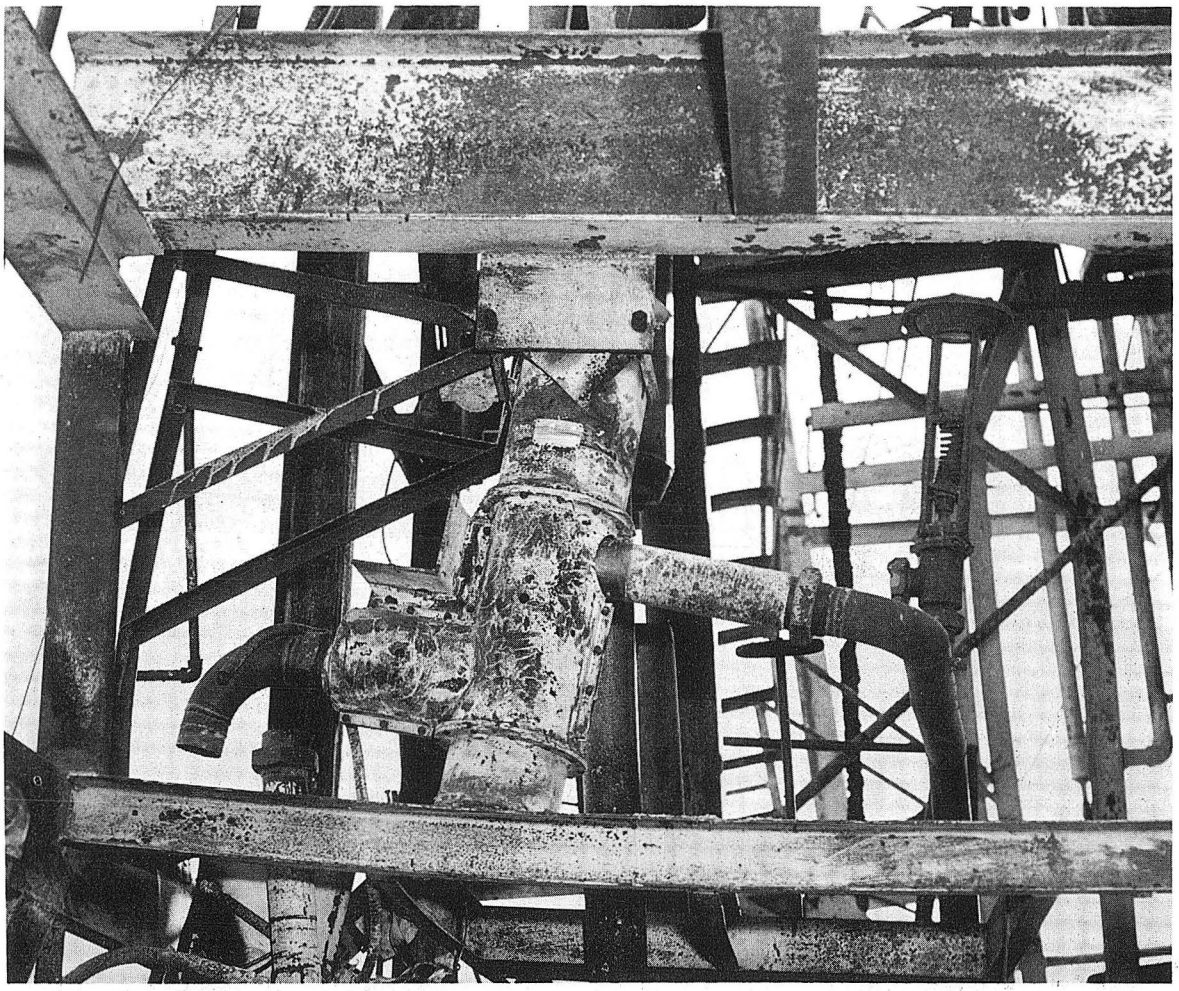

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Fig. 3. Structural mounting of source.

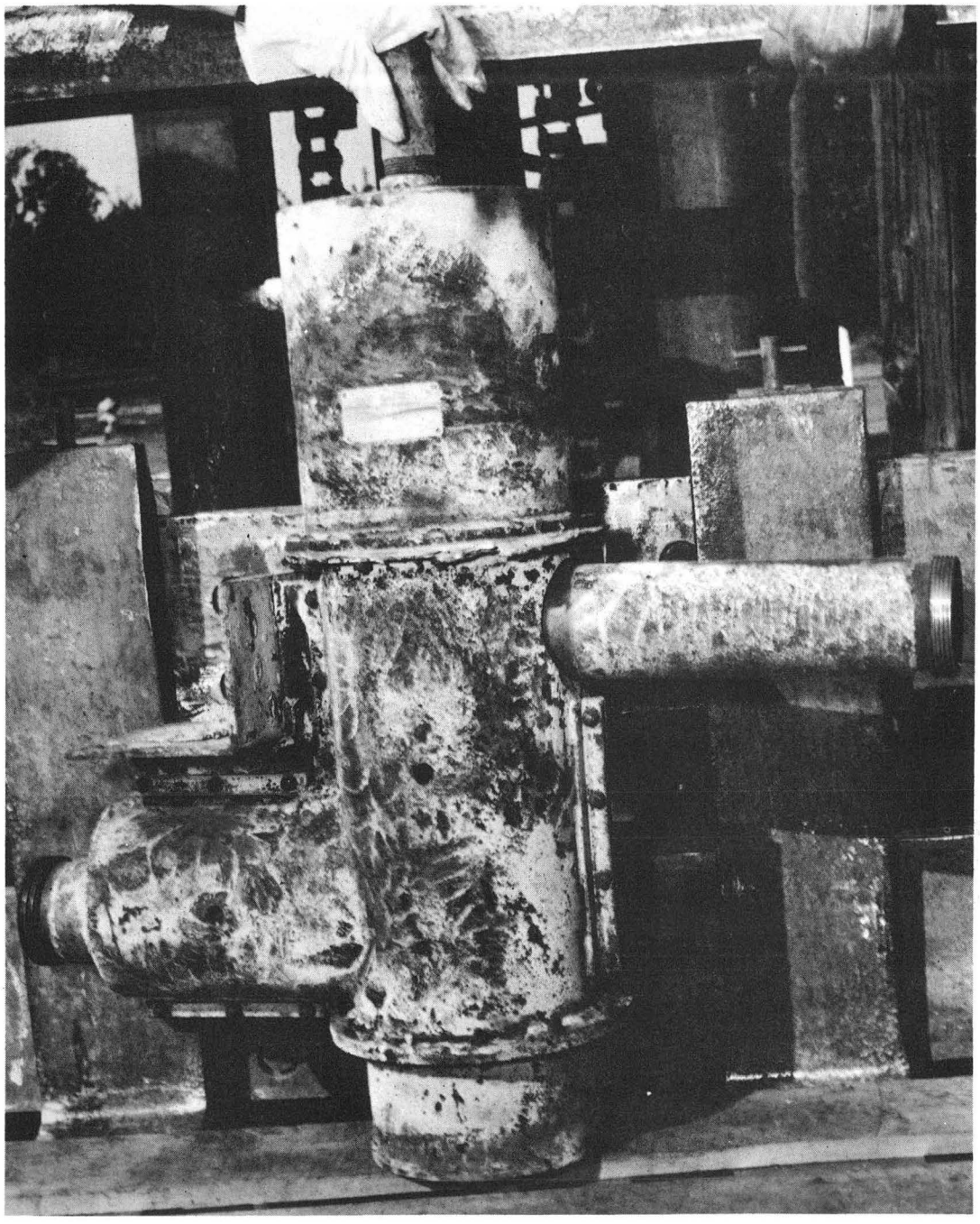

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Fig. 4. Source assembly as removed to Radiation Laboratory.

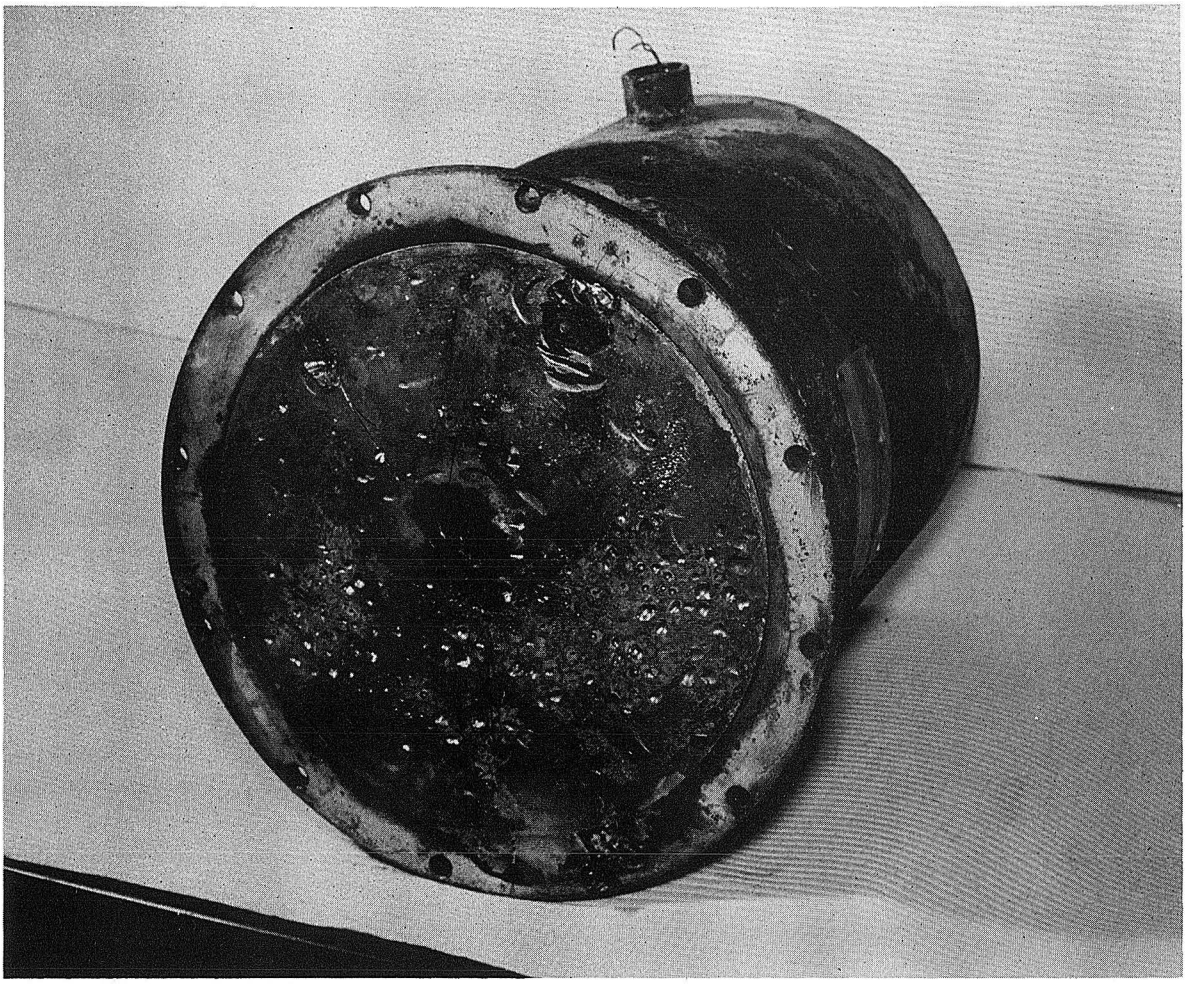

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Fig. 5. Detector housing from beneath, showing fused lead.

Radiation readings taken on the source housing confirmed that the primary activity container was at the bottom. Juno instrument readings (uncorrected for beam size) were 40 mr/hr at contact with the top of the housing and 10 r/hr at contact with the bottom. A traverse made about 1 foot away from the bottom showed practically no collimation.

In structure, the source housing was a steel cylinder completely closed except for two plugged pour holes in the top, and cored out on the axis. No plug was found in the top of the core hole. The lower end of the core hole was closed off (Fig. 6) by a large steel plate screwed to the source housing and a small steel plate screwed and soldered to the pot. A lead washer was between the two plates, pressed onto the smaller one. After the screws were removed the small plate was easily pried loose from the source housing in spite of the solder.

During the foregoing disassembly, swipes were taken repeatedly, but no contamination found. A probing rod was then inserted in the core hole and the cesium capsule forced out with considerable difficulty. It appeared intact and a swipe showed no contamination. A Juno reading of 44 r/hr at contact, uncorrected for source size, was obtained.

Two metal labels were found on the assembly. One, on the side of the detector housing, was not legible. The second, on the bottom of the source housing, appeared to be of thin aluminum plate which had partly melted. The radiation symbol and the wording "Radioactive material inside - Caution - 300 millicuries Cesium-137", together with the manufacturer's name and address, were distinct.

Figure 7 is an exploded view of the device. The components are (a) ring from detector housing; (b) detector housing; (c) aluminum end plate from detector housing; (d) insulating material; (e) structural bracket; (f) solidified lead pried loose from detector housing; (g) split housing for process piping; (h) lead scrap found loose inside split housing; (i) process piping; (j) source housing; (k) small steel plate; (l) lead washer; (m) large steel end plate; (n) radiation label mounted on end plate. The arrow (o) indicates the space from which the primary capsule was removed.

Conclusions

1. The cesium-137 capsule came though the fire with no spread of radioactivity.
2. The minimum shielding over the cesium capsule was 1/8 in. of steel plus 1/16 in. of lead. A radiation warning label, attached near this minimum shielding spot, had started to melt.

Recommendations

The "Radioactive Material" warning on devices of this sort should be stamped into the metal.

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Fig. 6. Source housing with end plate removed.

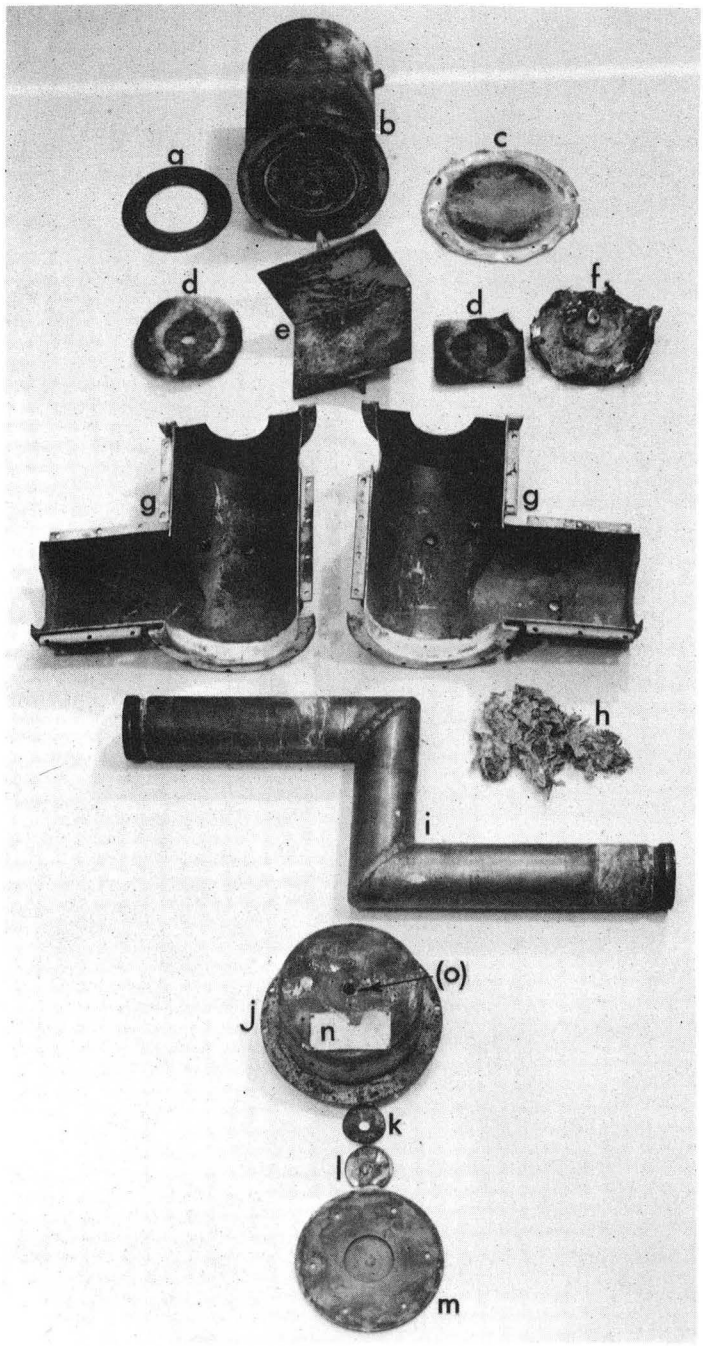

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Fig. 7. Exploded view of source assembly. (See text.)