Common Sense Radiation Protection in the Radiopharmacy: Utilization of Existing Resources

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A radiopharmacy generates a multitude of radioactive waste products including syringes, gloves, needles, absorbent paper, and expired and unused radiopharmaceuticals. We describe how lead delivery containers furnished by commercial manufacturers can be used to build storage containers for radioactive waste, which can reduce background radiation levels in a radiopharmaceutical manufacturing area. Shields from Squibb generators can be cut and joined to make decay pots, syringe and glove receptables, and vial containers. One-quarter in. sheet lead can be held in place by home-made supports to build side shields for drawing stations. The use of these shielding devices and storage containers has decreased the radiation exposure we receive despite handling multicurie quantities of activity daily.

The Intermountain Radiopharmacy Program provides complete radiopharmaceutical services to hospitals throughout a large geographical area. Our inventory consists of large amounts of radioactive materials and consequently we generate a large volume and variety of radioactive waste materials including contaminated syringes, needles, gloves, alcohol wipes, absorbent paper, and expired and unused radiopharmaceuticals. The storage and disposal of these contaminated waste materials present a difficult problem when working with the limited amount of storage space available at our institution. Even prior to the government's ALARA (*1*) concept of reducing personnel exposure to ionizing radiation, our philosophy was "the best amount of exposure is no exposure at all" and we have made several oral presentations that describe the techniques we use in our radiopharmacy laboratory (*2,3,4,*). Two of the more common obstacles to achieving maximum personnel protection from exposure to ionizing radiation are lack of concern and cost. With the current economic problems of double digit inflation and little available money, expenditures for costly radiation protection supplies are often given a low priority when budgets are prepared.

We describe how increased protection from radiation exposure can be accomplished by using existing resources at minimum cost.

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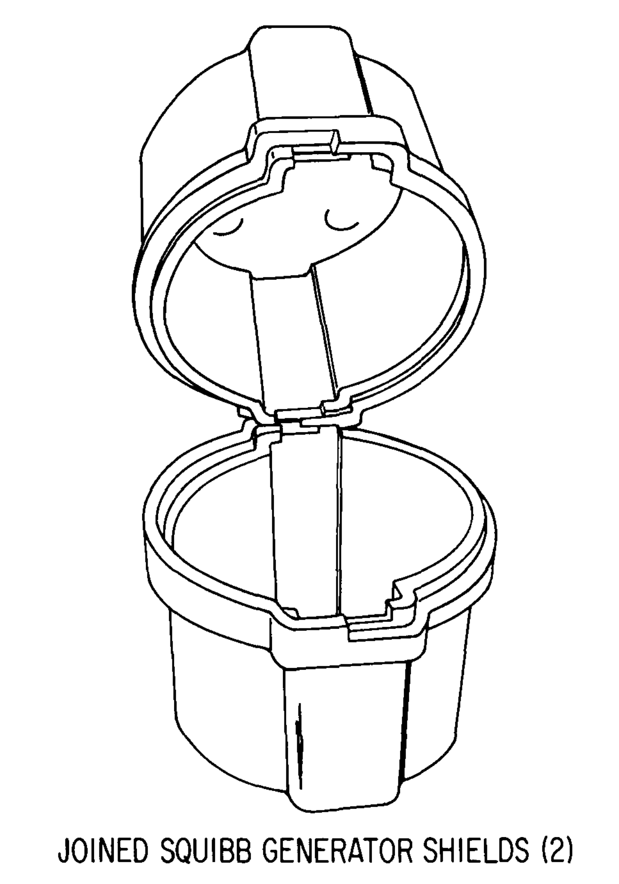

FIG. 1. Lead shipping shields for Squibb Tc-99m generators are used to fabricate storage pots for contaminated materials disposal.

Materials and Methods

All radioactive materials are shipped in containers that minimize the radiation emanating from the material itself. Shipments containing large amounts of radioactivity, such as Mo-99/Tc-99m generators, are provided with additional external shielding. We use the large lead shields that surround the Squibb Tc-99m generators during shipment (Fig. 1) to make lead storage "pots" that can be used for disposal of contaminated materials. These lead shipping containers can be cut and soldered to form storage containers of different heights as shown in Fig. 2. The soldering line does not affect the shielding when the containers are joined snuggly. The tops for

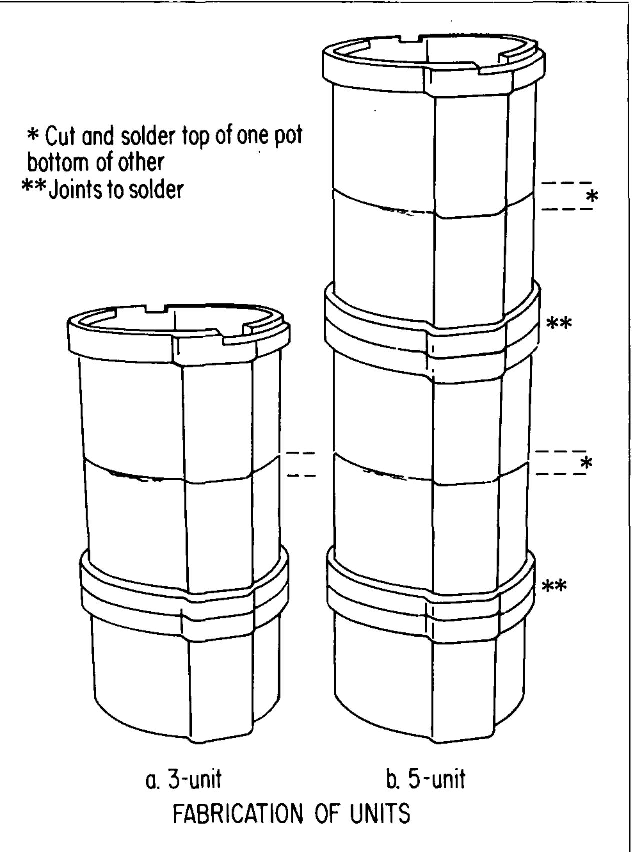

FIG. 2. Soldered, lead shipping containers of varying heights for different purposes.

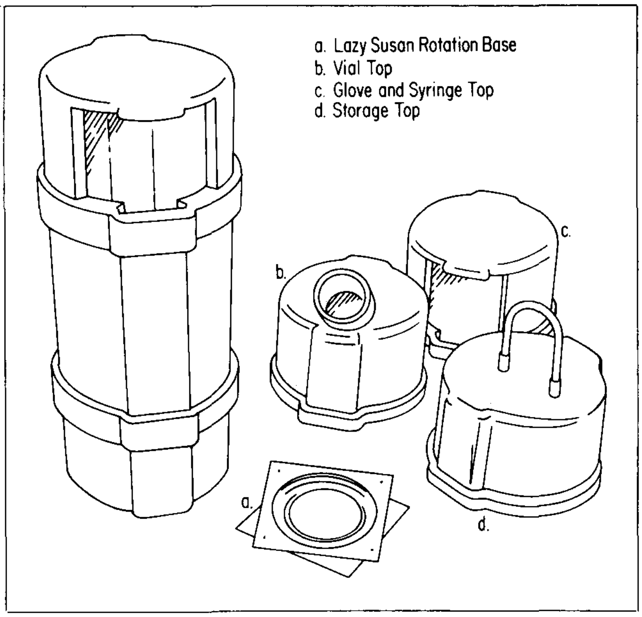

FIG. 3(A). "Lazy Susan" bearings for rotation of waste storage containers. (B). Waste container designed for disposal of expired or unused radiopharmaceutical vials (C). Waste container designed for disposal of gloves, syringes, needles, swabs, etc. (D). Solid top for waste storage.

these waste containers are then designed with a specific style of opening to accommodate different types of waste materials. (Fig. 3A).

To further decrease exposure to personnel during the manufacturing process, the storage containers are placed on "lazy susan" bearings so the container may be rotated and the "opening" is facing away from the pharmacist or technologist when not in use. The container that is used for disposing vials of expired or unused radiopharmaceuticals has an opening that is made by drilling a hole in the top of the pot and soldering a lead container (such as those for NEN's thallium-201 or Mallinckrodt's therapeutic iodine-131, depending on the diameter of opening necessary) in the top at a 45° angle as shown in Fig. 3B. The waste container designed for disposal of gloves, needles, syringes, and swabs (Fig. 3C) is made by cutting away a section of the top of the container and leaving an opening large enough for easy disposal of contaminated materials during the manufacturing process. A solid top is used for waste storage (Fig. 3D).

Results

These two waste containers are located in the dose drawing station on either side of the dose calibrator (Fig. 4).

Because the waste containers placed in the drawing station are designed to hold only the amount of waste generated during one day, larger units, fitted with solid tops, were constructed. These larger waste containers are then used to hold an amount of waste generated over two or three days. The waste is transferred daily from the smaller pots in the drawing station (Fig. 4), to the larger storage units (Fig. 5), where it is allowed to decay to background. To facilitate the removal and transfer of the radioactive waste material, the bag containing the vials, gloves, etc. is removed to one of the larger waste containers, which also contains a plastic bag. We have 16 of the larger containers, which are numbered and used for storage of Tc-99m waste (Fig. 5). When the highest numbered container is filled, we are able to empty the first container, which will have decayed to background. The decayed material can be monitored, the readings recorded, and the material placed in the trash for disposal. To promote easy removal of the waste container tops and prevent smashed fingers, each top is fitted with a standard U-bolt, which serves as a handle (Fig. 3D).

The construction and design of areas for preparing and drawing up doses of radiopharmaceuticals often neglect protection from exposure to personnel outside the drawing station. In order to minimize the amount of radiation escaping from the drawing station, we have placed ¼ in. lead sheets, supported by a brace of angle iron, on both sides of each drawing station (Fig. 4). These side panels, incorporated with commercially available L-block shielding, provide a very functional area where radiopharmaceuticals may be prepared with a minimum amount of exposure.

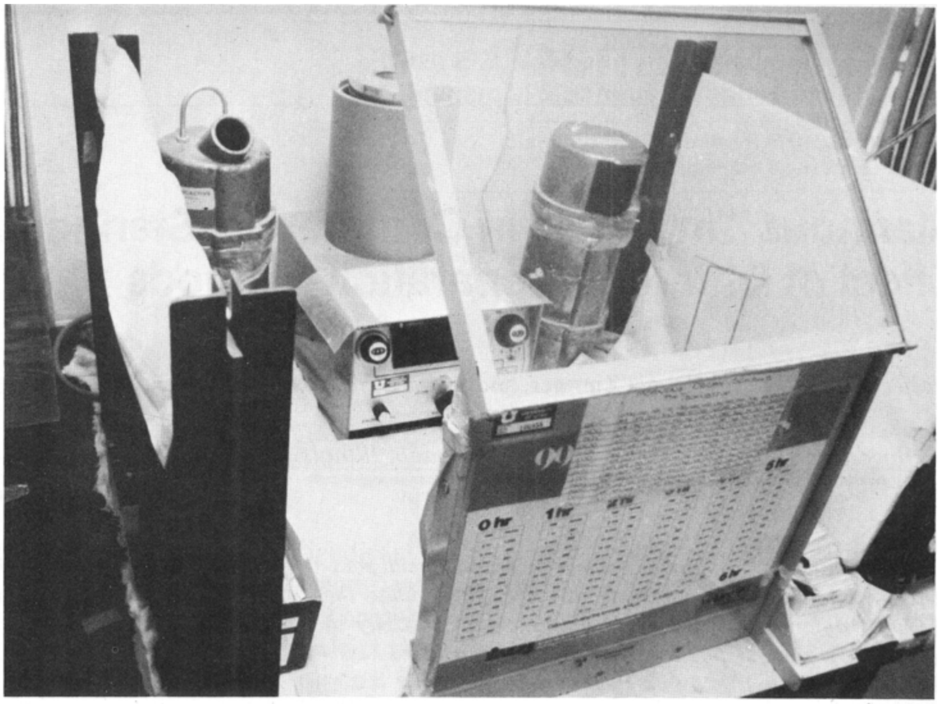

FIG. 4. Drawing station surrounded with ¼ in. lead shields supported by a brace of angle iron. Note waste containers located on either side of dose calibrator.

FIG. 5. Larger containers are numbered and utilized for storage of Tc-99m waste.

Conclusion

We feel these relatively inexpensive innovations can be extremely helpful in decreasing exposure in the radiopharmaceutical preparation area.

References

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