

IONIZING RADIATION

to have been spilled and perhaps spread. Everything that leaves the plant should be monitored, including wastes, water, air, trash, and materials in process. Searches should be made wherever employees may have contaminated facilities, such as scrub-up sinks, retention tanks, or doorknobs. Work clothing and other items likely to be contaminated because of their use should also be monitored.

In most cases, radiation and radioactive materials are easy to detect. It is good practice never to assume that an item is radioactively clean, especially since a check can so readily be made. Even if there is little risk of injury, it makes good sense to clean contamination from the skin, hands, feet, clothing, and equipment since usually only a good scrubbing is required.

Decontamination

Decontamination is essentially a process of washing, cleaning, and safely disposing of radioactive "dirt" to clean the area or to prevent contamination of counting equipment, research materials or equipment. Since the contaminants cannot be destroyed, they must be transferred to a place where they will do no harm while they are decaying.

Several methods of decontamination have been used*. Scrubbing and washing down with a hose stream of uncontaminated water will carry away easily removable contamination. However, care should be exercised to prevent further spread of contamination by the force of the hose stream.

Tenaciously adhering contaminants (grease and industrial grime) can sometimes be removed by scrubbing and scouring with steam, soap, or synthetic detergents and with dry cleaning solvents.

Absorbed or surface-reacted contaminants can be removed by chemical reagents (citric, pyrophosphoric and hydrochloric acids, and their sodium salts, oxalic and nitric acids are often used as are various proprietary decontaminating agents) which dissolve or form complexes with the contaminant or by removal of the contaminated surface (stripping paints with paint remover, planing wood, sandpapering, burning with a blow torch, or sandblasting) in such a manner that the contaminated material can be safely collected and disposed of. Consideration should, of course, be given

to avoidance of chemical toxicity and flammability in the cleaning solvents used, see Chapter 41.

If decontamination is impractical, there are several possible courses of action:

1. The area may be temporarily abandoned and isolated until the radiation intensity decreases by natural decay of short half-life radioisotopes.
2. The contaminated surfaces may be sealed off with spray coatings of paints or plastics to fix the radioactive matter (not necessarily shield it) if the contaminants are alpha or beta ray emitters and there is relatively little secondary gamma- or X-radiation to guard against later troubles, a decal over the painted surface can indicate that contaminated surfaces are covered by the paint.
3. Some contaminated articles may be disposed of by deep burial or by sinking in deep water in the ocean.
4. Other contaminated articles may be returned to their original service after reduction of contamination to acceptable levels.

After decontamination, the wash water and rubble must be carefully disposed of either by burial in controlled areas so that it will not be dug up before it has decayed (Fig 42-17), or by isolation, or by sea disposal. Really deep burial (several thousand feet) is under investigation for liquids and sludges. Land burial of solid wastes is commonly done at 10 to 20 feet depths. If the levels are within guide limits, decontamination wash water is often disposed by dilution and discharge to storm or sanitary sewers.

It generally is advisable to carry out the decontamination of large areas in two steps. The first step is a preliminary careful wetting down with plain water or water with an admixture of detergents, which will remove a considerable amount of the surface contamination and reduce the radiation level to make the second step safer. Dry

*See "Decontamination Techniques for Small Equipment," by John B. Huff, *Nucleonics*, 19 151-153 (Nov. 1961).