Low-Level Radioactive Waste Management

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THE SAFE DISPOSAL of low-level radioactive waste has in recent years received increasing national attention. Of particular concern has been the availability of shallow land burial sites in face of the increasing volume of low-level radioactive waste produced and the limited capacity of sites currently open. The problem of adequate and safe disposal has serious implications regarding the protection of the environment and the health and safety of the American public. In particular, patients must not be denied the diagnostic and therapeutic advantages of safe and effective medical technologies due to a lack of safe disposal sites for the low-level radioactive waste that such technologies may produce. For this reason, the position of the American College of Physicians necessarily focuses on the present need to resolve the problem of availability of disposal sites rather than on a discussion of the possible or potential technological alternatives to shallow land burial.

Position

The safe disposal of low-level radioactive waste is essential to protect the health and safety of the American public. A substantial portion of that waste is generated by the production of radionuclides and by their use in medical diagnosis, therapy, and research. Unless safe disposal sites are available, not only will the health and safety of the public be threatened, but the performance of critical medical activities will be seriously impaired.

Rationale

Low-level radioactive wastes are produced by myriad commercial activities—industrial, medical, and research—as well as through the production of electricity by nuclear energy. Low-level waste is characterized by relatively low levels of radioactivity, generally requiring little shielding and no cooling, and usually representing a potential hazard of limited duration (generally a half-life of hours or days). The Department of Energy has estimated that institutions (hospitals, universities, and research laboratories) generate one fifth of the total volume of low-level radioactive waste in our country (1). Hospitals generate low-level wastes by using radioactive materials in diagnostic procedures and therapies. According to an April 1983 General Accounting Office report (2), approximately 80 to 100 million nuclear medical procedures are performed annually in the United States, with an average-sized hospital producing roughly one semi-trailer load of low-level waste per year. Research institutions produce low-level waste through biochemical, biological, and physiological experimentation as well as through research in physics, inorganic chemistry, and geology. Industry generates low-level radioactive waste through the production of radiopharmaceuticals and the manufacture of watch dials and radiography instrumentation.

In medicine, radionuclides are used for diagnostic in-vivo procedures to establish the presence or absence of disease. Radiopharmaceuticals have been developed to examine many organs and body systems. Therapeutic in-vivo procedures use radioactive drugs for the treatment of specific diseases such as thyroid cancer. In addition, radioactive material is used for diagnostic in-vitro procedures to examine body fluids for hormonal or enzyme levels. In research, radioactively labeled biochemical agents are used to trace abnormal physiology, allowing for the development of specific treatments and drugs (3). According to the American College of Nuclear Physicians, 30% of all biomedical and cancer research in the United States is done using a radioactive marker. In addition, nearly 95% of early-phase drug research and development uses radioactive markers (4).

Low-level radioactive waste produced through medical uses consists of a wide range of materials, including dry solids, liquids, laboratory animal carcasses, and contaminated handling materials. This waste is generated not only by the administration of radioactive agents to patients but also as a byproduct of the preparation of radiopharmaceuticals. The radioactive half-lives of the many radionuclides used in clinical and medical research activities vary significantly and, accordingly, may be disposed of differently. For example, the half-lives of clinical radionuclides range from hours (6 hours for technetium-99, 13 hours for iodine-123) to weeks and months (60 days for iodine-125, 270 days for cobalt-57). The variation in the half-lives of medical research radionuclides is even more significant, ranging from 64 days for strontium-85 to 5730 years for carbon-14. Radionuclides with short half-lives, generally those used in medical diagnosis, decay quickly and may be disposed of as nonradioactive trash (for example, by incineration). However, the longer-lived radionuclides used in medical research as

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well as the radioactive materials and waste generated in the production of radiopharmaceuticals create a more significant disposal problem.

At present the primary method of disposal of low-level radioactive waste is through burial at commercial shallow land sites. The wastes are packaged in barrels or boxes, placed in long trenches, and then, as the trenches are filled, covered with several feet of earth. The trenches are monitored to detect and prevent any release of radioactivity into the environment. According to both the *General Accounting Office and the Department of Energy*, commercial shallow land burial sites are regulated by federal, state, and local agencies (2).

The federal government's regulatory authority is dispersed among at least four separate departments or agencies (Department of Energy, Department of Transportation, the Environmental Protection Agency, and the Nuclear Regulatory Commission). The Department of Energy has been characterized as the lead agency for overall national planning and coordination with the states and others for low-level waste management, and has provided the states with technical and resource assistance (2). The Department of Transportation is responsible for regulating the interstate transportation of hazardous material, including radioactive waste. The Environmental Protection Agency is responsible for developing general radiological criteria and standards for siting and operating low-level waste disposal sites. The Nuclear Regulatory Commission regulates and licenses the disposal of commercial low-level radioactive wastes as well as the activities of its generators and users, such as nuclear power reactors, medical facilities, research institutions, and industry. These responsibilities of the Nuclear Regulatory Commission have been assumed by 26 states (called Agreement States) that have demonstrated the capability and willingness to license and regulate low-level waste disposal facilities within their borders.

Presently, low-level wastes are disposed of in three commercial land burial sites—Hanford, Washington; Beatty, Nevada; and Barnwell, South Carolina; there had been six commercial sites in operation. The volume of low-level radioactive waste is always increasing. According to the General Accounting Office, 2.8 million cubic feet (84 000 m^3) of low-level radioactive waste was buried in 1979. The volume is expected to increase to 5 million cubic feet (150 000 m^3) in 1986, 6.5 million (195 000 m^3) in 1990, and almost 8 million (240 000 m^3) in the year 2000. The report concludes that by the "mid-1980s, the United States is expected to be generating more low-level radioactive waste than the three existing burial sites can or will accommodate" (2).

Without a place to dispose of their radioactive waste, hospitals, research institutions, nuclear power plants, industrial users, and manufacturers would have to attempt to store them on site or cease the affected activities entirely. Even if hospitals or research institutions have some on-site storage capacity, unless the radiopharmaceutical manufacturer can dispose of its radioactive byproducts, the production of radioactive medical products may be suspended. According to the General Accounting Office, stoppage of necessary medical activities nearly occurred in 1979, when both Nevada and Washington temporarily shut down their disposal sites and South Carolina restricted the volume of waste it would accept. The General Accounting Office report noted that some institutions, many of which used radioactive isotopes to treat or diagnose illnesses, claimed that they were within 2 weeks of stopping their nuclear medicine research services because of the temporary closures. Other sources of low-level waste were similarly affected by a lack of disposal space. This situation and the impending shortage of disposal space led to the passage of the *Low-Level Radioactive Waste Policy Act* in December 1980 (Public Law 96-573).

The Act clearly enunciates a federal policy that the individual states are responsible for providing the availability of capacity for disposal of low-level waste generated within their borders. The law authorizes, but does not mandate, the individual states to enter into regional compacts for the establishment and operation of regional disposal facilities for low-level radioactive waste. The compacts must receive congressional approval before they take effect. To provide a strong incentive for states to enter into regional compacts, the law specifically provides that beginning in 1986 congressionally approved regional compacts can prohibit the importation of low-level waste generated outside the compact region. Consequently, six regions are in various stages of compact formation: Central, Midwest, Northeast, Northwest, Rocky Mountain, and Southeast. California and Texas plan to develop their own individual sites. If successful, the regional compact approach will provide a comprehensive national program administered locally by the states for low-level radioactive waste disposal and management.

References

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