ENGINEERING

Hot Problem in Atomic Wastes

As the world accelerates toward its atomic future, the urgency of getting rid of the "hot" lethal waste products of the atomic industry keeps growing.

By RALPH SEGMAN

➤ AS THE NATION and the world develop a tremendous atomic-powered future, an equally large problem—the disposal of radioactive wastes—confronts planners.

The problem has had the attention of atomic energy specialists in past years and now is being taken up at open Congressional hearings by the Joint Committee on Atomic Energy (Jan. 28-Feb. 3).

If radioactive wastes were the kind that could be buried somewhere and forgotten, there would be little to worry about. But because of its nature, radioactivity can contaminate foods and pollute drinking water at great distances from the original dumping places.

Ordinary trash usually loses whatever toxic activity it contains in a fairly short time. Some atomic wastes may remain radioactive for a few hours or days. But others keep pouring out deadly radiations for as long as thousands of years.

The immediate and long-range effects of radiation on man are at best imperfectly understood. It is known that large doses of radiation can kill rapidly. This has happened to three atomic energy workers, none of them involved in waste disposal operations, since 1945. (Employees in the atomic energy industry are generally well-protected; their accident rate is below the national industrial average.)

Radiation Damage

Smaller chronic doses are believed to have deleterious effects but there is little specific information. In its 1958 report, the United Nations Scientific Committee on the Effects of Chronic Radiation says long-term exposure to certain radiation levels could cause illnesses after latent periods. It may damage blood-forming tissues and bring on the development of leukemia and a type of anemia.

It may also cause fibrotic and sclerotic changes in tissues, a diminished resistance to infection, a shortening of life span and malignant tumors. The U. N. report also points to genetic damage that may be carried from generation to generation.

Very small radiation doses are a subject of controversy, some scientists believing they do not cause biological and genetic damage and others arguing that no dose is too small not to have some such biological effect.

How then is the potent disposal problem now being handled and what are the future prospects?

Dr. Joseph A. Lieberman, chief of the Environmental and Sanitary Engineering branch of the U. S. Atomic Energy Commission's Reactor Development Division, said that the management of radioactive wastes is primarily concerned with the protection of man and his environment.

The AEC uses a series of standards for maximum permissible concentrations with which to work in all its programs, including waste disposal. They were developed and recommended by the National Committee on Radiation Protection under the National Bureau of Standards' sponsorship. The standards are complex since each organ of the body has its unique sensitivity to radiation, and each type of radiation has individual characteristics.

Actually, Dr. Lieberman said, there is more than a single problem. The wastes come in three forms: solid, liquid and gaseous. Some have high levels of radioactivity while others are relatively weak.

Is it possible to dispose of them into the sea or the atmosphere, or to store them for long periods of time?

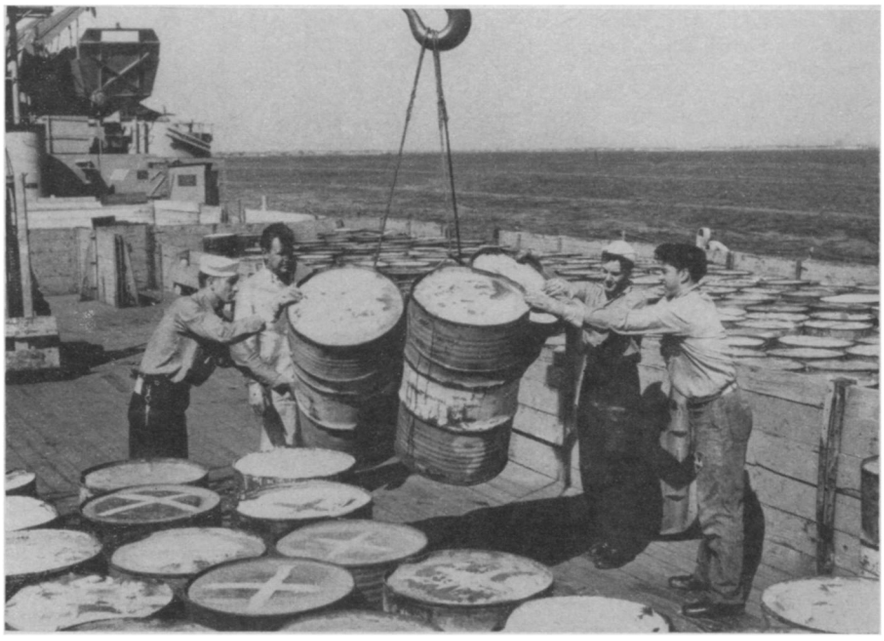
What are the geologic, oceanographic and meteorologic characteristics of the disposal and storage areas?

With these and other considerations in mind, Dr. Lieberman put the approaches to disposal into two rough categories. One is a technique for handling low level wastes containing quantities of radioactive materials as small as fractions of a millionth of a curie—a curie being the equivalent of one gram of radium. Dr. Lieberman called the technique the "dilute and disperse approach." Some low level wastes are dumped at sea to sink 1,000 fathoms or more in concrete-lined containers. Should the containers deteriorate, the wastes would be diluted to negligible levels in the water. At present, the AEC has designated ocean dumping areas 120 miles off the New Jersey coast and 60 miles out of San Francisco.

Gaseous Wastes Filtered

Gaseous wastes containing radioactive materials are routed through filter systems for removal of small particles and then passed out a high stack to be dispersed by the atmosphere. In order to insure safety, the atmosphere and environment are thoroughly investigated. For this, the AEC has enlisted the aid of the U. S. Weather Bureau, the U. S. Geological Survey, the U. S. Public Health Service and other specialized agencies.

What could go wrong with this kind of set-up is exemplified in the Windscale air-cooled reactor accident in England a year and a half ago which indirectly involved the waste control system. In a maintenance operation, the uranium fuel overheated and caught fire, sending fission products out the stack. Radioactivity spread over a wide area contaminating pastures and authorities were forced to condemn 250,000 gallons of milk. Newer reactors are not of the air-cooled type and have multiple controls that reduce the



RADIOACTIVE WASTES READY FOR DUMPING IN OCEAN—Two sailors and two health physicists from the Brookhaven National Laboratory, Upton, N. Y., stow low level radioactive wastes aboard a Navy LST for disposal at sea. This Brookhaven picture was made at Floyd Bennett Field, Brooklyn.

probability of such an accident recurring.

High level liquid wastes, containing up to hundreds of curies per gallon, are handled through what Dr. Lieberman called the "concentrate and contain approach." At present, these powerful waste products are kept at the AEC's Savannah River, Idaho and Hanford installations away from highly populated areas. Stored in specially designed underground steel tanks holding from 50,000 to 750,000 gallons, some wastes require cooling to prevent boiling due to the heat of radioactive decay.

Dr. Lieberman said there is little danger in these areas of radioactivity seeping into ground water and becoming a biological hazard. Should materials escape from the primary containers their radiations could be detected and the leaking tanks could be emptied. The ability of natural soils to absorb and hold certain radioactive isotopes might also be considered a safety factor.

Dr. Lieberman is skeptical about the disposal of high level wastes into the sea and he believes it never probably will be done. Not only do there appear better and cheaper ways, he said, but our knowledge of the sea environment, its mineral resources and its life is not complete.

Uncontrolled radioactive contamination could possibly render some of man's seafood and marine resources useless.

The disposal of radioactive wastes until now seems to have been well and safely handled. But what about the future with its expected large concentrations of nuclear reactors?

Tanks Hold 60,000,000

It is estimated that the U. S. in the last 14 years has accumulated 60,000,000 gallons of radioactive wastes in storage tanks. Some of the materials will remain dangerous for centuries, plutonium for at least 24,000 years. By the year 2000, the accumulated high level liquid waste volume has been estimated to reach approximately 2,000,000,000 gallons.

Dr. Lieberman cited some research into the problem. Four possible future techniques for managing high level wastes are:

1. Conversion of liquid wastes into chemically inert solids. For example, montmorillonite clay absorbs some radioactive materials. The clay is heated to 800 degrees centigrade causing a collapse of its lattice structure around the radioactive materials. Thus held fast in solid form the waste substances are impermeable to water and will not dissolve away. The solids may be stored in special locations indefinitely.

2. Direct disposal into geologic formations. Investigations are just beginning into the feasibility of using salt structures, impermeable shales and porous formations.

3. Disposal into deep wells and basins containing brines. Drilled for the purpose, the wells, according to preliminary reports, will have to be not less than 3,000 feet deep.

4. Specific removal of certain usable fission products. Long-lived radioactive products that might be useful in medicine and industry could be separated and removed from short-lived wastes. The removal would have to be enormously efficient if it were to serve a useful disposal purpose.