doubled then the number of cancer cases will rise by an amount equal to the natural incidence of that cancer. Thus, if one population shows a natural cancer rate of 70 cases per million and another has 700 per million, doubling the dose would produce 70 new cases in the first instance and 700—not 70—new cases in the second.

A situation exists today that can be studied to test the concept. Americans have relatively little stomach cancer when compared to the Japanese. As a consequence of the atomic explosions at Hiroshima and Nagasaki, a large increase in the incidence of stomach cancer should be seen among the Japanese as compared to the Americans if the doubling-dose concept is valid.

"There are no extra cases from the bombings," says Dr. Evans.

"The stomach cancers are just now coming in," says Dr. Tamplin. "We haven't been able to get all the data. We'll have to wait another 10 to 15 years for the whole story to come in. I'm sure you will find some doubling dose."

It is this kind of contradictory evidence that is bound to divide the council in their efforts to come to grips with a safe level—if there is one. □

NUCLEAR ENERGY

Disposing of the waste

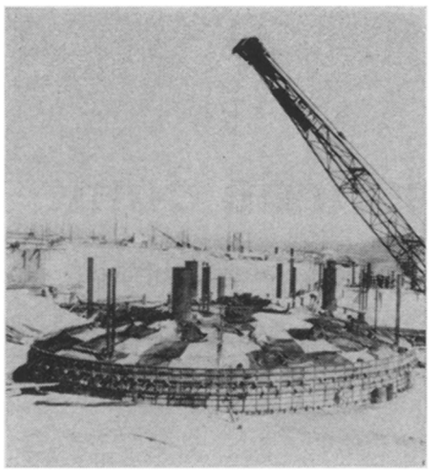
Ever since the beginning of the atomic age the Atomic Energy Commission has had the problem of safely disposing of its lethal nuclear garbage. And the problem will grow as more facilities are built and as more nuclear power plants go on-line. Right now, for example, 48 nuclear power plants are being built that will produce 38 million kilowatts, nine times the present nuclear capacity.

According to a report of a National Academy of Sciences Committee, the AEC is plodding along with its old waste-disposal methods. The report revealed some real shortcomings—in the handling of three basic radioactive waste classifications: high, intermediate and low levels. The survey was done four years ago. The procedures have not changed.

High radioactive liquid waste is disposed of by storage in 85-foot diameter steel tanks buried about eight feet below ground.

The concern is that the tanks will leak—as has happened several times at the Hanford, Wash., plant—and the radioactive liquid will seep into the water-table system. Newer tanks are built on concrete saucers to prevent this kind of leakage.

As for low- and intermediate-level solid wastes, the present method of disposal is burial in trenches in which,



AEC

Waste tank: Storage, not disposal.

says the NAS report, "there is always the danger of a build-up of concentrations in the soil."

Disposal of low-level liquids is done in streams—a practice the report found apparently harmless, if constantly monitored. Low- and intermediate-level liquids are disposed of by injecting them into evaporation ponds or into the ground. The NAS committee says that, in the long run, this would "lead to a serious fouling of man's environment.

". . . None of the major sites," the NAS report concludes, "at which radioactive wastes are being stored or disposed of is geologically suited for safe disposal of . . . other than very dilute, very low-level (radioactive) liquids. . . ."

The AEC maintains that it is storing, not disposing. "We do regard these sites as safe places for the processing and storage of the wastes while developing programs and facilities for final disposal," says John Erlewine, assistant AEC general manager for operations.

In anticipation of problems, the AEC is looking at such alternatives as hydraulic fracturing (SN: 2/8/69, p. 143), by which radioactive wastes are introduced into cement, which is forced into horizontal rock strata where the cement hardens in a thin layer. But this method is just for intermediate wastes and requires such special geological conditions as layered shale.

Better results are expected from calcining, in which high-level liquid wastes are converted to lower-volume solids by heating. Safer for transport and easier to dispose of, these solid wastes would be put in steel containers and stored indefinitely in abandoned salt mines. Salt mines are considered the best choice because they are isolated from water. Their capacity also appears to be no problem. "It should last for a long, long time," predicts James Pollock of the AEC's production division. □

CANCER THEORY

Charges on the cell membrane

Cancer research is, by and large, descriptive.

Research has for years focused on the nature of the cancer cell's aberrant behavior, the things in the cells or its environment that trigger that behavior and what, if anything, can be done clinically about it.

Out of this have come several general hypotheses. One is that viruses cause cancer (SN: 10/4, p. 308). There is undeniable evidence that they induce some types of animal tumors, and a growing body of circumstantial evidence exist linking them to some human cancers.

A second explanation of the cause of cancer stresses the role of chemicals in the environment. Additionally, radiation is known to induce tumors. And deficiencies in the immune system have been implicated in the occurrence of malignancies (SN: 5/10, p. 457). In all likelihood the cause of cancer is related not to one or the other of these possibilities but to each of them, alone or in combination. Further, the genetic constitution of an individual appears to play a role in his susceptibility to cancer.

Each of these probable factors linked to malignancy was discussed by scientists this week in San Antonio at a seminar sponsored by the American Cancer Society.

Each contributes pieces to the incomplete jigsaw puzzle of cancer. None of them draws a single thread of biological theory to tie the pieces together.

Cancer theorists recognize the lack of such a thread in their work, and consider studies of the cell membrane as a likely source of the answer—the defective mechanism that allows a tumor cell to proliferate and spread.

So the participants in the symposium were understandably stimulated by one such attempt, the presentation of a general hypothesis which, right or wrong, seemed to be a biophysical stab at least in a promising direction. It was the observations of Clarence Cone, a chemical engineer at the National Aeronautics and Space Administration's Langley Research Center in Hampton, Va.

Cone, who began studying the effects of radiation on human cells, ended up with the suggestion that electrical changes in the surface of cells may account for both uncontrolled proliferation and metastasis. His theory, he believes, will contribute to understanding of the fundamental changes occurring in tumor cells and fits with previously explored descriptions of cancer causation.