LIQUID WASTES

Questioning deep well disposal

The deficiencies of the old saying, "Out of sight, out of mind," are nowhere better illustrated than in the waste-disposal aspects of the environmental problem. Lessons have come hard, but it is finally being realized that the effluents and byproducts of industrial civilization can no longer be sent down the river, wafted into the air or dumped into the ocean without creating unfortunate and sometimes unexpected consequences.

What is to be done with unwanted wastes is another matter. They have to be eliminated at the source, or put somewhere. And despite the growing awareness of the concept that one never disposes of anything, one only moves it about, the search for ever more isolated and politically safe locations for getting rid of waste products continues.

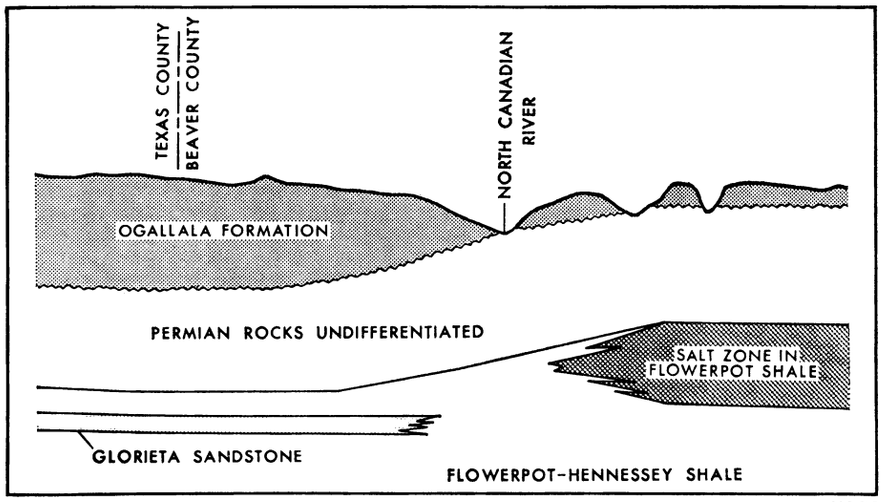
As pressure against pollution of rivers and streams mounts, one possibility for disposal of liquid wastes has become increasingly more attractive: burial deep underground. From 1964 to 1967 more new deep wells for industrial waste injection were put into operation than during all of the previous 14-year period. No survey has been carried out since 1967, but the total number of injection wells is estimated to have increased from 110 to about 150.

Chemical, petrochemical and pharmaceutical plants use wells for injection of everything from alcohols to sulfuric acid. Refineries and natural gas plants dump phenols, acids and spent caustics. Metal products companies flush steel pickling solutions into wells. A paper mill in Pennsylvania, an airliner maintenance facility in Oklahoma, a uranium mill in New Mexico all wash wastes deep into subsurface rocks. Even a large Michigan laundromat has an 1,800-foot-deep well for disposal of its liquid byproducts.

Ground-water experts are becoming troubled by all this acitvity. They are concerned that pressure to protect surface waters is creating a situation potentially dangerous for subsurface water supplies—which furnish one-fifth of the water used in the United States.

"The United States appears to verge on accepting deep injection of wastes as a certain cure for all the ills of water pollution," says Arthur M. Piper, a research geologist for the U.S. Geological Survey. "Uncritical acceptance would be ill advised."

The gist of the complaint by groundwater geologists, such as those in the Geological Survey's Water Resources Division, is that disposal of liquid wastes in deep wells is no more disposal than is the placing of one man's garbage in another man's backyard. Injection is merely storage, and the chemicals—and their potential for water contamination—can never be forgotten.



USGS

Oklahomans fear brine injected into Glorieta rocks may pollute ground water.

An example is the current controversy in the Oklahoma Panhandle and portions of the four adjacent states over the potential for contamination of the Ogallala rock formation, an aquifier that supplies water to 9,000 irrigation and public-supply wells over a 47,000-square-mile area. The USGS has been asked to determine whether disposed oil-field brine injected into the deeper Glorieta Sandstone will move upward into the fresh water. With limited information, its geologists could answer only that it is possible.

As a result of such deficiencies in knowledge, Secretary of the Interior Walter J. Hickel has directed the Geologic Survey to take the lead in a research program to evaluate the effects of underground waste disposal on the subsurface environment, particularly ground-water supplies.

The geologists realize that underground liquid waste injection is here to stay. In many cases it is the most suitable means available for removal of a noxious liquid. But they protest that too little is understood about what happens to the liquids beneath the surface at any particular geological site—where they are liable to go and what they are liable to do.

Piper has a list of what he calls common false premises used in arguments by proponents of liquid waste injection. One is that the total volume of pore space in an injection zone is available to be filled by liquid wastes. In actuality much of that space is already occupied by native brine and other liquids. Another misconception, is that waste placed in a downfolded stratum will remain there, immobile for all time. Hydrodynamic factors commonly determine movement independent of geologic structure.

So far no major contamination of ground water by injected liquid wastes is evident. But so little is known that geologists feel this may be simply temporary good luck on which they don't dare count for long. □

NEW SOCIETY

Toxicity and mutagens

The specter of genetic damage to human beings from environmental contaminants was raised after World War II when it was realized that significant amounts of radioactive fallout from nuclear testing were entering the world's ecosystems and might contribute to genetic aberrations or mutations. The threat was exorcised to an extent by the limited nuclear test ban treaty, which the United States ratified in 1963. New guidelines for X-ray dosages in medical practice reduced another radiation threat to the human gene pool.

Until recent years there has been much less concern about chemical mutagens in the environment. But chemical mutagenicity promises to become a boiling issue in the 1970's with controversies already having erupted over cyclamates, pesticides, LSD and many other substances.

Because some 30,000 new chemicals are discovered annually in the United States, the problem of monitoring both old and new substances for possible mutagenic effects is an immensely complex and difficult one. The Environmental Mutagen Society, which held its first annual meeting in Washington, D.C., this week, was formed last year to bring some structure to a field that has been characterized by fragmented efforts and lack of standardized procedures.

Sorely needed is a standardized set of tests that will allow a positive presumption of mutagenicity, or lack of

it, in humans. The actual mechanisms of mutation in DNA molecules are not observable, and although visible chromosome breakage is associated with mutations, scientists are not sure how yet.

Tests on organisms other than man demonstrate mutagenicity in these organisms. But extrapolation to man, or even to another strain of the same organism, is sometimes doubtful. Some tests identify only dominant mutations, not the more insidious and long-term recessive ones. Population sampling is inconclusive because of the difficulty of attributing a mutation to a specific cause.

The result is, according to EMS president Dr. Alexander Hollaender of the Oak Ridge National Laboratory, that human mutagenicity has not been completely proved for any chemical. Dr. Hollaender suggests that perhaps five or six tests, including some existing ones, will eventually be selected as a routine gamut for any suspect substance. Already, he says, EMS is compiling a registry of compounds that have undergone various kinds of testing by various researchers, and he sees this kind of coordination as a prime function of the new group.

Dr. Samuel S. Epstein of Children's Cancer Research Foundation in Boston believes, that presently available tests include enough different approaches to provide a practical basis for assessing human mutagenicity. These include the dominant-lethal test, in which mutations caused chemically in male mice are measured through fetus death in females impregnated by the males; host-mediated assays, in which microorganisms and chemicals are introduced into the same mammal and mutations in the microorganisms are identified, and various tissue-culture or bacterial tests that measure more specific cell changes. Dr. Epstein says all the tests provide good screening of one kind or another and that the mammalian tests have a high degree of relevance to man.

Dr. Epstein calls for integrating the tests—many of them inexpensive—into toxicology as standard procedures, and he suggests that we view this science from a far broader perspective—so that tests not only for mutagenicity, but also for the related carcinogenicity and teratogenicity, become standard operating procedure for any compound suspected of toxicity of any kind. "We need a conceptual reintegration that will rely on an interdisciplinary approach." He says that the mixed bag of toxicologists, pathologists, geneticists and others in EMS is the cadre for such a thrust.

Dr. H. Bentley Glass of the State University of New York at Stony Brook is convinced that too little is being done, even with existing tests. "Almost nothing is done to mitigate the dangers of chemical mutagens or to protect the population," he says. But Dr. Glass, too, is hopeful that the formation of EMS will mark a turning point.

Glass: New protection essential.

The fallibility of existing tests is still evident, however. None of them, says Dr. Glass, is conclusive, especially for low chronic doses.

It may be that tests on human embryos will be the only conclusive answer, he says. "No other species will answer the questions in regard to human beings." □

NEWS BRIEFS

NSF; crown of thorns

An increase of $27.63 million over the President's $498 million request for the National Science Foundation's budget for fiscal year 1971 (SN: 2/7, p. 144) has been recommended by the House Committee on Science and Astronautics. The increase includes $9.5 million more for graduate traineeships, $10 million for support of research projects dropped by other Government agencies (primarily the Defense Department), and $4 million for the college science improvement program. □

The coral-eating crown of thorns starfish was first noticed in large numbers six years ago on Australia's Great Barrier Reef. Now the once rare spiny creature threatens coral reefs through a wide area of the South Pacific and Indian Oceans and the Red Sea (SN: 9/13, p. 218).

There is little that can be done to stop the devastation, says a report of the Australian Academy of Sciences which was released this month. There is no evidence of any decline in proliferation of the starfish, adds the report, which resigns itself to recommending local control actions in tourist areas. □