and encourages illegal dumping. New technologies are needed to solve this nation's problems. However, the impediments to innovation are high. Regulations in the environmental laws make permitting of innovative technologies difficult. The technical innovators are hampered by complex regulations, questionable insurability, and public concerns about safety. The public perception is that innovative technologies imply greater risks; and feed into the NIMBY (not in my backyard) syndrome. The overall result is a significant barrier to the introduction of innovative technology.

A proposal for the salt dome disposal of hazardous wastes at a site near Houston, Texas, is used to illustrate the technical, legal, and social impediments to innovation. Although the proposal is clearly innovative, the company applying to the State of Texas for a permit has attempted to fit their concept into current slots and downplay any innovative aspects of their technology. The strategies are delineated in the paper.

The overall conclusions are that in the heavily regulated environments of hazardous waste management innovative technologies are difficult to implement. As a consequence, the pipeline to deliver innovations is sealed off at the end.

Testing for waste degradation during deep well injection

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Abstract

Deep-well injection of chemical wastes into saline formations is a common method of waste disposal in the Texas Gulf Coast. Four lines of evidence suggest biodegradation may be altering the organic wastes to nontoxic materials. Naturally occurring organic materials (oils and organic acid anions) show evidence of degradation. Degradation of carboxylic acids, acrylonitrile, cyanide, and methyl alcohol has been demonstrated during injection at depths of approximately 1,000 ft (300 m). Chemical injection wells typically exhibit decreases in injectivity (injection rate/surface injection pressure) and require frequent acidization, suggesting formation plugging by microbial processes. Injection wells commonly fill over time, with deposits composed of calcium car-

bonate or sediments that are acid soluble. These carbonate sediments may be byproducts of waste decomposition.

In situ identification of waste degradation can be accomplished by three approaches. Fluid and rock samples can be collected from within the injection plume by coring through the plume and collecting water and sediment samples for detection of microbes, wastes, and their byproducts, and for identification of mineral alteration by the waste. The injection well can be back-flowed to pull the waste to the point of injection for sampling, so that the degree of waste degradation can be tested. The sediments within the well can be analyzed to determine whether they represent chemical precipitates from waste decomposition within the well or from surrounding formations. The last approach is considered the most feasible and is presently being tested. Sediments from five wells are being analyzed chemically (inorganic, organic, X-ray analysis), biologically (lipid analysis and activity counts), petrographically (petrographic microscope and scanning electron microscope), and isotopically (carbon isotopes) to determine their source.

Treated waste/soil interactions and long-term metal mobility under acid rainwater leaching conditions

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Abstract

Column flow-through experiments have been conducted in which a treated municipal waste effluent has been reacted with two silty loam and two sandy loam soil samples having different TOC values, clay contents, and densities to study the attenuation of waste solution metals on soil columns. Reacted soil