CONF-811130--10

HUMID SITE STABILIZATION AND CLOSURE

MASTER

Norman H. Cutshall
Environmental Sciences Division
Oak Ridge National Laboratory

It is functionally and economically imperative that planning for final stabilization and closure of shallow land burial sites begin early in the course of site utilization, preferably as a component of site selection. Site characteristics will greatly influence the cost and degree of effort required for site closure. The purpose of the work I shall describe here will be to identify and evaluate the importance of factors that are expected to dictate the nature of site stabilization and closure requirements. Subsequent efforts will plan for implementation of such requirements. This project will be new in FY1982 and the present report simply outlines current planning for the two major areas of effort that will be pursued at the outset. Those areas are: 1) geological management and 2) vegetation management.

The two most important geological processes related to site stabilization and closure are expected to be chemical weathering and surficial erosion. Chemical weathering typically occurs throughout the soil zone and, at humid

Research sponsored by the Office of Waste Management, U. S. Department of Energy, under contract W-7405-eng-26 with Union Carbide Corporation.

sites, is most intense where downward-percolating waters encounter less weathered bedrock and the saturated ground water zone. There, neutralization of the relatively acidic waters derived from precipitation and soil reactions result in conversion of the most abundant metallic elements into soluble ionic forms such as Na^{+}, Mg^{++} and Ca^{++}. Removal of these soluble ions in dilute ground water solutions leaves a rather less-aggregated set of oxides of Si, Al and Fe. Engineered structures such as burial vaults, ground water diversion barriers, etc. will be subjected to stresses during gradual weathering process. It is necessary that chemical weathering and surficial erosion processes be considered to ensure attainment of long term site management goals.

At the surface, the component of incoming precipitation which does not infiltrate but runs off provides a transport medium that strips away the surface residual material. In some situations, wind erosion will supplement erosion by runoff. Susceptibility to erosion will be influenced by site operations including land clearing, excavation and installation of infiltration control systems. The relative significance of wind and water erosion will be partly determined by such environmental factors as climate, amounts of rainfall, intensity of rainfall, surface slope, rock type, vegetation coverage and anthropogenic factors such as compaction and solidification of wastes. In the long run,

unchecked surficial erosion will expose most buried waste and eventually transport it away. (I have assumed that siting is likely to avoid upland depositional areas where ground water problems will probably be greatest.)

Erosion will be closely related to vegetation management. Invasion of a burial site by plants will occur whether or not revegetation is practiced. This invasion and the subsequent development of plant communities has been termed "succession" and surprisingly consistent successional sequences have been delineated for humid Eastern U. S. environments. In the most direct approach to vegetation management, the natural successional trends are countered by planting and nurturing desired species coupled with cutting or mowing of undesired species. This approach is both labor and cost intensive and is consequently unsuitable for site closure. Ideally, we would like to ensure that the natural course of succession would would be compatible with site management goals. In actual practice it may be necessary to provide infrequent, periodic control actions such as are practiced along highway or power line rights-of-way.

In addition to providing erosion control, plants can act as a shunt for buried materials into the surface environment. Root growth in zones containing water, nutrients or merely the interstices between waste packages can invade trenches and, perhaps, waste packages themselves. Radioisotopes of elements mobilized by the plants can be

delivered to the surface much more rapidly than if invasion had not occurred. Furthermore, the roots are powerful invaders that can destroy the integrity of waste containers or engineered barriers and leave major pathways for entry of percolating waters into waste. Thus it will be necessary to ensure that the rate and course of plant succession at a site will be compatible with site management goals.

In summary, two principal areas of site stabilization and closure effort will be pursued initially-- geological management and vegetation management. The geological effort will focus on chemical weathering and surficial erosion. Such catastrophic geologic events as landslides, flooding, earthquakes, volcanos, etc. are already considered in site selection and operation and these factors will not be emphasized initially. Vegetation management will be designed to control erosion, to minimize nuclide mobilization by roots and to be compatible with natural successional pressures. It is anticipated that the results of this work will be important both to site selection and operation as well as the actual stabilization and closure procedure.