

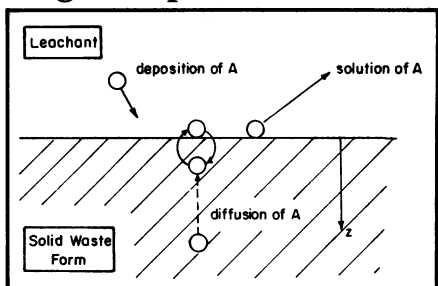
Damage on the rebound?

The leach resistance of a solid nuclear waste form in ground-water partially determines that material's ability to isolate radioactive waste in the environment. Researchers suspect several phenomena may influence leach resistance, and the latest to fall under suspicion is alpha (α)-recoil damage.

The decaying actinide elements (radioactive elements number 89 through 103 on the periodic table) in high-level nuclear waste solids emit alpha particles. At the same time, due to conservation of momentum, the elements emit recoil nuclei that travel in the opposite direction of the alpha particles. These α -recoils are "heavy" particles that undergo "billiard ball," or elastic, collisions, causing a cascade of collisions that change the structure of the surrounding matrix. The question facing nuclear waste researchers is whether these α -recoil-induced structural changes increase the leachability of the waste form. Conflicting opinions were presented at the Boston symposium.

J. C. Dran and colleagues of the Laboratoire René Bernas in Orsay, France — who reported their findings in the Sept. 26 *SCIENCE* — conclude that α -recoil causes a "drastic increase" in leach rates. But William J. Weber and colleagues of the Pacific Northwest Laboratory of Battelle in Richland, Wash., report no significant increase. While the French researchers say the Battelle group has failed to achieve the "critical dose of α -recoils" necessary to observe the effect, Weber says the discrepancy can be explained by the different methods used by the two groups to simulate α -recoil damage. Dran and co-workers irradiate a glass surface with lead ions from a particle accelerator; Weber's group "dopes" a simulated waste form with short-lived actinide species. The internal source of radiation in the Battelle method provides more realistic results than the external irradiation used by Dran and colleagues, Weber says. "It's very difficult to extrapolate ion bombardment data to the real effects of radiation damage," he says.

Forgotten processes in leach models



What happens when the final resting spot of a nuclear waste form is exposed to underground water has been characterized by several models. These models describe the process of dissolution of the

glass, cement or ceramic matrix and the diffusion of the enclosed nuclear species through the matrix. Such mathematical models are used to predict the quantity of radioactivity that will enter the environment 100 or 1,000 years, for example, after waste burial.

But present models do not fit available leach test data, says Albert J. Machiels of the University of Illinois at Urbana, and Machiels suspects these models have neglected important surface processes that occur during leaching. In developing mathematical models for leaching, he explains, the slight attachment between a waste species (A) and the repository surface must be taken into account. This "bonding" between the species and surface must be broken before the waste ion can be carried off in solution. In addition, says Machiels, waste ion species that dissolve in stagnant leachants can be redeposited onto the repository surface. Machiels and colleagues, having formulated a model of leaching that includes these surface processes, have been able to predict experimentally observed leach rates.

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The Alaska Land passage

A bill to protect more than 100 million acres of virgin Alaskan wilderness from environmental plunder in the name of economic development won easy congressional passage on the first day of the lame-duck Congress last week. It now awaits President Jimmy Carter's signature.

Immediately upon hearing of the vote's outcome — which involves more land than is contained in both California and Maine — Carter hailed it the "greatest land conservation legislation of the century." Mineral and resource exploitation of any type is banned from at least 56 million acres of mountain wilderness and wildlife sanctuaries. Another 49 million acres would receive more qualified protection; limited mining and logging would be permitted within national parks and wildlife refuges.

Last year the House introduced and passed a stricter bill that would have doubled the "untouchable" wilderness acreage. However, threatened with a Senate filibuster (*SN*: 9/6/80, p. 157) that would have killed the bill's chances of clearing this Congress, the House compromised with passage of a Senate version on Nov. 12. Most backers of the House version suspect the incoming Reagan Senate will prove even less receptive about such sweeping protection of Alaska's "crown jewels."

Among chief differences in the two versions of the bill, this Senate one permits oil and gas exploration in the William O. Douglas Arctic Wildlife Range on Alaska's North Slope — breeding ground for North America's last large caribou herds.

Morris K. Udall (D-Ariz.), who heads the House Interior Committee, lamented that House members had to compromise with passage of the Senate bill, but vowed he would introduce amendments next term to make the law conform more closely to provisions of the bill as drafted by the House. In so doing, Udall will have to contend with Alaska's sole representative, Don Young (R-Alaska). He plans a campaign to further open up Alaska's newly protected zones to resource — especially energy resource — exploitation.

Manifest destiny for hazardous wastes

"Cradle-to-grave" protection began last week as the Environmental Protection Agency initiated its program to ensure that hazardous wastes are disposed of safely.

Hazardous wastes may only be disposed of at licensed sites. And a manifest must accompany all shipments, listing the waste generator, each transporter, the disposal firm and the wastes. A generator must get back a copy of the manifest within 35 days — signed by the disposal firm — or find out why. If the manifest is still missing 10 days later, EPA must be notified.

New laws also make it illegal to handle wastes in any way without first registering with EPA. Although the agency estimates there are 750,000 generators of hazardous wastes, only 46,800 had registered as of Nov. 12. At least 9,500 firms identified themselves as transporters; 30,300 registered as owners or operators of waste storage/disposal sites.

EPA plans inspections of 2,000 to 3,000 waste handlers over the next year. Criminal and civil penalties totaling \$25,000 per day can be levied against violators.

A developing plight

Third World women under 40 — unlike women in the developed world — "have strikingly higher death rates compared with men, and health programs have done little to narrow the gap," the Population Crisis Committee says. A new Draper Fund report credits malnutrition due to bias against females in food allocation, too early and too frequent childbearing, illegal abortions and differential access to health care as leading causes.

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