Finding a resting place for radwaste

And now there are three. Late last month, the Department of Energy (DOE) narrowed its choice of possible sites for the first high-level radioactive waste repository from nine areas in six states to one location in each of Nevada, Texas and Washington. But the announcement brought renewed complaints from the governors of the affected states, environmental groups and others who are unhappy with the idea of a nuclear waste dump "in their own backyards" and with DOE's procedures for selecting a site.

Texas Gov. Mark White, for one, vowed, "Before the people of Deaf Smith County will glow in the dark, sparks will fly."

Deaf Smith County in the Texas Panhandle, about 30 miles west of Amarillo, is one of the three sites that rate highest in DOE's initial environmental assessments. If this area is selected, the nuclear waste repository would be carved out of beds of salt more than 1,000 feet below the surface of the prairie. Local residents fear that the required underground shafts will interfere with the vast Ogallala aquifer that supplies the area's drinking and irrigation water.

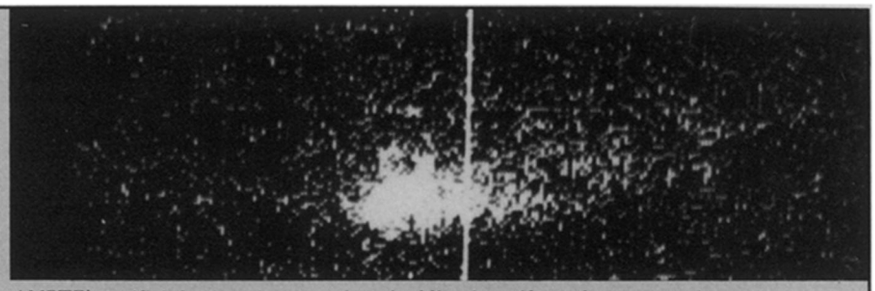
Yucca Mountain in Nevada, on the edge of the Nevada Test Site (federal government land where nuclear weapons are tested) and about 100 miles northwest of Las Vegas, consists largely of consolidated volcanic ash called tuff. Preliminary studies indicate that a Nevada repository would be the easiest and least expensive to construct, but the region is geologically complicated.

The veteran candidate (SN: 1/2/82, p. 9) is a volcanic basalt site on the federal government's Hanford nuclear reservation near Richland, Wash. Local residents generally welcome the money that the building of a repository will bring in. Says John Poyner, Richland's mayor, "I think this is a real shot in the arm for the city of Richland."

Detailed studies of the three leading sites will begin later this year, including the drilling of deep, exploratory shafts so that researchers can study the underground rock directly. The studies, which may cost as much as $500 million for each site, should be completed by 1990, when the President will make the final choice. Although a state governor or legislature can veto the choice, Congress has the authority to overturn the veto.

Last month, DOE also issued its guidelines for establishing a nuclear waste repository (SN: 1/7/84, p. 5). These specify how well the final disposal system must perform and define the technical qualifications that potential sites must meet. However, several environmental groups, including the Sierra Club, have sued the government, contending that the guidelines are inadequate. —*I. Peterson*

Speedy comet AMPTE



D. Rees/NASA Galileo II airborne obs.

AMPTE's artificial comet in space (vertical line is artifact of processing).

It was inevitable that the first "artificial comet" generated in space would not play by the rules. It had never been tried before — releasing a cloud of barium atoms from a satellite outside earth's magnetic field to be ionized by the sun's ultraviolet light and swept away on the solar wind (SN: 12/8/84, p. 362). The "rules" could be no more than hypotheses. But according to Mario Acuña of NASA's Goddard Space Flight Center in Greenbelt, Md., "It really did everything that was not expected."

The experiment, part of AMPTE, the Active Magnetospheric Particle Tracer Explorer project, certainly worked. After the goal of conducting the test on Christmas morning was scrubbed because of clouds (which frustrated ground observers) and air turbulence (which shook up the one of two airborne observatories that could even get aloft), it worked just as hoped on Dec. 27, the only other possible day. To be sure, observers at Kitt Peak National Observatory in Arizona were again clouded out; brilliant aurorae reportedly ruined chances of spotting the comet in the skies over Alaska, and the telescopes on Hawaii's Mauna Kea were beset by snow. But instrumented aircraft from NASA and the Argentine Space Research Organization were both on the job, and there were even some successful ground observations from White Sands, N.M., and Boulder, Colo. And the key player in the multinational plan — Germany's Ion Release Module (IRM) satellite, which would generate the barium cloud — worked right on the money.

"I'm elated," said German principal investigator Gerhard Haerendel of the Max Planck Institute for Extraterrestrial Physics in Munich (though he acknowledged frustration at the poor visibility over his own post at Kitt Peak). "The data are looking wonderful."

The unexpected part came from the solar wind, whose flow past the barium cloud would carry it off to form the ion tail known heretofore only from comets of the natural kind. Typically, says Acuña, the solar wind might be expected to flow by at about 300 to 400 kilometers per second. Its speed varies widely, however, and Haerendel estimated (though after only an early look at the data) that the actual flow was more like 600 km/sec.

One result was that the glowing barium, which became a cometary tail about 10,000 to 20,000 km long, was dissipated to undetectability in perhaps 13 to 15 minutes. "That blew us all away," says Acuña. "We were expecting more like 90 [minutes]." Another effect was that the forward flank region of earth's magnetosphere, just outside which the comet was to have formed, was more compressed than usual. This meant that the IRM satellite and its nearby companion, the United Kingdom Subsatellite (UKS), which were intended to be in the "magnetosheath" region edging the field, turned out to be outside the sheath completely. A goal of the experiment's highly constrained geometry, says Acuña, was for the solar wind to reach the UKS by being deflected from the magnetosheath at a carefully calculated angle. It worked, he says, but even a little more solar-wind activity could have deflected the magnetosheath until the stream of the "wind" missed the UKS completely.

Sensing the solar wind's accelerated flow in advance from the satellites' instruments, the researchers decided to use only two of the four barium canisters aboard the IRM earmarked for the comet experiment, just in case the UKS might find itself and its important instruments out of the picture altogether. The precaution proved unnecessary, but "next time," says Acuña, "we'll be a lot smarter."

Although the test worked, the fact that the two unused canisters have even provided a potential "next time" is a plus. The scientists have learned more, for example, about the best ways to deploy the airborne observatories to record the event. There are also many uncertainties about the behavior of the comet, notes Acuña, such as the report by some observers that the comet's "head" seemingly disappeared before its "tail" became visible.

The "next time" is in July.

—*J. Eberhart*