enriched uranium taken from dismantled nuclear weapons.

Hollister, a vice president of the Woods Hole Oceanographic Institution, in Massachusetts, and Nadis, a science writer, have a different solution to the problem of radioactive waste: bury it beneath the ocean floor.

Marine scientists have identified broad zones of suboceanic terrain in the Atlantic and Pacific that have remained geologically inert for tens of millions of years in the dark and frigid depths. Three or so miles below the surface, note the authors, lie vast mudflats, with a clay-rich blanket, hundreds of meters thick, above the underlying rocky crust. Present evidence, they say, "suggests that mobile, multicellular lifeforms inhabit only the top meter or so of the abyssal clays," and that below that there are no organisms capable of transporting radioactive substances up to the sea floor. Employing technology that has been in use in the petroleum industry for decades, canisters of radioactive waste could be lowered into cylindrical shafts drilled hundreds of meters deep in the thick sediment, well below the ocean floor.

The cannisters themselves would last only a few thousand years at most, but "the muddy clays, which cling tenaciously to plutonium and many other radioactive elements, would prevent these substances from seeping into the waters above," the authors say. Scientists have concluded from experiments that plutonium would not migrate from a breached cannister more than a few meters, even after 100,000 years. Burial of the radioactive waste in the sediments "would most likely buy enough time for the radioactivity of all the waste either to decay or to dissipate to levels below those found naturally in seawater."

Yes, more research is needed, but there has never been a serious challenge to subseabed disposal on technical or scientific grounds, Hollister and Nadis say. Persuading the public is another matter, of course, but subseabed burial, the authors observe, has at least this advantage: it won't produce "not in my backyard" (NIMBY) opposition.

Wet Planets

"Surfing the Solar System" by Michael Milstein, in *Air & Space* (Dec. 1997–Jan. 1998), 370 L'Enfant Promenade S.W., 10th Fl., Washington, D.C. 20024.

Plain old water has long been regarded as one of Planet Earth's distinctive possessions. But as astronomers in recent years have taken a closer look at the rest of the solar system and beyond, free-lance writer Milstein reports, "they are arriving at the conclusion that Earth is really not that special after all. Water . . . turns up almost everywhere." [Including the moon, scientists announced in March.] Most of the extraterrestrial H_2O is in the form of ice, but—it increasingly seems—not all of it.

The sun long ago burned off most of the water and ice from the inner planets nearest to it, and most of the solar system's water now "resides in the frigid outposts beyond the asteroid belt" that separates Mars and Jupiter, Milstein writes. "The gas giants of the outer solar system—Jupiter, Saturn, Uranus, and Neptune—are still loaded with the stuff, although under such astounding pressures and mixed with such a noxious stew of other compounds that it's a stretch to think of it as water."

However, Europa, one of Jupiter's moons, may be a different story. Photographs taken by the Galileo spacecraft "show cracked ice plates that almost surely have slid apart," indicating, Milstein says, that the visible surface "is probably no more than a frozen shell floating atop a massive global sea." Tidal heating—generated by Jupiter's gravitational pull, first strong as the moon nears the planet, then loosened as it moves away—could explain why the water doesn't freeze. "Other moons, too, show external signs of liquid interiors," Milstein adds.

Although Mars, which may once have had oceans as huge as Earth's, probably "still has pockets of groundwater beneath its arid surface," notes Milstein, Europa may offer what planetary geologist Jeffrey Kargel of the U.S. Geological Survey calls "the best chance that we have" to find an ocean resembling those on Earth. For that reason, the author says, more and more researchers are coming to believe that "Europa is more likely than Mars to hold signs of primitive life."