

RESPONSE TO SIMENS

Dear Editors:

SIMENS' response to our recent article (Suchanek et al. 1996) is a good example of the way in which the handling and disposal of radioactive wastes was perceived by the majority of professionals and lay people during those decades when the wastes were being produced. The fact that wastes were hand packed is an indication of the casual attitude of the workers, even though many barrels were required to contain lead shields to reduce the radionuclide emissions from the barrels.

First, Simens' emphasis that the wastes packaged and dumped at the Farallon Islands Nuclear Waste Dump Site (FINWDS) were "low level" needs some clarification. There has never been an accurate total inventory of the wastes dumped at the Farallons and there never will be (because complete records were never kept). However, it has been reported (Joseph 1957) that there were some drums containing reactor irradiated materials. One non-quantitative definition of "low level" wastes during that time was basically everything that was not "high level waste," which was defined from the Ocean Dumping Act (administered by the EPA) as "aqueous waste resulting from the operation of the first cycle solvent extraction system, or equivalent, and the concentrated waste from subsequent extraction cycles, or equivalent, in a facility for reprocessing irradiated reactor fuels, or irradiated fuel from nuclear power reactors." Using this definition, any highly

radioactive materials originating from a research laboratory, no matter how radioactive, would have been defined as "low level." A more quantitative measure of radioactivity for disposal materials, from a declassified 1955 Atomic Energy Commission's document used for licensing disposal contractors, identified allowable radioactivity levels per hour on the external portion of the container in which they were sealed, not on the contents (see discussions above and below). Other more quantitative criteria at that time for "low level" waste within the barrels yielded conclusions that at least some of the FINWDS wastes were high level, and some were extremely high level (Davis 1980a,b).

Simens makes a good point that for risk assessments made at that time "it was never planned, nor was it expected that the drums would provide any environmental containment once dumped." The fact that these risk assessments "assumed immediate, complete mixing of the drum contents in the sea water into which they were dumped" is highly relevant. A common perception in that era was "the solution to pollution is dilution." However, rather than dispersing and mixing completely, these wastes remained primarily in the dump site area. In a report apparently intended to allay fears of elevated levels of radionuclides at the FINWDS, an EPA researcher (Dyer) reported elevated levels of $^{239+240}\text{Pu}$ in sediments at the FINWDS in 1977 at only 2–25 times background levels expected from weapons testing fallout. Other researchers, however, calculated elevated levels (from the same data) at up to approximately 1,000–2,000 times background (LFE 1979; Davis 1980b; Suchanek et al. 1996). Based on the estimated decay rate of waste barrels at the FINWDS, radionuclides are now likely entering that localized marine environment at higher

rates than ever before. It should also be noted that the U.S. EPA, in 1973 (shortly after the last of the Farallon barrels were dumped), issued a regulatory requirement on the Ocean Dumping Act pertaining to low level wastes calling for the "isolation and containment of the radioactive isotopes to prevent their direct dispersion and dilution in ocean waters, until the radio decay of the wastes to innocuous levels" (Mattson and Dyer 1980).

That floating barrels were shot with rifles to speed their sinking is yet another example of the fact that old practices were not necessarily safe practices. A number of these barrels did float ashore along the California coast, and if higher level wastes were contained within the perforated barrels (see discussion above), they could have leaked, potentially increasing risk to anyone encountering such packages. At that time, the National Academy of Sciences' National Research Council, in their evaluation of practices associated with the disposal of packaged low level radioactive wastes at sea (NAS-NRC 1962), made specific recommendations to ensure that "Any drums that do not sink upon release are sunk by non-destructive methods (no gunfire) such as casting a specially ballasted net over them."

It is in all of our best interests to continue to monitor the levels of radioactivity in the physical and biological environment at ocean disposal sites containing radioactive waste. No recent surveys have been conducted on radionuclide levels in the FINWDS benthic invertebrates, which continually consume contaminated sediments and serve as prey for commercially important fish species. Assuming that these wastes have dissipated, diluted, disappeared or will never pose a threat is likely premature for wastes which contain radionuclides with half lives up to 25,000 y. As these waste containers continue to deteriorate we should institute a sound monitoring program to be sure that we do not experience food chain bioaccumulation in species that impact human resources.

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