
RESPONSE TO ROSENBLUM ET AL.

Dear Editors:

WE ARE pleased to reply to the letter from Rosenblum et al. (1997) concerning our recently published article (Suchanek et al. 1996) regarding our measurements of radionuclides in marine biota from the Farallon Islands Nuclear Waste Dump Site (FINWDS) and a comparison site also in the Pacific Ocean off the coast of California. The 1991 report which we referenced (Suchanek and Lagunas-Solar 1991) contains the primary raw data from the study. This most recent publication is an analysis and interpretation of those initial results providing (1) relevant calculations for whole body committed effective dose equivalents based on the earlier results and (2) important discussions of the environmental ratios of ^{241}Am : $^{239+240}\text{Pu}$ and ^{137}Cs : $^{239+240}\text{Pu}$ in these biota.

Rosenblum et al. (1997) provide no reference for, nor are we familiar with, any published report from the cited 1992 NOAA/EPA cruise on radionuclide levels in benthic sediments

or fish tissues. Even so, their finding that there was "no evidence of activity above background," although contrasting with an earlier EPA published report (Dyer 1976; and see discussion in Suchanek 1987 and Suchanek et al. 1996), does not conflict with the primary results of our study in which we reported: "There were no statistically significant differences in the radionuclide concentrations observed in samples from the Farallon Islands compared to reference samples from Point Arena, CA."

^{241}Am is widespread in the environment. However, when TMA conducted their analyses on a few split samples, they reported finding no americium. Our analyses, including the use of tracers and standardized procedures clearly detected ^{241}Am in (a) NSIT (formerly NBS) human lung tissue standards, (b) all four fish species as well as mussel tissues collected from both the FINWDS and the comparison site at Point Arena, and (c) fish tissues from the FINWDS collected previously by EPA. Fig. 1 provides an alpha detector energy calibration reference plot (Fig. 1a) plus original spectral data plots (taken directly from Suchanek and Lagunas-Solar 1991) indicating conclusively that both the tracer ^{243}Am as well as environmental ^{241}Am were detectable using our analytical procedures in NSIT

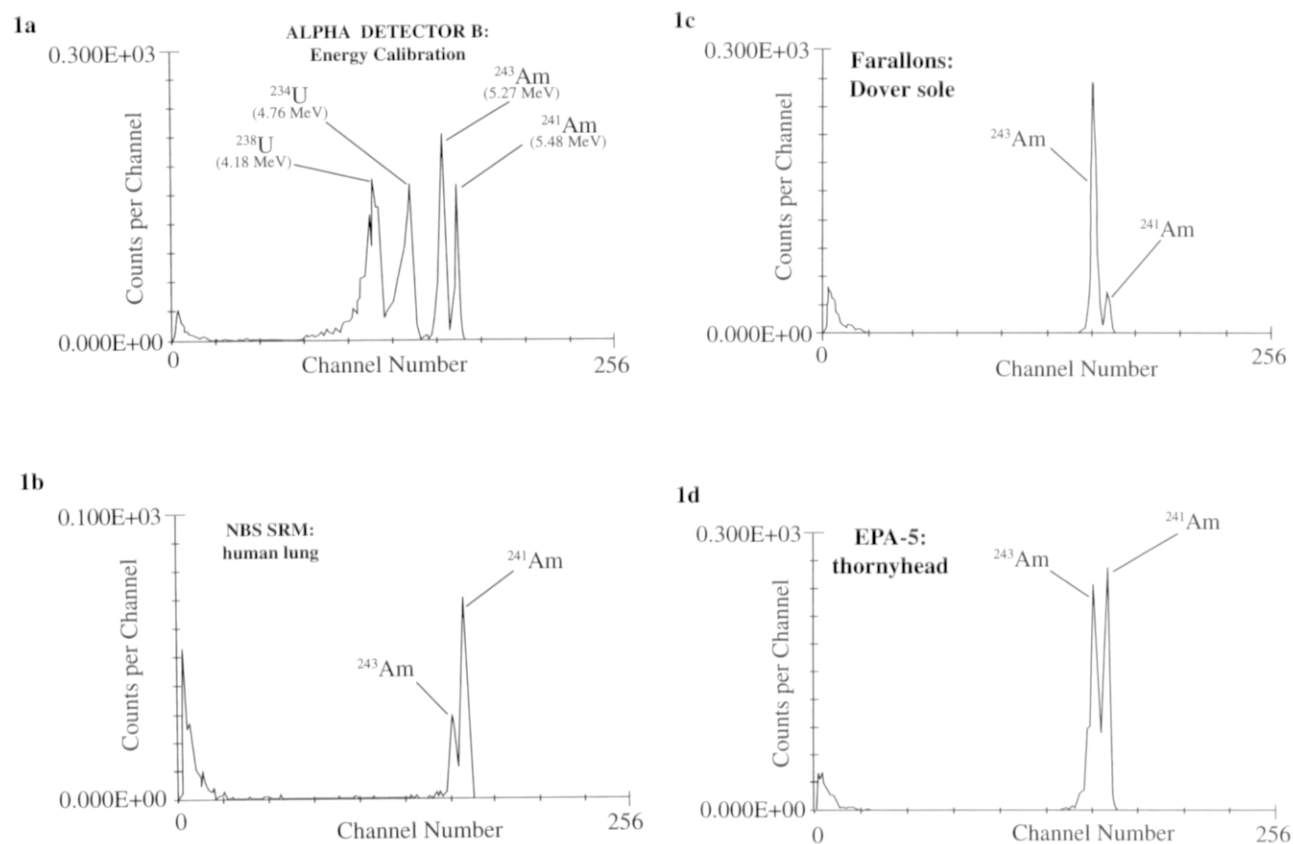


Fig. 1. Alpha spectral plots from americium sub-fraction showing the ^{243}Am (5.27 MeV) spike and the presence of environmental ^{241}Am (5.48 MeV), with updated energy values. If plutonium contamination were present (indicating an incomplete separation of plutonium and americium), there would be noticeable peaks to the left of the ^{243}Am peak associated with the ^{242}Pu spike (4.89 MeV) and/or environmental $^{239+240}\text{Pu}$ (5.15 MeV). (1a) Energy calibration plot for alpha detector B (original Figure B2 from Suchanek and Lagunas-Solar 1991), (1b) NSIT human lung tissue (original Figure B31 from Suchanek and Lagunas-Solar 1991), (1c) Dover sole muscle tissue from Farallons (original Figure B29 from Suchanek and Lagunas-Solar 1991) and (1d) thornyhead muscle tissue from EPA (original Figure B25 from Suchanek and Lagunas-Solar 1991).

human lung reference standard material (Fig. 1b), in Dover sole from the Farallons (Fig. 1c) and in thornyhead tissue from the Farallons provided to us by EPA (Fig. 1d). There is no indication in these spectra of contamination of the americium sub-fraction samples by the ^{242}Pu spike or environmental $^{239+240}\text{Pu}$ based upon the energy calibration (Fig. 1a). Why TMA failed to detect any americium is still a mystery since more complete interlaboratory comparisons between the U.C. Davis Crocker Nuclear Laboratory and the California Department of Health Services (DHS) (Suchanek and Lagunas-Solar 1991; p 77) revealed reasonably good agreement (with the exception of one sample) for both the ^{243}Am tracer and the environmental ^{241}Am for Dover sole, sablefish and mussels. Contrary to the accusation that we violated our own quality assurance practices, we depended on the intercomparison study in which our results for americium (as well as for plutonium) compared very favorably with those from samples independently analyzed by the California DHS (Suchanek and Lagunas-Solar 1991; p 77). The few samples sent to TMA were never considered to be a component of our formal quality

control plan. It should be clear that while there were variable tracer yields, our results are by no means contradicted by our own quality assurance practices. Although there was sometimes low recovery for americium in our study, the use of the ^{243}Am spike allowed for correction of recovery losses.

Our study does show that there were no statistically significant differences in the concentrations of radionuclides in fishes collected from the Farallon Islands Nuclear Waste Dump Site, and from a comparison site 100 km to the north at Point Arena. However these fishes did contain approximately 10 times higher concentrations of $^{239+240}\text{Pu}$ and ~40–50 times higher concentrations of ^{238}Pu than those reported from a 1977 collection of identical species at the FINWDS reported by Schell and Sugai (1980). Concentrations of ^{241}Am at both sites were also higher than comparable fish muscle tissue values reported at relatively contaminated sites (e.g., the Pacific Testing Grounds at Enewetak and Bikini Atolls and in the vicinity of the Windscale Nuclear Plant in the Irish Sea). Studies of this type are important for improving our understanding of the environmental behavior of actinide radionuclides.

References

- Dyer, R. S. Environmental surveys of two deep-sea radioactive waste disposal sites using submersibles. In: International Symposium on the Management of Radioactive Wastes from the Nuclear Fuel Cycle. Vienna: IAEA; IAEA-SU-207/65; 1976.
- Rosenblum, S.; Lessler, R.; Griggs, J.; Broadway, J. A. Response to Suchanek et al. *Health Phys.* 72: 936; 1997.
- Schell, W. R.; Sugai, S. Radionuclides in the U.S. radioactive waste disposal site near the Farallon Islands. *Health Phys.* 39:475-496; 1980.
- Suchanek, T. H. Potential bioaccumulation of long-lived radionuclides by marine organisms in the vicinity of the Farallon Islands Nuclear Waste Dump Site. In: Current Research Topics in the Marine Environment. Proc: NOAA/NPS Symposium on Marine Research in the Gulf of the Farallones National Marine Sanctuary; 1987: 20-32.
- Suchanek, T. H.; Lagunas-Solar, M. C. Bioaccumulation of long-lived radionuclides by marine organisms from the Farallon Islands Nuclear Waste Dump Site. Final Report to the California Department of Health Services (September 30, 1991). UCD/CNL 92/101; University of California Crocker Nuclear Laboratory, Davis, CA; 1991.
- Suchanek, T. H.; Lagunas-Solar, M. C.; Raabe, O. G.; Helm, R. C.; Gielow, F.; Peek, N.; Carvacho, O. Radionuclides in fishes and mussels from the Farallon Islands Nuclear Waste Dump Site, California. *Health Phys.* 71:167-178; 1996.

THOMAS H. SUCHANEK

*Division of Environmental Studies
University of California, Davis, CA 95616*

MANUEL C. LAGUNAS-SOLAR

*Crocker Nuclear Laboratory
University of California, Davis, CA 95616*

OTTO G. RAABE

*Institute for Toxicology and Environmental Health
University of California, Davis, CA 95616*

We wish to acknowledge the invaluable professional guidance and personal instruction we received from Narayani P. Singh, Salt Lake City, Utah, concerning plutonium and americium radioanalytical methods that we utilized in our study.