



UNITED STATES
NUCLEAR REGULATORY COMMISSION
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MEMORANDUM FOR: T. S. Sherr, Chief, Technology Assessment Branch

FROM: R. Mullen, Consultant, ONMSS

SUBJECT: REVIEW OF SAI PHASE I DRAFT REPORT: "ADVERSARY ACTIONS IN THE NUCLEAR POWER FUEL CYCLE: REFERENCE EVENTS AND THEIR CONSEQUENCES"

As with the previous draft of this report, I fail to see the relevance to safeguards of some of the Event Categories; in particular, Event Category 1. Equally unsettling is what seems to be the intent to undertake projects for which answers already exist. Again, it is Event Category 1 which appears to be heading in this direction, although there are subsets of other Event Categories which may be similarly characterized. Finally, it is not apparent from the report whether SAI has been directed to coordinate relevant aspects of this study with similar work underway elsewhere. Examples follow.

It is stated in the summary that the event consequences listed in this report are to form bases for detailed consequence analyses to be performed in later phases of this study. I submit that Event Category 1 consequences, for any conceivable safeguards purpose they may be put (which uses still elude me), have been described in thorough and exhaustive detail in work done approximately ten years ago (1,2,3). I can fathom no reason for continuing consequence work in this Event Category.

With respect to Event Category 2, it may be observed that Sandia Laboratories has performed for ERDA experiments on the explosive penetration of spent fuel casks. In a number of specific recommendations, it has been suggested to ERDA that this work be continued (see enclosure 1). I would suggest that before any additional work on 2.1 is performed, that the status of the ERDA program (Package Failure from Malevolent Attack) be determined. If it is subsequently found that there remains sufficient justification to continue funding SAI for this subset of Event Category 2, that the work be fully coordinated with that sponsored by ERDA. See also reference 4.

Subsets 2.2, 2.3, and 2.5 all depend heavily upon respiratory physiology, and the effective diameters of deposited particles. This effective diameter may be a function of mass median aerodynamic diameter (MMAD), activity mean aerodynamic diameter (AMAD), count mean aerodynamic diameter (CMAD), but rarely, actual physical diameter. Again, Sandia Laboratories has done some work in this area (5), but their results are suspect (see enclosure 2). I suggest that what is needed in this area is a thoroughgoing study on:

March 21, 1977

- Respiratory physiological relationships to the aerodynamic properties (MMAD, AMAD, CMAD, etc.) of plutonium, and other nuclide particles of various chemical composition.
- Problems in producing a monodisperse aerosol from solid or liquid phases of plutonium and other nuclides.
- Expected consequences of polydisperse versus monodisperse aerosols as functions of the aerodynamic properties of aerosol particles, and respiratory physiology of humans.

A good introduction into the literature is available (6).

Again, as with 2.1, there should be some coordination with ERDA in this area. There are indications that Sandia is reviewing the results of their previous work.

In addition, SAI should also be made aware of the extensive studies on plutonium resuspension done by LLL at the ERDA Nevada Test Site under the auspices of the Nevada Applied Ecology Group, ERDA Nevada Operations Office. Headquarters contact (within NRC) for that work is Jared Davis, Assistant Director for Fuel Cycle and Environmental Research, NRR. ERDA NVOO contact is Paul Dunaway, Nevada Operations Office, USERDA, P. O. Box 1676, Las Vegas, Nevada. An introduction into the literature may be found in reference 7.

Concerning Event Category 3; I have difficulty rationalizing any continuation of this work. Consequences from sabotage to nuclear reactors have been thoroughly covered by Sandia Laboratories (8,9,10,11). That work includes consequences from all subsets under Event Category 3. Plutonium recycle would not introduce source terms into reactor sabotage events significantly different from those already developed by Sandia for LWR reactors, and by WASH-1400.

Source terms are needed for Event Categories 4 and 5. With respect to subsets 4.5 and 4.6, some data is available (12).



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Enclosures:

- 1a Memorandum on Sandia Package Failure Briefing
- 1b Letter, KRChapman to JLLiverman
- 1c Letter, JLLiverman to KRChapman
- 2 Memorandum on SAND 76-0298 Review

1. L. Wayne Davis, W. L. Baker, and D. L. Summers. Analysis of Japanese Casualty Data, DC-FR-1054, The Dikewood Corporation; April, 1966.
2. L. Wayne Davis, D. L. Summers, W. L. Baker, and J. A. Keller. Prediction of Urban Casualties and the Medical Load From a High-Yield Nuclear Burst, DC-FR-1060, The Dikewood Corporation, January, 1968. (CONF)
3. Donald L. Summers, L. W. Davis, R. G. Kirkpatrick, and R. K. Miller. Completion of Urban Casualty Prediction Model for a High-Yield Nuclear Burst, DC-FR-1070, The Dikewood Corporation; March, 1969. (CONF)
4. C. V. Hodge and J. E. Campbell. Calculations of Radiological Consequences from Sabotage of Shipping Casks for Spent Fuel and High Level Waste, USNRC, NUREG-0194; February, 1977.
5. Ivan G. Waddoups and T. W. Hoover. Malevolent Use of Less than Strategic Quantities of Plutonium. Final Report, Sandia Laboratories, SAND 76-0298; October, 1976. (CONF)
6. R. O. McClellan. Appendix A-1. Relevant Physical and Biological Data. In: "Health Effects of Alpha-Emitting Particles in the Respiratory Tract," National Academy of Sciences/National Research Council, E-520/4-76-013; October, 1976.
7. L. R. Anspaugh and P. L. Phelps. Resuspension Element Status Report, May 1975. In: "Studies of Environmental Plutonium and Other Transuranics in Desert Ecosystems," USERDA, NVO-159; March, 1976.
8. Anon. Safety and Security of Nuclear Power Reactors to Acts of Sabotage, Part I - Case Study of a Typical PWR Plant, Sandia Laboratories, SAND 74-0069; March, 1975. (SECRET/NSI)
9. Anon. Safety and Security of Nuclear Power Reactors to Acts of Sabotage, Part II - Case Study of a Typical BWR Plant, Sandia Laboratories, SAND 75-0336; October, 1975. (SECRET/NSI)
10. Anon. Safety and Security of Power Reactors to Acts of Sabotage, Part III- Current U.S. LWR Plants, Sandia Laboratories, SAND 76-0108; July, 1976. (SECRET/NSI)
11. David E. Bennett. Vulnerability of Nuclear Power Plants to Conventional Warfare Attack, Sandia Laboratories, SAND 76-0018; No Date, Draft. (CONF)
12. William P. Bishop and F. J. Miraglia. Environmental Survey of the Reprocessing and Waste Management Portions of the LWR Fuel Cycle, USNRC, NUREG-0116; October, 1976.