

MAY 21 1988

TJ/RESNIKOFF REPORT

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MEMORANDUM FOR: Donald Nussbaumer, Assistant Director  
State Agreements Program  
Office of Governmental  
and Public Affairs

FROM: Richard L. Bangart, Acting Director  
Division of Low-Level Waste Management  
and Decommissioning

SUBJECT: RESNIKOFF REPORT

We have completed our review of Dr. M. Resnikoff's report entitled, "Living Without Landfills." We consider it appropriate to distribute copies of the summary of our review to the States. Attached please find a copy of the review summary.

If you have any questions please contact G. Roles (20595) or T. Johnson (20558).

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Richard L. Bangart, Acting Director  
Division of Low-Level Waste Management  
and Decommissioning

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As stated

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LIVING WITHOUT LANDFILLS  
SUMMARY OF NRC STAFF COMMENTS

A. INTRODUCTION

In October 1987, Nuclear Regulatory Commission (NRC) staff received the final version of a report by Dr. Marvin Resnikoff entitled, "Living Without Landfills." In this report Dr. Resnikoff makes recommendations on the management of low-level radioactive wastes.

Early in the development of this report NRC staff was asked to participate in the project and review an outline of the report. At that time we responded that it would be inappropriate to participate. NRC staff was later asked to review a draft report. In response to this request we provided in June 1987 broad comments following a limited review. We concluded that major revisions would be needed to make the report an objective one. Although the final report addresses our June 1987 comments, the authors response has been to reaffirm his original position without making the recommended changes. We have reviewed each of their responses to our previous comments and believe that the final report continues to contain a large number of inaccurate and incomplete statements which lead to inappropriate conclusions and recommendations.

B. MAJOR COMMENTS ON REPORT

The NRC staff performed a review of "Living Without Landfills" focusing only on the major issues. No attempt was made to comment on all inaccurate or incomplete statements. As a result of the review the NRC staff identified significant concerns in the following areas: technical information on low-level waste sources; historical experience at commercial low-level waste disposal facilities; analysis of 10 CFR Part 61; discussion of disposal alternatives; and conclusions and recommendations. Below we discuss our major comments in each of these areas of the report.

1. Low-Level Waste Sources

The report states that virtually all of the low-level waste activity is generated by nuclear power plants. It states that 99 percent of all low-level waste activity, projected to the year 2020, is from this source. This value is used to provide a basis for the report's

recommendation that wastes should be stored at nuclear power plants rather than disposed of in low-level disposal facilities.

We believe the 99 percent value is misleading in a discussion on commercial low-level waste management principally because it includes Greater-Than-Class C (GTCC) wastes which are considered in the Part 61 regulation to be generally unsuitable for near-surface disposal. The discussion does not reflect the actual radionuclide activities in wastes currently being disposed, the fact that GTCC wastes are not being shipped for disposal to commercial low-level waste disposal facilities, or the NRC staff recommendations on the disposition of GTCC wastes.

The report furthermore blurs the significant distinctions between Class C and GTCC wastes, including radioactivity content and disposal methods. GTCC wastes are currently being stored at waste generator facilities; the operating low-level disposal sites are not accepting GTCC wastes for disposal. Under the Low-Level Radioactive Waste Policy Amendments Act of 1985 (LLWPA) GTCC wastes are the responsibility of the Federal government. It will be, therefore, unlikely that these wastes would be accepted by States for disposal at future commercial disposal facilities even if a technical rationale is provided. NRC staff has recommended that GTCC wastes be disposed in the high-level waste repository because of its small volume (2000 m<sup>3</sup> projected through the year 2020) and because criteria already exist for waste disposal in a geologic repository.

Another problem is that the report's 99 percent value is based on some highly conservative, yet contradictory, assumptions. The 99 percent value is based on the inclusion of wastes from decommissioning nuclear power reactors several years in the future, coupled with the assumption that all nuclear power reactors are dismantled as soon as they are shut down. Elsewhere, the report voices the expectation that shutdown nuclear power plants will sit for up to thirty years prior to dismantlement. This is significant since the great majority of the radionuclides in power reactor decommissioning wastes will have half-lives of about 5 years or less. A few years of delay between shutdown and dismantlement will therefore have a significant effect on radioactivity in decommissioning wastes. (It can also be noted that greater than 95 percent of the radioactivity in wastes from decommissioning nuclear power reactors will be in wastes that exceed Class C concentrations.)

As another point, the report indicates that greater than 99 percent of the long-lived activity in LLW is contributed by nuclear power reactors. No basis for this statement is presented. In any case we believe that the statement is questionable. LLW generated by nuclear power plants is, in fact, dominated by very short-lived radioisotopes.

To evaluate the significance and impacts of the source term, the report presents a concept called "Hazardous Life," which the report defines as the time required for the radionuclides within waste to decay to a factor of 100 times the release limits in 10 CFR Part 20, Appendix B, Table II. The term is recommended in place of the 10 CFR Part 61 waste classification system as the basis for determining the time a waste must be controlled.

We believe that use of the Part 20 limits in this manner is questionable. The Part 20 limits are radionuclide specific concentration limits for release to an unrestricted area from a licensed facility. They serve to limit the dose to an individual, who is assumed to be continuously (over a 50 year period) ingesting or inhaling radionuclides at the listed concentration. If the Part 20 limits were to be applied to waste disposal, they would properly be applied to environmental releases from the disposal facility. It is therefore constructive to compare these limits with those in 10 CFR Part 61.

Pursuant to Part 61, a disposal facility must be sited, designed, operated, and closed, and waste must be classified and disposed, so that the Part 61 performance objectives are met. These performance objectives limit possible releases to the environment so that a member of the public will not exceed a prescribed dose limit, and also serve to limit the dose to a potential inadvertent intruder. The Part 61 performance objectives and waste classification system are based on a detailed set of disposal facility pathway analyses which include considerations for radionuclide toxicity, half-lives, uptake factors, projected waste properties, and reference site environmental conditions. Together, they limit doses due to potential environmental releases to levels roughly 20 times less than those used to set the current Part 20 concentration limits. Potential doses to an inadvertent intruder are limited to levels comparable to those used to set the Part 20 concentration limits.

## 2. Historical Experience at Disposal Sites

The report discusses the site characteristics of the six low-level waste disposal facilities in the United States and the problems which resulted in the closure of three of them. In the report many references are made to past disposal practices, activity measurements made on trench sump liquids, and activity detected off-site.

The report draws the conclusion that current disposal practices represent a failed technology. Conclusions are drawn, however, without full consideration of other information. That is, the low-level waste management regulation, 10 CFR Part 61, was developed to preclude the poor practices of the past and costly remedial activities. In addition, the three open commercial disposal facilities, whose operations are consistent with the 10 CFR Part 61 requirements, have not observed the problems associated with the closed facilities. The report also suggests that activities measured in trench sump liquids represent off-site releases. The report also fails to clearly put into perspective the fact that off-site releases from the closed facilities, despite the poor practices, have been below the release limits in 10 CFR Part 20 and have, therefore, not threatened public health and safety.

## 3. 10 CFR Part 61

The report compares the requirements of the 10 CFR Part 61 proposed rule with that published as a final rule. In this discussion the report concludes that the final rule is substantially weaker than that proposed. As an example, the report states that 150 year waste form stability requirement in the proposed rule was dropped in the final rule. The report is correct in stating that the requirement was dropped, however, it was replaced with a stability objective of 300 years (10 CFR §61.7).

Detailed guidance for demonstrating a stable waste form, including immersion and leaching tests, were published in a Technical position which has been adopted as a requirement by all operating disposal sites. The report also criticizes the increase in the Class C limits by a factor of 10 by stating that no calculations were performed to justify this change. The changes made to the waste classification system in the proposed rule were made to reflect public comments and a more realistic waste source term. The changes are based on detailed calculations of the impacts for the disposal of typical low-level wastes (which include the long-lived nuclides) and are discussed in the Final Environmental Impact Statement (FEIS)



supporting the rulemaking (NUREG-0945). These calculations showed that, even if no credit were taken for disposal at greater depths, or incorporation of some other intrusion barrier as required in the Part 61 rule for Class C waste, there would be insignificant dose impacts in increasing the Class C limits, this is because the incrementally added waste activities and volumes are small relative to the other wastes. The rationale for all other changes are also discussed in the FEIS.

#### 4. Waste Management Alternatives

The report discusses alternatives for volume reduction, segregation of wastes by half-life and engineered disposal concepts, and concludes that wastes should be compacted and segregated by half-life with wastes stored in above ground facilities designed for the waste's hazardous life. As an integral part of developing major recommendations, the report suggests segregation of waste by half-life into three groups (hazardous life of 100 years, 300 years, and greater than 10,000 years). Wastes having a hazardous life of 100 years would be "stored in engineered above ground structures until it decays to non-hazardous levels." (Presumably, this would include almost all low-level waste.) Wastes having a hazardous life of 300 years would be stored retrievably in "more substantial, shielded structures, with leachate collection systems." (The report states that this consists of utility waste, comprising less than 5% of the total low-level waste volume.) All wastes with a hazardous life greater than 10,000 years (which the report states would include Class C and GTCC wastes and would comprise only a few percent of the waste volume) would be disposed in a high-level waste repository. The report is silent on disposal of waste having a "hazardous life" between 300 and 10,000 years.

The report provides an incomplete rationale justifying the proposed hazardous life classification system. Some of the factors that could be considered in such a rationale include, relative to Part 61, short and long-term environmental impacts, occupational exposures, and costs. No methods are suggested by the report or known by the staff for practically segregating wastes containing many different radionuclides having different half-lives. In order

to separate mixtures of radionuclide we would expect complex isotope separation processes to be needed. While isotope separation is used for small numbers of isotopes (e.g., Cs-137 and Sr-90 at Hanford,) processes have yet to be developed for complete separation of a wide range of nuclides such as those present in wastes produced by many waste generators.

Above-ground storage is recommended by the report because releases can be easily detected and corrected. The report, however, does not address the issue of increasing institutional commitments or ensuring that institutional control will remain effective for periods exceeding 100 years to ensure that remedial care activities will take place. In the development of 10 CFR Part 61 the NRC staff conservatively assumed that remedial activities and institutional control could not be assumed for greater than 100 years. Staff then set concentration limits on long-lived nuclides such that an inadvertent intruder would receive less than 500 mRem/yr from exposure to the remaining activity. The increase in the accessibility of above-ground structures to intruders is also treated lightly. NRC staff has recommended below-ground alternative concepts for disposal in part because these structures would be protected from freeze/thaw cycling and acid rain and because a soil cover acts as an additional intruder barrier.

## 5. Conclusions and Recommendations

The report recommends that siting activities for new low-level waste disposal capacity should be halted. Instead nuclear power plant sites should be used for permanent waste storage. (Note: the NRC staff considers permanent waste storage to be synonymous with waste disposal.) The report states that because 99 percent of the low-level waste activity is from nuclear power plants all wastes should be stored there.

The report does not address the question of proliferation of disposal sites nor does it recognize that the siting objectives for a power plant are very different than for a disposal site. In fact, staff believes that few current power plant sites would meet the 10 CFR Part 61 site suitability requirements.

The report also recommends storage of wastes in above-ground structures with eternal vigilance and recommends a Manhattan Project II to develop the technology for these structures. (Note: the NRC staff considers storage with eternal vigilance to be synonymous with disposal.) While there are nuclides with long half-lives in low-level wastes, the pathway analyses performed to support the

waste classification system consider their dose impacts and limit the allowable concentrations for near-surface disposal. In addition, while above-ground disposal may be feasible, the NRC staff considers that below-ground structures will provide a higher level of confidence that the structures will properly function with service lives of hundreds of years. In addition, below ground structures also improve the disposal facility intruder protection in the event that institutional control is not able to be consistently maintained.

#### C. CONCLUSION

The report is intended by the Radioactive Waste Campaign "to provide the public with rigorously accurate, scientifically impeccable information." In this goal the NRC staff believe the report falls far short. Instead, the staff believe that the report's recommendations are based on inaccurate and incomplete information and analysis.

This report fails to provide the public with a source of accurate and objective information which it needs and deserves in making responsible decisions regarding low-level radioactive waste management issues.