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Position Paper on the Use of Lead Shielding for the Disposal of Low Level Waste at the Nevada Test Site

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The U.S. Department of Energy, National Nuclear Security Administration/Nevada Site Office (NNSA/NSO) adopted a *Position on the Use of Lead Shielding for the Disposal of Low-Level Radioactive Waste at the Nevada Test Site (NTS)*[1] justifying the use of lead lined containers and bulk lead shielding for disposal of Low Level Radioactive Waste (LLRW) at NTS. The position is based on numerous United States Environmental Protection Agency (EPA) letters from the Office of Solid Waste and Emergency Response (e.g. OSWER Directives) stating lead that provides shielding in disposal operations are not solid wastes.[2] Revision 1 specifically excluded the use of radioactively contaminated lead as shielding. This position was documented in Issue 6 of the "Position Paper on the Proper Characterization and Disposal of Sealed Radioactive Sources", June 1996. The prohibition on the use of radioactively contaminated lead was based on consistency with practices at a commercial disposal facility. The acceptance of the June 1996 position paper on the proper characterization and disposal of sealed radioactive sources was documented in the August 7, 1996 letter from Runore C. Wycoff to distribution. The letter stated, "Based on the above reasoning and with the State of Nevada concurrence, the use of lead for shielding in containers for the disposal of LLRW should be an acceptable practice provided that standard packaging would not reduce the exposure rate to less than 0.005 rem/hr at 30 centimeters and shielding is necessary for radiation protection. The lead being used for shielding cannot be radioactively contaminated when introduced. The addition of lead shielding to LLRW where additional radiation protection is not required is prohibited by RCRA".

The justification for the use of lead shielding was based on EPA's position on the use of lead-lined containers, documented, most notably in OSWER Directive 9432.00-2[3]. The subject guidance addresses the issue of identifying if lead container liners whose primary use is for shielding in disposal operations are hazardous waste under RCRA. The directive stated that while lead container liners may exhibit the hazardous characteristic for lead, those containers whose primary use is for shielding in low-level waste disposal operations are not considered solid waste and thus, not subject to the hazardous waste rules.

The position paper determined that bulk lead introduced into LLRW packages was also not considered a hazardous waste under RCRA as long as the lead was necessary for radiation protection during disposal operations and it was not radioactively contaminated when introduced.

Generators who use the NTS for disposal of LLRW have requested to use radioactively contaminated lead shielding in lieu of radioactively uncontaminated or virgin lead shielding in the disposal packages. The use of radioactively contaminated lead shielding provides U.S. Department of Energy (DOE) generators waste minimization opportunities as opposed to procuring virgin lead. In 2001, the United States DOE Oak Ridge National Laboratory prepared

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[1] NNSA/NSO, *Position on the Use of Lead Shielding for the Disposal of Low-Level Radioactive Waste at the Nevada Test Site*, Revision 1, August 2001

[2] EPA OSWER Letter from Richard Kinch to Gaynor Dawson, "Lead Shielding For Radioactive Waste Is A RCRA Solid Waste", April 30, 1991, RPPC Number 9444.1991(02), Faxback Number 13468, EPA Publication Number Not Applicable; and EPA OSWER Letter from Marcia Williams to Terry Husseman, "Treatment And Disposal Methods For Low-Level Wastes That Contain Uncontaminated Or Radioactive Lead ", June 26, 1987, RPPC Number 9441.1987(52), Faxback Number 12956, EPA Publication Number Not applicable;

[3] EPA OSWER , Memorandum from Jonathan Z. Cannon and Robert Bernero to all All NRC Licensees, "Joint EPA/NRC Guidance on the Definition and Identification of Commercial Mixed Low-Level Radioactive and Hazardous Waste," Directive No. 9432-00-2, October 4, 1989;

a paper titled *Supplemental Release Limits for the Directed Reuse of Lead in Shielding Products* (ORNL/TM-2001/36). The paper included life cycle costs analysis for the use of residual contaminated lead in shielding versus the disposal of the material demonstrating the cost savings and waste minimization opportunities by using residually contaminated lead as shielding in storage disposal containers.

> "The cost comparison of alternatives uses as a baseline the burial of 400 tons annually of contaminated Pb as mixed waste (MW Burial). The value of 400 tons is chosen because it represents the amount of Pb that may be processed annually for directed re-use in radiation shields, the single other alternative considered. Four cost elements—characterization/survey/sorting, packaging, transportation, and disposal—are common to both alternatives. Costs for packaging in strong, tight containers are the same ($69K) in both alternatives, since the number of SeaLand containers required is the same in either case. Transportation costs are also considered to be essentially equivalent (at $25K), since the scrap lead must move from various DOE sites around the continental United States to a fairly central location for either recycling or burial. More extensive characterization, survey and sorting requirements for burial as mixed waste result in higher cost ($186K), compared with the re-use alternative ($6K). A significant difference is also noted in disposal costs for the two alternatives: burial as mixed waste at the EnviroCare disposal facility costs are estimated at $3.00/lb, for a resulting total burial cost of $2,400K – almost twice as expensive as encapsulation of the lead as shielding for an estimated $1.60/lb and a total cost of $1,280K. A cost saving is present in the re-use option as an approximately $800K credit against the price of commercial lead which does not have to be purchased for the construction of radiation shields. The cost comparison, detailed in Attachment 1 (provided by NMR for this analysis), shows that burial of contaminated Pb as mixed waste would cost the DOE approximately $2.7M annually, compared with an annual cost of $0.6M for re-use as encapsulated radiation shields. Directed re-use of the Pb in radiation shields therefore represents a $2.1M annual cost savings for the DOE."[4]

Based on the above reasoning, and with the State of Nevada concurrence, the use of lead for shielding in containers for the disposal of LLW should be an acceptable practice provided the shielding is necessary for radiation protection. The use of contaminated lead shielding would be acceptable under the following conditions:

1. Documentation demonstrating that standard packaging without lead shielding would not reduce the exposure rate to less than 0.005 rem/hr at 30 centimeters and the shielding is necessary for radiation protection must be maintained.

2. Documentation demonstrating that the amount of lead used for shielding is not excessive for each specific container of LLRW. The documentation shall include calculations demonstrating the amount of lead (thickness/quantity) in the container is not excessive by justifying the quantity of lead required in each given container, or on a container-by-container basis. Justification for using the appropriate amount of lead shielding can be demonstrated by a detailed dose rate survey that shows the shielded dose rate exceeds 0.005 rem/hr at 30 cm from the waste package.

[4] DOE ORNL *Supplemental Release Limits for the Directed Reuse of Lead in Shielding Products by the Department of Energy,* ORNL/TM-2001/36, Section 3.5, p. 13, August 2001.