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### Summaries of 3 Independent Reviews of the Mixed Waste Landfill

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Summaries of  
3 Independent Reviews of the  
Mixed Waste Landfill  
Sandia National Laboratories/U.S. Department of Energy

Commissioned by Citizen Action  
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The following reports were made possible with a grant from the Monitoring and Technical Assessment Fund (MTA) to assist in performing independent technical studies of the Mixed Waste Landfill (MWL), a hazardous waste site containing radioactive and chemical legacy wastes located at Sandia National Laboratories (SNL). The funding, established as a part of a \$6.25 million court settlement between the U.S. Department of Energy (DOE) and 39 nonprofit and environmental groups, assists tribes and other non-governmental organizations in conducting their own independent technical studies of sites at DOE facilities.

## **1. “Review of the Risk Screening Assessment for the Mixed Waste Landfill, SWMU76” –**

**by Marvin Resnikoff, Ph.D., Radioactive Waste Management Associates**

### **Conclusions:**

- Sandia’s risk assessment calculates risk to adult males only using outdated conversion factors that do not consider risk to women, children, infants, etc.;
- Calculates risk associated with tritium only, and neglects to consider types and amounts of various other radioactive contaminants and their decay products;
- Subtracts chemical inhalation factors from assessment instead of adding chemical and radionuclide cancer risks to determine combined risk;
- Sampling methods for radiological and non radiological contaminants questionable;
- Does not consider contaminant exposures to future populations or future pathways;
- Does not consider failure of physical and institutional controls for times greater than 100 years as recommended by EPA (\*see DOE Radioactive Waste Management Manual 435.1-1, 7/09/99, IV-12: “For intruder analyses institutional controls shall be assumed to be effective in deterring intrusion for at least 100 years following closure);
- Gamma readings of high levels of radiation in certain pits do not match the inventory of waste recorded buried in them;
- Information is missing with regard to curie levels, types, and amounts of waste.
- Waste (contaminant source) buried at MWL has not been fully identified and landfill has not been adequately characterized;
- Potential risks associated with buried wastes have not been fully evaluated.

### **Recommendations:**

1. Better characterization of waste (types, amounts, curie levels) buried in the landfill to fully identify risks to human health and the environment.

2. Risk calculations should use dose conversion factors based on risk to women, children, infants, pregnant mothers.
3. Risk needs to future populations should be based on the FULL inventory of buried waste (long and short-lived radionuclides, decay products, hazardous waste constituents) and evaluated to determine potential long-term risk.
4. Risk needs to be calculated based on a variety of intrusion scenarios and loss of institutional controls for times greater than 100 years, (i.e.) if a home is constructed someday on the site with a foundation and garden, etc., bringing radioactive and toxic chemical materials to the surface; a well drilled through the landfill to the water table; potential releases of contaminants through intrusion of the landfill by burrowing animals.
5. Combined risk from both chemicals and radionuclides needs to be calculated.
6. The new baseline risk assessment should be reviewed by an independent third party.
7. Any plan that involves leaving waste in-situ should have a dedicated fund for continued monitoring/maintenance of landfill.

## **2. “Review of Sandia National Laboratories Evapotranspiration Cap Closure Plans for the Mixed Waste Landfill” – by Tom Hakonson, Ph.D., Environmental Evaluation Services, LLC.**

### **Conclusions:**

- Buried waste can be mobilized to the ground surface through plant roots and animals and insect burrowing can dramatically increase infiltration of water into landfill with covers as thick as those proposed;
- Vertical transport of contaminants to the ground surface by biota may be small on a short time scale, *but over many decades these processes may become dominant in mobilizing buried waste*;
- The long-term consequences of biointrusion into low level waste landfills located in arid areas estimated that doses to humans resulting from biological transport were as high as doses calculated from a human intrusion scenario (Pacific Northwest Laboratory);
- One of the more important deficiencies in Sandia National Lab’s (SNL) closure plan proposed for the MWL is the assumption that vertical and horizontal transport of contaminants resulting from biological processes is not an important contributor to exposure pathways;
- Both cap designs (Dwyer et, al., SNL Environmental Restoration group) do a credible job of analyzing the evapotranspiration (ET) cover, and in the reviewer’s opinion both cap designs will provide adequate protection of contaminants to ground water *assuming the site is diligently monitored and maintained throughout the post closure monitoring period while assuming the surface pathway proves to be unimportant in contributing doses to humans*;
- Under the right conditions the roots of ALL types of vegetation have the ability to extend several meters into the soil and transport contaminants to the surface.
- While an ET cap can minimize soil moisture it can contribute to vapor phase transport of volatiles;

- SNL's conclusion that waste has not been mobilized to the ground surface by animals is poorly supported as it is: 1) based on soil samples taken (in part) from areas of landfill recently backfilled; 2) sampling was coarse in resolution; 3) samples were non-random in space; and 4) samples purposely did not include disturbed areas created by burrowing animals;
- Once contaminants are transported to ground surface a complex distribution process occurs that can result in widespread transport of contaminants across the landfill surface to offsite areas;
- Human intrusion scenarios should take a conservative approach such as the loss of institutional controls under a subsistence farmer scenario;
- Changes in climate can radically affect the integrity of cap;
- SNL's proposed plan to use a neutron moisture gage (NMG) are vague on how the monitoring data will be used to conclude that percolation is or is not occurring. NMG is labor intensive (data must be downloaded and managed); NMG must be calibrated to soil (difficult when layered soils are involved); reliable measurements are limited to volumetric water contents above 5%; NMG integrates moisture content over a relatively large area making it difficult to pinpoint the specific zone depth being interrogated; NMG provides instantaneous estimates of soil moisture so that measuring after precipitation is critical; NMG should not be used as an early warning system (see page 50 for detailed review).
- Little or no planning has been done on the post-closure phase of Mixed Waste Landfill (MWL) closure and there is no contingency plan should the ET cap not perform as predicted.

### **Recommendations:**

1. Any post closure plan should provide measurements on all possible migration pathways that include vadose zone transport, soil sampling for surface contamination, and biological transport.
2. Soil surveys should be required in undisturbed areas closed early in the landfill operation with a comprehensive long-term sampling program after MWL is closed consisting of sampling of surface soils and biota.
3. A comprehensive sampling plan should be required that *reflects the inventory of contaminants in landfill, not just short-lived tritium.*
4. The use of biointrusion barriers to keep animals from burrowing into landfills has had mixed reviews in terms of effectiveness; a wire mesh type barrier proposed by Dwyer et.al. is the best choice for the MWL although it will not keep ants and other insects from burrowing into the landfill.
5. A contingency plan should be developed and incorporated into the post closure plan in the event the cap fails and/or contaminants are found to be migrating.
6. Establishment of a decision criteria to respond to any problems that may occur at MWL.
7. A financial assurance mechanism should be established for monitoring, maintenance, and contingency costs based on NMED requirements for closure and post-closure plans under RCRA: a) evaluation of the effectiveness of the cover at specific time intervals; b)

monitoring; c) remedial measures that include excavation and removal of landfill contents should a significant problem be revealed through monitoring.

**3. “Is ‘Trust Us, We’re the Government’ Really A Guarantee? A Review of Financial Assurance Options for Long-Term Stewardship at the Mixed Waste Landfill, Sandia National Laboratories” – by W. Paul Robinson, Research Director, Southwest Research and Information Center.**

**Conclusions:**

- Recent policy initiatives and considerations by the Department of Energy (DOE) related to long-term stewardship (LTS) do not provide a clear path to solve the LTS dilemma;
- Transfer of waste sites to other federal agencies does not solve the LTS dilemma nor does it address questions about potential long-term risks associated with specific sites;
- Clean up without removal of hazards will result in a greater emphasis on LTS;
- LTS necessitates the use of a financial assurance mechanism or other guarantees to ensure that all post closure activities and contingency plans will be implemented;
- Trust funds have been established at DOE facilities such as the Oak Ridge model.

**Recommendations:**

1. The Corrective Measures Study (CMS) that is being conducted for the Mixed Waste Landfill (MWL) should include costs of full remediation to minimize or eliminate LTS requirements.
2. The CMS should identify the FULL COST for closure and post-closure plans including periodic evaluation of the effectiveness of the proposed evapotranspiration (ET) cap, monitoring, maintenance, and repair of cap on a PERPETUAL basis.
3. A financial assurance mechanism should be included as part of the post closure remedies in the CMS as an option to guarantee that the full cost of LTS at the MWL will be available when needed.