

U.S. DEPARTMENT OF ENERGY  
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

**NUCLEAR WASTE TECHNICAL REVIEW BOARD  
FULL BOARD MEETING**

**SUBJECT: WASTE ISOLATION IMPACT  
EVALUATION**

**PRESENTER: DR. JEAN L. YOUNKER**

**PRESENTER'S TITLE  
AND ORGANIZATION: MANAGER, REGULATORY AND TECHNICAL EVALUATION  
M&O/TRW ENVIRONMENTAL SAFETY SYSTEMS  
LAS VEGAS, NEVADA**

**PRESENTER'S  
TELEPHONE NUMBER: (702) 794-7650**

ARLINGTON, VIRGINIA  
JANUARY 12, 1994

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# Overview

- **Regulatory background**
- **Waste isolation evaluations**

# Site Characterization Plan Background

## Consultation Draft (SCP/CD) (1/88)

- **NRC's Objections 1, 2, and 4 addressed possible adverse impacts on waste isolation**
- **DOE revised final SCP to address NRC concerns**

## Final SCP/CD (12/88)

- **Objections 2 and 4 were lifted on the basis of DOE commitments to evaluate potential impacts**
- **Objection 1 was re-issued on final SCP**
  - **"...the NRC staff concludes that the analyses presented are not sufficient to assure ... that damage to the ability of the site to isolate waste will be avoided." (NUREG-1347, NRC, 1989)**
- **Objection 1 lifted 12/92**

# Waste Isolation Evaluations

- **Evaluate potential impact of site characterization and construction activities and materials on the ability of a potential repository to isolate waste**

# Potential Impacts

- **Enhanced aqueous or gaseous radionuclide transport (chemical, physical, biological)**
- **Increased volumes/rates of water flowing into the potential repository**
- **Increased saturated-zone ground-water travel time**
- **Adverse thermo-mechanical effects**
- **Cumulative effects of site characterization**

# **Activities and Materials Reviewed for Inputs on Waste Isolation**

- **Applied surface and subsurface water**
- **Disturbances to geohydrologic pathways**
- **Applied materials (other than water)**
- **Physical/chemical characteristics of seals**

# **Activities and Materials Reviewed for Inputs on Waste Isolation**

(Continued)

- **Applied surface water**
  - **Dust control/fill compaction/washdown water**
  - **Cooling water for concrete batch plant**
  - **Infiltration studies**
  - **Leach fields and muck piles**
  
- **Applied subsurface water**
  - **TBM dust-control water**
  - **Fire-fighting in ESF**
  - **Aqueous drilling fluids**
  - **Accidental spills down boreholes**

# **Activities and Materials Reviewed for Inputs on Waste Isolation**

(Continued)

- **Disturbances to geohydrologic pathways**
  - **Increased infiltration due to ponding in trenches and pits**
  - **Flood waters entering exposed boreholes**
  - **Induced movement of perched water**
  - **Surface leveling and use of compacted fill for road and pad construction**

# Activities and Materials Reviewed for Inputs on Waste Isolation

(Continued)

- **Materials (other than water) used in surface activities**
  - Organic soil stabilization and dust-control products
  - Gasoline and diesel fuels
  - Grout
  - Hydraulic fluids, lubricants, and coolants
  - Explosives
  - Drilling fluids
  
- **Materials (other than water) used in subsurface activities**
  - Aqueous tracers
  - Exhaust emissions
  - Hydraulic fluids, lubricants, coolants, diesel fuel
  - Other construction materials used in ESF (wood, grouts)
  
- **Physical/chemical characteristics of borehole/ramp seals**

# **Example of Evaluation in Progress Diesel Emissions**

## **Alternatives**

- **Electric**
  - **Avoids diesel exhaust and fuel**
- **Diesel**
  - **Simpler design/construction**
  - **Greater flexibility**

# Potential Diesel Use

- **Personnel and materials transportation**
- **Earth-moving equipment**
- **Other construction equipment**

# Concerns Related to Diesel Usage

- **Enhance waste-package corrosion**
- **Facilitate radionuclide migration**

# **Strategy to Evaluate Potential Impact of Diesel Emissions**

- **Determine quantity retained**
- **Compare concentration of retained materials to natural concentrations**
- **Determine if potential for significant adverse impact exists**
- **Provide risk/benefit assessment to DOE management**

# Preliminary Results for ESF Diesel Usage

Constituent	kg/yr	Incremental	PPM	
			With ECT*	Natural
<b>Inorganic constituents</b>				
• Carbon Monoxide	5,700			
• Carbon Dioxide	24,000	1.8	1.8	1000
• Nitric Oxide	12,000	} 1,300 (aq.)	1,300	10
• Nitrogen Dioxide	600			
• Sulfur Dioxide	9,200	730 (aq.)	350	20-170
<b>Organic constituents</b>				
• Hydrocarbon	11,000	1 (aq.)	0.1	1
• Diesel Particulates	1,800	90 (aq.)	1.8	1

\* Emission-control technology

# Preliminary Conclusions

- **Some components of diesel exhaust may be permanently retained and alter the natural water composition**
- **These components could adversely impact waste-package corrosion or radionuclide transport**
- **Additional field, lab, and modeling underway to provide improved basis for evaluating risk/benefit**

Log of Waste Isolation Evaluations

PA: Site Construction/Characterization Activity Schedule as of 1/11/94

Activity	Contributors	Requestor	Start	Due	Compl.
Completed					
Waste isolation evaluation - Liner for Exploratory Studies Facility (ESF) Phase 1A rock storage area	A. Brandstetter	J. Gardiner	10/30/92	11/04/92	11/04/92
Waste isolation evaluation - plugging of existing drillhole NRG-1	C. Bruch	R. Dyer D. Williams	11/10/92	11/10/92	11/23/92 12/15/92
Meet with involved organizations to discuss internal and external coordination	A. Brandstetter	A. Brandstetter	10/01/92	none	11/30/92
Waste isolation evaluation - Fran Ridge Borrow Pit No. 1	A. Brandstetter J. Houseworth E. Paleologos	C. Gertz R. Dyer J. Gardiner	11/05/92 11/25/92 12/17/92	11/19/92 11/30/92 ASAP	11/10/92 12/10/92 12/21/92
Waste isolation evaluation - Exploratory Studies Facility (ESF) Phase 1A tracers, fluids and materials (TFMs)	A. Brandstetter E. Paleologos	H. Kalia J. Gardiner	11/13/92 12/17/92	11/20/92 ASAP	12/11/92 12/18/92
Waste isolation evaluation - plugging of existing drillholes RF-3, 3B, 5, 9, 10 and 11	C. Bruch	R. Dyer D. Williams	11/25/92	12/04/92	12/15/92
Waste isolation evaluation - cement to be used in plugging of existing drillhole NRG-1	C. Bruch	H. Kalia	11/24/92	12/11/92	12/15/92
Waste isolation evaluation - UZ-1/UZ-14 hydrocarbon spill remediation	A. Brandstetter	R. Dyer T. Sullivan	12/15/92	12/14/92	02/16/93
Waste isolation evaluation - C-well complex testing	E. Paleologos	R. Dyer C. Newbury	12/01/92	12/15/92	03/01/93
Waste isolation evaluation - prototype ponding and infiltration tests at existing neutron borehole UZN-85	J. Houseworth	R. Dyer A. Girdley	11/19/92	12/31/92	01/04/92

PA: Site Construction/Characterization Activity Schedule as of 1/11/94					
Activity	Contributors	Requestor	Start	Due	Compl.
Waste isolation evaluation - data acquisition phase of drillhole UZ-16, including geophones and sealing - status report	C. Bruch	R. Dyer M. Tynan	11/10/92	12/31/92	03/09/93
Prepare prioritized list of PA evaluations in support of ESF design and testing	A. Brandstetter	T. Petrie	12/03/92	12/31/92	01/19/93
Input to Test Planning Package (TPP) process improvement recommendations	A. Brandstetter	J. Boak	10/05/92	01/04/93	01/18/93
Formulate constraints on organic fluid leakage and on water use for dust control by first ESF tunnel boring machine	A. Brandstetter J. Houseworth	J. Younker	01/12/93	01/13/93	01/13/93
Waste isolation evaluation - drilling of drillhole UZ-14	C. Bruch	R. Dyer T. Sullivan	12/18/92	01/22/93	02/25/93
Waste isolation evaluation of TFMs for starter tunnel testing	A. Brandstetter	R. Oliver	02/17/93	03/04/93	03/11/93
Waste isolation evaluation - construction of drillhole NRG-4 road and NRG-5 road and pad	E. Paleologos	R. Bullock	01/20/93	not specified	03/04/93
Waste isolation evaluation - hydrocarbon spill at C-well complex	J. Houseworth	R. Dyer C. Newbury	02/24/93	02/26/93	03/31/93
Tracer Use in Fill Compaction and Dust Control Water	J. Houseworth	M. Blanchard	02/08/93	03/12/93	03/12/93
Waste Isolation Evaluation, Electrical Grounding Grid for NRG-5	J. Houseworth	H. Kalia	03/04/93	03/10/93	03/17/93
Waste Isolation Evaluation, Drilling of NRG#2A	J. Houseworth	R. Dyer	02/16/93	04/01/93	03/23/93
Evaluation of Potential Impacts Due to Use of Lithium Bromide in the ESF	J. Houseworth	N. Elkins	02/26/93	03/31/93	03/31/93

PA: Site Construction/Characterization Activity Schedule as of 1/11/94

Activity	Contributors	Requestor	Start	Due	Compl.
Waste Isolation Evaluation for YMP Temporary 69 kV Power Distribution System	E. Paleologos	W. Kopatich	03/01/93	?	04/06/93
Waste Isolation Evaluation; Road Oyl and EMC <sup>2</sup> , Dust Suppression and Soil Stabilization Products	C. Bruch	H. Kalia	03/23/93	04/16/93	04/20/93
Define design and construction requirements for ESF to assure repository can be sealed	SNL: Larry Costin	T. Petrie	12/03/93	04/30/93	02/02/93
Waste isolation evaluation - need for separate rock storage areas for Topopah Spring and Calico Hills muck	SNL: Larry Costin	T. Petrie	12/03/93	04/30/93	02/02/93
Waste Isolation Evaluation, TFM for C-Well Pump Tests	J. Houseworth	H. Kalia	04/06/93	04/10/93	04/29/93
Waste Isolation Evaluation, TFM for NRG-4, Electrical Grounding Grid	J. Houseworth	H. Kalia	04/06/93	04/10/93	04/29/93
Waste Isolation Evaluation, Drilling of SRG-5	C. Bruch	J. Weaver	04/28/93	05/03/93	05/04/93
Waste Isolation Evaluation, Drilling of UE-25 NRG#2 and UE-25 NRG#2A, Supplement #1	J. Houseworth	R. Dyer	05/24/93	05/24/93	05/25/93
Waste Isolation Evaluation, Drilling of UE-25 NRG#5, Supplement #1	J. Houseworth	R. Dyer	05/24/93	05/24/93	05/25/93

PA: Site Construction/Characterization Activity Schedule as of 1/11/94

Activity	Contributors	Requestor	Start	Due	Compl.
Waste Isolation Evaluation, Package 1A Water Supply System for the Exploratory Studies Facility	J. Houseworth	P. Hastings	05/17/93	05/28/93	06/01/93
Waste Isolation Evaluation, Package 1B Surface Buildings, Parking, and Compressed Air Facility	J. Houseworth	P. Hastings	05/17/93	06/01/93	06/01/93
Waste Isolation Evaluation, Fran Ridge Large Block Experiment	C. Bruch	R. Oliver	04/22/93	05/28/93	06/04/93 ?
Waste Isolation Evaluation, Concrete Batch Plant	J. Houseworth	W. Kopatich	05/24/93	06/02/93	06/16/93
Letter Response for TFM for thread compound	J. Younker	R. Dyer	05/26/93	ASAP	06/15/93
Waste Isolation Evaluation, Drilling of UE-25 NRG#2B	J. Houseworth	M. Voegele	05/26/93	ASAP	06/15/93
Letter Response for 138 kV service for the North Portal and 12.47 kV service from the North Portal to the South Portal	J. Younker	W. Simecka	05/27/93	07/30/93	06/15/93
Waste Isolation Evaluation, Package 1A Water Distribution System for the Exploratory Studies Facility	J. Houseworth	P. Hastings	NA	07/19/93	06/17/93
Performance Assessment Concerns Regarding a Diesel Transportation System to Service Tunnel Boring Machine (TBM) Operations	J. Houseworth	R. Sandifer	NA	07/12/93	07/13/93

PA: Site Construction/Characterization Activity Schedule as of 1/11/94

Activity	Contributors	Requestor	Start	Due	Compl.
Waste Isolation Evaluation, Package 2A Extension of the North Ramp Starter Tunnel	C. Bruch	P. Hastings	NA	07/05/93	07/15/93
Waste Isolation Evaluation, Tracers, Fluids, and Materials for North Ramp Starter Tunnel Testing and Construction, Supplement #1	J. Houseworth	H. Kalia	07/07/93	07/12/93	07/15/93
Waste Isolation Evaluation - Different ESF Ramp/Drift Sizes - Thermo-Mechanical and Flow and Transport	F. Tsai	T. Petrie	12/03/92	04/15/93	07/26/93
Waste Isolation Evaluation TFM for North Portal Pad Substation & 69 kV Power and Feeder System	J. Houseworth	H. Kalia & P. Hastings	05/28/93	06/11/93	07/26/93
Waste Isolation Evaluation, ESF Subsurface Wastewater Pond, Pkg 1B	C. Bruch	P. Hastings	NA	07/19/93	07/27/93
Waste Isolation Evaluation, Shop, Pkg 1B (Package 1B Surface Buildings Supplement #1)	J. Houseworth	P. Hastings	NA	07/19/93	07/29/93
Waste Isolation Evaluation, H-Road Widening and Paving, Pkg 1B (Pkg 1A Water Supply System Supplement #1)	J. Houseworth	P. Hastings	NA	07/19/93	07/29/93
Waste Isolation Evaluation Package 1B Sewer System	E. Paleologos	P. Hastings	06/07/93	06/18/93	07/30/93
Waste Isolation Evaluation, ESF Explosives Storage Area, Pkg 1B	J. Houseworth	P. Hastings	NA	07/19/93	07/30/93
Waste Isolation Evaluation, Excavation Trenches along Solitario Canyon Fault	J. Houseworth	J. Weaver	06/23/93	07/15/93	08/03/93
Letter Response to Ghost Dance Fault Roadcuts	J. Houseworth	R. Dyer	06/08/93	06/22/93	08/12/93

PA: Site Construction/Characterization Activity Schedule as of 1/11/94

Activity	Contributors	Requestor	Start	Due	Compl.
Waste Isolation Evaluation, Drilling and Testing of USW SD-12	E. Paleologos	J. Weaver	06/27/93	-	09/01/93
Clarification of Ghost Dance Fault Letter of 08/12/93	J. Houseworth	R. Dyer	-	-	09/03/93
Waste Isolation Evaluation, ESF Package 1A North Ramp Alcove #1	J. Houseworth	R. Oliver	07/05/93	08/30/93	09/03/93
Waste Isolation Evaluation, TFMs for North Ramp Starter Tunnel Testing and Construction, Supplement #2	J. Houseworth	H. Kalia	09/02/93	09/07/93	09/08/93
Waste Isolation Evaluation, ESF Package 1A North Ramp Alcove #1: Rev. 01	J. Houseworth	P. Hastings	-	-	09/10/93
Waste Isolation Impact Evaluation, TFMs for FY-1993 ESF Phase 1A Construction, Rev. 02	J. Houseworth	P. Hastings	-	-	09/10/93
Waste Isolation Evaluation, Package 1A Water Supply System for the ESF, Rev. 01	J. Houseworth	P. Hastings	-	-	09/10/93
Waste Isolation Evaluation, UZ-14 Perched Water Grouting Plan	J. Houseworth	H. Kalia	09/03/93	09/07/93	09/10/93
Waste Isolation Evaluation, NRG-7 Drill Pad and Access Road	J. Houseworth	R. Dyer	08/09/93	08/23/93	09/13/93
Waste Isolation Evaluation, Midway Valley Alice Ridge Trenching	J. Houseworth	J. Weaver	08/10/93	08/20/93	09/15/93
Waste Isolation Evaluation, Package 1A Water Distribution System for the ESF, Rev. 01	J. Houseworth	P. Hastings	09/20/93	-	09/16/93

PA: Site Construction/Characterization Activity Schedule as of 1/11/94

Activity	Contributors	Requestor	Start	Due	Compl.
Waste Isolation Evaluation, TFMs for North Ramp Starter Tunnel Testing and Construction, Supplement #2, Rev. 01	J. Houseworth	H. Kalia	09/02/93	09/07/93	09/20/93
Waste Isolation Evaluation, Seismic Reflection Line, ESF Support	J. Houseworth	J. Weaver	09/07/93	09/15/93	09/20/93
Waste Isolation Evaluation, TFMs for the UE-25C-Well Complex, Rev. 01	J. Houseworth	H. Kalia	-	-	09/24/93
Waste Isolation Evaluation, ESF Package 1B Explosives Storage Area, Rev. 01	J. Houseworth	P. Hastings	-	-	09/24/93
Waste Isolation Evaluation, ESF Package 1B Surface Buildings, Parking, and Compressed Air Facility, Supplement #1, Rev. 01	J. Houseworth	P. Hastings	-	-	09/24/93
Waste Isolation Evaluation, TFM, for the ESF North Portal Pad 69-12.47 kV Electrical Power, Site Grounding and Lightning Systems, Rev. 01	J. Houseworth	P. Hastings	-	-	09/24/93
Waste Isolation Evaluation, H-Road Widening and Paving, Rev. 01	J. Houseworth	P. Hastings	-	-	09/28/93
Waste Isolation Evaluation, ESF Package 1A North Ramp Alcove #1, Rev. 02	J. Houseworth	R. Oliver	-	-	09/28/93
Waste Isolation Evaluation, TFMs for North Ramp Starter Tunnel Testing and Construction, Supplement #2, Rev. 02	J. Houseworth	H. Kalia	-	-	09/28/93
Waste Isolation Evaluation, Additional Grouting of Perched Water Zones in USW UZ-14	J. Houseworth	R. Dyer	09/30/93	09/30/93	09/30/93

**PA: Site Construction/Characterization Activity Schedule as of 1/11/94**

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Waste Isolation Evaluation, Drilling of NRG-7	J. Houseworth	R. Dyer	09/24/93	09/30/93	10/04/93
Waste Isolation Evaluation, Seismic Reflection Line, Revision	J. Houseworth	R. Dyer	09/29/93	-	10/12/93
Waste Isolation Evaluation, Drilling and Testing of USW SD-12, Rev. 01	E. Paleologos	R. Dyer	10/08/93	10/11/93	10/13/93
IOC: Meeting Minutes concerning use of oil-flooded compressors	J. Houseworth L. Engwall	N/A	-	-	10/29/93
Waste Isolation Evaluation, Pulling Casing on NRG#2A and B	J. Houseworth	R. Dyer	11/2/93	11/3/93	11/03/93
IOC : Trenching for Electrical Ducts at ESF North Portal Pad	A. Brandstetter	P. Pimentel	11/3/93	11/3/93	11/03/93
Waste Isolation Evaluation, ESF 69 - 12.47 kV System	D. Sassani	P. Hastings	-	-	11/04/93
Waste Isolation Evaluation, Bow Ridge Fault Trenching near Drillhole UE-25 NRG#2A	A. Brandstetter	J. Weaver	-	-	11/09/93
Test and Waste Isolation Analyses for Activities at Reclamation Sites	J. Houseworth C. Newbury	N/A	-	-	11/09/93
Waste Isolation Evaluation, Infiltration Test in Fortymile Wash near H-Road Crossing	A. Brandstetter	J. Weaver	-	-	11/12/93

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PA: Site Construction/Characterization Activity Schedule as of 1/11/94					
Activity	Contributors	Requestor	Start	Due	Compl.
Waste Isolation Evaluation Pumping Tests at USW G-2, USW WT-1, UE-25 WT#12, UE-25 WT#17	E. Paleologos	J. Weaver	-	-	11/12/93
Waste Isolation Evaluation, Tracers, Fluids, and Materials for the Radiological and Environmental Field Monitoring Program	D. Sassani	H. Kalia	-	-	11/12/93
Waste Isolation Evaluation, Drilling of UZ-14 Through the Perched Water Zone	J. Houseworth	R. Dyer	-	-	11/15/93
Waste Isolation Evaluation, Construction of Drillpads and Drilling and Testing of Boreholes UE-25 NRG-2C, 2D and 2E	A. Brandstetter	J. Weaver	-	-	11/16/93
IOC: Preliminary Evaluation of the Future ESF Muck Storage Area Location	J. Houseworth R. Wernheuer	J. Nesbitt	-	-	11/18/93
TBM Seal Purge letter	J. Houseworth R. Kirk	J. Replogle	-	-	11/22/93
Waste Isolation Evaluation for Use of Non-Permanent Fluids and Materials at the Site Surface	D. Sassani	P. Hastings	-	-	11/22/93
Preliminary Waste Isolation Evaluation, Emissions from a Diesel Transportation System Supporting Tunnel Boring Machine (TBM) Excavation of the Exploratory Studies Facility (ESF) from the North Portal to the First Turn	D. Sassani	J. Nesbitt	-	-	11/24/93

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PA: Site Construction/Characterization Activity Schedule as of 1/11/94					
Activity	Contributors	Requestor	Start	Due	Compl.
IOC: Performance Assessment Capability Letter- ESF Package 1B	J. Houseworth	P. Pimentel	-	-	12/01/93
Waste Isolation Evaluation, Tracers, Fluids and Materials Usage for Construction of the Waterline for the North Ramp	D. Sassani	H. Kalia	-	-	12/02/93
Cleaning of LM-300 Drilling Rig on the USW UZ-14 Borehole Drilling Pad	A. Brandstetter	R. Dyer	-	-	12/08/93
IOC: Conservative Water Use Limit in Advance of Completed DIE Revision fo ESF Starter Tunnel	J. Houseworth R. Kirk	J. Naaf	-	-	12/16/93
Waste Isolation Evaluation, Construction of Access Road and Drill Pad, and Drilling and Testing of Borehole USW SD-9	A. Brandstetter	J. Weaver	-	-	12/17/93
Waste Isolation Evaluation, Drilling and Testing of Boreholes UE-25 NRG-8A, NRG-8B and NRG-8C	A. Brandstetter	J. Weaver	-	-	12/23/93
Waste Isolation Evaluation, Exploratory Studies Facility, Surface Systems for Water Conveyance and Disposal	J. Houseworth	P. Hastings	-	-	12/31/93
Waste Isolation Evaluation, Pumping Tests at USW WT-10 and UE-25 WT#13	E. Paleologos	J. Weaver	-	-	1/6/94

**PA: Site Construction/Characterization Activity Schedule as of 1/11/94**

Activity	Contributors	Requestor	Start	Due	Compl.
Waste Isolation Evaluation, Tracers, Fluids, and Materials Usage at Yucca Mountain C-Well Complex Tests - Use of Argon and Nitrogen to Inflate Packers	D. Sassani	H. Kalia	-	-	1/7/94
Waste Isolation Evaluation, Exploratory Studies Facility, Standby Electrical Generators and Air Compressors on the North Portal Pad	J. Houseworth	P. Hastings	-	-	1/7/94
Waste Isolation Evaluation, Tracers, Fluids and Materials for Exploratory Studies Facility (ESF) Phase 1A Construction	D. Sassani	P. Hastings	-	-	1/10/94