Overview of the Amargosa Desert Research Site (ADRS)

A Field Laboratory for the Study of Arid-Site Processes

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Arid sites often proposed for isolating Nation’s radioactive & other hazardous wastes
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Modified from Stonestrom & Harrill (2007)
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Dual needs ... waste management & resource protection ... require an understanding of both natural-hydrologic systems & contaminated systems
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![Dry, dust-storm](image1.jpg)

![Heavy rain, standing water](image2.jpg)
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  - Complexities in characterization, instrumentation, & monitoring

**So what’s the problem?**

- UZB-3 borehole (115-m deep, 15-cm diam.) – ~2 km of cables & tubing ... “The White Mamba”
- Waste trench under construction – 18 m ... 1/6th of the way to the water table
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Detailed data for arid sites are often lacking ...

- Limits ability to test assumptions about natural & contaminated systems
- Increases uncertainty in predictive models
AMARGOSA DESERT RESEARCH SITE (ADRS)

Field laboratory for sustained study of arid-site processes

- 1983 – USGS, BLM, State of Nevada
- Adjacent to Nation’s first commercial low-level radioactive waste (LLRW) facility – Beatty, Nevada

Overall objective

- Improve understanding of processes controlling unsaturated-zone transport of water & contaminants in arid environments
LLRW typically is “mixed waste”

- Contains both radioactive & hazardous components

- LLRW
  - “... waste not classified as high-level, spent-nuclear fuel, or mill tailings”  
    (Regulated by USNRC, Agreement States; LLRW Policy Amendments Act; 10 CFR Part 61)
  - Commercial sources & forms
    - Hospitals, research, industry, nuclear-power plants, ...
    - Shoe covers & lab coats, tools, nuclear-power reactor filters & residues, ...
  - Hazard to public health
    - Up to 500 yr for high-concentration/long-lived radionuclides

- Hazardous components
  - May include radioactive organics & heavy metals  
    (Regulated by USEPA; RCRA; 40 CFR Part 261)
    - Scintillation vials, cleaning solvents, mercury amalgam, ...
Amargosa Desert Research Site

- **Waste facility**
  - State owned; surrounded by BLM
  - LLRW, 1962-92
    - USNRC & State of NV regulation/oversight
  - Hazardous chemical, 1970-present
    - RCRA Subtitle C
    - USEPA & State of NV

- Precipitation (25-yr record)
  - 112 mm/yr average
  - min = 4, max = 225 mm/yr
- Creosote bush (*Larrea tridentata*)
- Alluvial/fluvial sediments
- Depth-to-water ~110 m
Shallow-land burial of LLRW

- Excavation, waste emplacement, backfill with stockpiled soil
- No liner required
  - Rely on natural- & disposal-site features to minimize water-waste contact
- Liquid waste solidified/dewatered prior to burial
  - "Early days" ... some liquids disposed directly into trenches

LLRW trench #22 – June 1988
Surfaces of completed trenches during operational period
  • Kept free of vegetation

Final cover over entire LLRW area (22 trenches)
  • Additional backfill to 2 m above land surface
Field-intensive research with multiple lines of data
  - Weather; ET; plants; microbiology;
    soil properties; soil water & gas monitoring;
    geology; geophysics; ground water

Natural & perturbed/contaminated conditions
  - Water & gas movement
  - Mixed-waste contaminants data
    - Tritium, carbon-14, VOCs, elemental mercury
  - Natural nitrate, perchlorate

Methods development

Field data integrated with modeling
  - Test & refine conceptual & numerical models

Multidisciplinary collaboration
  - USGS, University, Research Institute, National Lab, Other Agency
Instruments & monitoring within 400-m buffer zone*

* Distant/background study area located 3 km from waste facility
Cape Cod tracer-test array is impressive ...
but we’ve got the instrument shaft!

Cape Cod tracer-test array is impressive ...

15 m
Topical Outline for ADRS Session

- Oral
  - Overview
  - Water & gas flow
  - Tritium transport
  - VOC distribution & fluxes
  - Mercury transport
  - Tritium release by evapotranspiration
  - Wrap up ... Use of results

- Poster
  - Dispersion of contaminants by barometric pumping
  - Diurnal distillation for dewatering non-volatile point sources
  - Modeling water movement in desert soils
  - Natural perchlorate in precipitation, soils, & plants
  - Geologic framework
  - Geophysical mapping of hydrogeologic features