Cover Designs for Washington State's LLRW and U-Mills Tailings Facilities

Workshop on Engineered Barrier Performance
August 3-5, 2010

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Considerations for ET Cover at Western Nuclear, Inc.

- Long-term climate change.
- Vegetation succession and responses to potential climate change.
- Natural, stable site analogs.
- Worst case scenarios from fires, pests, and invasive plant communities.
- Effects of soil permeability.
- Effects from soil erosion.
- Effects of burrowing animals.
- Effects of soil development processes on water storage, permeability, and ecology.

NUREG-1620

- Geology and Seismology
- Geotechnical Stability
- Surface Water Hydrology and Erosion Protection
- Protection Water Source
- Radiation Protection


WAR
MONGRE


POLICE LINE

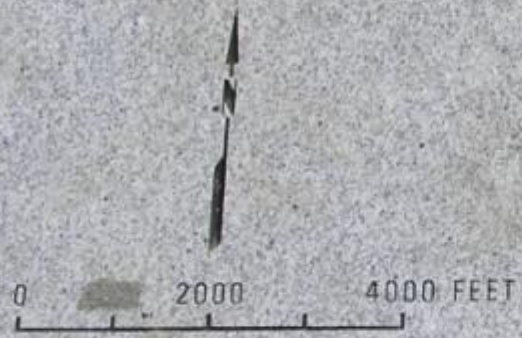

DEMAG

SHERWOOD, WASHINGTON

DATE OF CLOSURE: DECEMBER 1996

TONS OF TAILINGS: 2,900,000

RADIOACTIVITY: 470 CURIES, RA-226

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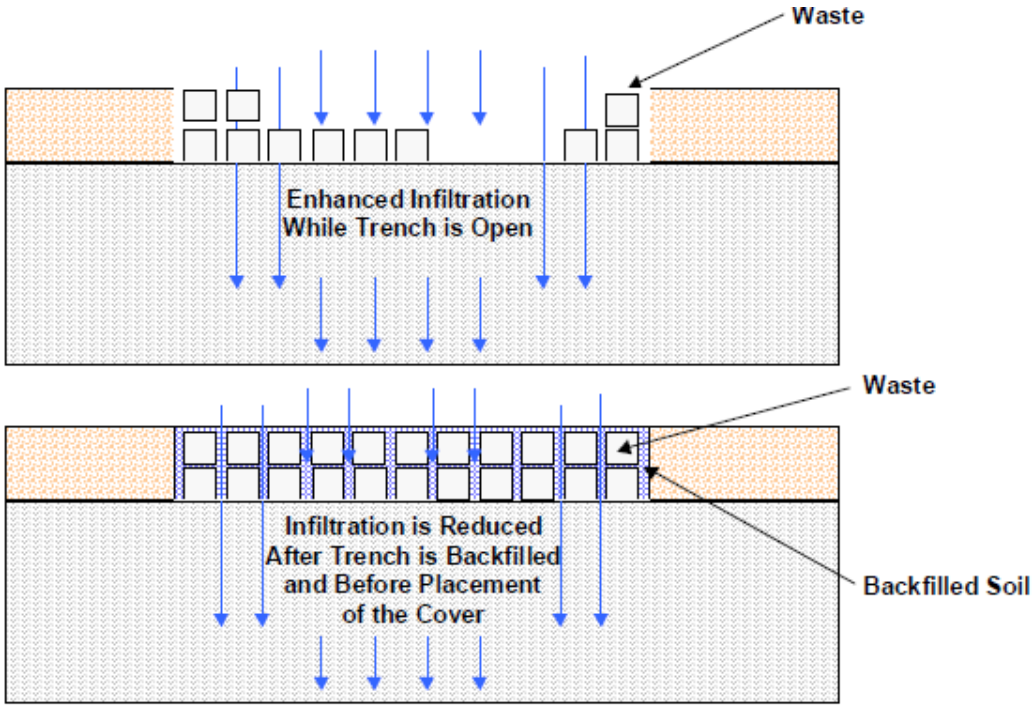
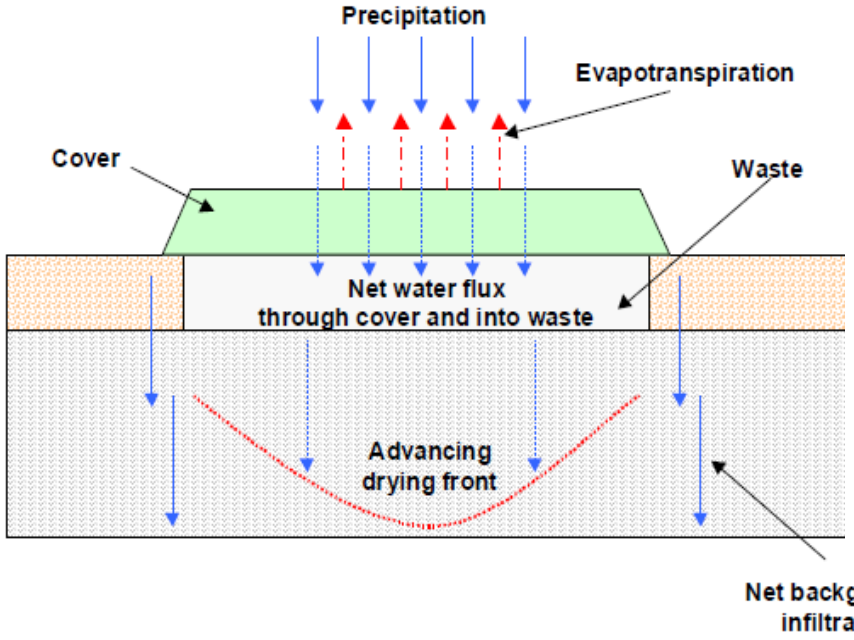
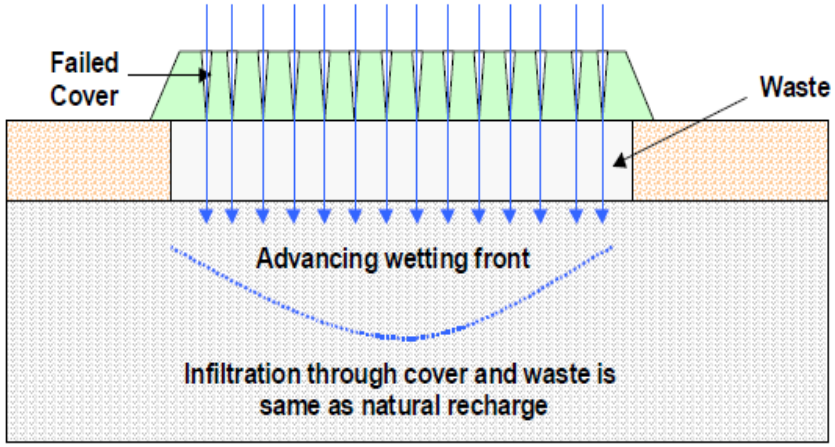
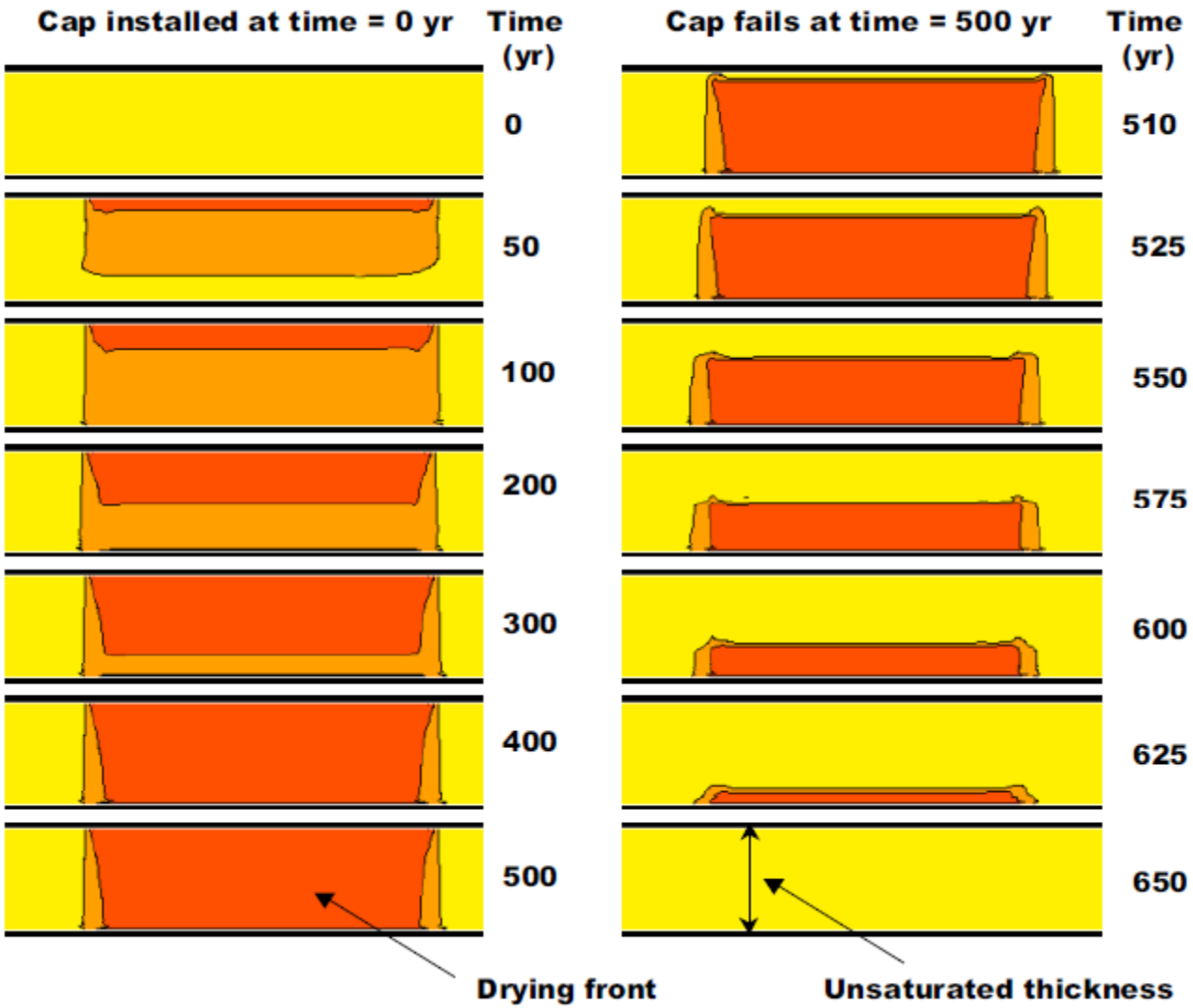
FULL

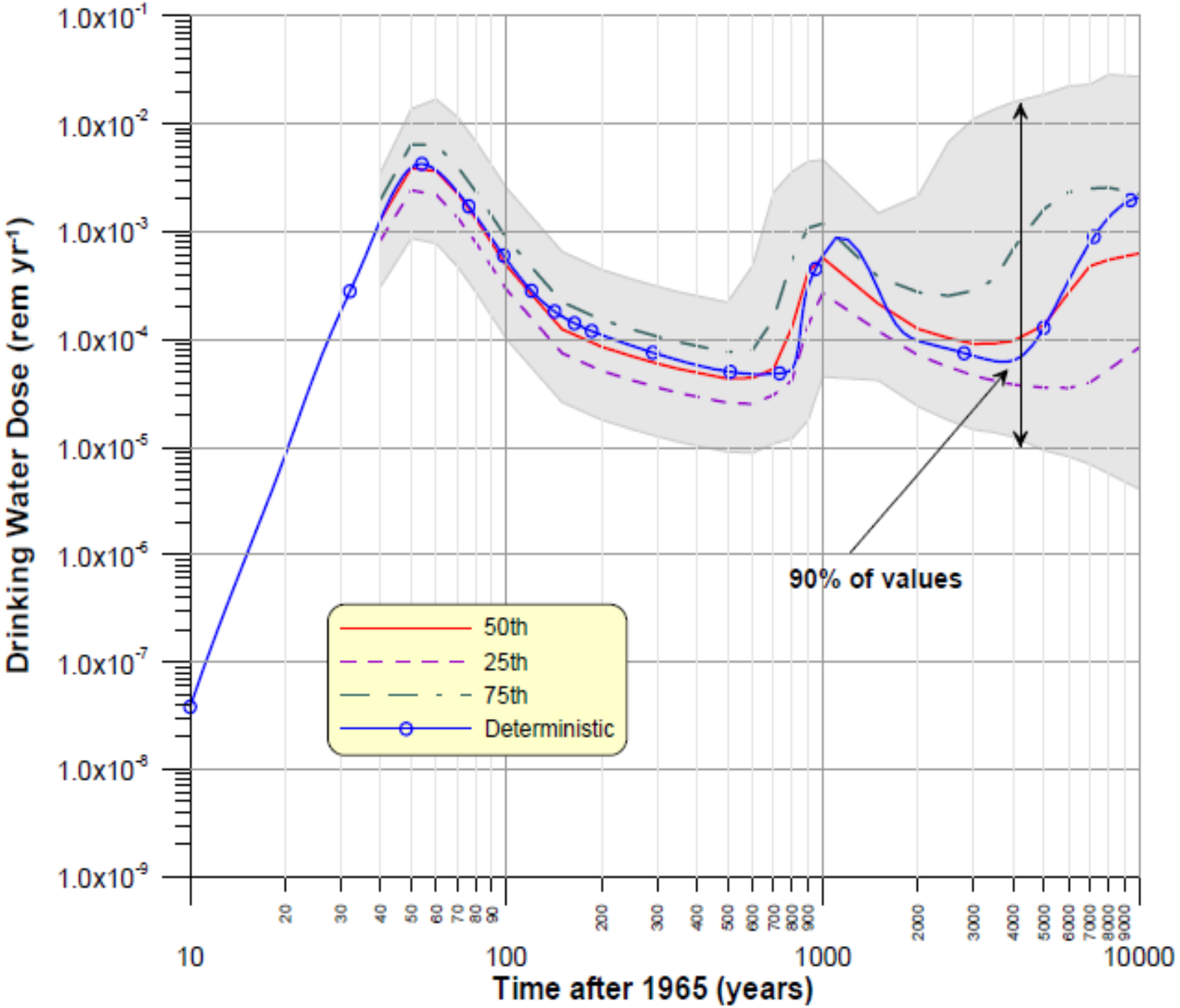

Bigge
Bigge

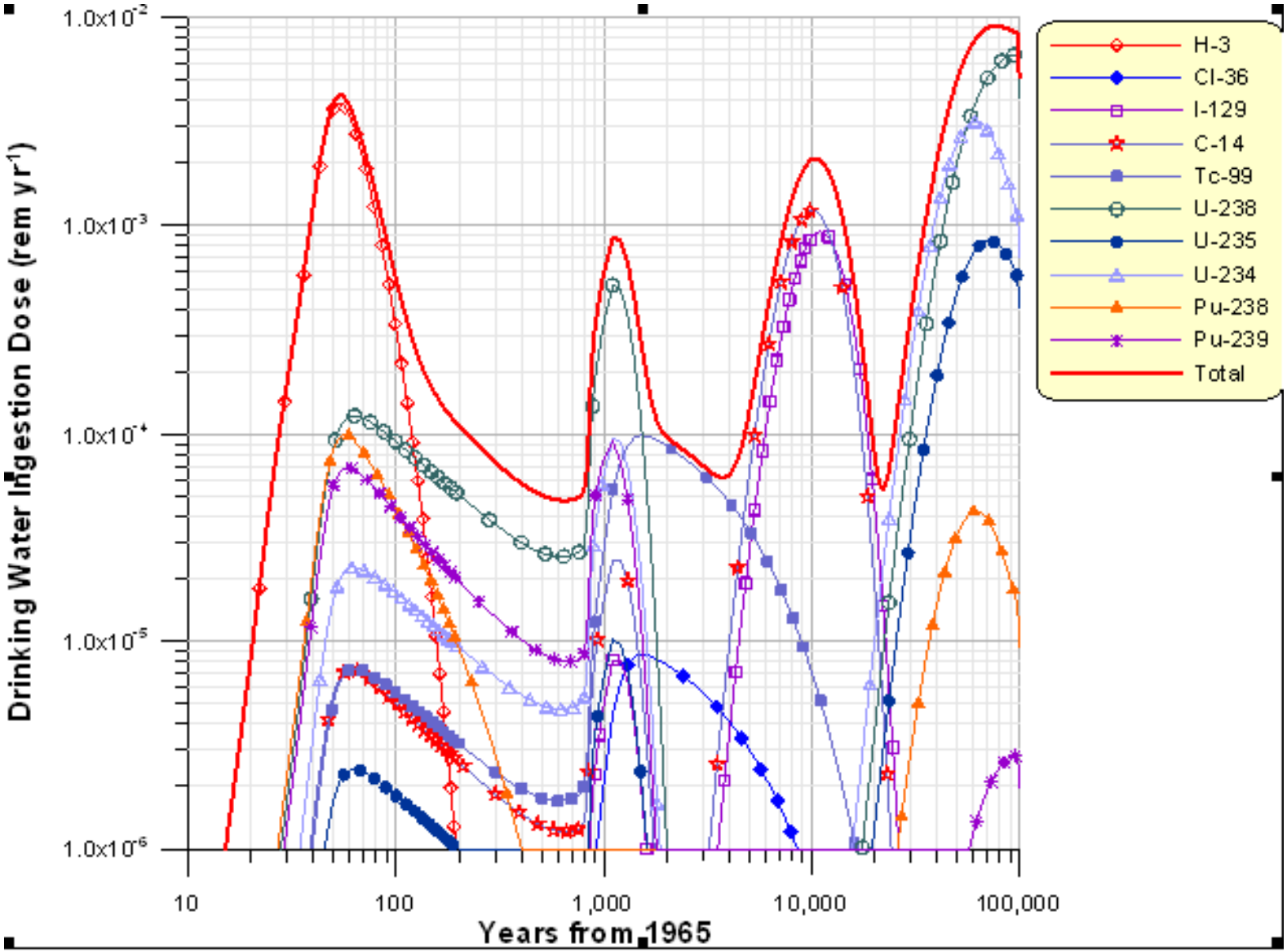

Waste
Enhanced Infiltration
While Trench is Open
Waste
Infiltration is Reduced
After Trench is Backfilled
and Before Placement
of the Cover
Backfilled Soil

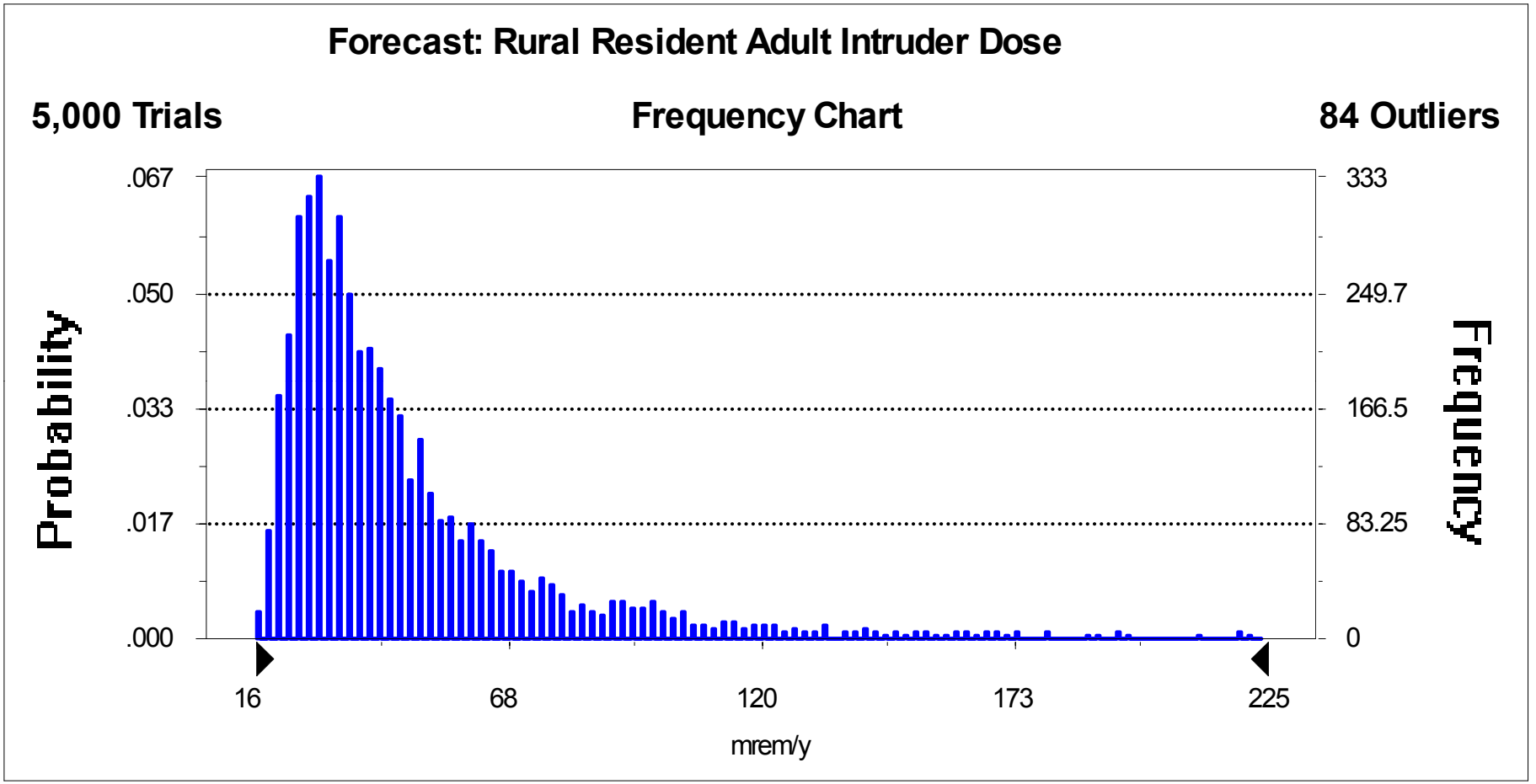

Precipitation
Evapotranspiration
Cover
Waste
Net water flux
through cover and into waste
Advancing
drying front
Net background
infiltration


Failed
Cover
Waste
Advancing wetting front
Infiltration through cover and waste is
same as natural recharge


Cap installed at time = 0 yr
Time (yr)
0
50
100
200
300
400
500
Drying front
Cap fails at time = 500 yr
Time (yr)
510
525
550
575
600
625
650
Unsaturated thickness


Drinking Water Dose (rem yr⁻¹)
1.0x10⁻¹
1.0x10⁻²
1.0x10⁻³
1.0x10⁻⁴
1.0x10⁻⁵
1.0x10⁻⁶
1.0x10⁻⁷
1.0x10⁻⁸
1.0x10⁻⁹
10
100
1000
10000
Time after 1965 (years)
90% of values
50th
25th
75th
Deterministic


Drinking Water Ingestion Dose (rem yr-1)
1.0x10-2
1.0x10-3
1.0x10-4
1.0x10-5
1.0x10-6
10
100
1,000
10,000
100,000
Years from 1965
H-3
Cl-36
I-129
C-14
Tc-99
U-238
U-235
U-234
Pu-238
Pu-239
Total


Forecast: Rural Resident Adult Intruder Dose
5,000 Trials
Frequency Chart
84 Outliers
Probability
.067
.050
.033
.017
.000
333
249.7
166.5
83.25
0
Frequency
16
68
120
173
225
mrem/y

Mitigation Measures Being Implemented at the US Ecology

- Evaluate ways to reduce the offsite materials needed for cover construction.
- Institutional controls for the foreseeable future.
- License limits for radionuclides predicted to contribute to a post-closure dose; Ra-226, H-3, I-129, Tc-99, U-238, C-14, U-234, and Pu-239.
- Deeper burial of discrete NARM.
- Secondary containment for radionuclides predicted to contribute to groundwater concentrations; H-3, I-129, Tc-99, U-238, C-14, U-234, and Pu-239.
- Continued environmental monitoring to refine future hypothetical groundwater concentrations.
- Establish and maintain vegetation on the completed cover.
- Use of the Close-As-You-Go Schedule for future trenches.

Key Takeaways

- Early and frequent stakeholder involvement.
- Transparency.
- Having on staff seasoned technical experts that include a geohydrologist, geochemist, geotechnical engineer, civil engineer, soil scientist, plant biologist, seismologist, meteorologist, quality assurance engineer, and health physicist.
- Depending on the construction schedule, conduct weekly (if not daily) site visits by the state technical expert(s).
- Holding routine periodic meetings with the company and also with the NRC.
- Keeping a good working relationship with the design contractor and the construction contractor.
- Identifying and characterizing an adequate nearby soil and rock borrow source.