

Depleted Uranium Waste and the Disposal System



Neptune and Company, Inc.



Presentation Outline

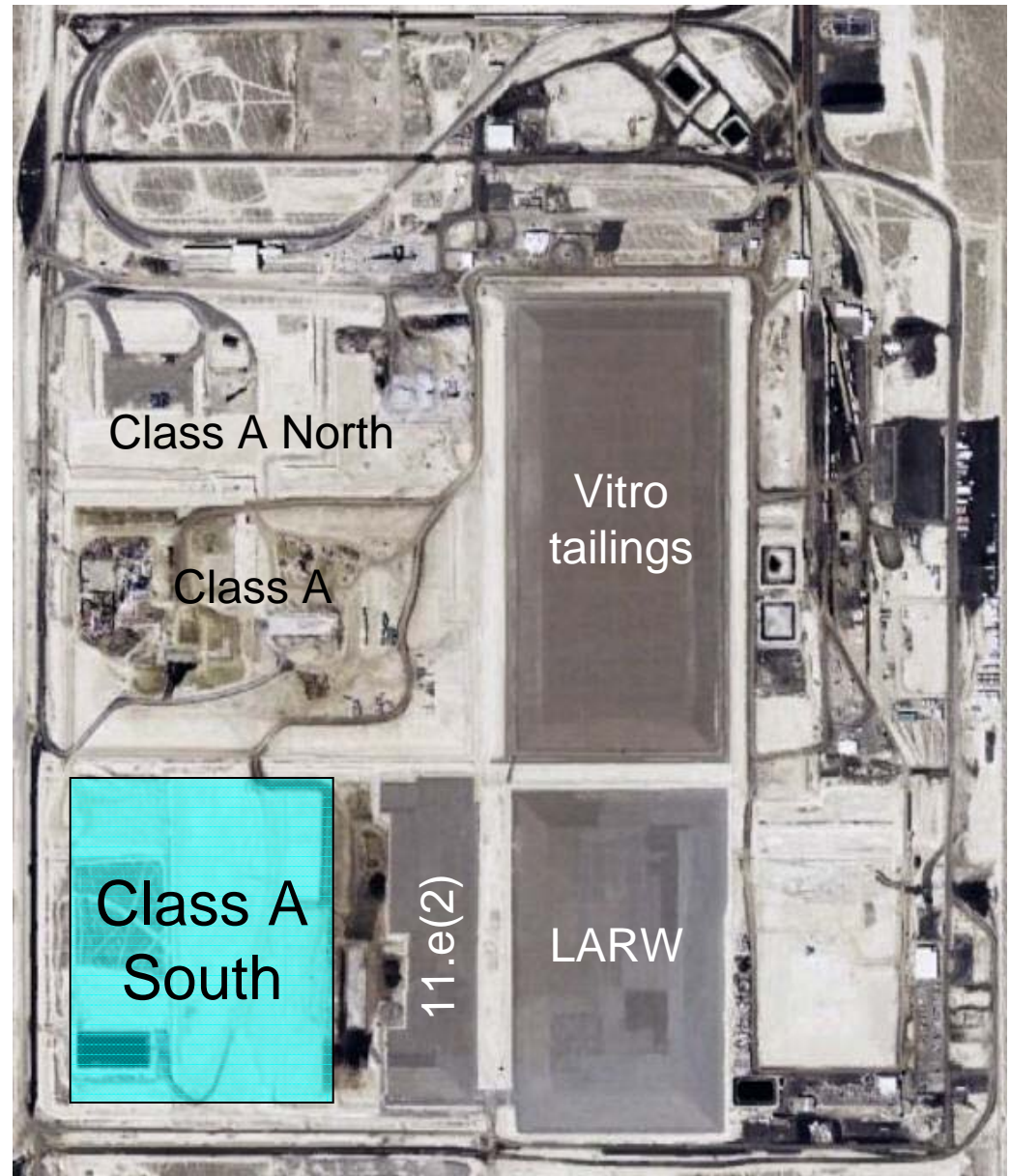
- The Class A South embankment
- Dimensions and materials
- DU Waste and the waste form



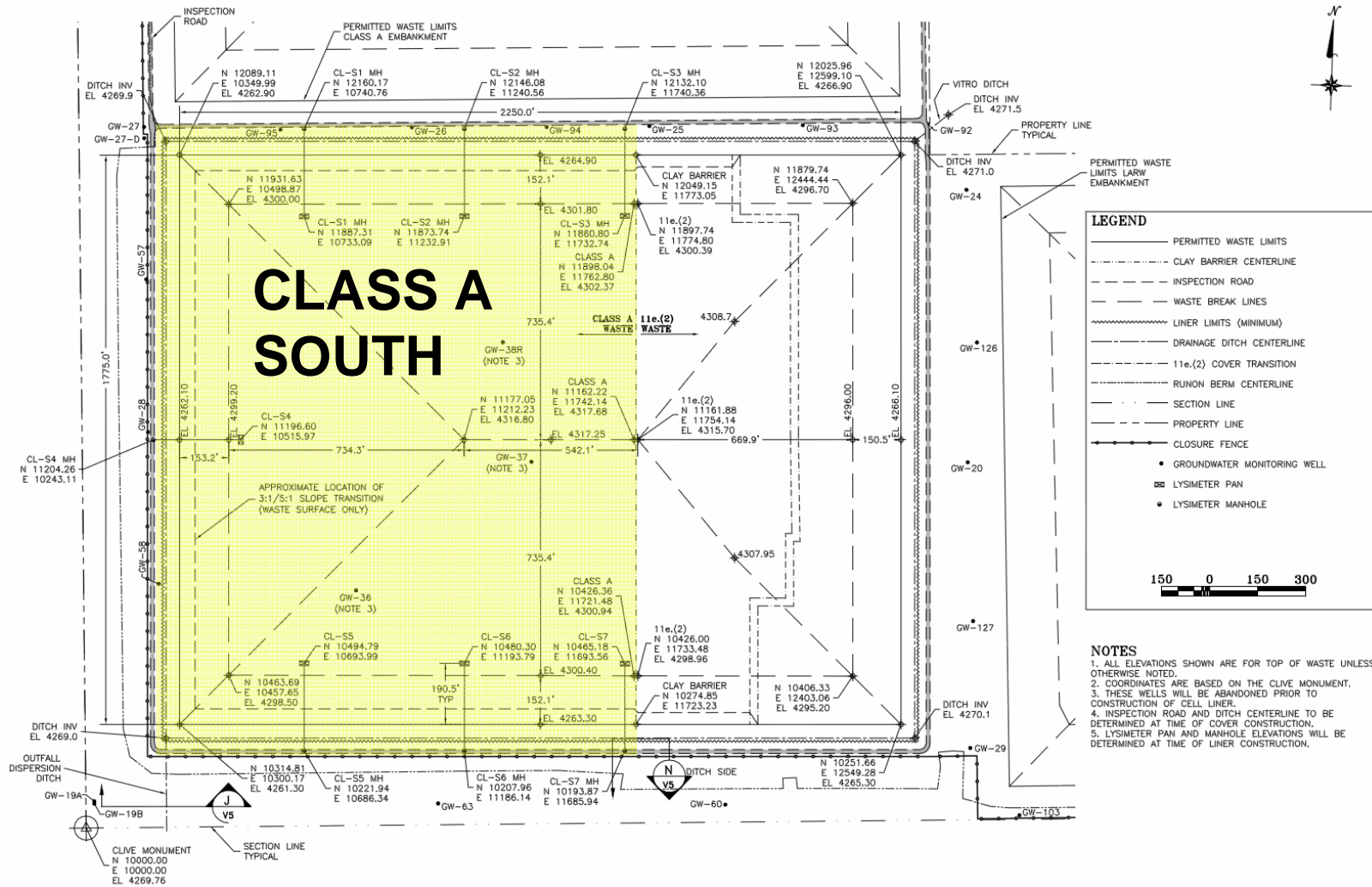
Class A South Embankment

Modeling assumptions:

- Class A South only
- future DU waste only

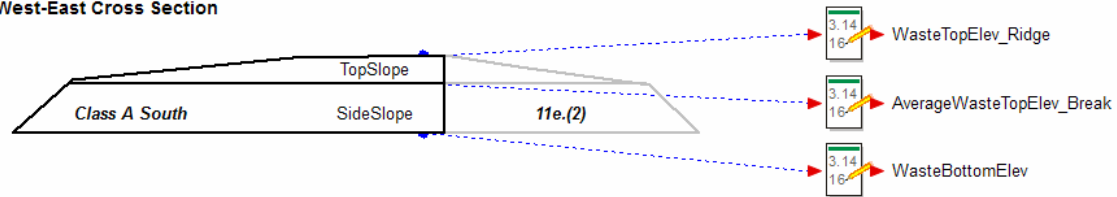


Embankment Drawings

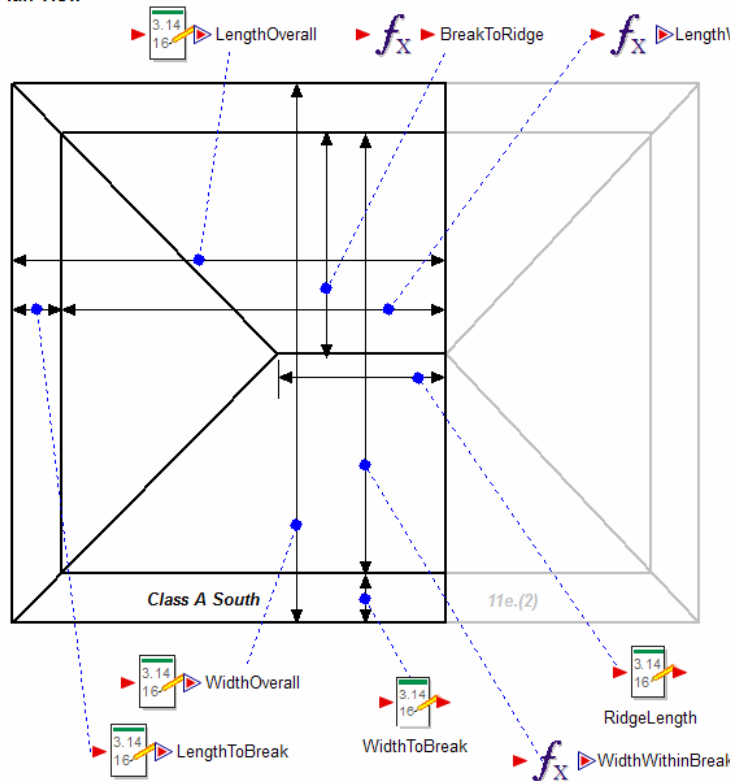


Embankment Dimensions

West-East Cross Section



Plan View



Average break height is calculated based on the heights at the side slope break points on the engineering drawings and calculated base elevations. The base elevations were calculated based on the slope of the east-west and north-south cross sectional drawings and distance from a reference base elevation on the engineering drawings.

f_x AverageBreakHeight

f_x Thickness_Break

f_x Thickness_Ridge

f_x WasteArea_Cell

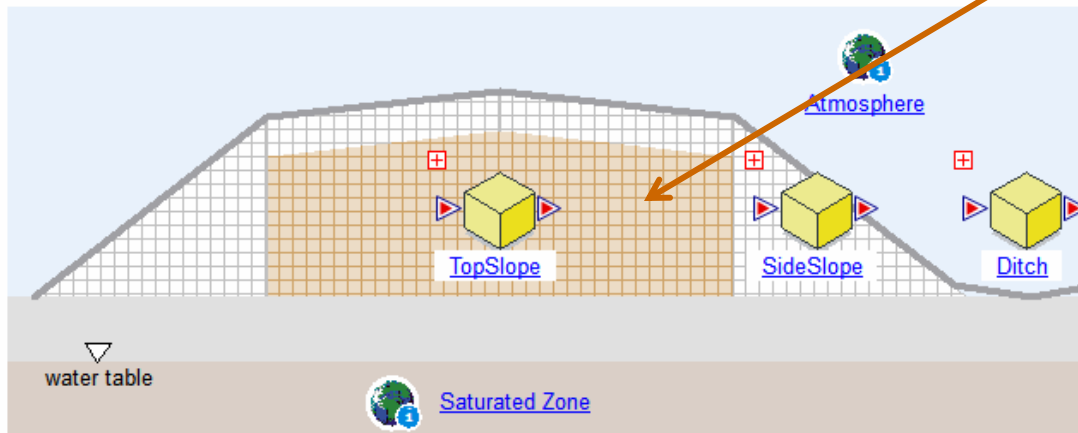
f_x Footprint_Perimeter

Embankment Model

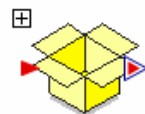
Class A South Cell Model

The standard waste embankment design is best modeled by separating the top slope of the embankment from the side slope due to differences in the engineered features (e.g., slope, waste thickness, etc.). The TopSlope container contains all layers relevant to the top slope of the embankment while the SideSlope container contains all layers relevant to the side slope of the embankment.

DU waste

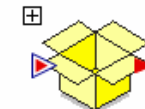


The "Federal Cell" is combined from Class A South and 11e.(2) Cells



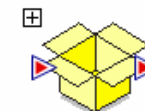
[ClassASouth_Cell_Dimensions](#)

Physical dimensions of the Class A South waste embankment are documented, and waste volumes calculated. Waste thicknesses are quite different between the top slope and side slope.



CAS_Inventory

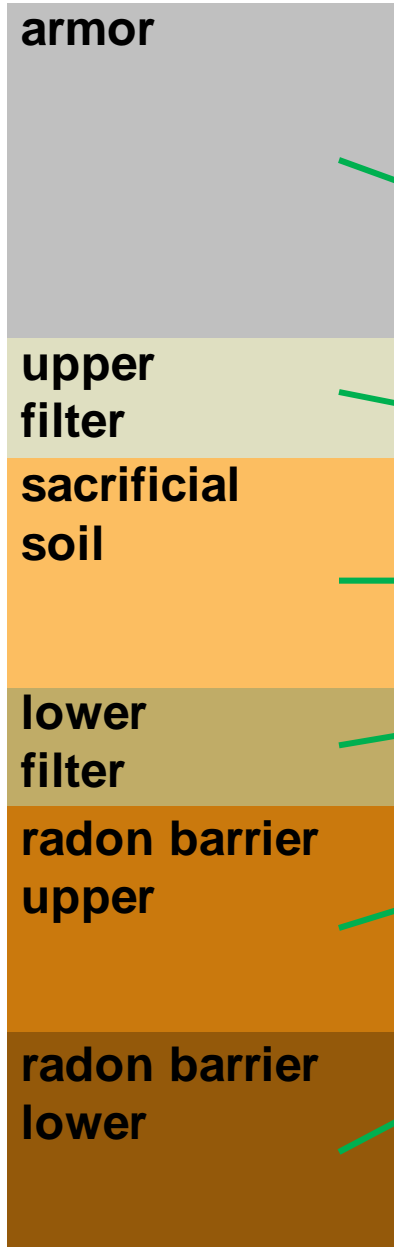
Inventory for the CAS cell is developed here.



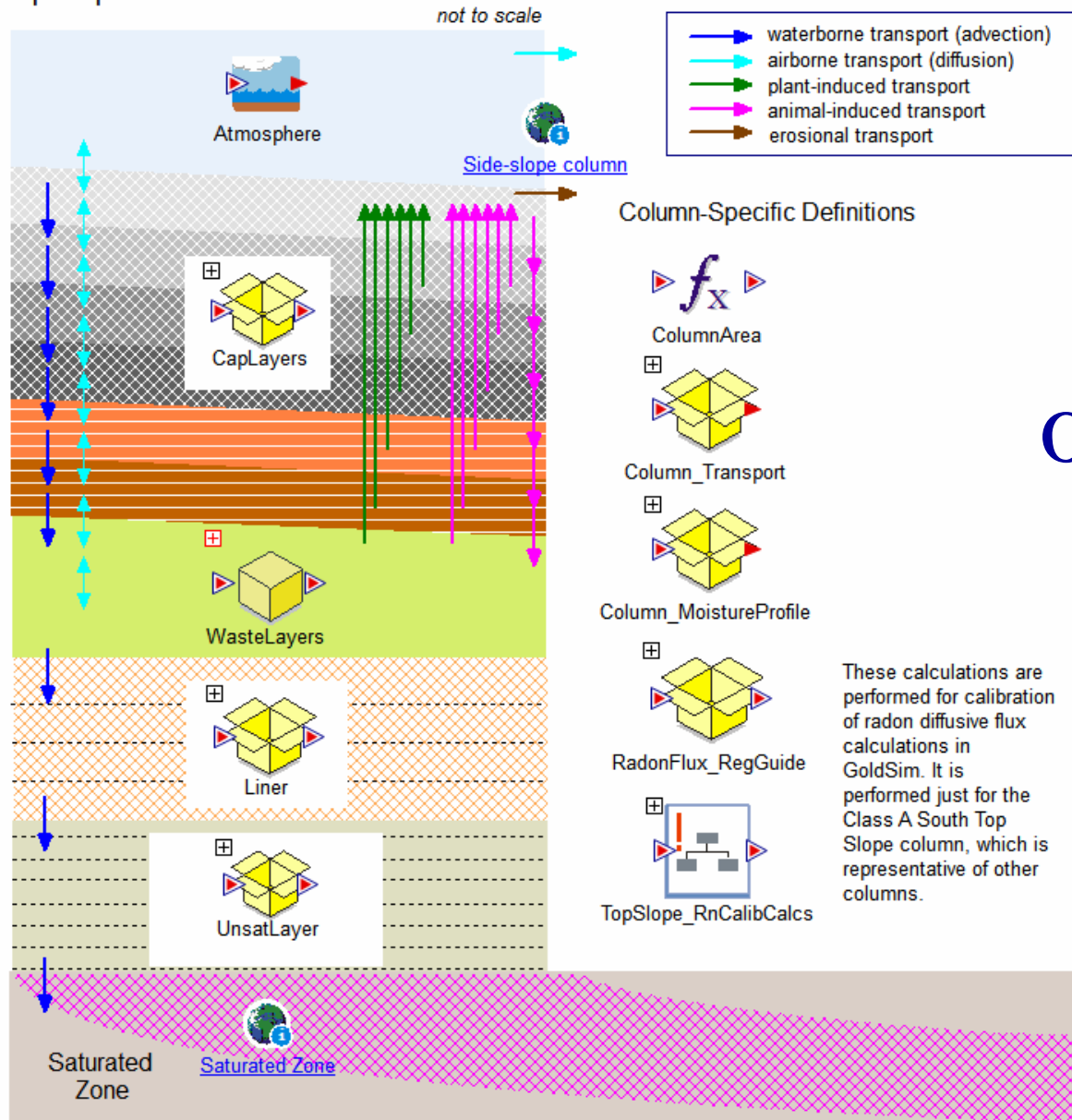
CAS_Results

Results pertaining to this embankment are collected here.

Cap Layers



Top Slope of the Embankment



Modeling of Layers in GoldSim

DU Waste

- DU waste is mostly ^{238}U
- Decay products slowly ingrow
- Other “contaminants” include fission products and actinides (mostly transuranics) from introduction of irradiated fuel into the separations process



DU Waste Proposed for Disposal

Depleted UO_3 from the Savannah River Site staged at Clive is packaged in 5408 steel drums.



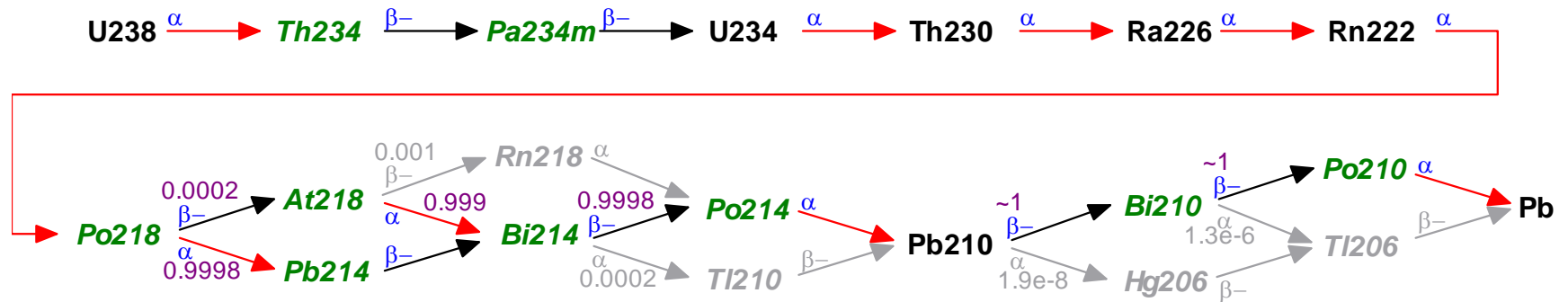
Depleted U_3O_8 from the gaseous diffusion plants (GDPs) will be packaged in diffusion plant cylinders.

Total mass about ~700 Gg (~700,000 tonnes) of waste.

No credit is taken for any packaging or containerization.



The Uranium Decay Series



Radionuclides in black are considered for contaminant transport and dose.

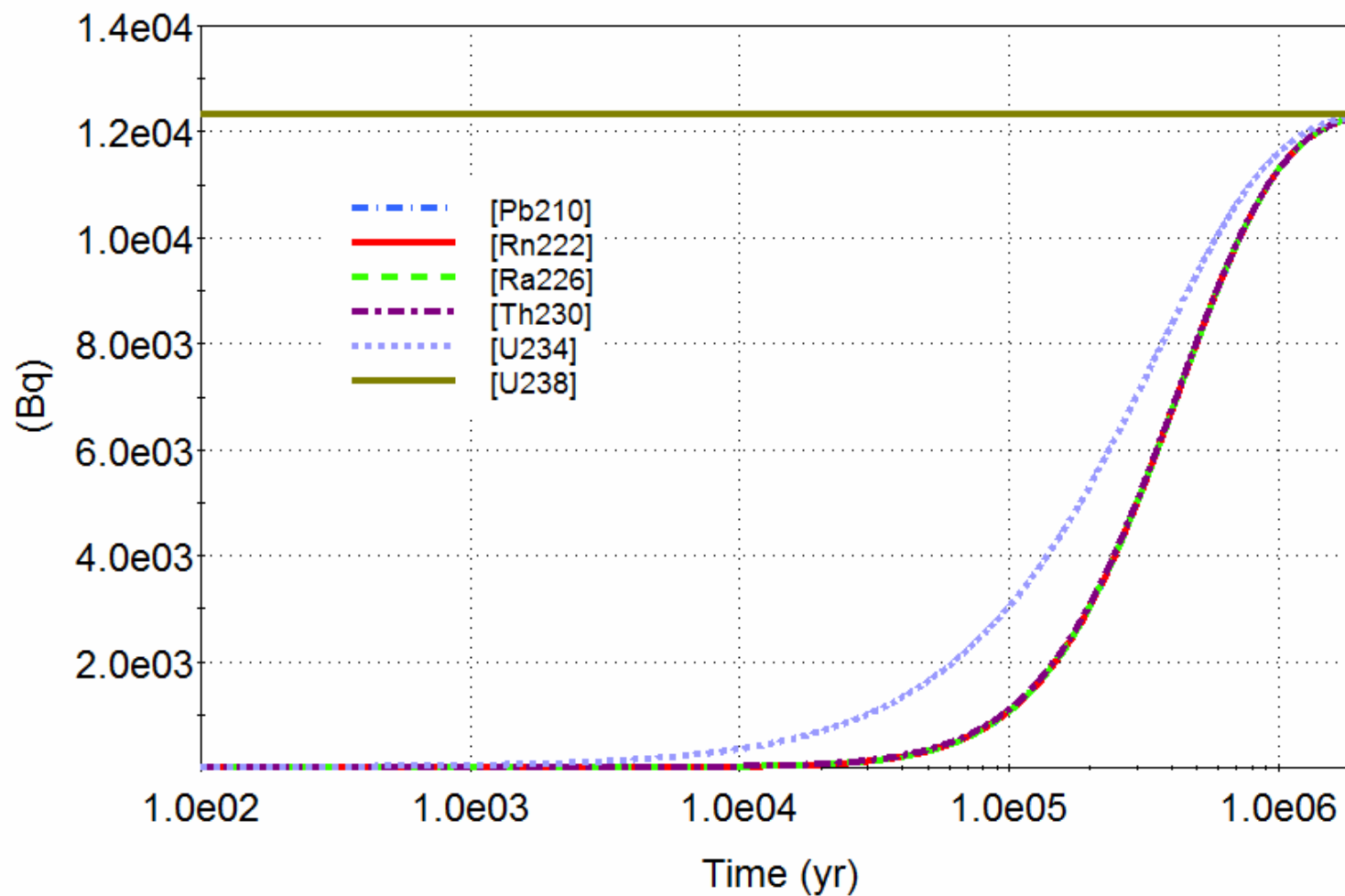
Radionuclides in green are considered for explicit dose calculations.

Radionuclides in gray are considered for dose, bundled with parents.



U-238 Decay and Ingrowth

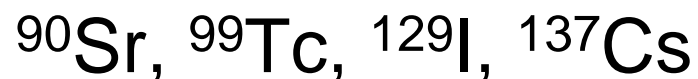
Activity of progeny from 1 g U-238



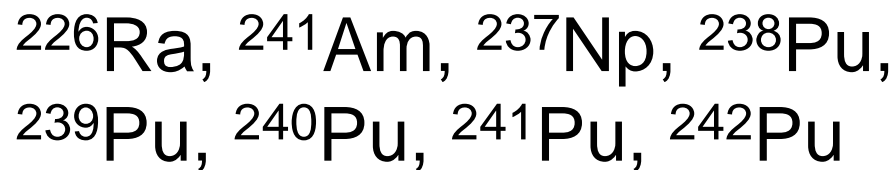
DU Trace “Contaminants”

These are found in some DU wastes in *small amounts*:

- Fission products:



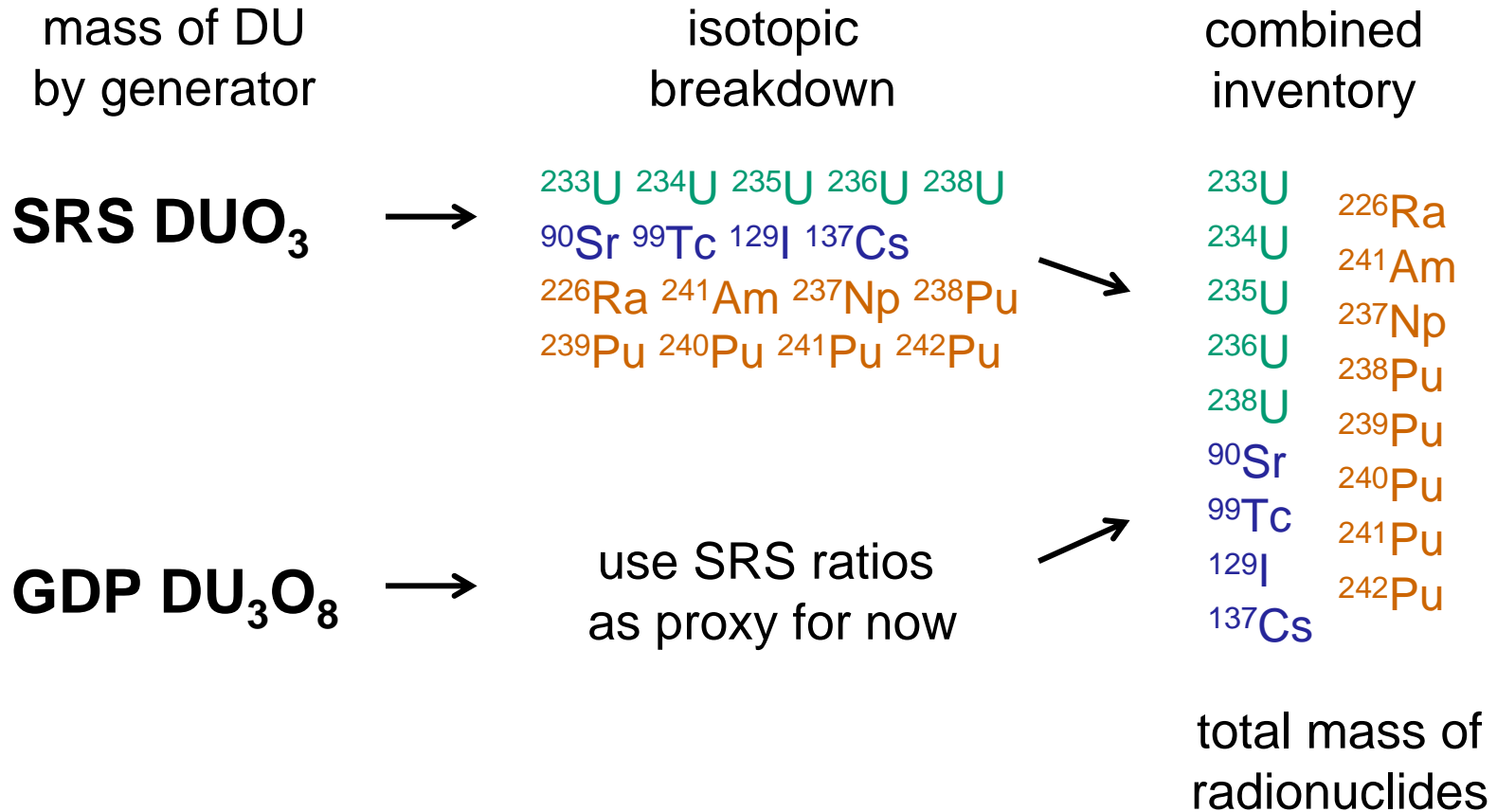
- Other actinides (plus radium):



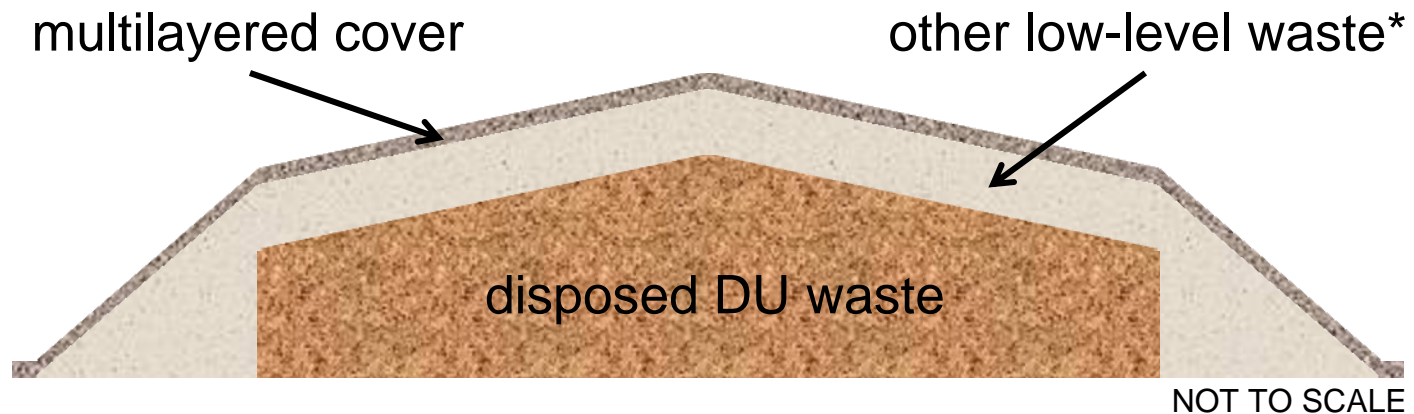
All of these
are included
in the model.

Beals, et al (2002), EnergySolutions (2009), Hightower (2000), DOE (2007)

DU Accounting



Proposed Waste Configuration



DU waste characteristics:

- DUO_3 powder (this is a proxy for DU_3O_8 as well)
- no credit given for containers (drums or cylinders)
- no credit given for co-disposed "filler",
which occupies about 2/3 of the total volume

*for the purposes of this DU PA, this LLW has no inventory

Waste Physical Properties



disposed DU waste

Modeling assumptions (physical properties):

- Volume of waste is the entire volume of Class A South
- Total radionuclide inventory is in this volume
- DU waste is assumed to be uniformly mixed with “filler”
- Bulk density and porosity of resulting homogeneous material are weighted averages
- Moisture content is calculated as a function of infiltration, solving the Richards Equation

Waste Chemical Properties



disposed DU waste

Modeling assumptions (chemical properties):

- Aqueous solubility is that of SRS UO_3 , which is likely higher than solubility of the GDP uranium oxides
- Leaching is likely to be solubility-limited for some time
- Partitioning and retardation chemistry will be dependent on assumptions about the “filler”