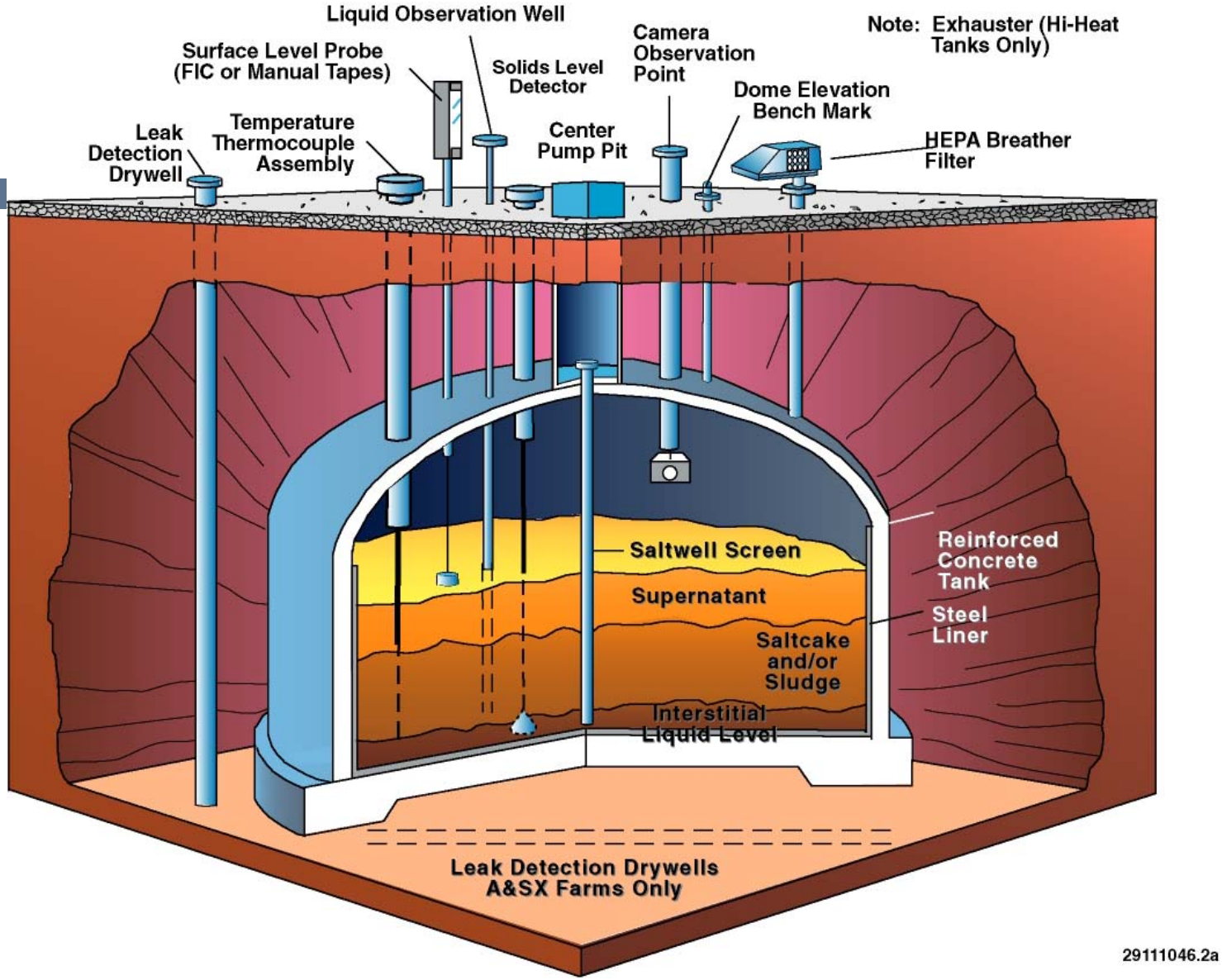
United States Department of Energy

Stabilized Tank Waste Concentrations

July 19, 2005



Anatomy of a Typical Single-Shell Tank*

* Although a typical DOE single shell tank, it is not representative of all tanks at DOE sites.

Statutory Provision

NDAA Section 3116(a)(3)(A)

(3)(A) does not exceed concentration limits for Class C low-level waste as set out in section 61.55 of title 10, Code of Federal Regulations, and will be disposed of—

Statute refers to 10 CFR 61.55, which invokes principle of averaging concentration of a radionuclide over volume or weight of the waste

Considerations

- Determination of concentration in following structures and components for closed facilities involved in managing reprocessing wastes:
  - Storage tanks
  - Piping between tanks, evaporators and other components
  - Examples of other components:
    - Diversion boxes
    - Pump pits

Regulatory Provisions

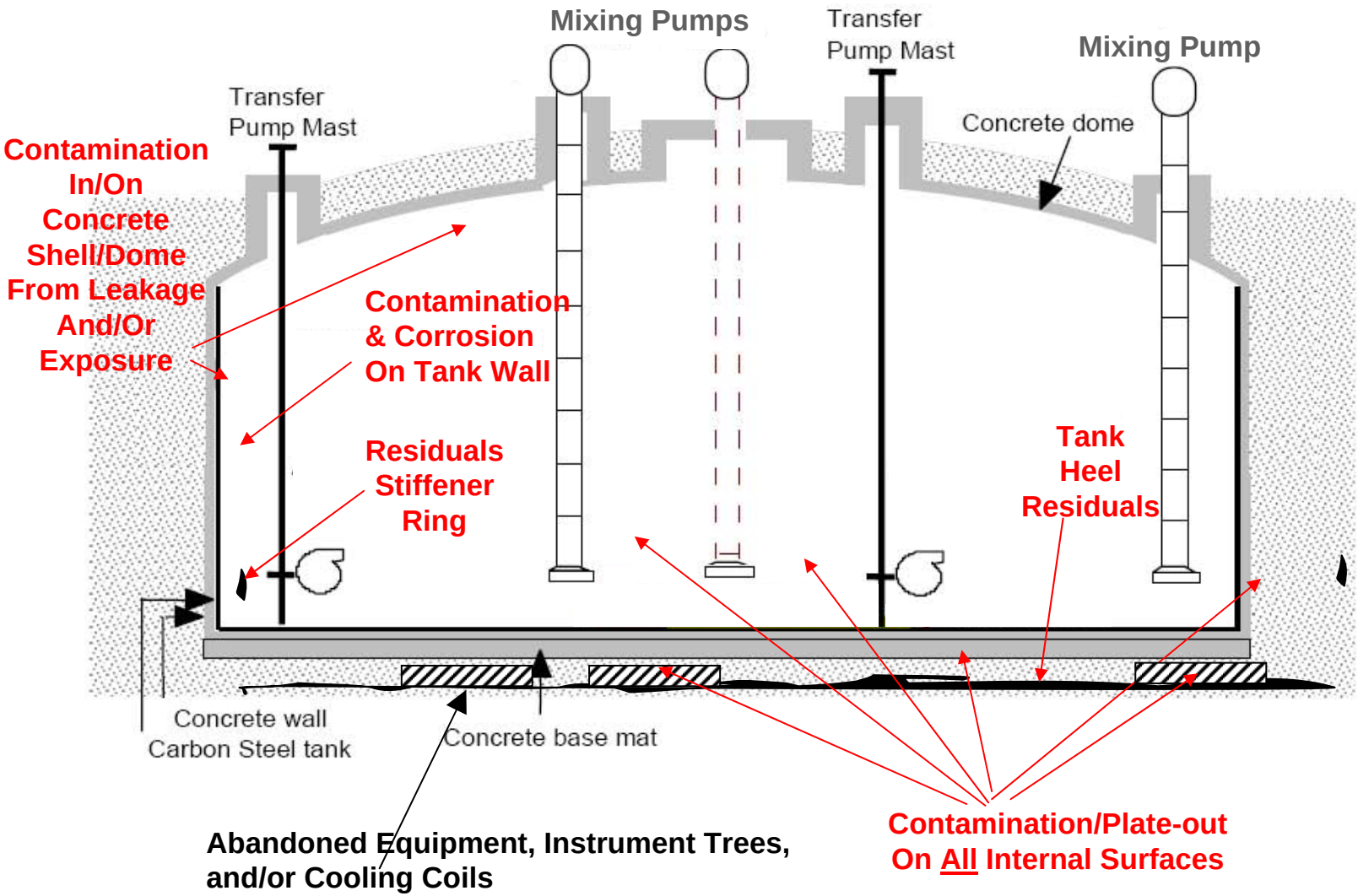
Applicable regulatory provision for determining radionuclide concentrations under 10 CFR 61

10 CFR 61.55(a)(8) Determinations of Concentrations in Wastes

"The concentration of a radionuclide may be averaged over the volume of the waste, or weight of the waste if the units are expressed as nanocuries per gram."

$$\text{Concentration (Ci/m}^3\text{ or nCi/gm)} = \frac{\text{amount of radionuclide}}{\text{volume or weight of waste}}$$

A Typical Tank After Retrieval Is A Collection of Residual Wastes and Contaminated Materials*



* Not representative of residual contamination in tanks at Idaho and certain tanks at other sites after waste retrieval.

Case Specific Concentration Determination

- Waste in the tank will depend on the design of the tank
  - Coils
  - Equipment
  - Support structures
  - Risers
- Waste in the tank will depend on nature of the source, special nuclear, or byproduct material
- Waste in the tank will depend on removal techniques

Past DOE Practice

- Closure of Tanks 17 and 20 at SRS
  - Use of 3 grout formulations to stabilize waste residues
    - Reducing grout to promote chemical retention of residual wastes at bottom
    - Controlled Low-Strength Material for most of volume
    - High compressive strength grout at tank top
  - NRC review (1997-2000)
    - Filled tanks will provide an acceptably stable waste form in conformance with the structural stability requirements of 10 CFR 61.56(b)(1)
    - Application of the BTP on Concentration Averaging is an acceptable means of meeting waste classification criteria of Part 61
    - Alternative provisions for waste classification comparable to 10 CFR 61.58 would be acceptable
- Other DOE stabilization of separated low-activity wastes
  - Saltstone at SRS (homogeneous, Class C or less)
  - Drumcell waste at WVDP (homogeneous, Class C or less)

Approaches for Determining Concentrations

- Use of section 3.2 of the BTP on Concentration Averaging to credit amount of grout for which some physical mixing/encapsulation occurs
- Use of section 3.2 of the BTP on Concentration Averaging to rely upon the stability criteria of 10 CFR 61.56
- Use of section 3.9 of the BTP on Concentration Averaging for alternative provisions of classification and characterization addressed under 10 CFR 61.58
- Other considerations:
  - Accounting for mass/volume of tank structures and components in determining concentrations

Credit Amount of Grout for Mixing/Encapsulation

- Difficult to determine what amount actually provides mixing or encapsulation
- How much credited for residual waste or contamination on tank walls, domes
- Cases where vertical cooling piping, structural components, and other equipment would entail a volume of grout equivalent to the entire tank

Stability Criteria of 10 CFR 61.56

- Section 3.2 of BTP:

  "Classification of evaporator concentrates, filter backwashes, liquids, or ion-exchange resins solidified in a manner to achieve homogeneity or meet the stability criteria of 10 CFR 61.56 should be based on solidified nuclide activity divided by the volume or weight of solidified mass"

- Waste must have structural stability, per NRC review of SRS Tank Closure methodology, with regard to determining concentrations:

  "The filled tanks will provide an acceptably stable waste form in conformance with the structural stability requirements of 10 CFR 61.56(b)(1)"

Alternative Provisions (3.9 of BTP)

- Considerations:
  - Specific characteristics of wastes
    - Residues solidified in layers at depths of 3 to 10 meters below ground
  - Disposal site
    - Disposal sites generally stable based upon use as storage site
  - Method of disposal
    - Although all features are not credited, multiple barriers exist: solidified wastes, tank structure, vault structure
  - Reasonable assurance of compliance with performance objectives of 10 CFR 61
    - Performance Assessments
    - Closure plans

Possible Concentration Averaging Approaches

- Transfer Piping
  - use source term averaged over only the piping materials – waste form assumed to be the piping with associated contamination
  - use source term averaged over the mass of the piping materials and the grout materials – waste form assumed to be contamination contained within piping and grout matrix
  - selection of approach dependent upon ability to fill piping systems with grouting
- Ancillary Equipment (Tank Vaults)
  - average source term in the vault over the mass of grout necessary to immobilize/stabilize residual waste (e.g., if residual is on the vault floor, use a mass of grout necessary to encapsulate/mix with/cover the residual contamination)