VAULT MODEL

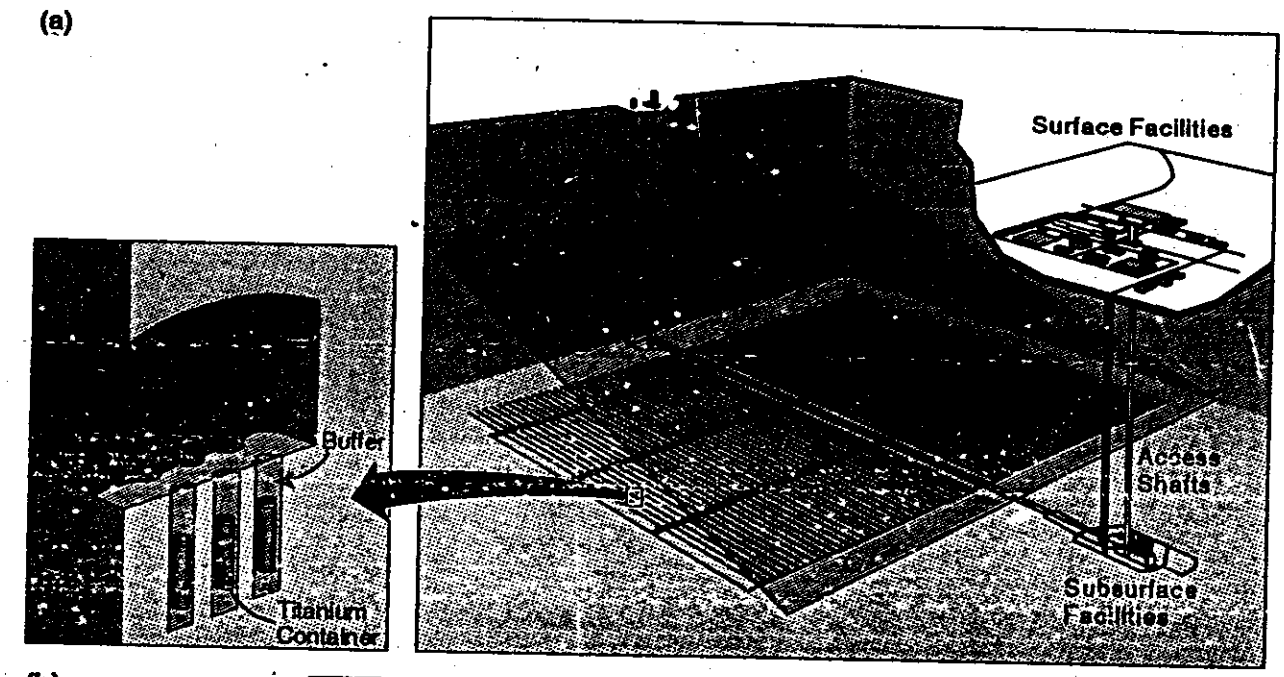
Model to calculate time-dependent release from the vault, incorporating

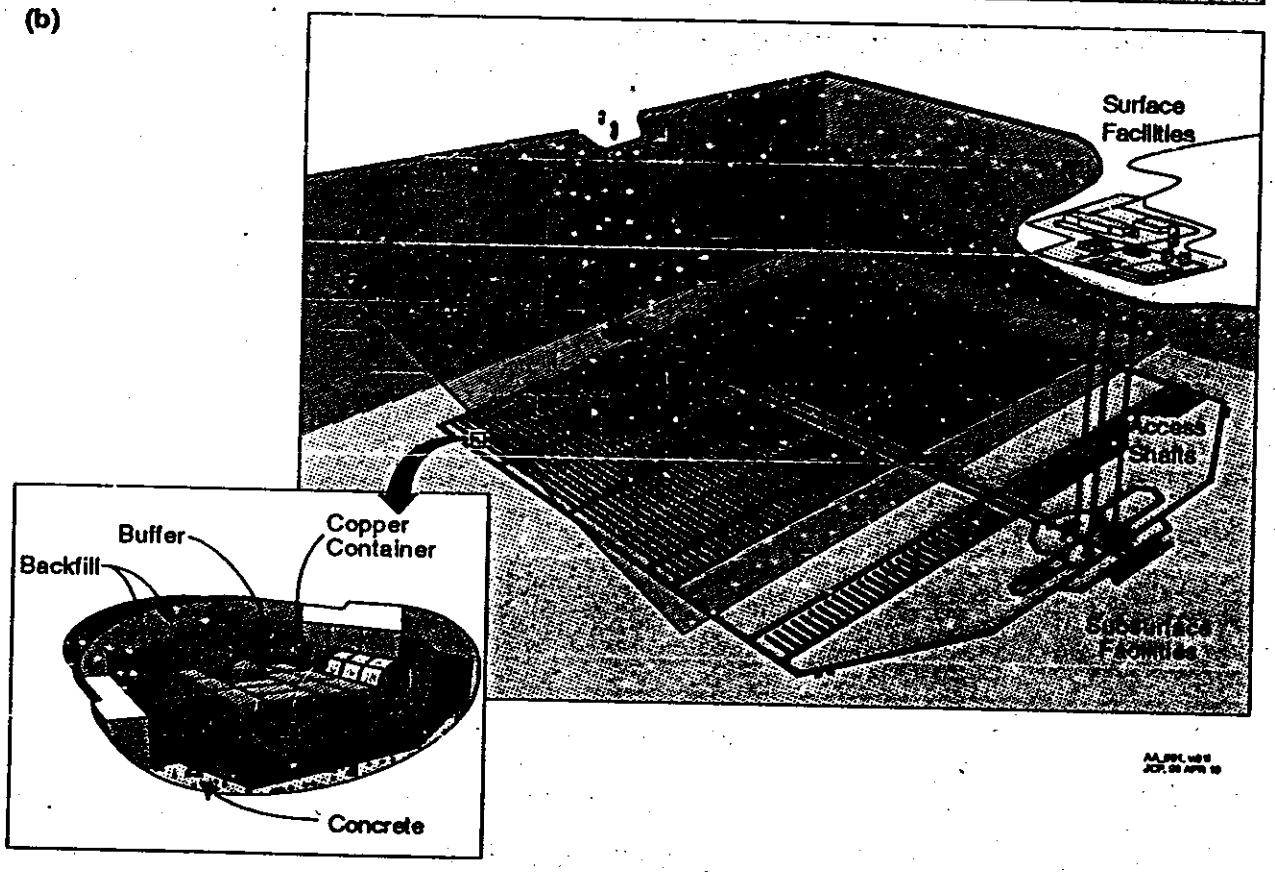
- Rates of failure of titanium containers
- Instant release of radionuclides from used fuel
- Congruent release of radionuclides from used fuel
- Precipitation of sparingly soluble radionuclides
- Rates of mass transport of radionuclides through buffer/backfill materials and into the geosphere

MATHEMATICAL MODELING OF CONTAMINANT TRANSPORT

Model must be

- **Appropriate for the groundwater transport conditions and vault design**
- **In agreement with independent model calculations**
- **Adaptable to a variety of source terms**
- **Practical for simulating release from a large number of sources over thousands of simulations**


(a)
Surface Facilities
Buffer
Access Shafts
Titanium Container
Subsurface Facilities

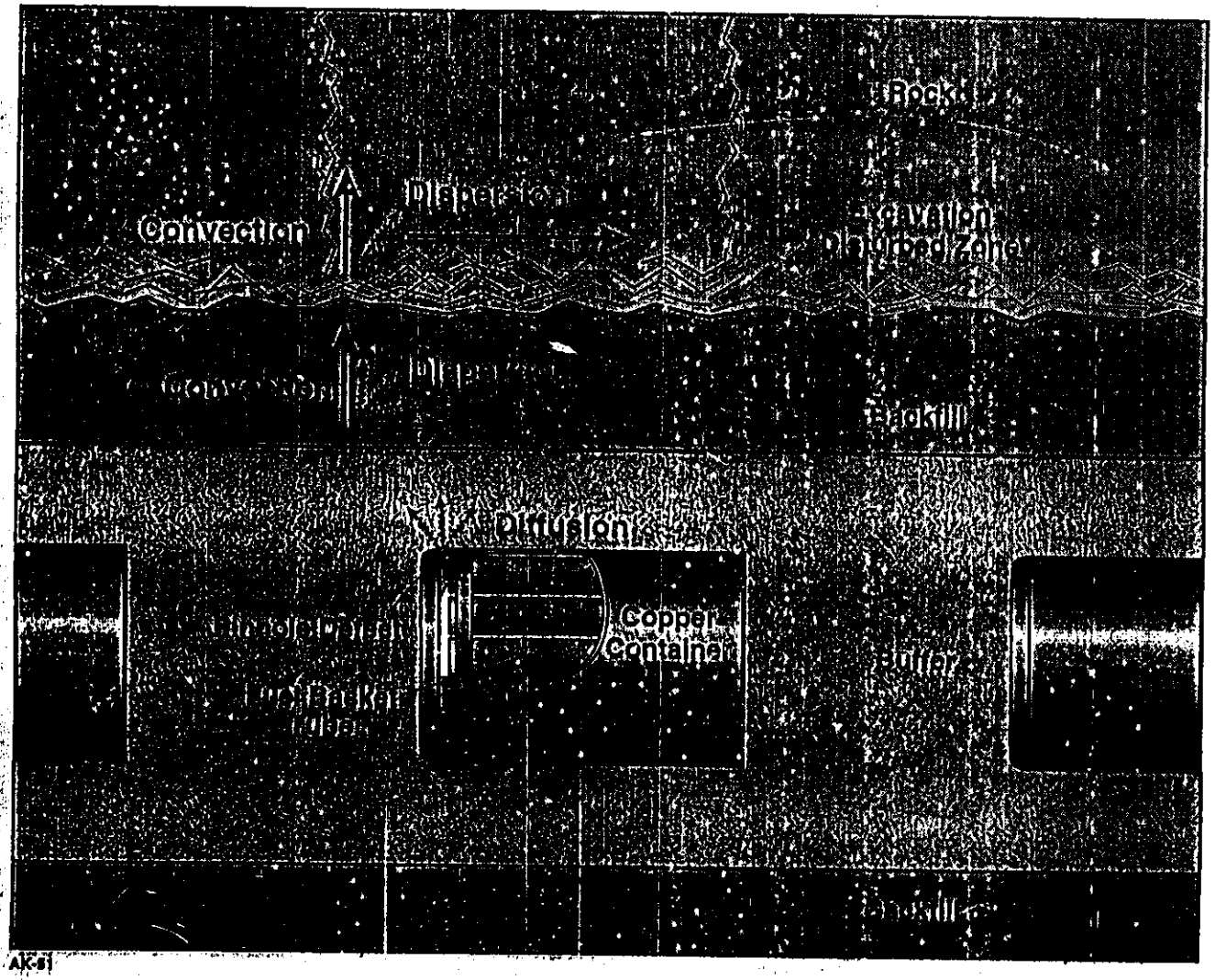

(b)
Surface Facilities
Access Shafts
Buffer
Copper Container
Backfill
Concrete

MODELLING OF ENGINEERED BARRIERS

A range of modelling approaches is necessary, from the most detailed feasible to simplified models capturing only dominant processes

Comparisons between alternative models with different levels of detail are valuable. The most detailed models tend to be process specific and spatially limited. It is generally not feasible with current technology to include the most detailed models in an integrated system model.

Comparisons of the integrated system model with more detailed process specific and spatially limited models indicate that detailed models are not necessarily required in the system model.



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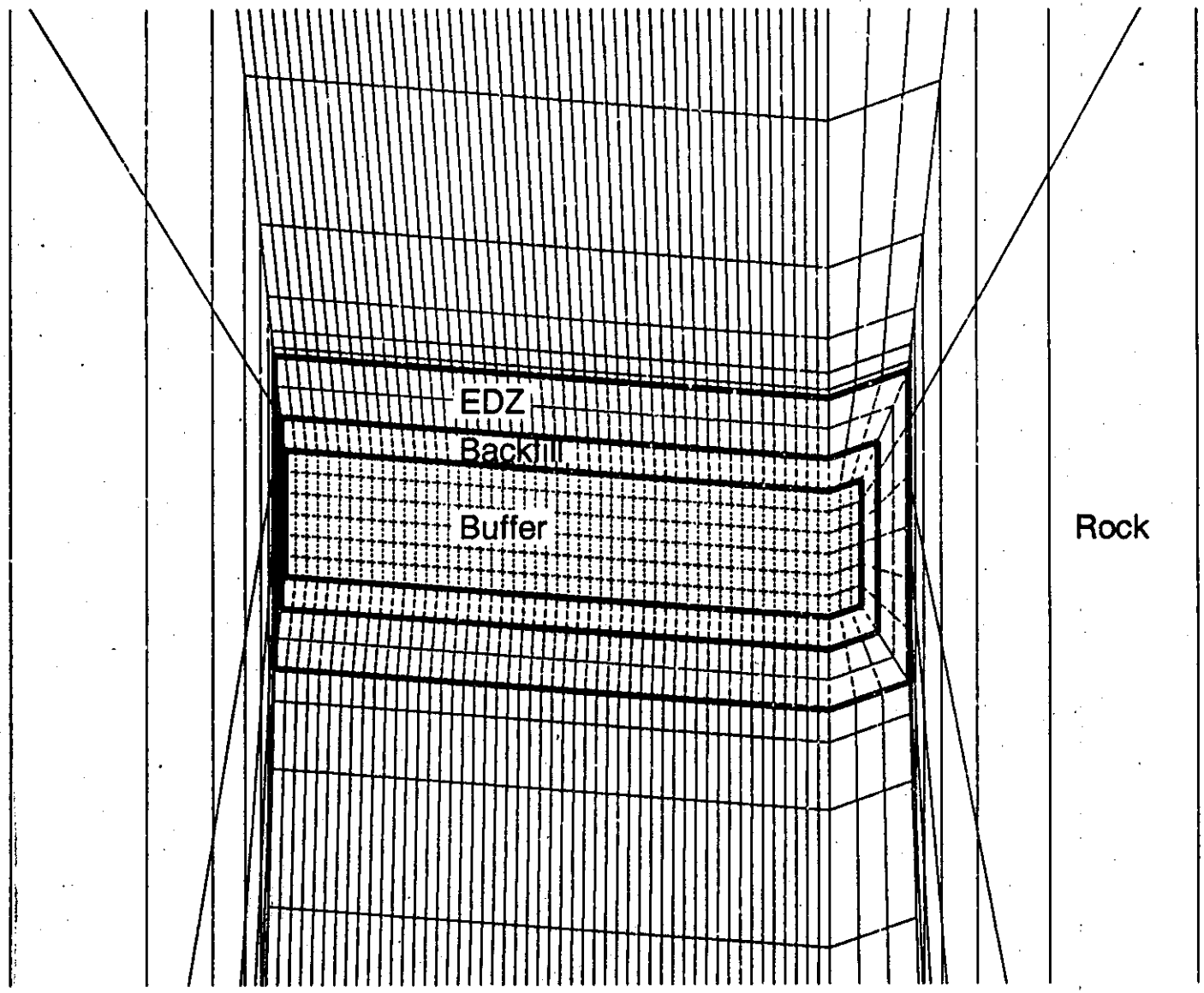
CONTAMINANT TRANSPORT MODELLING FOR THE IN-ROOM ASSESSMENT STUDY

A boundary integral model (BIM) with cylindrical symmetry was used to represent rooms in the vault. The model can handle decay chains and multiple source terms from defected containers and has error testing

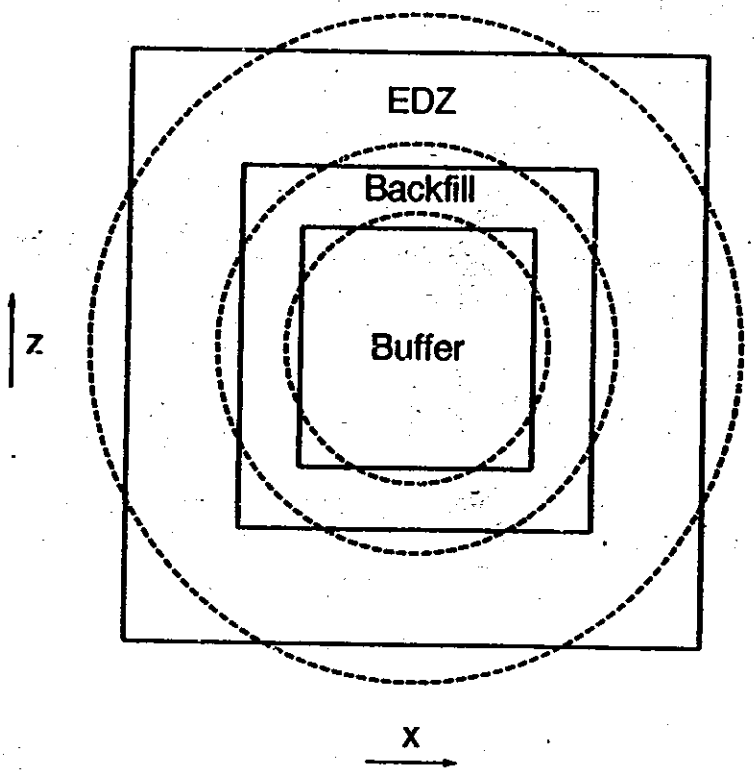
Good agreement was obtained between the room-scale BIM and a finite-element model (MOTIF) for a range of mass transport conditions. These include diffusion-dominated mass transport as well as high flow rate conditions relevant to the in-room case study. Where differences exist, BIM tends to calculate higher contaminant releases than MOTIF, thus, it is expected to overestimate risk.


EDZ
Backfill
Buffer
Rock

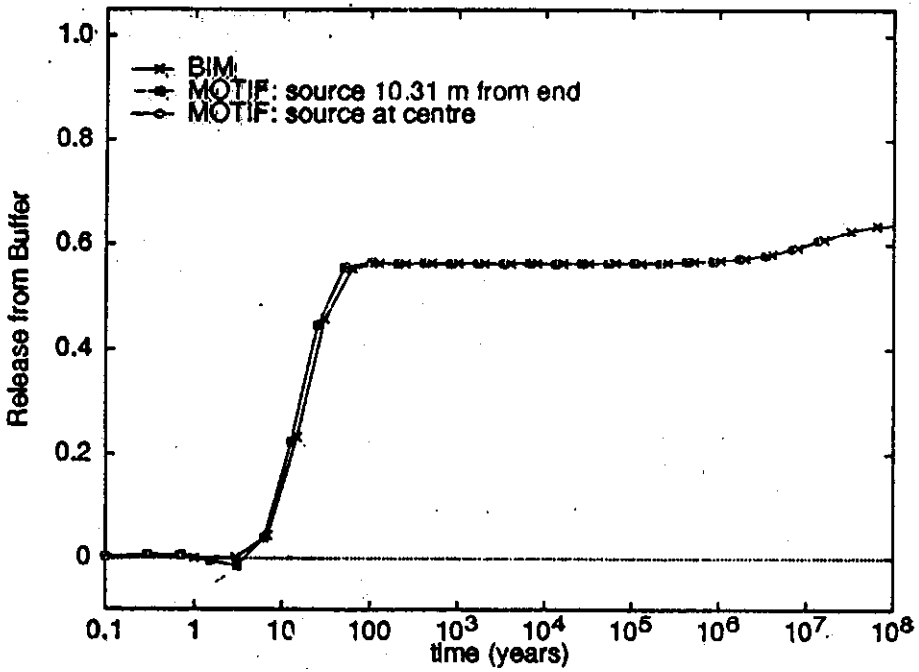
MODEL CROSS SECTIONS FOR A DISPOSAL ROOM

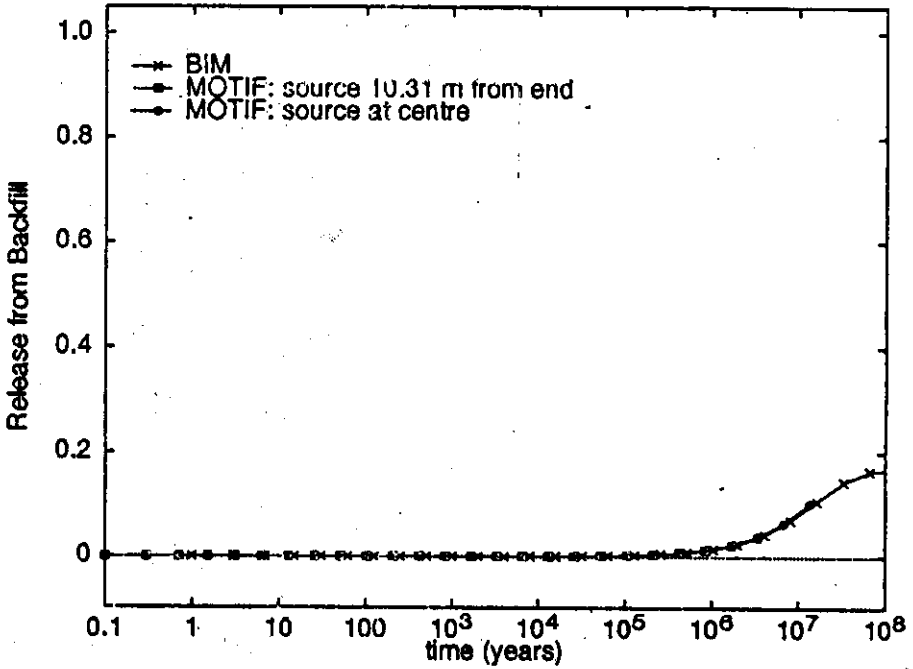
——— FINITE ELEMENT MOTIF

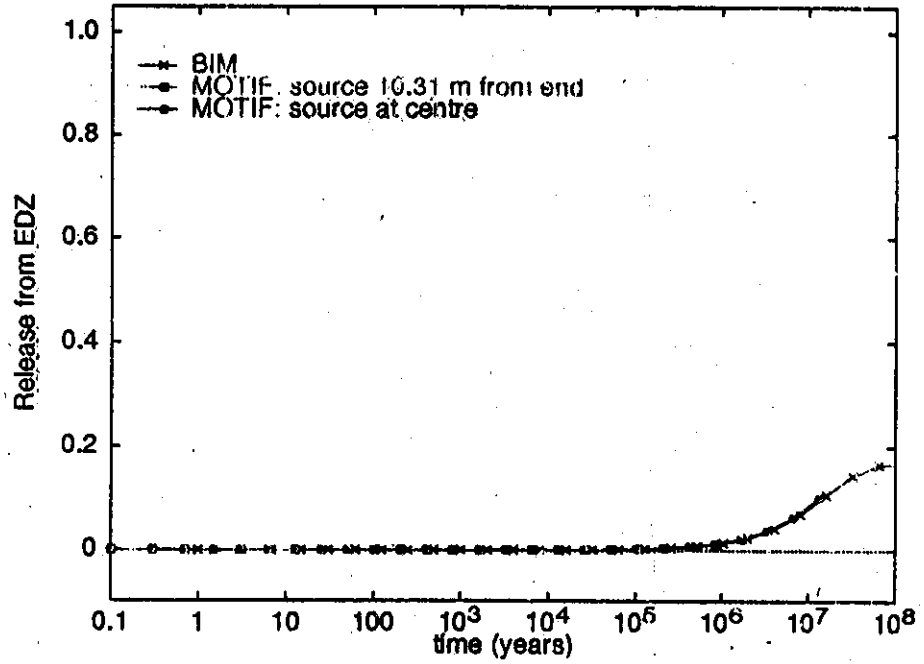
– – – – – BOUNDARY INTEGRAL



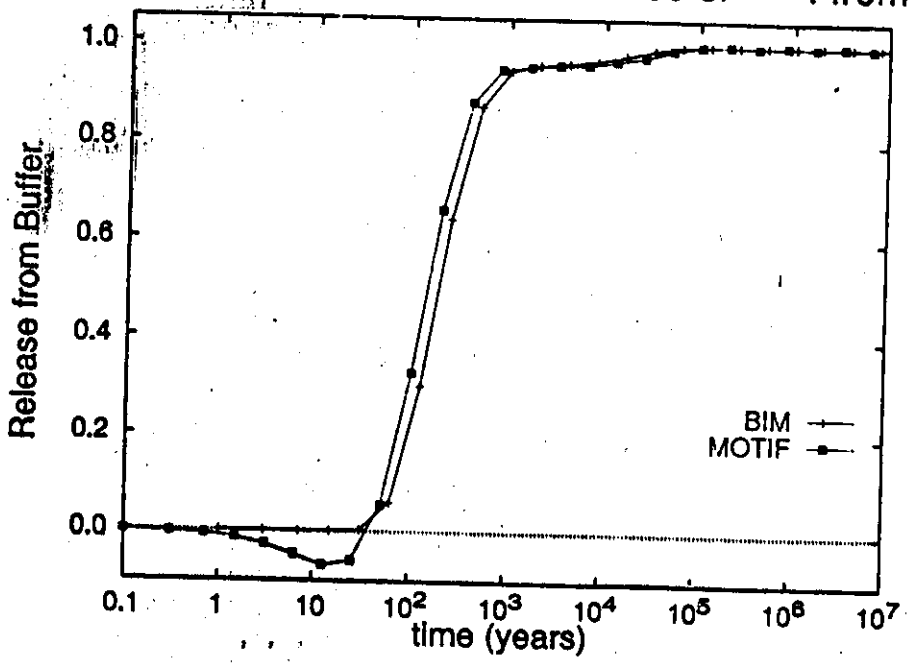
Comparison of Total Release of 129I from a Room for BIM and MOTIF in the Absence of Groundwater Flow

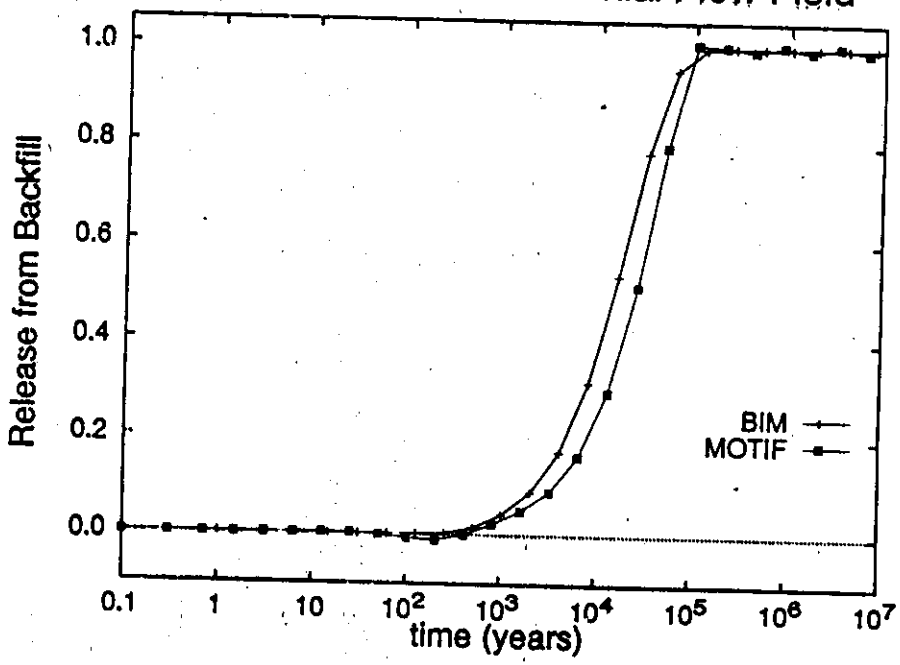


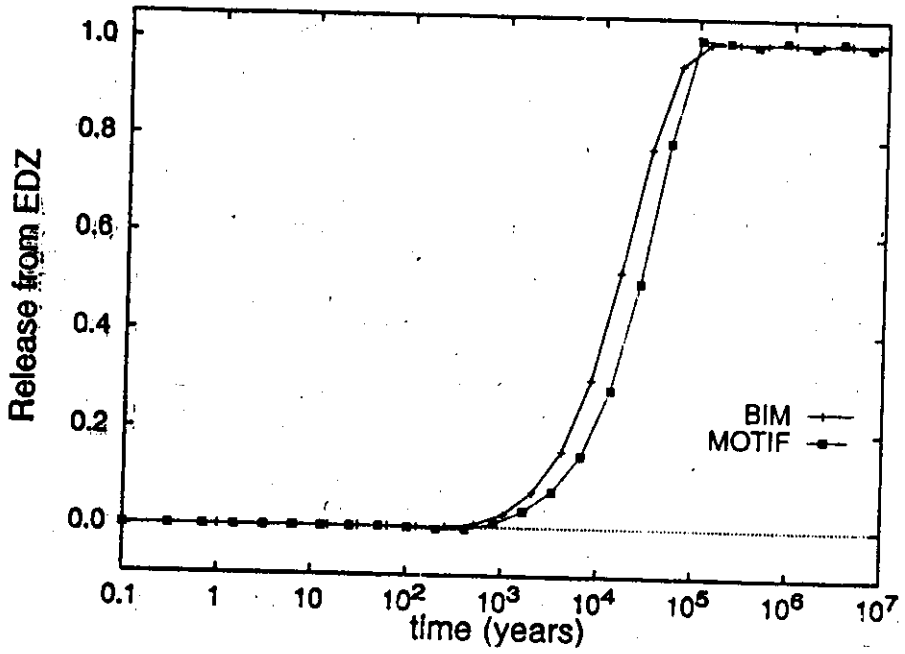


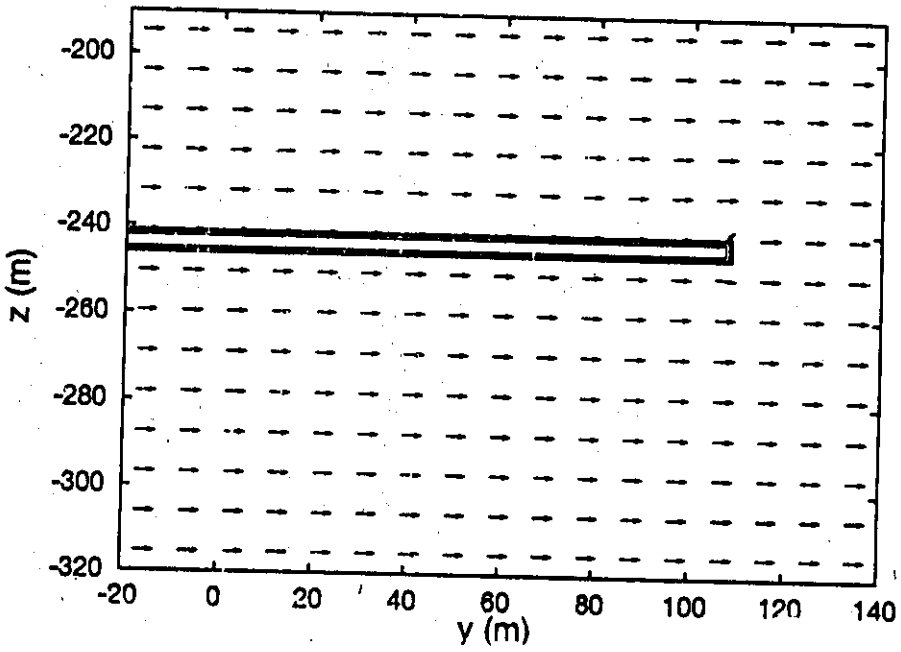


Comparison of Total Release of ^{129}I from a Roorn for BIM and MOTIF for an Axial Flow Field

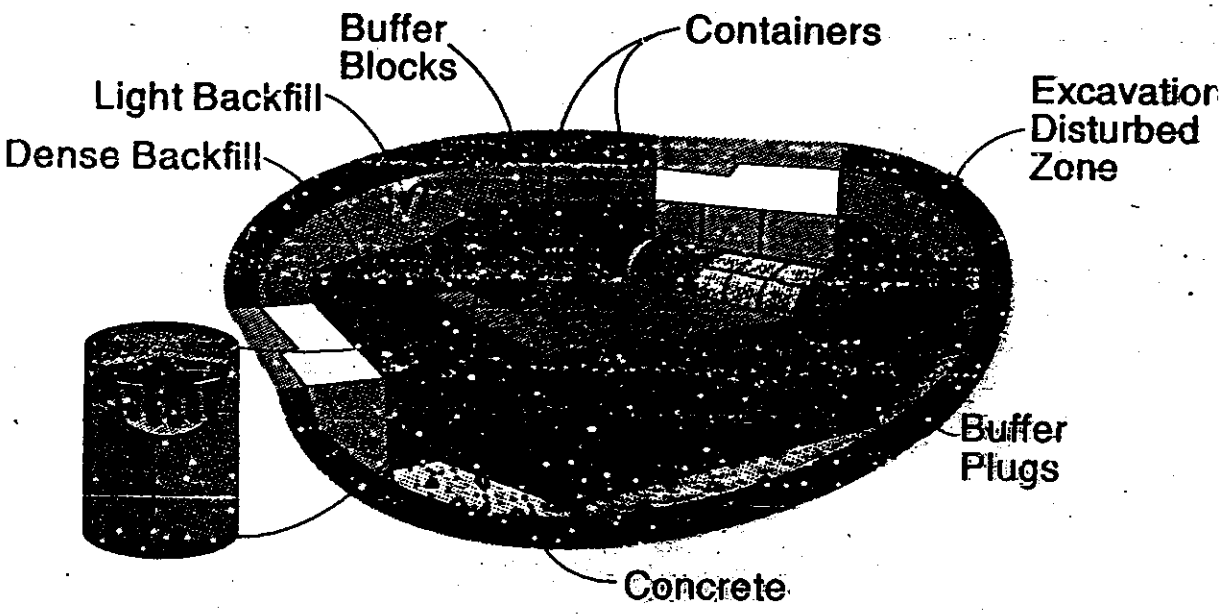


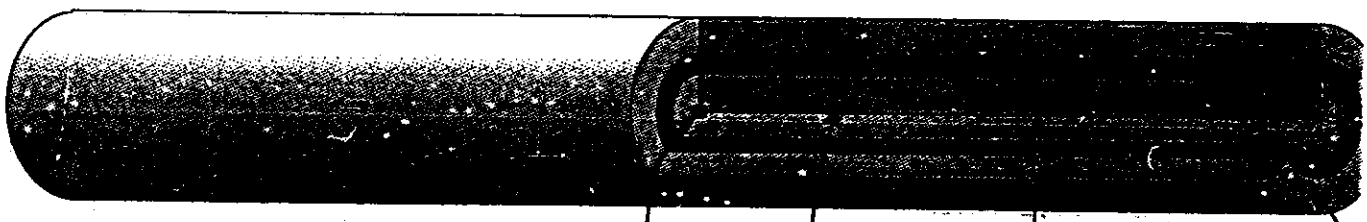






Physical Layout of Disposal Room





Model Geometry