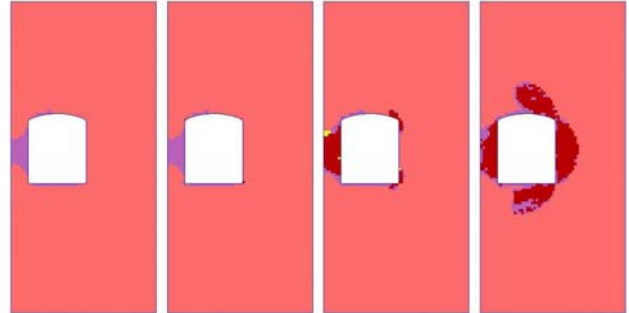


Nucleon Decay Detector—Conceptual Design

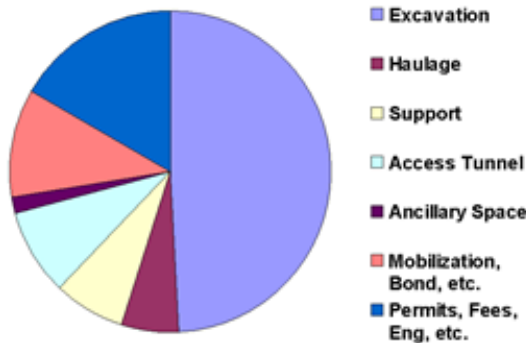
CNA Consulting Engineers prepared a conceptual design and cost estimate for a megaton-scale nucleon decay detector. The study was non-site specific and considered a range of depths, rock types and rock qualities. Cavern shapes considered included vertical cylinders, several torus shapes and the so-called rural mailbox shape.

Empirical design methods were used to estimate the structural support necessary for the project. This approach is appropriate for conceptual studies and feasibility assessments. These methods require assumptions about the general quality of the rock mass in which the project will be constructed. Costs were estimated for three different rock mass quality assumptions:

- Q=100—One joint set; rough, irregular, undulating joints with tightly healed, hard, non-softening, impermeable filling; dry or minor water inflow; high stress, very tight structure
- Q=3—Two joint sets plus misc.; smooth to slickensided, undulating joints; slightly altered joint walls, some silty or sandy clay coatings; medium water inflows, single weakness zones
- Q=0.1—Three joint sets; slickensided, planar joints with softening or clay coatings; large water inflows; single weakness zones



Project cost and schedule estimates were based on the following assumptions: 1. the site is initially undeveloped, 2. project development occurs in a civil construction environment, 3. highway access is available for bringing equipment and material to the site & for broken rock disposal, 4. the massive scale of the project is cost neutral, 5. advantages of scale offset disadvantages, 6. shafts are 600 meters deep, 7. access tunnels are 2,400 meters long, 8. ancillary space amounts to 2.5 percent of the total cost, 9. mobilization, bonds, etc. amounts to 15 percent, 10. permits, fees, engineering & environmental studies are 20 percent, 11. access tunnel costs include portal & limited site work, 12. shaft costs include shaft collar, equipment, & limited site work.



The study concluded that a megaton scale detector cavern is feasible. Costs are sensitive to cavern volume and rock quality; and insensitive to cavern shape. Costs are moderately sensitive to horizontal versus vertical access (within ranges considered).

The project challenges include: 1. find the best possible rock in an acceptable region, 2. find a site with feasible horizontal access, 3. explore co-use opportunities, 4. develop layouts amenable to low cost excavation methods, 5. Involve geotechnical engineers throughout the process.

Owner — SUNY Stony Brook

Completion Date — Study completed 1999

Construction Cost — Varying

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