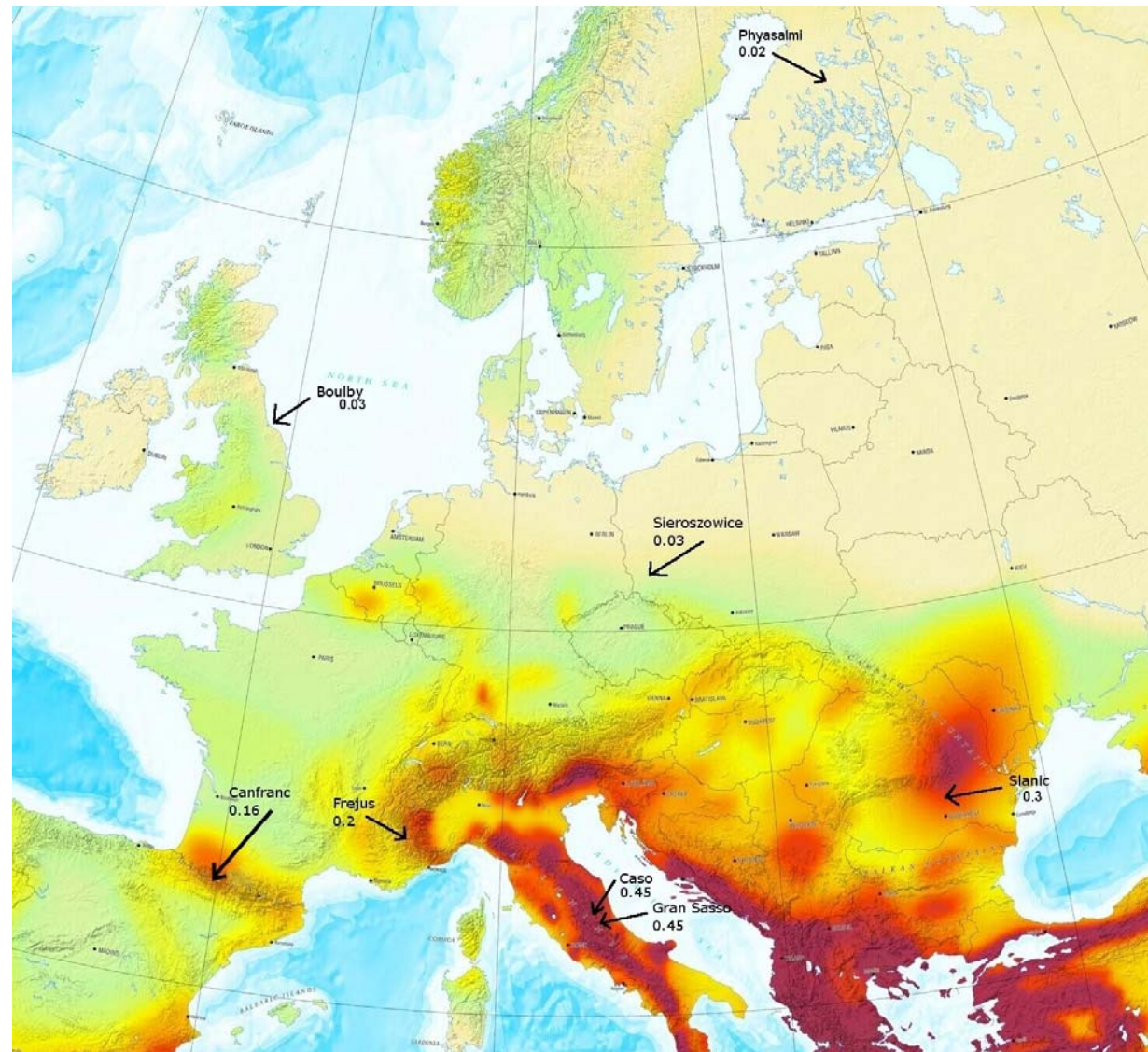
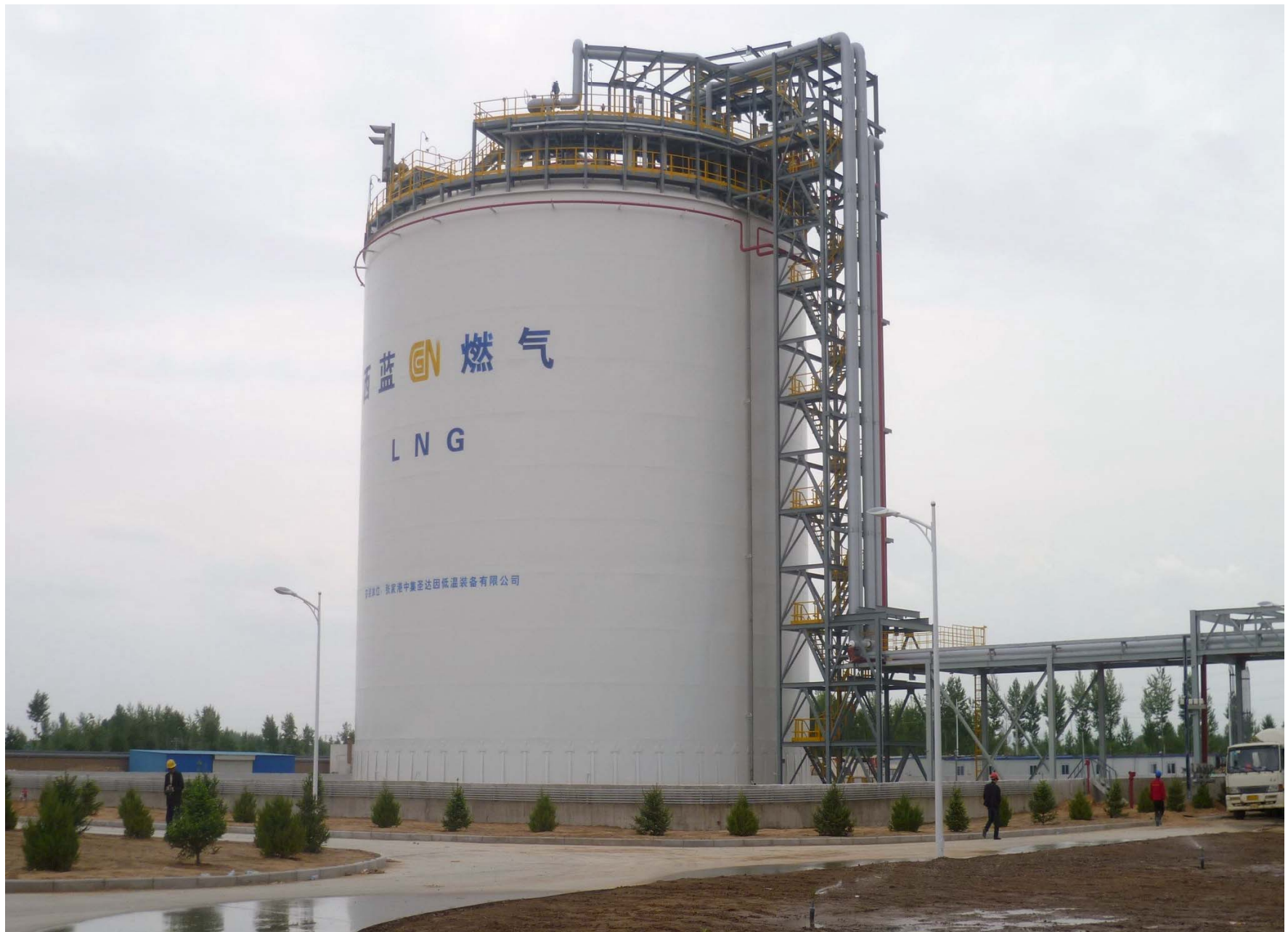

Presentation
by
Mike Haworth
Technodyne International Ltd

- **Initial Concept - 2004**
- **Use existing technology from industry experience**
- **Above ground tank, placed below ground**
- **De-couple the tank from the cavern**
 - **Several sites**
 - **Several seismic levels**
 - **Rock or Salt**

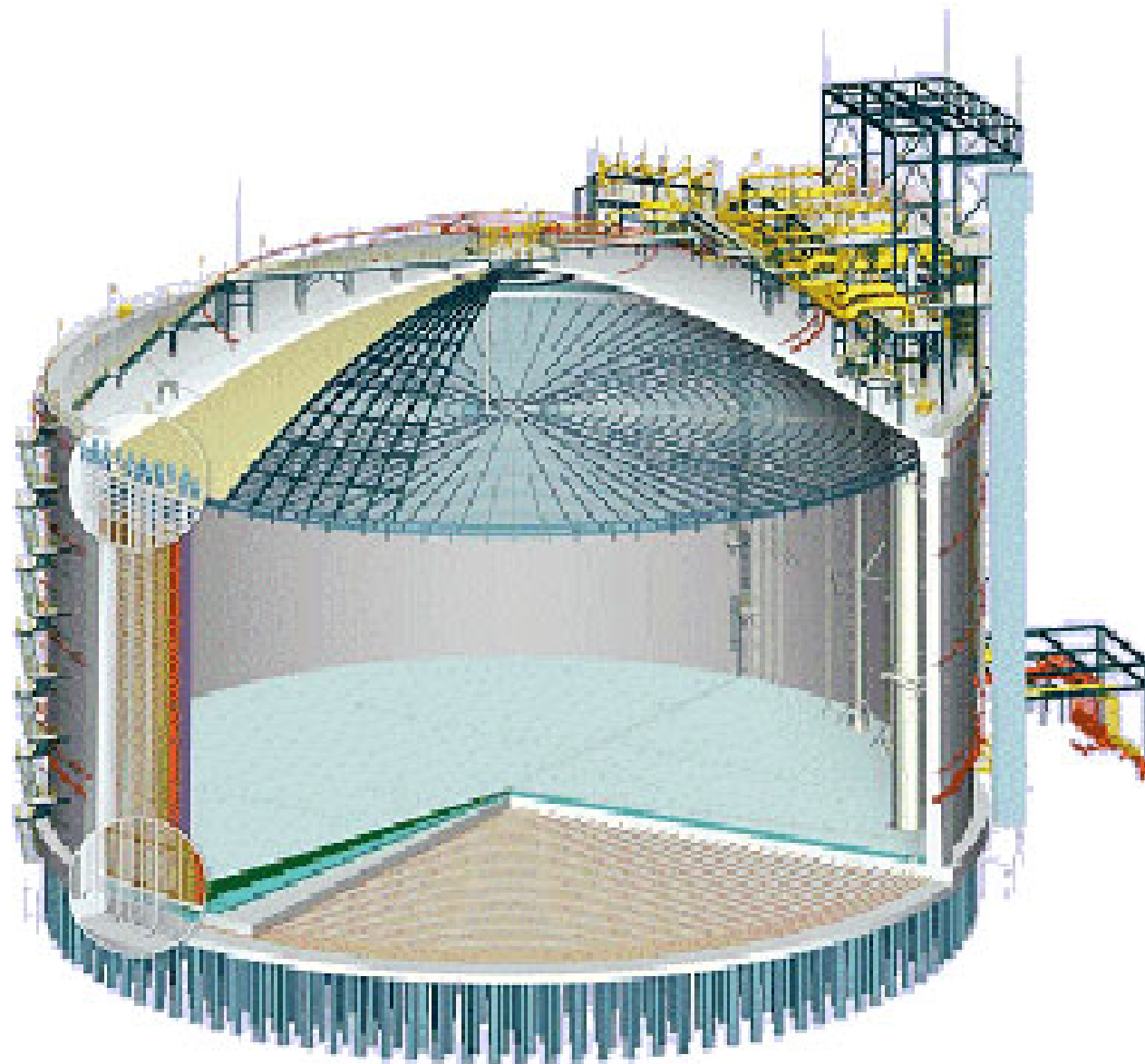






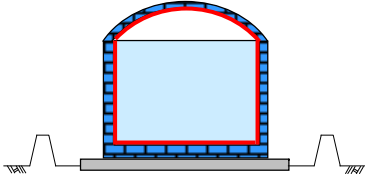
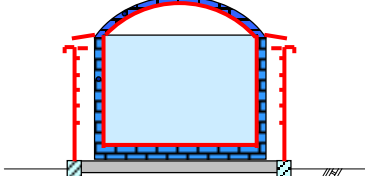
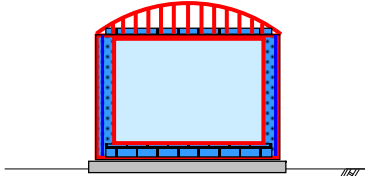
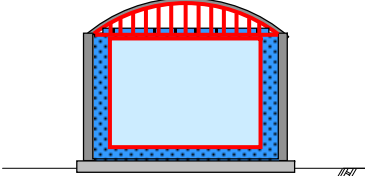
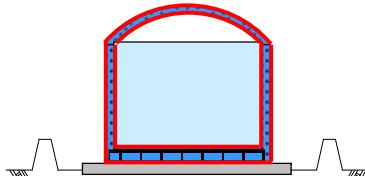
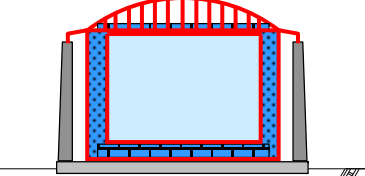
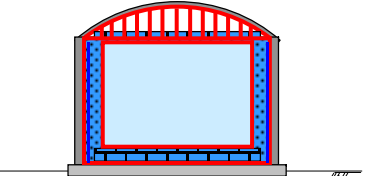
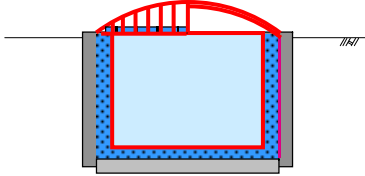
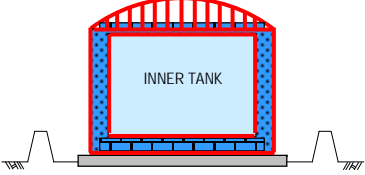
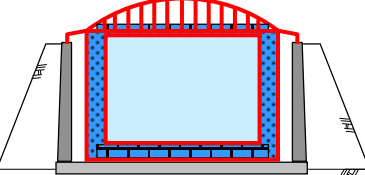
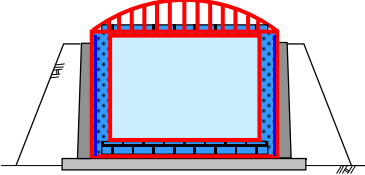
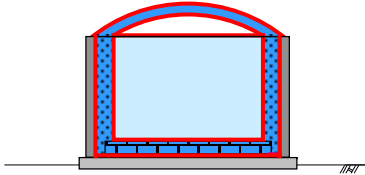




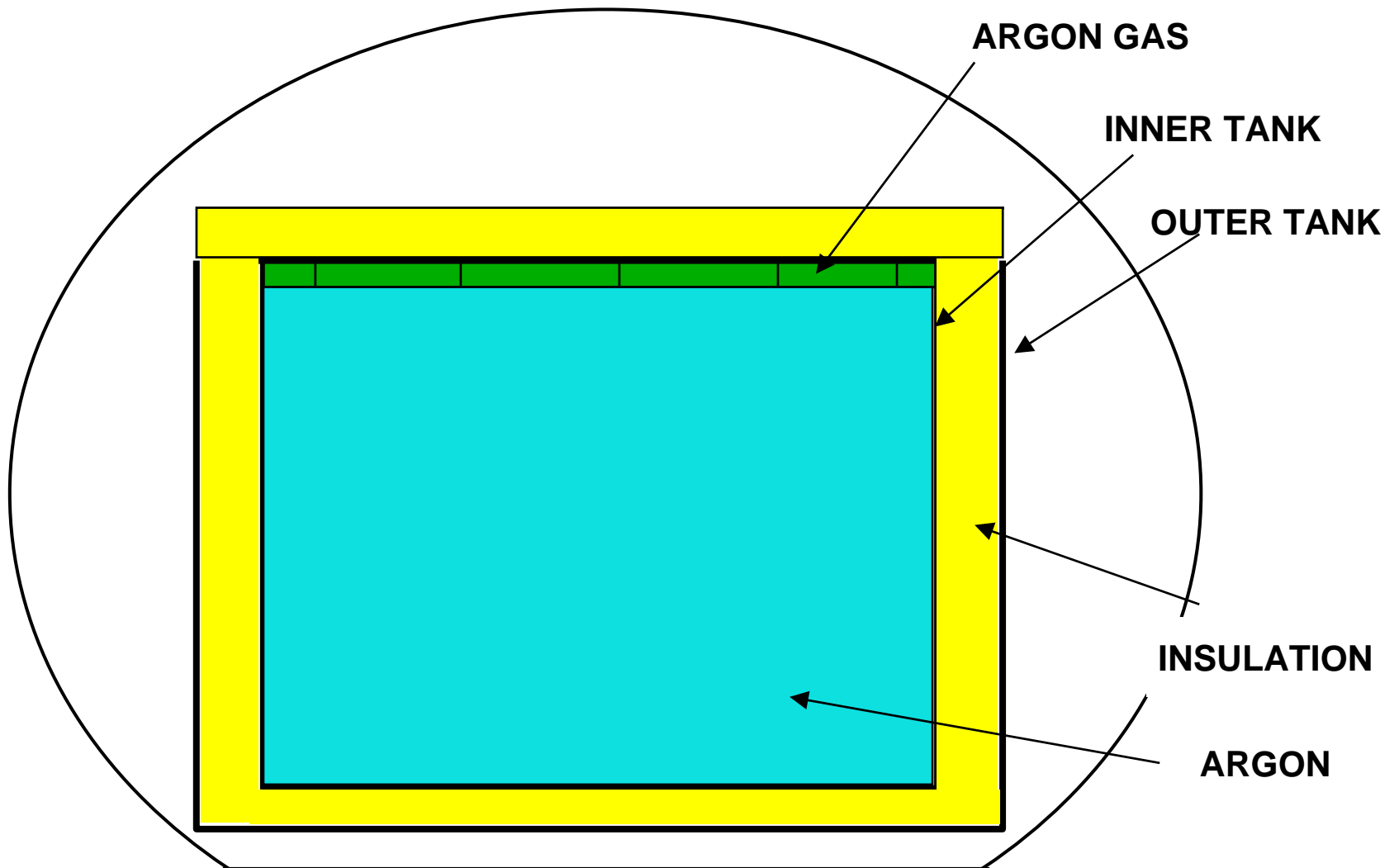


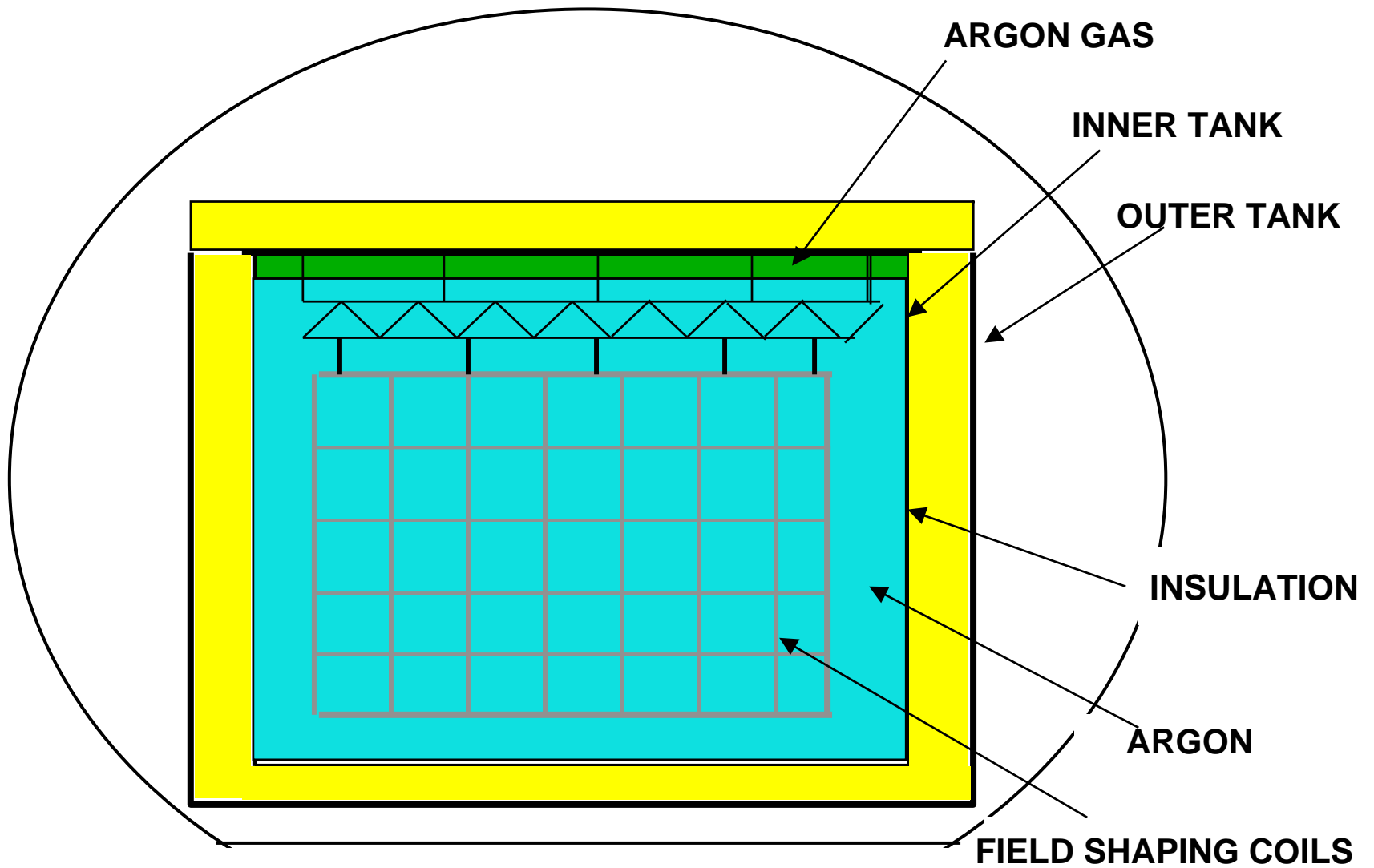
Various Tank Configurations

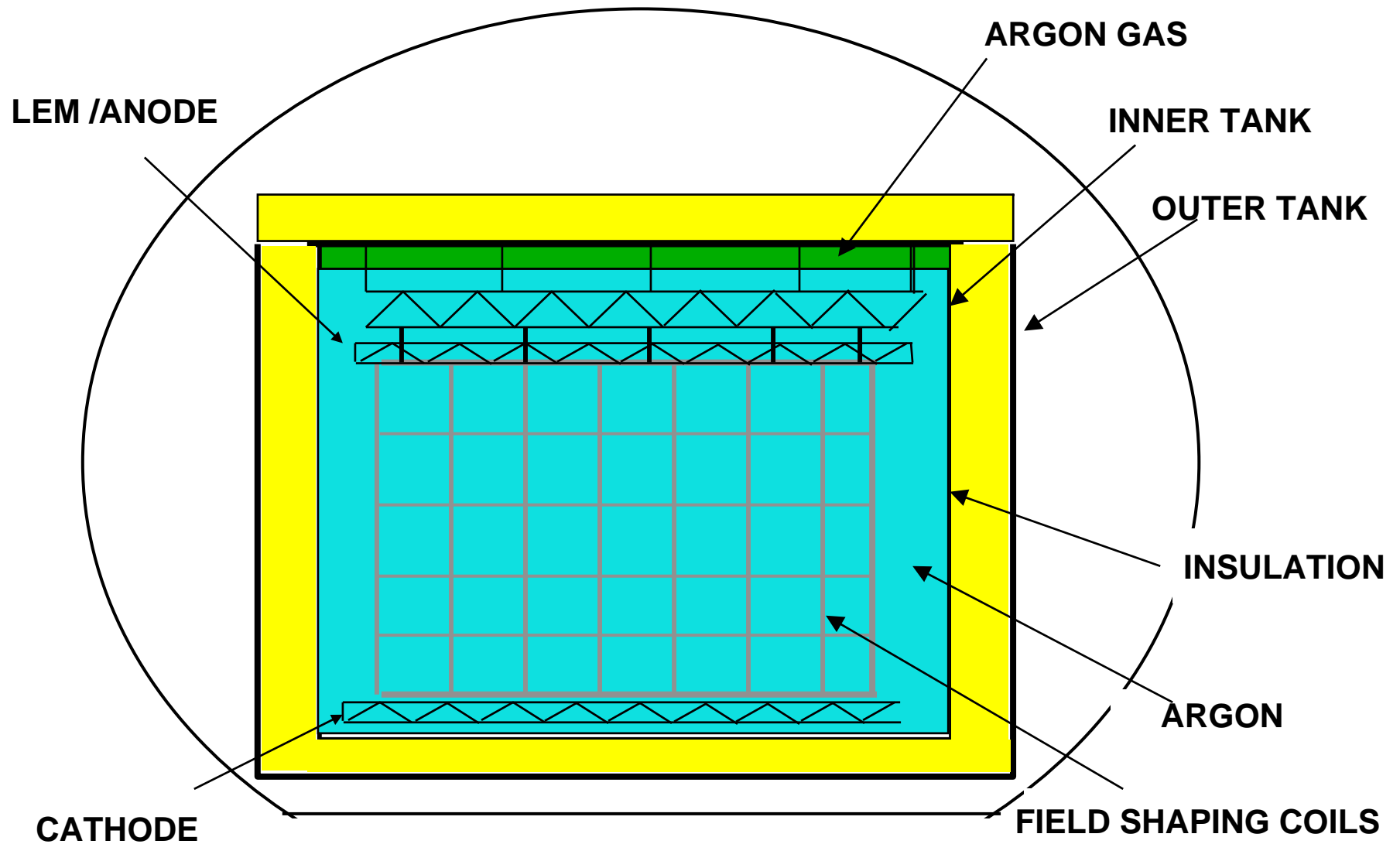


Single Containment	Double Containment	Full Containment	Others
<p>Single Metal Tank</p> 	<p>Metal Outer Wall</p> 	<p>Double Metal Tank</p> 	<p>Above Ground - Membrane Tank</p> 
<p>Double Metal Tank Dome Roof Inner Tank</p> 	<p>PC Outer Wall</p> 	<p>PC Outer Wall Tank</p> 	<p>In Ground - Membrane Tank</p> 
<p>Double Metal Tank w/Suspended Deck</p> 	<p>RC Outer Wall + Earth Embankment</p> 	<p>RC Outer Wall + Earth Embankment</p> 	<p>PC Outer wall Tank in Japan</p> 

Acknowledgement Chiyoda







- **Easier than above ground**
 - **Steady state use**
 - **No pressure variations**
 - **Fixed external ambients**
 - **No fill/empty cycles - fatigue**
 - **No wind loading**
 - **No external threats**
 - **Location**
 - **Hazards**
 - **Consequence of failure**

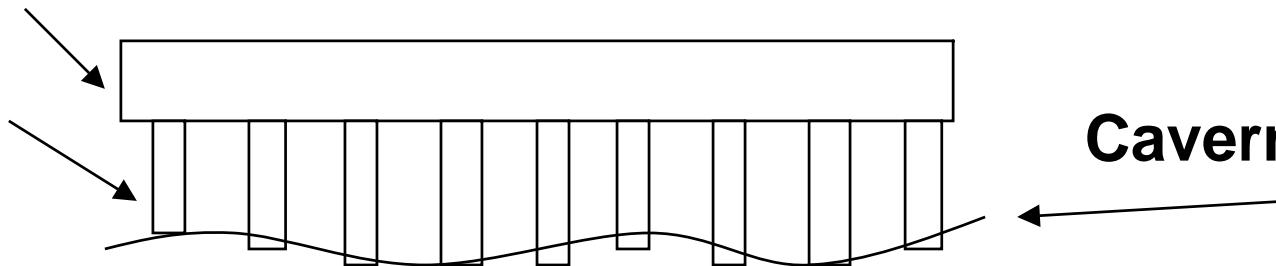
- **Harder than above ground**
 - Above deck is accessible
 - Large payload
 - Higher surface finish
 - Ventilation
 - Location
 - Construction
 - Logistics

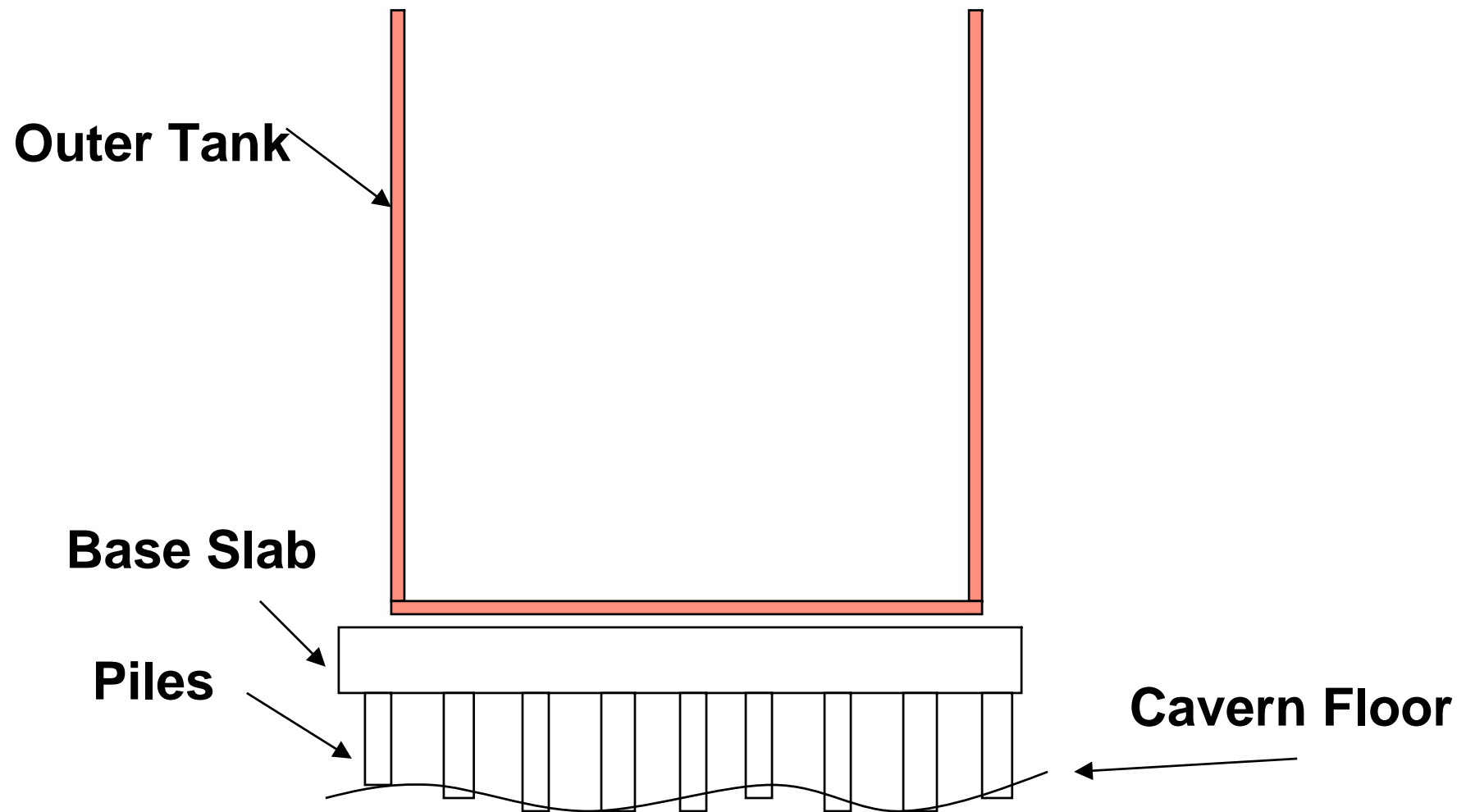
- **Single containment is suitable**
 - Full containment not warranted
 - Cavern will contain spill
- **Steel / Steel**
 - Steel concrete not necessary
 - Membrane not current practice
- **Modify design for deck access**
- **Modify design for sealing of inner tank**
- **Support for payload**

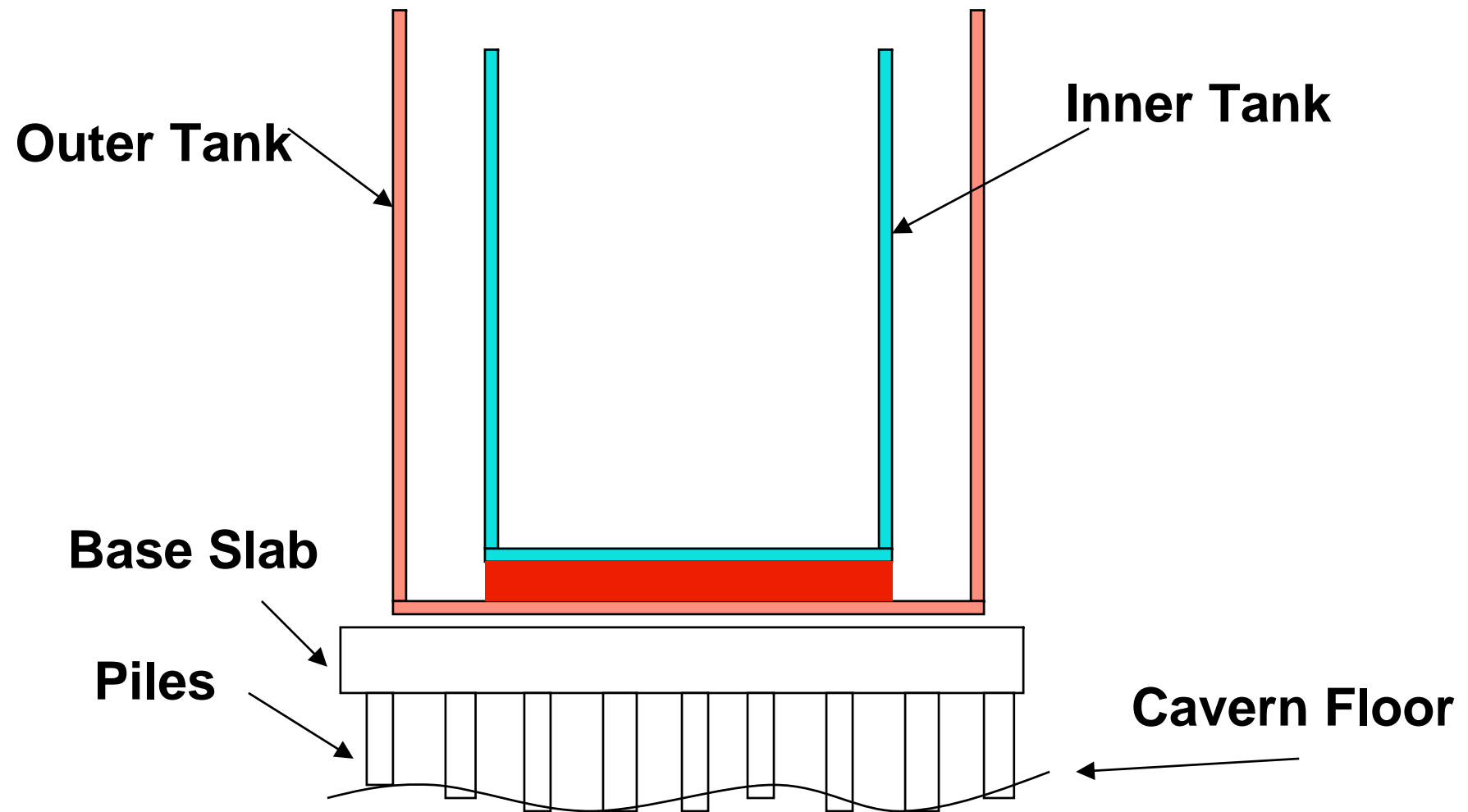
Base Slab

Piles

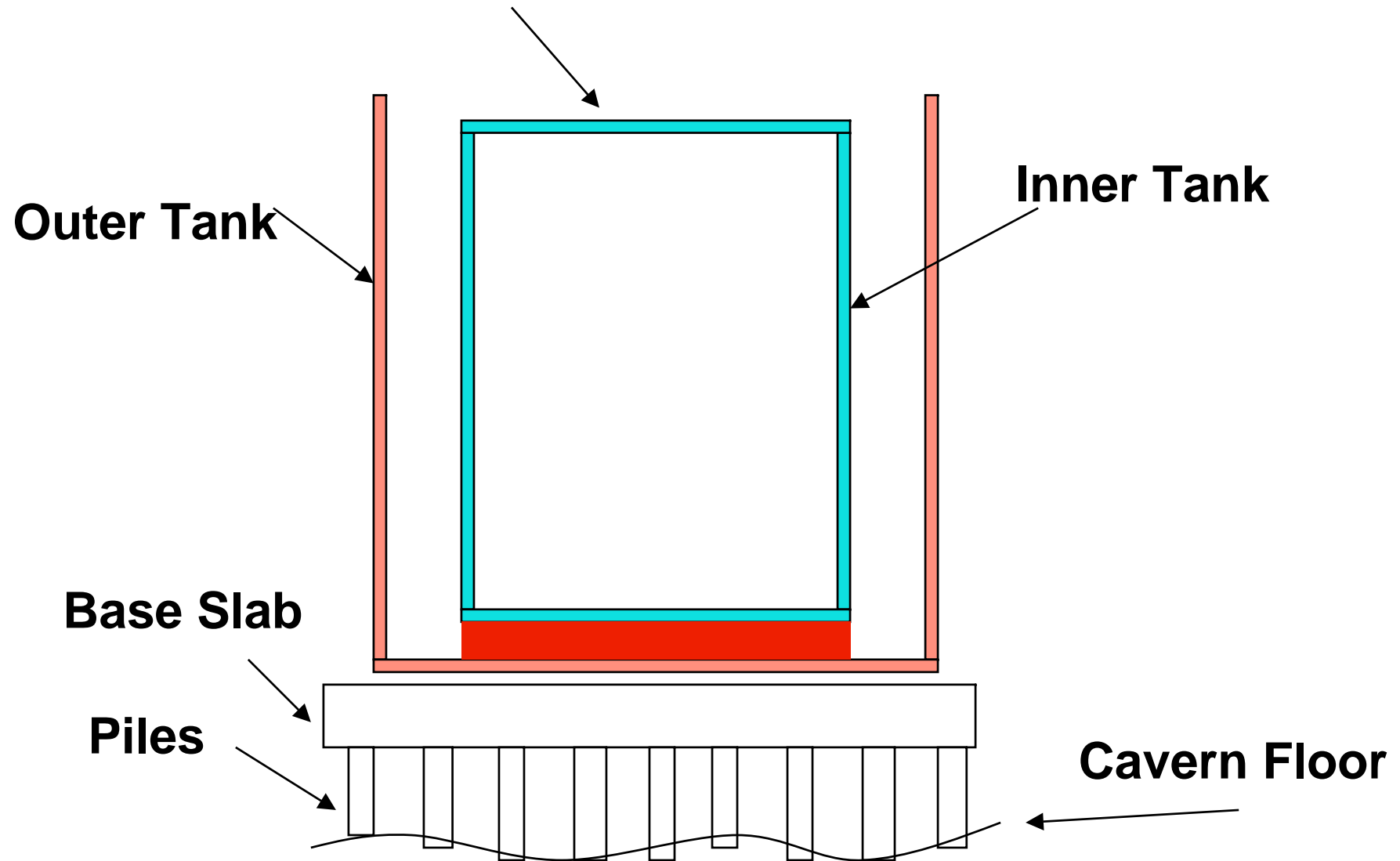
Cavern Floor



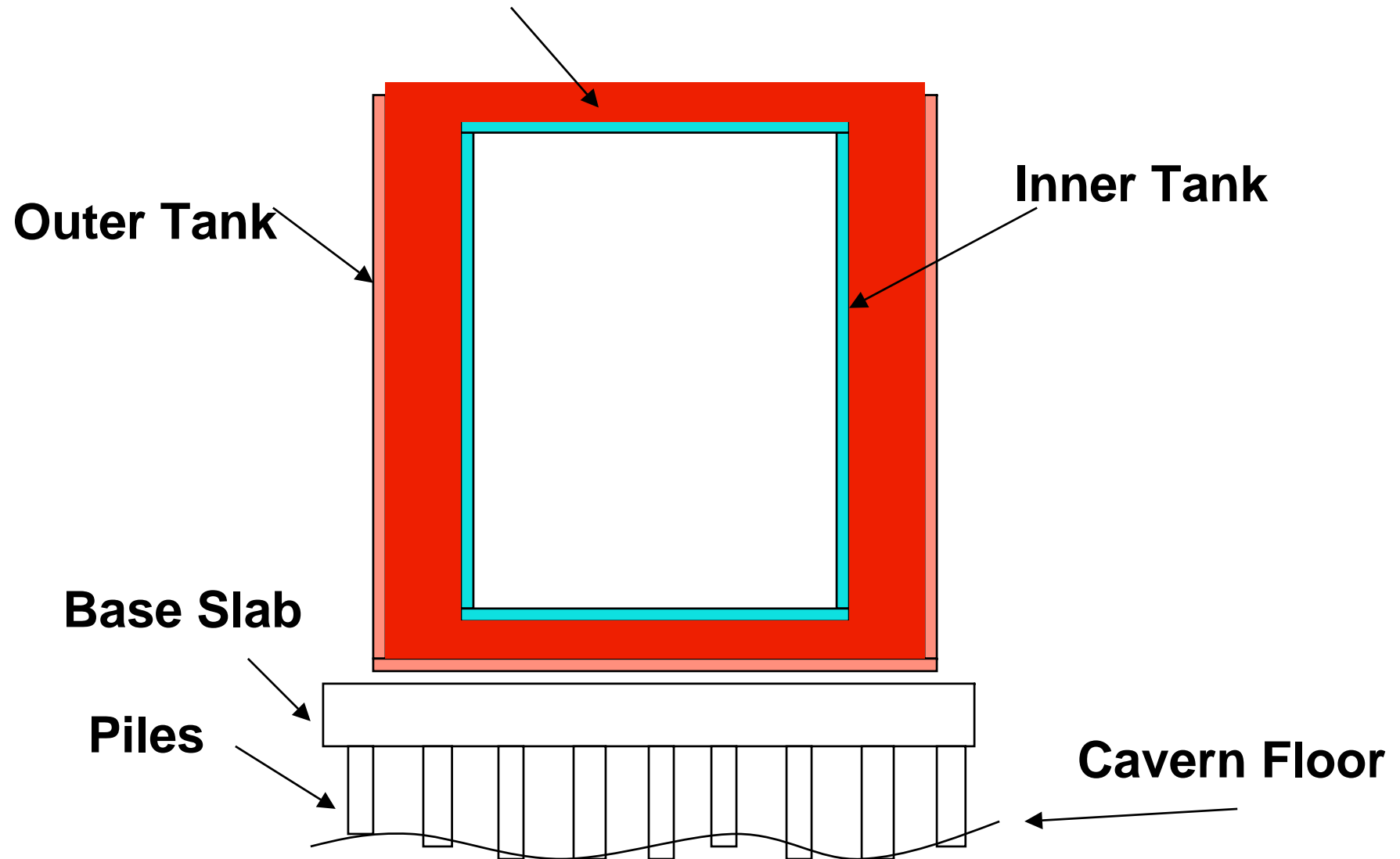


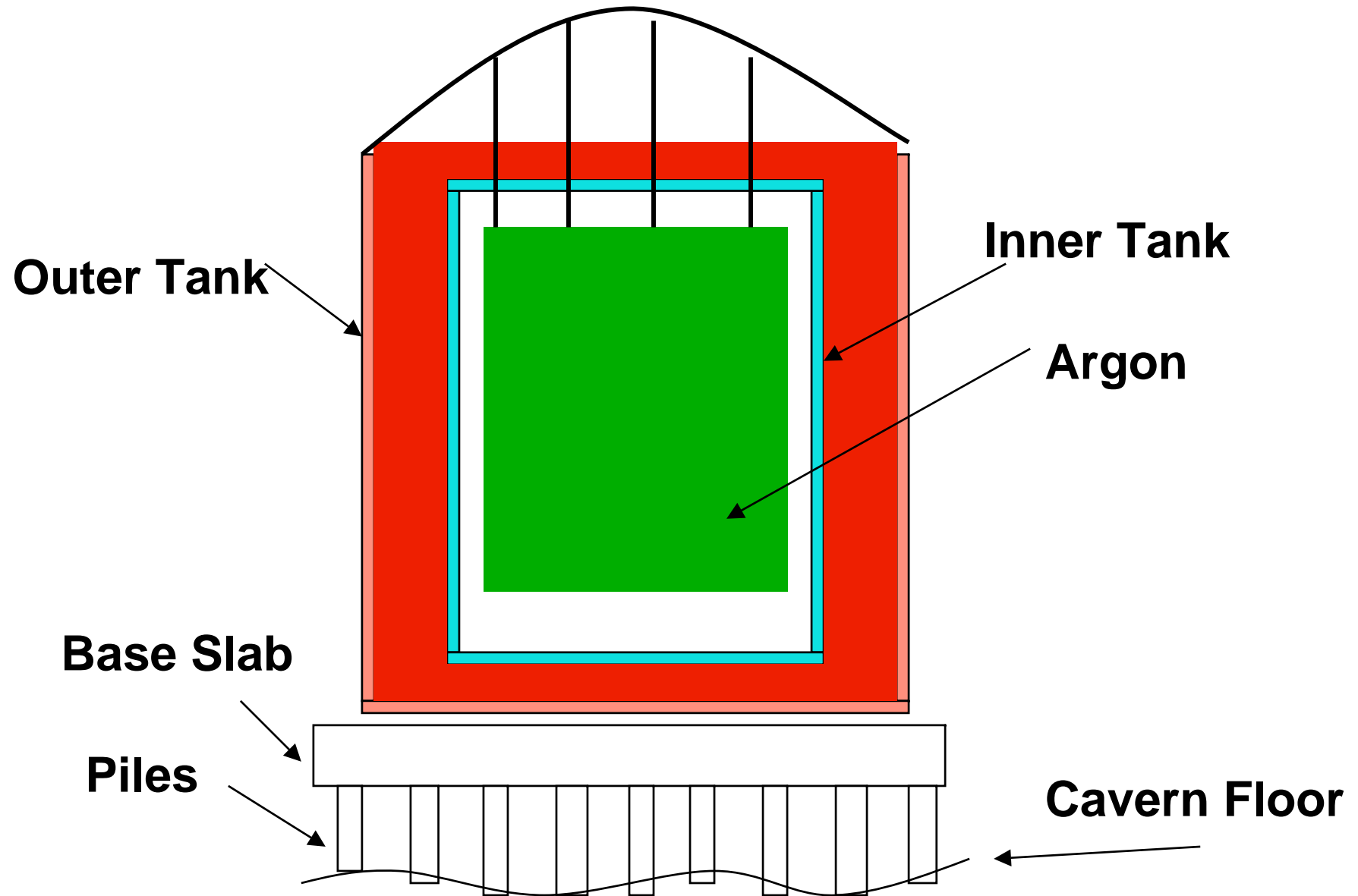


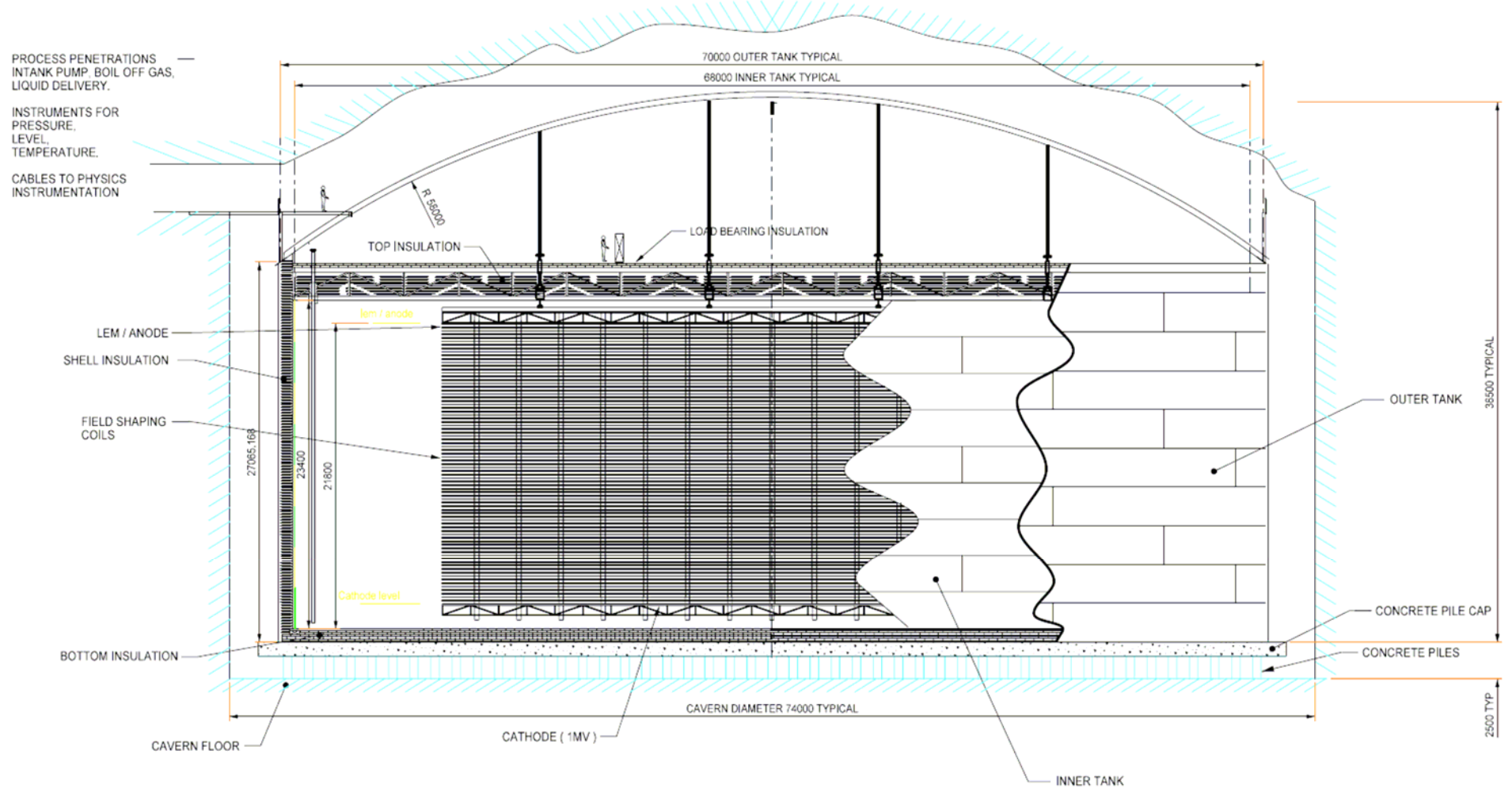
Suspended Deck

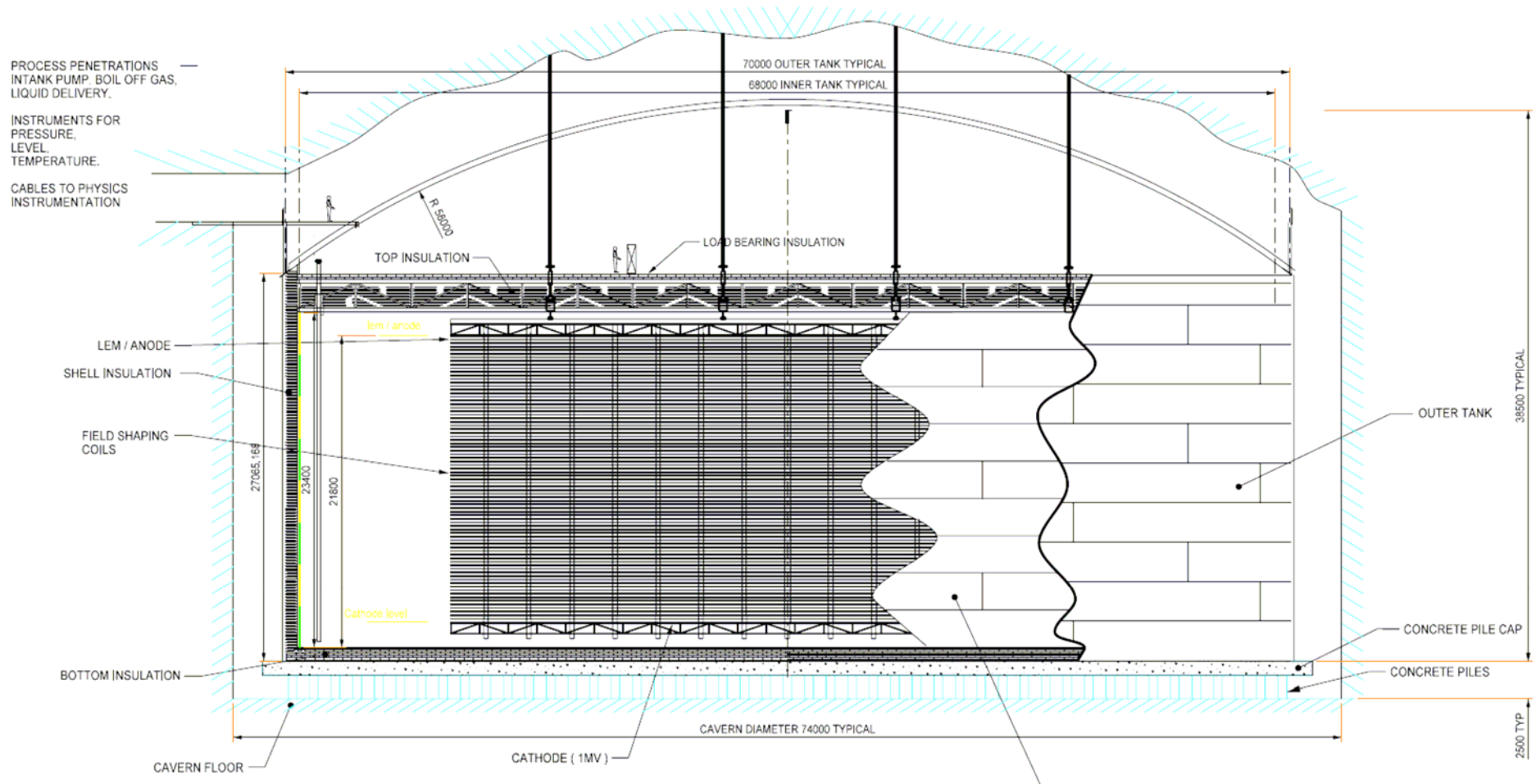


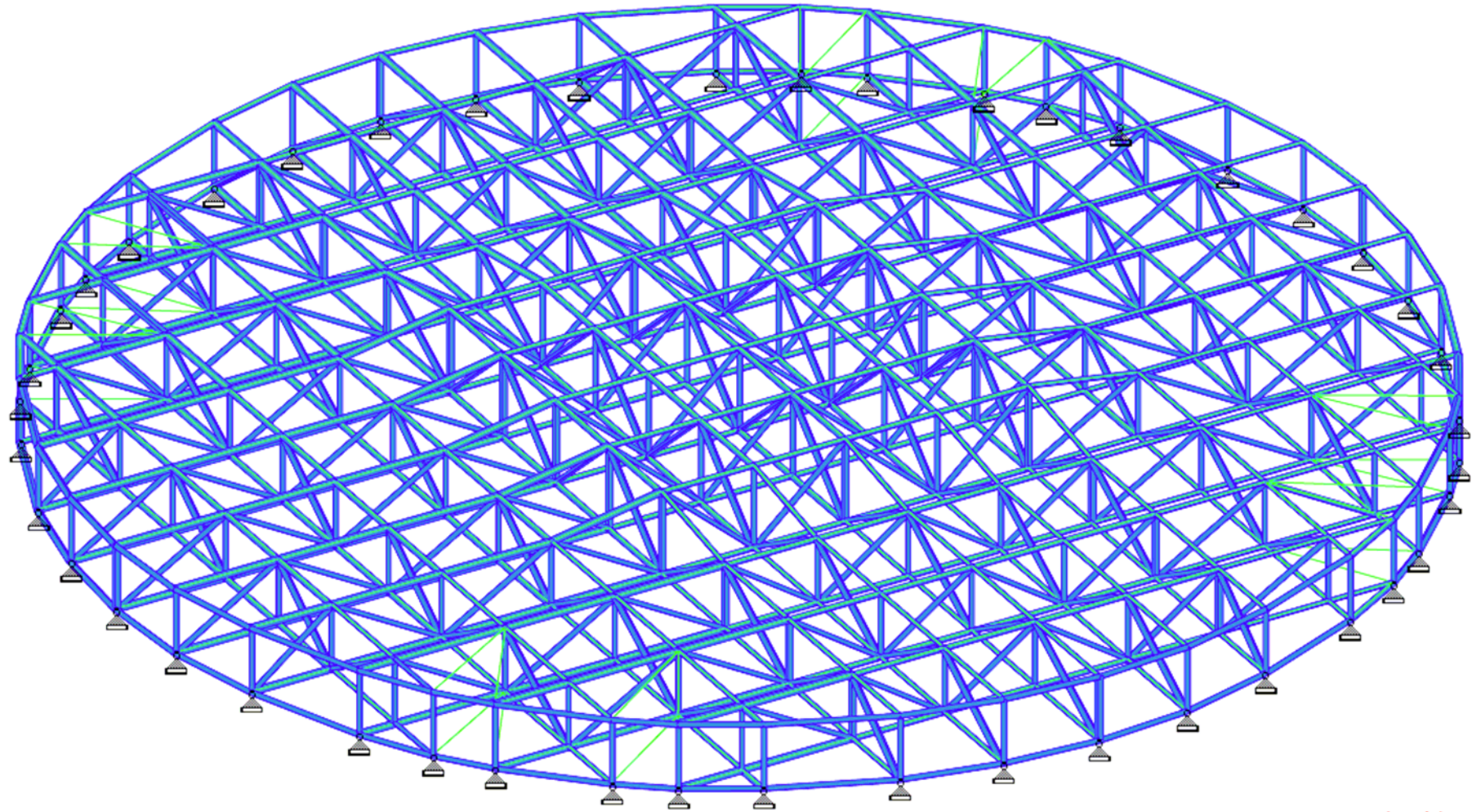
Suspended Deck



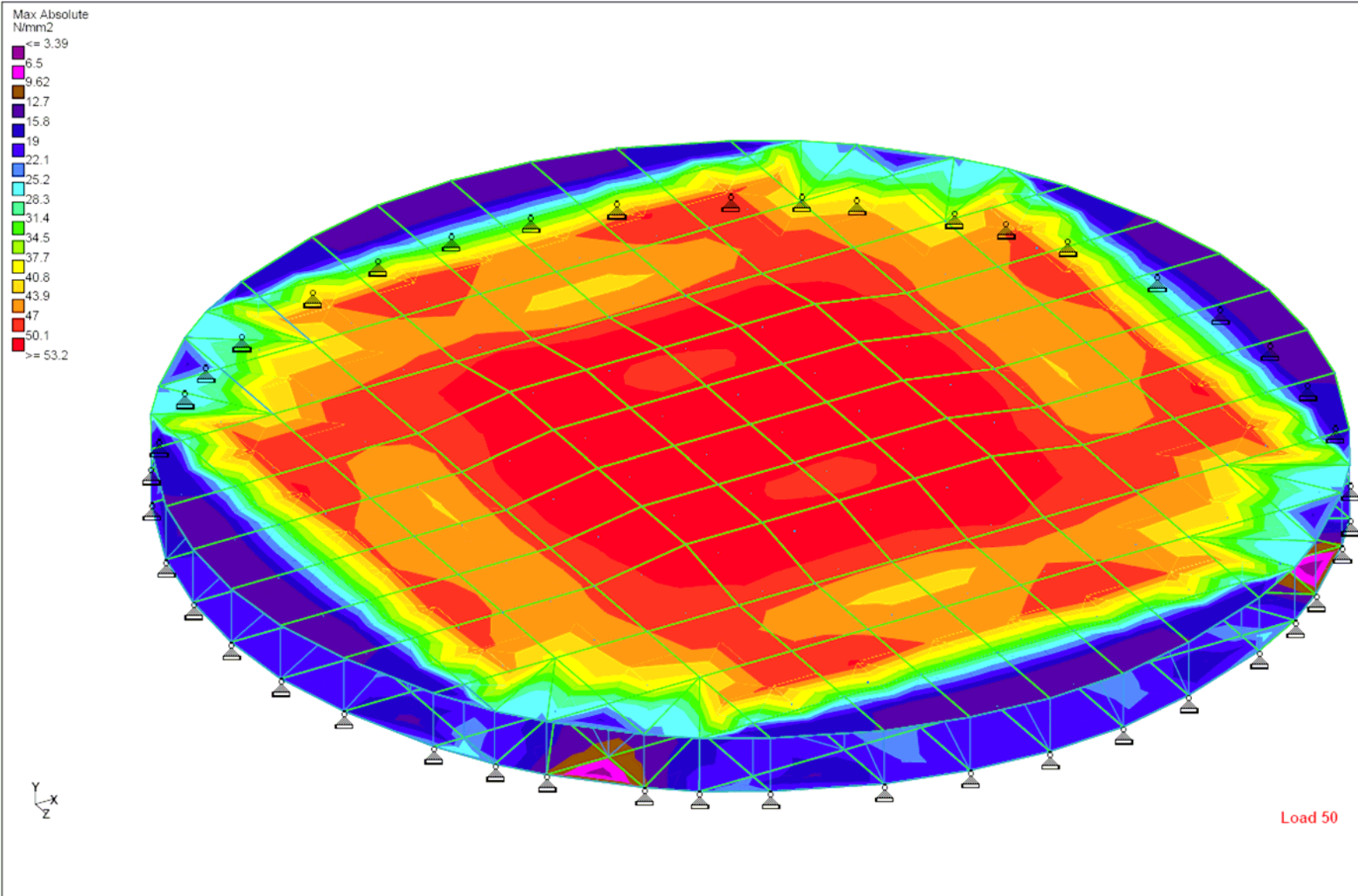


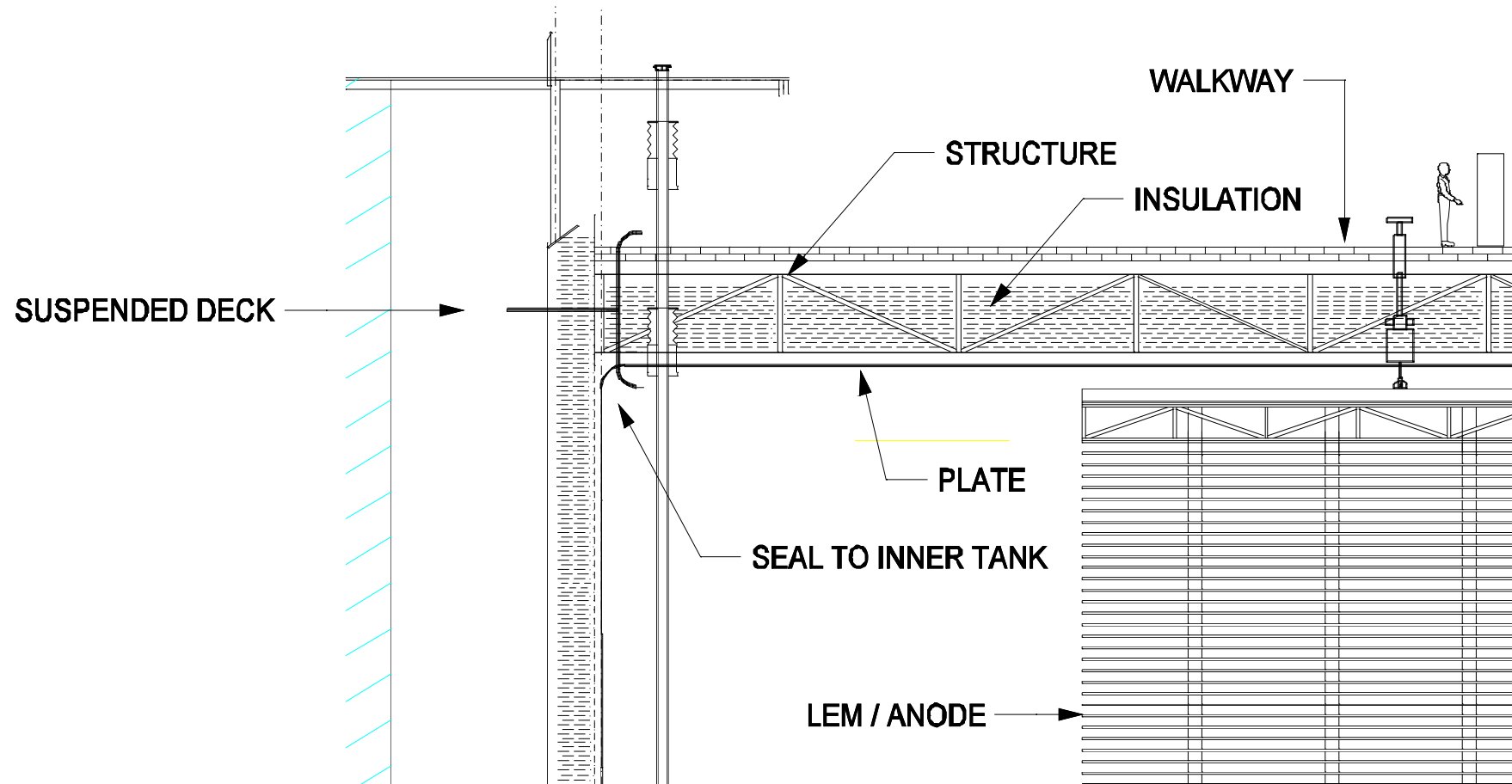


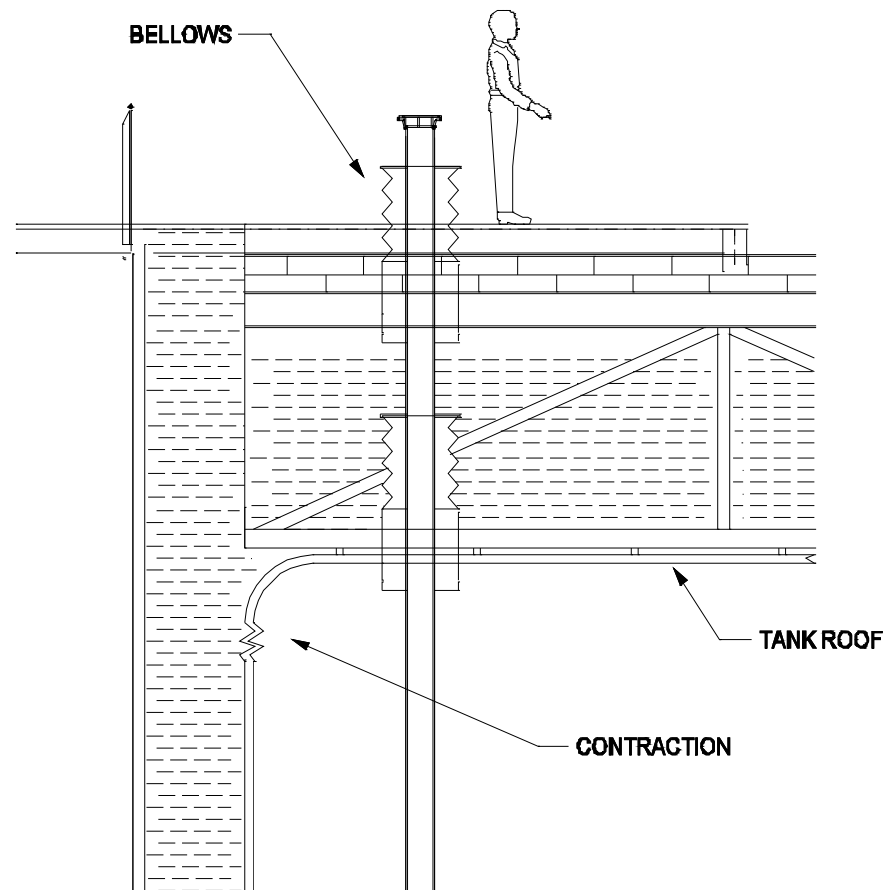


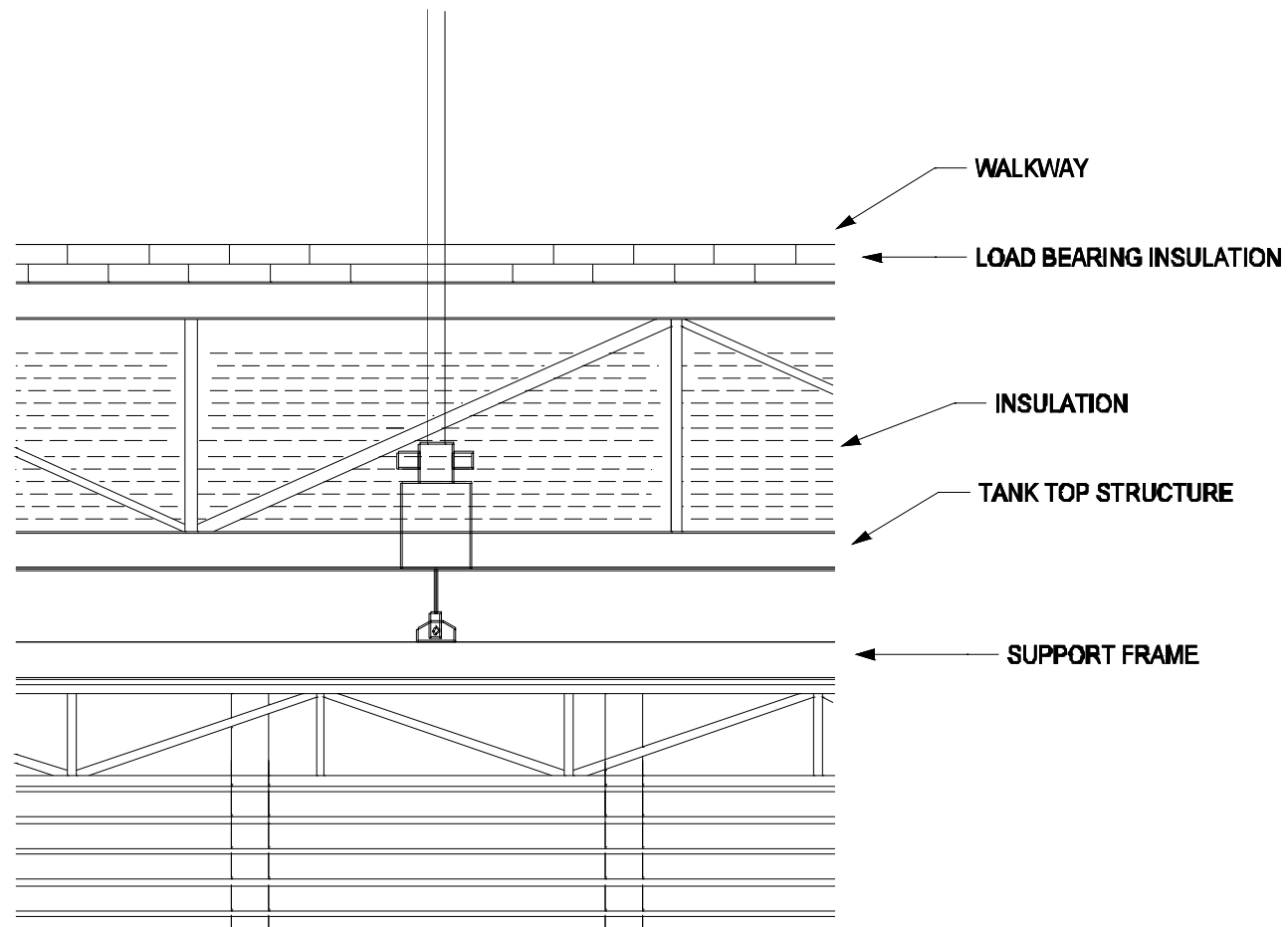


Load 1

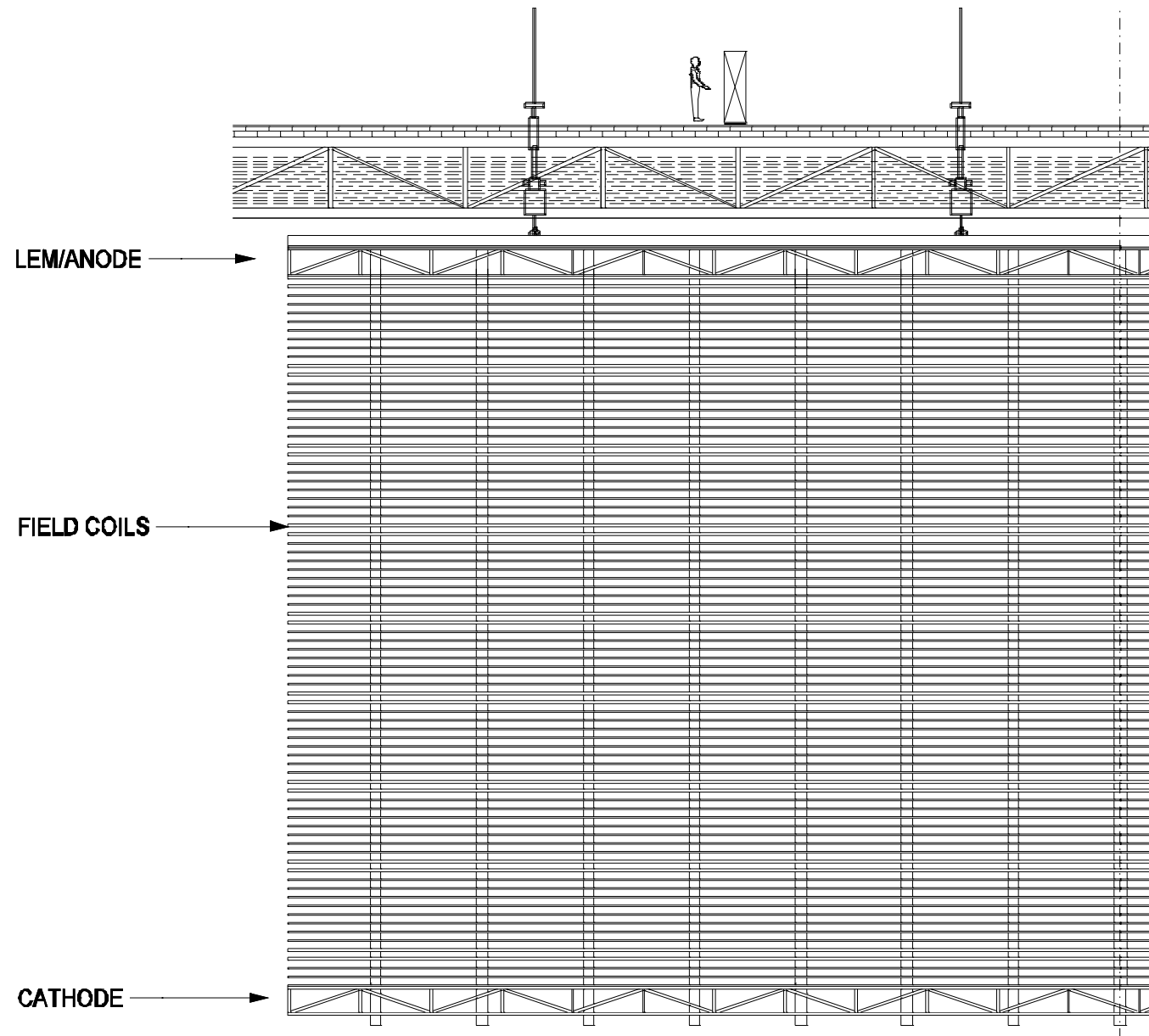


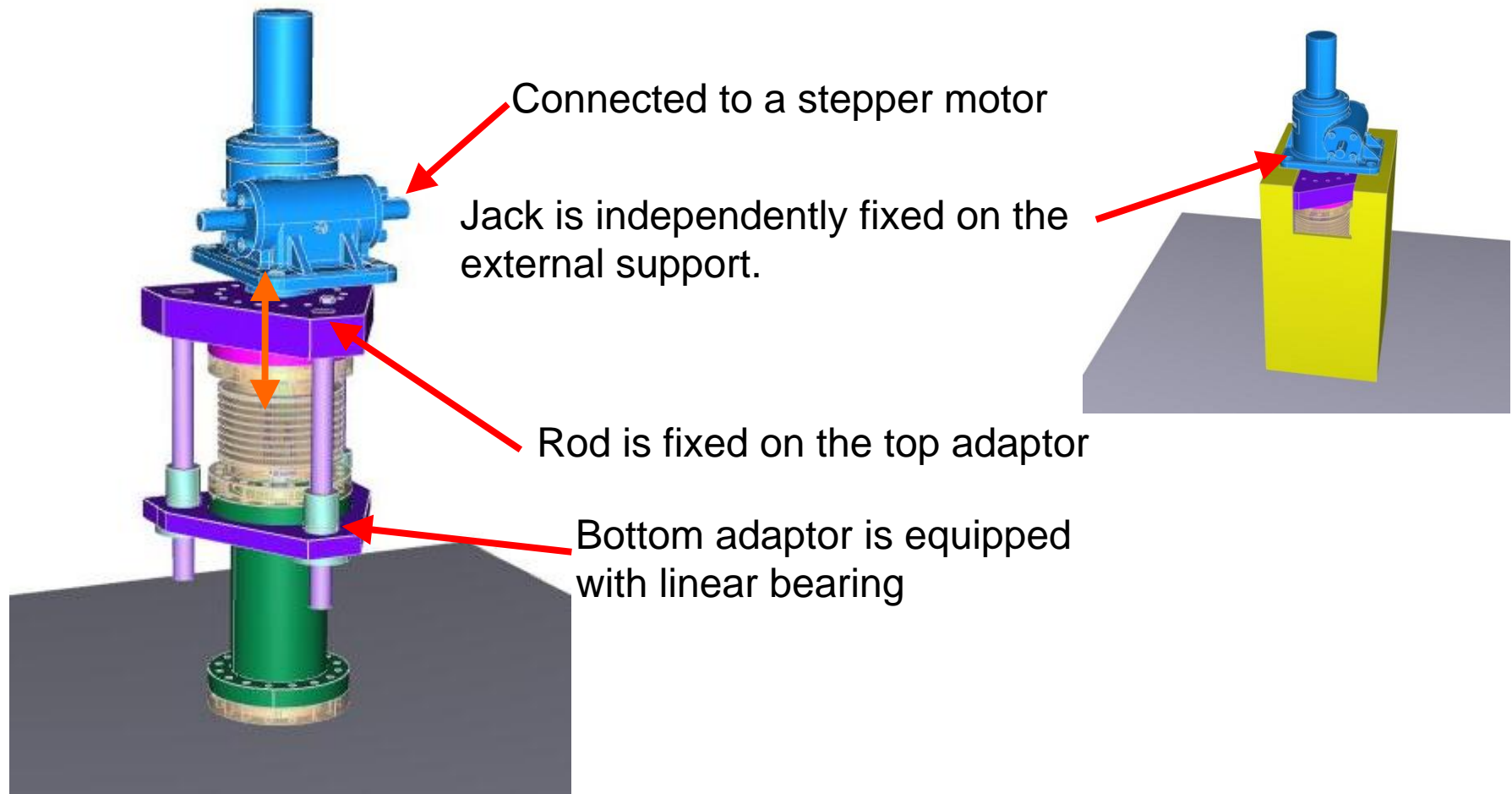






675 TONS





- **3D model**

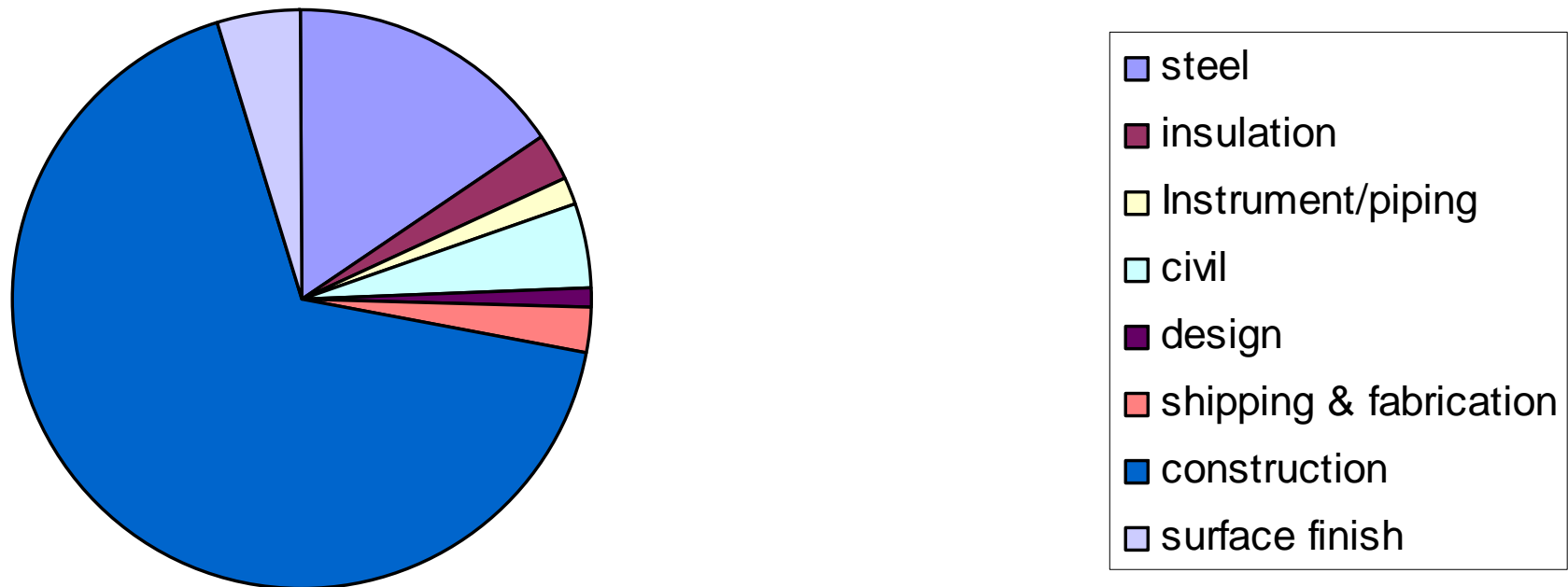
- **Stainless Steel**
 - Inner Tanks
 - Suspended Deck
- **Carbon Steel**
 - Outer Tank
 - Dome structure
- **Cavern Diameter 74.4m**
- **Outer Tank Diameter 70.4m**
- **Inner Tank Diameter 68m**
- **Operating Temperature –186 C**
- **Auto-refrigerates**
- **Operating Pressure 10 mbar**
- **Cathode location +/- 5mm**
- **Field Coils location +/-5mm**

- Based on existing design and operating experience
- Design variations are known
- Design variations have several solutions
- Design is scaleable from 4,000 to 70,000 m³

- A pilot will allow optimisation
 - Construction
 - Costs

- Cost for above ground installation
- Multiplier for below ground

Estimated Cost Split



- **Feasibility Study**
 - The tank is feasible
 - Costs are estimated
 - Several design solutions
- **Tank is scaleable**
- **A pilot plant would**
 - Pin down the design details
 - Pin down equipment costs
 - Allow construction costs to be more accurately known
 - Allow plant operating costs to be known