

Crude Oil Storage

Research, Selection, and
Design for SNC-Lavalin



Summary

- **Project description**
- **Above ground concrete tanks**
- **Cut & cover storage**
- **Underground concrete tanks**
- **Environmental considerations**
- **Above ground steel tanks**
- **Hard rock mine storage**
- **Cost analysis**
- **Scope of remaining work**

Project Description

- Newfoundland and Labrador Refining Corporation
- SNC-Lavalin contracted to design new refinery
- Southern Head, NL
- Crude Oil Storage:
 - 6.3 million barrels of oil OR
 - 264.6 million gallons OR
 - 990,000 cubic meters



Newfoundland Refinery Project at Southern Head. Newfoundland and Labrador Refining Corporation. October 16, 2006

Above Ground Concrete Tanks

- Prestressed – reduces wall thickness
- Dimensions for cost estimate
 - 90m diameter, 20m height
 - Based on 750,000 barrels per tank
 - 1m thickness wall from bottom to top



http://www.lusas.com/case/civil/ing_tank_design.html

Cut & Cover Storage

- Concrete lined trench
- Relatively easy construction
- Ideal for large capacity requirements
- Dimensions for estimate:
 - 230m length, 140m width, 20m height

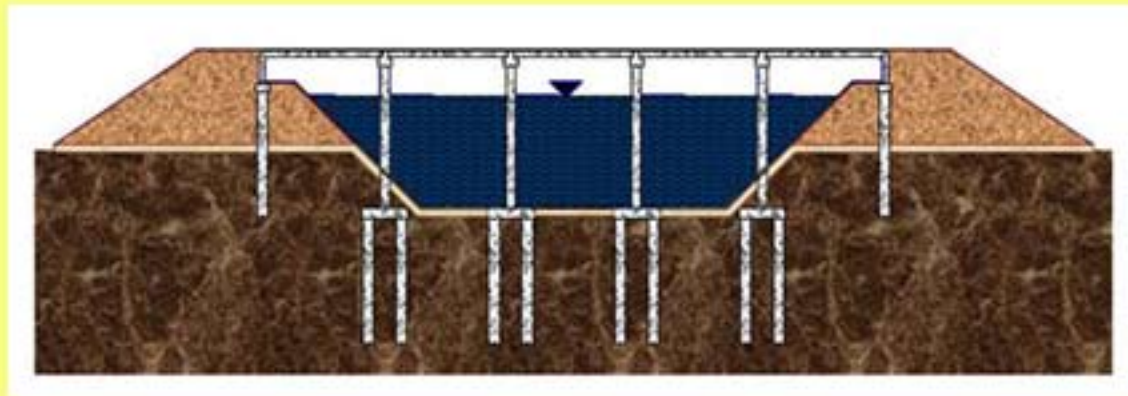




Image © 2007 DigitalGlobe

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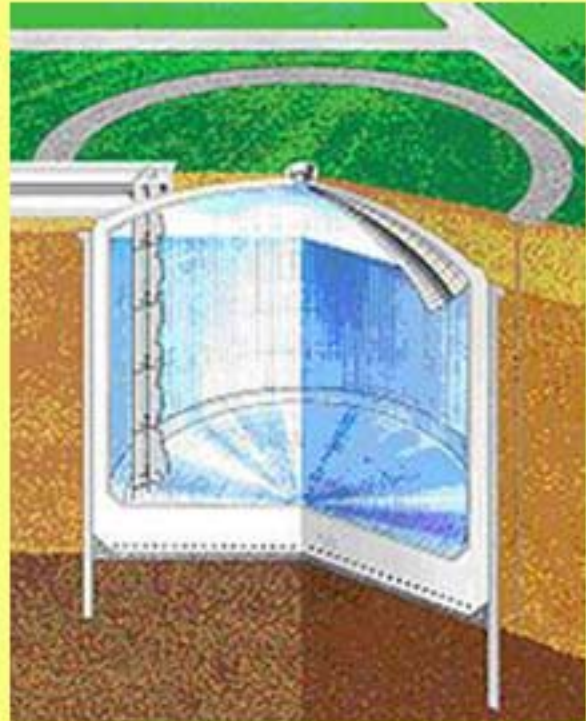
Pointer 32°59'57.45" S 18°03'14.98" E elev. 26 m Streaming 100%

Google

Eve alt 2.19 km

Underground Concrete Tanks

- Similar to above ground concrete
- Aesthetically pleasing
- Saves on site footprint
- Same dimensions as above ground concrete tanks, except thicker walls



Environmental Considerations

- Geotechnical concerns
- Two methods of dyking
 - 110% of maximum capacity per tank





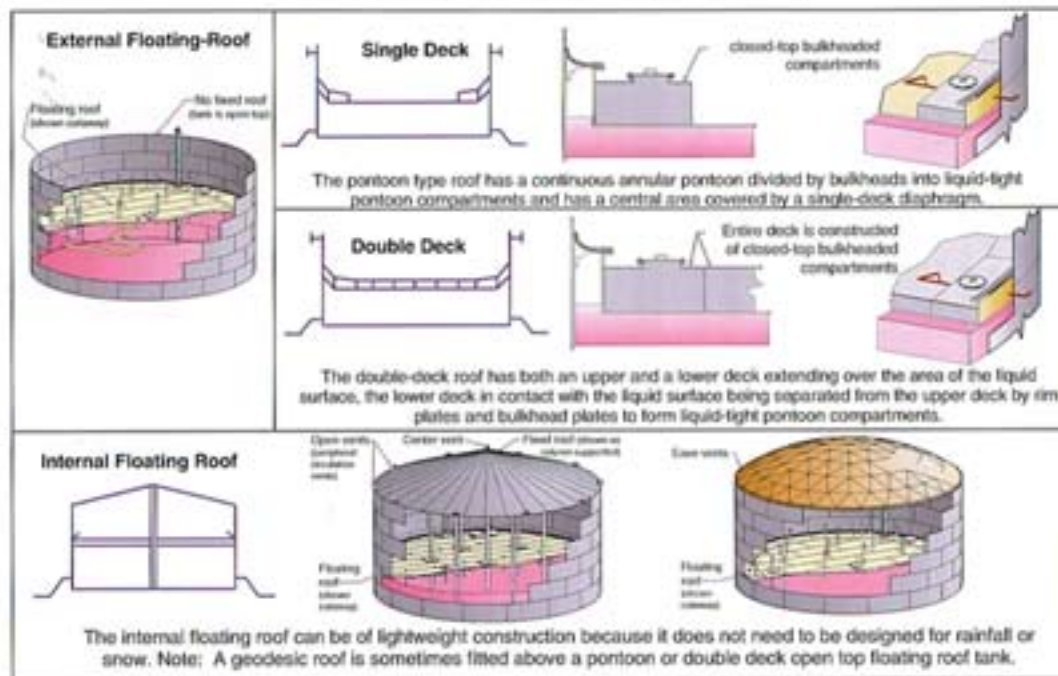
Above Ground Steel Tanks

- Industry standard
- Different roof types – floating for crude
- Dimensions for estimate:
 - 80m x 25m – based on Czech Republic design



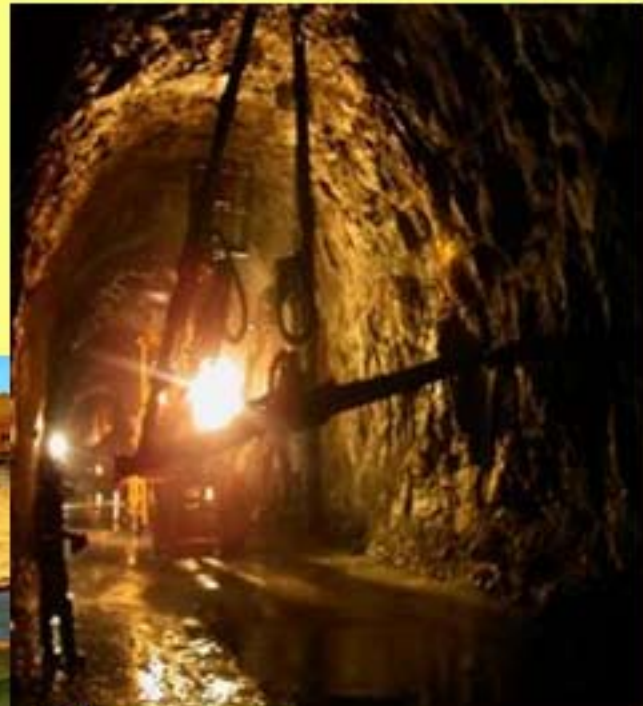
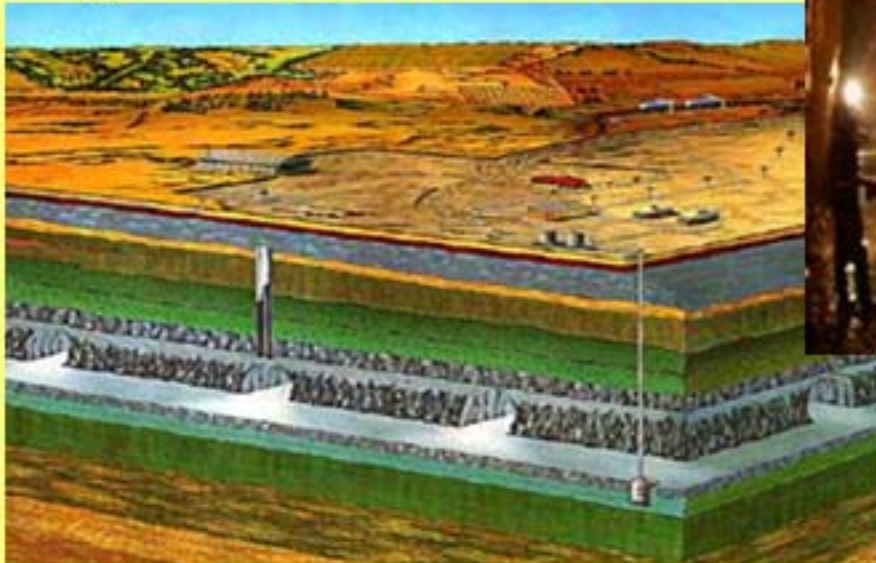
Steel Tanks – Roof Types

The main types of floating roof tanks are presented below:



Hard Rock Mine Storage

- Requires high water table
- Large storage capacity
- Long construction times



Cost Analysis Comparison

Technique	Total Cost	Cost per Barrel (6,300,000 bbls)
Aboveground concrete tanks	\$61,500,000	\$9.76
Underground concrete tanks	\$105,500,000	\$16.74
Cut and Cover storage	\$95,750,000	\$15.20
Aboveground steel tanks	\$64,700,000	\$10.27
Hard rock mine storage	\$185,000,000	\$29.37

Scope of Remaining Work

- Detailed design for above ground concrete
 - Dimensions, reinforcement
- Cost Estimate
- Site Layout
 - Must be appropriate for above ground concrete and for steel tanks

Questions?