LAGUNA-LBNO General Meeting

Experience in Tank Building
Contents

- Introduction to Rhyal Engineering
- Cryogenic Tank Construction
- Laguna Project Challenges
Rhyal Engineering

- Formed in 1998 with an experienced tank construction management team and workforce
- One of UK’s leading specialist storage tank contractors
- Extensive fabrication and construction experience
- Serving all industry sectors
- Strong culture of team work and partnering principles
Past Projects

Aviation Fuel Storage Tanks – Isle of Grain Terminal, UK
Past Projects

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Past Projects

Aviation Fuel Storage Tanks – Isle of Grain Terminal, UK
Past Projects

Bio-ethanol Storage Tanks – Kingsbury Terminal, UK
Past Projects

Bio-ethanol Storage Tanks – Kingsbury Terminal, UK
Past Projects

Typical Access Restrictions – Pembroke Refinery, UK
Past Projects

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Past Projects

Storage Tank and Vessels – Nitrogen Sphere
Past Projects

Storage Tank and Vessels – Crude Oil Tank
Past Projects

Storage Tank and Vessels – LNG Tanks
Involvement with LAGUNA

- Experienced tank contractor
- Assist with design and planning from the contractors perspective
- Generate cost estimates for the tank at proposed locations
Cryogenic Tank Construction

- LNG Tank Construction Sequence
- Case Study – Recent LNG Tank Build
LNG Tank Construction Sequence

Install foundation, slip-form cast outer concrete shell walls
LNG Tank Construction Sequence

Roof structure & plates – kingpost method
LNG Tank Construction Sequence

Roof structure & plates – blown roof method

Phase 1 – Construct roof at floor level

Temporary
Kingpost
LNG Tank Construction Sequence

Roof structure & plates – blown roof method

Phase 2 – Raise roof with air cushion
LNG Tank Construction Sequence

Roof structure & plates – blown roof method

Phase 2 – Raise roof with air cushion
LNG Tank Construction Sequence

Roof structure & plates – blown roof method
LNG Tank Construction Sequence

Complete concrete surround
LNG Tank Construction Sequence

Install & weld outer tank shell & floor liner
LNG Tank Construction Sequence

Lay insulation and temp sensors
LNG Tank Construction Sequence

Install & weld inner tank floor & shell
LNG Tank Construction Sequence

Install piping, hydrostatic test and insulate
LNG Tank Build - Milford Haven, UK

- Full containment concrete-steel type tanks
- Completed 2008
- Storage capacity 160,000m³ per tank
LNG Tank Build - Milford Haven, UK

Slip forming the concrete walls
LNG Tank Build - Milford Haven, UK

Installing King post
LNG Tank Build - Milford Haven, UK

Roof construction – transport petals from storage
LNG Tank Build - Milford Haven, UK

Roof construction – lifting petals into position
LNG Tank Build - Milford Haven, UK

Roof construction – lifting petals into position
LNG Tank Build - Milford Haven, UK

Roof construction – erecting infill structure
LNG Tank Build - Milford Haven, UK

Roof construction – erecting roof plates
Erecting and welding outer tank shell liner
LNG Tank Build - Milford Haven, UK

Outer tank floor, insulation and inner tank floor
LNG Tank Build - Milford Haven, UK

Inner tank shell erection and welding
LNG Tank Build - Milford Haven, UK

Inner tank shell erection and welding
LNG Tank Build - Milford Haven, UK

Installing internal tank piping
RHYAL ENGINEERING

Dragon LNG - Milford Haven, UK

Installing internal tank piping
LNG Tank Build - Milford Haven, UK

Tank complete ready for hydro test
LAGUNA Project Challenges
LAGUNA Project Challenges

- At present we believe the three main tank construction challenges are:
  - Location
  - Construction methodology
  - Construction costs
LAGUNA Project Challenges - Location

- Three unique locations which are all underground, each of which present individual access restrictions
- Access restrictions will impact on design, construction method, construction duration and costs
- Working environment will have to be carefully considered with regard to the health and safety of the workforce
LAGUNA Project Challenges - Location

- The size of the cavern and the access tunnels or shafts providing access to it will restrict and determine:
  - Transportation of the tank components to the workface
  - Limitation of height and work area within the cavern
  - Lay-down areas for materials and construction equipment
  - Available size and type of lifting equipment
  - Allowable construction sequence of other works
LAGUNA Project Challenges - Methodology

- Proven above ground construction methods can be transferred and adapted to below ground working
- For each location under review we will have to consider:
  - Developing cavern and tank design concurrently to establish most suitable solution
  - Tailoring tank design to construction methodology as well as location
  - Best fit tank construction method
  - Integration of the above methodology with regard to other services required, e.g. piping, EC&I, etc
LAGUNA Project Challenges - Cost

- Construction costs will be greater than an equivalent above ground tank
- Construction costs must not become prohibitive for the project
- Major challenge will be to reduce these costs to an acceptable level
Minimising construction costs will be possible by ensuring that:

- An integrated design and construction team is developed at the earliest possible stage of the project
- All operational and maintenance requirements are understood at outset of design
- Current above ground storage tank construction technology is used wherever possible
- Automated construction equipment is used wherever possible to reduce labour resource required
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