CASE STUDY

Stony Point

LPG secondary containment dykes
Port Bonython, SA, Australia

Reinforced Earth Walls
TerraClass®

Owner: Santos Limited
Contractor: CBI Constructors P/L
Construction: February 1984

Background

Santos is the senior partner in a programme to develop the resources of the Cooper Basin in Central Australia. A mixture of natural gas liquids and stabilized crude oil is piped 660km to the Port Bonython complex at Stony Point. There it is processed to its various fractions and the liquefied petroleum gas (propane-butane) stored prior to shipping for sale in domestic and international markets.

The secondary containment dykes built with Reinforced Earth form part of this storage complex. LPG production started in early 1984 and the complex will handle some 600 000 tonnes per year when fully operational.

Challenge

The challenge was to construct containment dykes with holding capacity equal to the storage capacity of the LPG tanks. In the even of a spill, the dyke would need to withstand extreme temperature differentials and be impermeable to the surrounding environment.

Solution

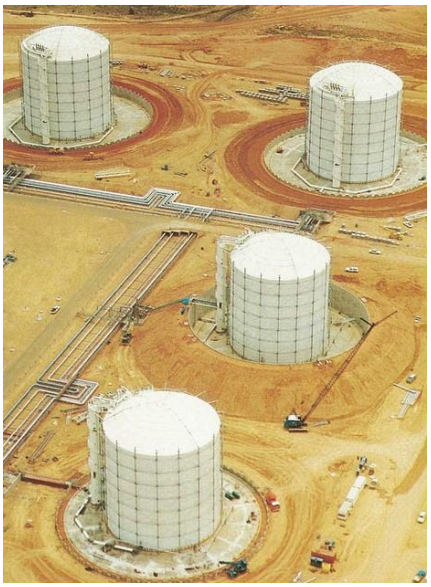
In 1984, four Reinforced Earth containment dykes were constructed around the propane / butane storage tanks. These structures have facings 10.5m high, vary in diameter from 63m to 75m, and have holding capacities equal to the storage tanks.

Due to the properties of the backfill used, the impermeability of the structures was enhanced using a thin layer of clay directly behind the facing panels to ensure 100% containment in the event of a spill.

Chill down to -45^{0}C at spill is followed by ignition and rise in temperature to several thousand degrees for up to 72 hours. Independent tests show that Reinforced Earth is capable of performing under such conditions without loss of function.

Earthquake loading was checked according to relevant SAA standards.

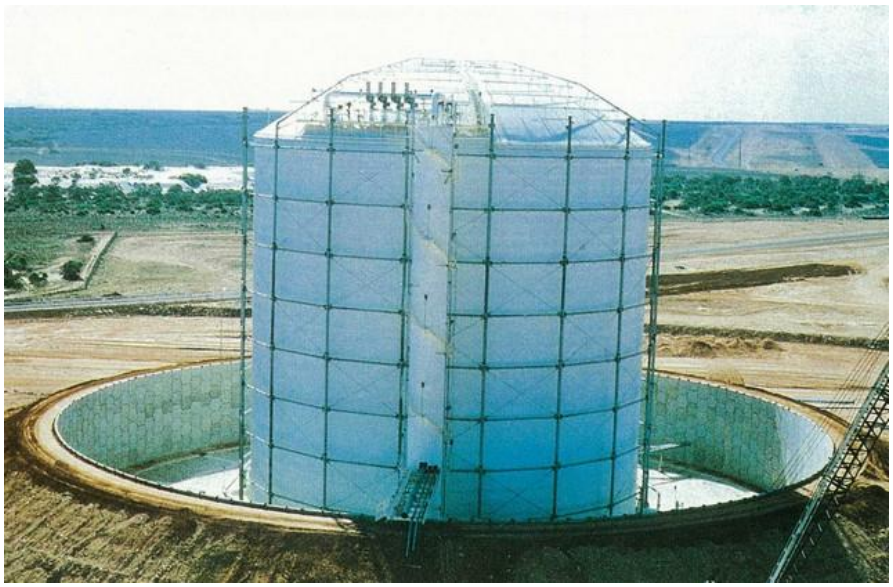
Due to the project's isolation, Reinforced Earth supplied panels from a precast yard set up specifically for this job and operated by the company in nearby Whyalla. Permanent onsite supervision and assistance ensured a smooth and speedy construction.

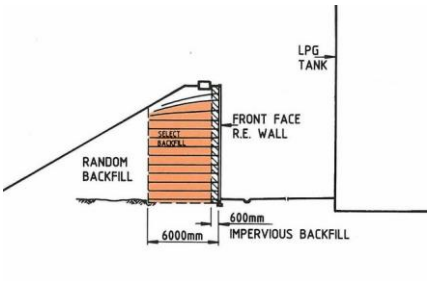


Four Reinforced Earth containment dykes, constructed using the TerraClass® system protect propane / butane storage tanks at Stony Point, South Australia.

Industrial, energy, military and hydraulic infrastructure

REINFORCED EARTH
SUSTAINABLE TECHNOLOGY





Left: Close up view of 10.5m high, 75m-diameter containment dyke.
Above: Cross section of the structure.

Special Features / Benefits of containment dykes

Reinforced Earth has been used to construct safety dykes around large tanks of liquefied natural gas (LNG) and other volatile liquid petroleum products. Some of these storage tanks have capacities in excess of 100 000m³.

In the event of an accidental rupture in one of these tanks, the function of the Reinforced Earth dyke is twofold:

1. Containment of the escaping liquid until corrective actions can be completed, and
2. Prevention of damage to nearby tanks or facilities.

Because of the enormous potential danger with accidents of this kind – where temperatures can range from -160^{0}C in an LNG leak to 1100^{0}C in a petrochemical fire – stringent testing is essential before a structure is put into service.

Tests at Gaz de France

Tests were conducted in 1973 at the Gaz de France (French national utility) at the request of La Terre Armée (Reinforced Earth), Paris. A square Reinforced Earth reservoir 1.5m deep and 3m long was constructed using concrete facing panels. Over a period of 3.5 hours, the reservoir was filled with liquid methane to a depth of 0.55m.

Two hours later, a temperature of -100^{0}C was recorded on the exterior face of the concrete panels, and -60^{0}C on the surface of the outside earthwork. After 20hours, the temperature recorded on the earthwork had only risen to -30^{0}C. No damage was observed on the concrete panels, which were covered with ice one centimetre thick at that stage.

During the second phase of testing, the same quantity of methane was poured into the reservoir. The temperature of the concrete facing had fallen back to -100^{0}C when the methane was ignited. During the fire, which lasted for one hour, technicians observed that certain panels at the top of the walls distorted into a slightly curved shape from contact with the flames. However, once the fire was extinguished the only damage noted on the exterior of these panels was superficial pitting or flaking.

When the reservoir structure was dismantled, it was found that neither the reinforcements, nor the sealing foam had been damaged. It was suggested that a slight overpressure of gas in the joints had prevented contact with the flames. There were some very fine cracks on the backfill side of the panels, but there was no evidence of significant penetration of methane into the backfill, which remained compact.

Project specifications

System	TerraClass®
Finish	Smooth, grey concrete
Structure	Containment Dyke
Area	8700m²
Max. Height	10.5m

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