Kawasaki has delivered a liquid ethylene storage and receiving/shipping terminal, including tanks, to the Chien-Cheng Petrochemical Station in Kaohsiung, Taiwan, owned by Chinese Petroleum Corporation (CPC). Delivery of this raised the number of liquid ethylene tanks delivered by Kawasaki to 19 since 1977.

The delivered tanks employ an aboveground double-wall liquid ethylene tank with a capacity of 27,500 m$^3$. Insulation materials have been installed between the inner shell made of materials for very low temperatures and the outer shell that uses ordinary temperature materials. Consequently, liquid ethylene can be stored at a temperature as low as -100°C or below. Besides the liquid ethylene tank, the system also integrates associated facilities that include a loading/unloading facility for liquid ethylene, an ethylene vaporizer, and vapor liquefaction equipment that re-liquefies naturally vaporized gas and returns it to the tank.

In Taiwan, competition in the liquid ethylene market has intensified in recent years as several local chemical companies open operations in this area. With the introduction of the delivered facilities by Kawasaki, CPC has expanded its capacity and reinforced its competitiveness in the region.

Besides liquid ethylene storage facilities, Kawasaki has long worked on the development of low and very low temperature tanks, as it foresaw an increase in transport and storage facilities for LPG, LNG and other gas fuel after the oil crises of the 1970’s. Kawasaki secured its first order for LNG storage facilities in 1982 and since then has secured orders for 26 units in and outside Japan, including those currently under construction.

In Singapore, at the Island of Pulau Ular on reclaimed land, a 18,000m³ Ethylene Cracker Complex has been built and completed in the course of 2008. Ethylene is widely used in petrochemical industry (mostly as an important raw material for many chemical compounds, such as poly-ethylene (plastic). The tender design and the detailed design of the secondary concrete outer safety shell were carried out. This included a structural -, a geotechnical -, a seismic - and a heat radiation (due to a PRV fire) analysis. The tank consists of a steel inner tank that contains the cold liquid, a concrete outer tank that serves as a safety shell in case of emergencies and isolation in between both shells. The product that is stored in the tanks is Ethylene which is a liquefied gas at -105 degrees ºC.

The concrete structure (outside diameter 34.9m, height 29.2m) is supported by a shallow foundation (no piles) by means of soil improvement on the reclaimed land (vibro flotation has been used). A reinforced concrete base slab (thickness 400mm and outside 1200mm), a pre stressed (horizontally) concrete wall (thickness varying from 650mm to 550mm) and a thin reinforced concrete dome (thickness varying form 400mm to 250mm) are the main concrete parts of the tank.
For the shape of this tank there was a strong preference for a slender structure. The reason for this is to minimize the combined area of floor and wall (and resulting costs). Due to detailed DIANA calculations and due to low seismic loads this slender structure proved to be possible without vertical prestressing.

Another accent in this project was on geotechnical matters. The reclaimed land results in more uncertainties on soil behavior. It is common to cast in two perpendicular inclinometers in the base slab to monitor settlement and more importantly, differences in settlement. The standards prescribe requirements for these differential settlements. These requirements were used during the design and they were met. Next, during construction, testing (a hydro test is performed in which the tank is filled with water) and operation settlements were monitored and the results matched the predictions of the calculations fairly well.

http://www.psengineers.nl/plsingapore.html

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http://www.vijaytanks.com/low_temprature.php

Dear all..

How do we store ethylene? With spherical tank, cylindrical tank, or horizontal tank?

In what temperature and pressure? What are the considerations when we want to store ethylene?

Thanks for your valuable responses.
Allow me to answer each of your questions:

How do we store ethylene? With spherical tank, cylindrical tank, or horizontal tank?
You store ethylene as economically and as safely as you can. You can do this with a spherical or a cylindrical tank.

In what temperature and pressure?
If your required capacity is small, you can use a “bullet” type of tank – cylindrical, horizontal, and with hemiheads. It could work well at about 250 psig and -25 oF – so you could easily keep it refrigerated with mechanical refrigeration. A sphere is usually designed for much lower pressures (and temperatures) – any where around 50 to 100 psig and -100 to -75 oF.

What are the considerations when we want to store ethylene?
The size, type, and orientation of tank you employ all depends on the quantity, and the best conditions that suit your use. Economics demands you store the ethylene as a liquid and not as gas. Therefore, you should try to store it as a saturated liquid. To do that you should study and know your thermodynamics and phase equilibria. The colder the saturated liquid, the denser it will be and the more you can store in a given tank size. However, the colder it is, the more special alloys for the tank material and the more insulation you require - so the capital cost increases. Spheres are only justifiable for very large sizes of capacity. A sphere is desirable because it is strongest natural geometric shape; it can withstand more pressure with a given wall thickness than any other shape. However, it is tough to keep insulated and takes a very big footprint.

Having read this interesting thread after summer vacations, I would like to add that ethylene is also stored in refrigerated atmospheric storage. From discussions on the perspectives of a Greek Polyethylene Plant in 1981, I had concluded that a lot of Polyethylene Plants use this kind of storage, highly affecting plant competitiveness (1981).
Kind of storage seems to depend mainly on the quantity of stored ethylene (vapor pressure 40 Bara @ 0 oC and 50.76 Bara @ 9.5 oC) and economics. For small capacities a cylindrical bullet can withstand ethylene vapor pressure. For higher capacities spheres have to be used, requiring less wall thickness than bullets (I have "seen" such case for propylene). As capacities go even higher, spheres can be used but with lower vapor pressure, hence ethylene is semi-refrigerated (see post by Art Montemayor, 17 Aug-10). And for stored quantities in excess of above atmospheric storage is adopted (cylindrical tanks) of about -103 oC.
http://www.cheresources.com/invision/topic/8765-ethylene-storage/