CANVEY ISLAND MADE HISTORY

During the 1950s it became apparent that there was a need to find new energy sources. The ever-increasing demand from industry and the domestic market, for both gas and electricity, required larger, more efficient plants to be built. Using mainly coal and oil products to produce gas and generate electricity, both of these feedstocks were becoming more expensive.

One commodity which was plentiful, but largely wasted, was natural gas consisting mainly of methane. This gas, which was present in oil-fields and gas-fields, was often flared off as a waste product. There were large gas-fields around the world, but it was not a viable proposition to transport gas at this time other than by pipeline. It had, however been discovered in the nineteenth century that there was a temperature above which gases could not be liquefied. However, by cooling the natural gas to a temperature of $-162^{O}C$ at atmospheric pressure, the gas would condense into a liquid, reducing its volume by 600 times. However, it was not until 1941, nearly a century after, that the first commercial liquefaction/distribution plant was built at Cleveland, Ohio.

The gas in its liquid form is known as Liquified Natural Gas (LNG) and is one of the cryogenic liquids. The storage of liquids at temperatures as low as $-162^{O}C$ required materials that would withstand such extreme temperatures. At that time aluminium was the preferred material for tank and pipeline constructions. America had been liquefying natural gas and transporting it around Lake Charles in the Gulf of Mexico in purpose built barges for some time. The British Gas Council, realising the potential of using this product in the United Kingdom, asked the chairman of North Thames Gas, Michael Milne Watson, to investigate the possibilities of shipping LNG to the UK. A feasibility study took place in the USA and a pilot scheme was planned.

Due to its location and the deep-sea mooring, Canvey Island was chosen to be the site of a terminal for the pilot scheme, the first in the World. LNG was to be transported by sea from Lake Charles, to purpose-built tanks at the Canvey site. Whilst under construction, a pipeline was laid from Canvey to Romford Gas Works, where the imported gas would be used as a feedstock to make town gas at a calorific value (CV) of 500 $Btu/ft^3$, the CV of the gas that time made from coal and latterly oil.

The Canvey pilot scheme was located on land owned by North Thames Gas, which had been purchased originally by the Gas Light and Coke Company about 1930 to build a coal gas plant. The land, however, had remained as farmland until the LNG importation scheme. The construction of the pilot scheme was completed in 1959 and consisted of a pipeline on the unused Texaco Oil terminal jetty, two 1000 tonne double-skinned aluminium tanks, with perlite insulation between inner and outer tanks. Liquid gas pumps, suitable for the low temperatures, an evaporator to return the LNG back to gas vapour and a steam boiler-house were installed. In America, a cargo vessel was converted to carry the LNG in two aluminium tanks, insulated between the tanks and the ship's hull with balsa wood. The ship, previously known as the "Normarti" was renamed "Methane Pioneer", the conversion being carried out in a shipyard at Mobile, Alabama.

During 1959, seven cargoes were transported to the new Canvey LNG terminal. The gas was evaporated and successfully sent to Romford Gas Works. At that time, natural gas from the North Sea had not been discovered in economic quantities. The experiment to transport this coldest of liquids by sea was a success and, with government approval, a contract with Algeria was agreed to import 700,000 tonnes of LNG a year into the UK for use as a feedstock for town gas. In 1962, work started to construct the permanent LNG terminal which consisted of six double-skinned storage tanks, each to contain 4,000 tonnes, of LNG plus two single-skinned LPG (Liquified Petroleum Gas) tanks, a purpose-built jetty, evaporators, generator house and other ancillary equipment. At the same time, at Arzew in Algeria, three 18,000 tonnes above-ground tanks were constructed, and one 18,000 tonne inground tank to store the gas prior to transportation to the UK. The natural gas feeding the liquefaction plant at Arzew came from gas-fields at Hassi R'Mel in the Sahara Desert.

Two purpose-built ships were commissioned to carry the LNG from Arzew to Canvey, these being "Methane Princess" and "Methane Progress" the first being built at Vickers Yard at Barrow in Furness and the second at Harland and Wolfe shipyard in Belfast. At the same time, a pipeline from Canvey to Leeds, was constructed with off-takes to various gas works to convert to town gas, plus a number of chemical companies customers directly as methane for a chemical feedstock. By 1964, the work was completed and on the 12th October of that year, the first 12,000 tonne cargo of LNG arrived at Canvey from Arzew.

The LNG was evaporated in several ways including using sea-water drawn from the Thames. As well as the LNG storage at Canvey, there were two Continuous Catalytic Reforming Plants each designed to make 15 million cubic feet/day of town gas. Before the LNG scheme the reforming plant fuel to make the gas was naphtha supplied by ship and pipelines linking Canvey with the Shell Refinery at Shell Haven, Esso storage at Purfleet and North Thames Gas Board stations at Romford, Bromley and Beckton. After the conversion of households to natural gas, the reforming plants made a lean gas to dilute the Algerian methane, which had a CV of approximately 1300 Btu/$ft^3$ to be compatible with the North Sea gas at 1035 Btu/$ft^3$. The two reforming plants required a large volume of distilled water to make superheated steam for use in the process. To supply this, each plant had a plant built by Aiton & Co. (later taken over by Whessoe which is now part of Samsung C & T) which made distilled water from raw water drawn from the River Thames, heated by waste heat from the plant and flashed under vacuum. Each plant was capable of producing 24,000 gallons per day.

In its heyday, the Canvey Terminal employed approx. 250 personnel, had 6 x 4000 tonne above ground LNG tanks, 4 x 21,000 tonne inground LNG tanks, 2 x 4,000 and 1 x 10,000 tonne LPG tanks, 3 steam boilers, numerous specialist pumps, evaporators, 4 compressor houses, evaporators, large generators to supply the terminal's needs if required, a jetty and 5 large seawater pumps and a liquefaction plant to re-liquefy boil off gas from the LNG. There was a large amount of ancillary equipment including the terminal's own fire station with 3 Rolls-Royce driven fire pumps and a fire engine equipped with dry powder.

With the discovery of North Sea gas, it was decided to build a high pressure national grid of gas pipelines all over the UK and convert every household and industrial user over to natural gas. Once again Canvey made history by being the first place in the UK to be converted. With the National Grid now in place a new control centre was set up at Hinckley in Leicestershire and Canvey was used to recruit and train personnel, several local people relocating to the centre.

Due to problems with high running costs incurred by the inground tanks it was decided to fill these in, greatly reducing the terminal's storage capacity. The terminal had become a plant only required on line at times of high demand which were becoming fewer due to the milder winters and the availability of LNG storage at other sites. A decision was taken to close the terminal as it was thought that with plentiful supplies of North Sea gas there would be no need to import gas into the UK again in the foreseeable future. (This has since proved wrong and LNG is imported once again into the UK through terminals at Isle of Grain and Milford Haven in Wales). British Gas closed the terminal in 1994 and it was purchased by an LPG operator a couple of years later who converted it to store and distribute LPG. It is currently owned by Calor Gas.

Since Canvey's 1959 experimental project, at the time of writing there are now 26 LNG liquefaction plants in 15 countries around the world with another 7 under construction and 24 more planned. There are also 60 import terminals in 18 countries.

Prepared by Rod Bishop 2010

# CANVEY METHANE TERMINAL INGROUND TANKS

By the late 1960s the need for more storage capacity of LNG (Liquified Natural Gas) was apparent to ensure reliability of the ever increasing demand for gas in the UK. A decision was made to build four frozen inground tanks at the Canvey terminal, each capable of holding 21,000 tonnes of LNG. The construction was achieved by sinking a series of double pass tubes approx. 130ft.into the ground with the same diameter. This was repeated four times to form the tanks. The tubes were then linked to a brine unit which pumped the refrigerant through the tubes, gradually freezing the ground. The freezing process took a number of months until the desired temperature was achieved. At ground level large concrete ring beams were constructed to form the top of each tank and support the aluminium dome roof that would be put into place once the digging was complete.

The digging commenced and as the ground was frozen a considerable amount of mechanical equipment was used including JCB's, Kango's etc. Working conditions gradually worsened as the holes became deeper due to the freezing conditions and air quality. Air was continuously pumped into the holes and extraction fans were used to remove the exhaust fumes created by the mechanical equipment. During the digging the ground was kept frozen by the brine units to keep the ground stable and free from collapse. The spoil from three of the tanks was continuously removed from the site by a fleet of lorries, some being used to raise the height of Canvey's sea wall, from Canvey Road at Waterside Farm in a westerly direction. Some of the material removed during the excavation was ballast which is part of a seam running through the Thames. This ballast seam would eventually become a problem by forming underground fissures linking all four tanks and creating excessive boil off from the LNG when the level reached the ballast seam. The spoil from the fourth tank was retained on site in case it was required later.

Whilst the digging continued, the roof framework was being constructed in a building on site by a company called Hamilton Roofs. The huge frames would eventually be lifted into place by giant gantry cranes running on railway tracks. Once the digging was complete the floor area was covered with concrete slabs. The roof frames were now lifted into place and work began fixing the aluminium plates and insulation to the frames. Each tank had two submersible pumps installed which would feed booster pumps that were sited at ground level that pump the gas once evaporated into the National Grid. Once the tanks were completed they were filled with LNG at $-162^{O}C$ and potentially increased the terminal's capacity from 24,000 tonnes to 108,000 tonnes.

However, it became apparent the tanks could not be used to their full capacity because of excessive boil off problems caused by the fissures in the ground which raised the temperature of the liquid. There were also problems with ground movement which required constant realignment of the pipe work. It also became apparent there was a problem with permafrost which was spreading. It was feared this would affect the piles supporting the above ground tanks and the sea wall at the terminal boundary. To counteract this, double pass pipes to form a radiator were sunk into the ground and a warm solution was pumped round which stopped any further growth of the permafrost. A constant check was carried out on the subsoil temperature using bore holes and, contrary to the belief of many local residents, the permafrost never came anywhere near the terminal's boundary. The radiator system was kept on for several years after the tanks were decommissioned, to shrink the permafrost.

Due to the problems and the ever-increasing cost of maintaining the tanks, a decision was made to decommission them. This was a huge undertaking as the tanks had to be completely emptied of the LNG, then purged with nitrogen to inert the voids before infilling could start. Preparations for the decommissioning took a number of months. This included building a temporary jetty on Scars Elbow with a conveyor belt running via an underpass under the main terminal road to an area adjacent to the inground tanks. Dredgers operating on a continuous basis brought in sand dredged from the Maplins to form a spoil heap with sufficient material to fill all four holes. At the same time the two original 1,000 tonne tanks used for the terminal pilot scheme were recommissioned to build up a stock of liquid nitrogen ready for the purge. Due to the large volume required, (which had to be delivered by road tanker), to supplement a shortfall in the UK supplies were brought in from the continent.

Huge gantries were erected running on railway tracks and fitted with nitrogen purge system and gas monitor equipment to be used whist the infill was in progress. Although the tanks would be purged prior to the infilling it was realised there could still be pockets of gas in the fissures running between the tanks so it was imperative there should not be any source of ignition.

Finally, with everything in place, the infill started and was a complete success thanks to the expertise of the British Gas engineers and McAlpine the contractors who built the tanks in 1969 and thirteen years later had filled them in. The spoil left on site from the original was now used to top off the sand infill. All that remains today are four mounds of grass covered earth. I feel, had the tanks been lined with aluminium like the above ground tanks a lot of the problems encountered would have been avoided. As a point of interest, a similar inground tank as Canvey's was constructed at Arzew in Algeria. This was a success due to the different type of ground and lasted until 2006, when it was successfully decommissioned and filled in. Two of Canvey's old British Gas personnel were consulted by the company carrying out the decommissioning on the methods to safely carry out this work.

Prepared by Rod Bishop 2010

THE NIGHT THE RIVER THAMES CAUGHT FIRE

This is my memory of the night the river caught light on 26th July 1970. I was on night shift at the Canvey Methane Terminal, working at the time on the reforming plants, when the incident occurred. Myself and five other plant personnel were sitting around a table in the control room when, all of a sudden, a door at one end of the room burst open and the Senior Shift Engineer ran through, passing us, calling out in a voice you could hardly hear, FIRE! FIRE! FIRE!. (he had run from his office in the main control room some 100 yards away after being alerted to the unfolding incident). He went out of the door at the other end of the room with several us following to find out what was going on. We followed him up on to the top of the reforming plant, about 60ft high where it became quite apparent what the problem was.

Looking towards Coryton the river was alight together with the most recently built Mobil Oil jetty. We immediately went back to ground level and ran out our fire equipment in case the fire spread to our plant. The operators on the LNG side of the plant had already been running out fire equipment and starting the fire pumps. Whilst doing this the Essex Fire Brigade arrived on our site to assist. Once our equipment was laid out, I went back up on the reforming plant roof, where the night was lit up by flames from the sea and lights from fire engines which were now at our next door neighbours, London & Coastal, Regent Oil and the Lobstersmack Pub. In the river fire tugs were spraying the flames whilst others were towing a ship off the London Coastal jetty to the safety of the far side of the river. The smell of oil fumes filled the air, and this was to remain for quite a few days whilst a clean up operation was carried out along the shore line.

Once the fire was out, information via the emergency services started to filter through what had caused the incident. A ship called the Monte Ulia, travelling towards Tilbury had veered into the Mobile Oil Jetty where a ship was discharging a cargo of crude oil, severing the pipeline, sending oil cascading into the river and catching light from the sparks made by the ship's hull grinding against the metal structure of the jetty.

The ship also struck two barges - lighters which were full of spirit, anchored in the mouth of Holehaven Creek. These were waiting to be towed for use up the river. One of these was alight with some of the spilt crude oil. They broke adrift and the tide took them towards the London Coastal jetty. Fortunately, two of Canvey's retained firemen, seeing potential danger, commandeered a rowing boat and boarding the barge

extinguished the fire. I believe they were George Blackwell and Geoff Barsby Senior. If they had not done this, the incident may have been far worse as the pipelines on the London Coastal jetty were full of spirit from the ship that had been discharging there and could well have caused a chain reaction affecting us all.

I have often wondered if the two firemen knew what was in the barges at the time, as the usual ones anchored at the entrance to the Haven were rubbish barges waiting to be towed around to Pitsea Tip.
After being relieved by the day shift I, together with some of my colleagues, went to have a look at the ship that had caused this " Night To Remember" The Monte Ulia had run aground in the mouth of Holehaven Creek and did not seem to be too badly damaged, considering the havoc it had caused.

Rod Bishop

AUTHOR'S BIOGRAPHY

Rod Bishop worked at the LNG terminal for North Thames Gas (later British Gas/Transco ) from 1966 until the terminal closure in 1994.He started work on the reforming plants as an operator before progressing to a control room officer then foreman. He remained on the reforming plants for nine years before going over to the methane side as a shift engineer and later progressing to senior shift engineer.

Like many others, when the site closed he took voluntary redundancy at the age of 51, quite happy to take his pension and go into retirement at the age of 51. Retirement lasted only a few months when he was asked to go back to sort out the drawing office, which had been left in a mess by various companies looking to purchase the site, including Mobil, Calor Gas etc.

After a few weeks, he went back into retirement for a short period, only to get another request from a company to return, along with another retired ex senior shift engineer Vic Andrews to a new company called National Gas that had been set up to purchase the site. They were requested to carry out a Hazop (Hazard Operation) on some new pipework and plant. The new company was changing the plant into propane storage with a tanker loading bay for export.

After a few days on completion of the Hazop it was back into retirement once again, only to get another request a couple of months down the line for them to return once more. This time the company wanted information on purging the tanks and pipework, then gassing and finally cooling them down, to take in the company's first cargo of propane. What was really required was for them to carry out the work, which they duly did over a period of approximately three weeks, with Vic doing a 12hr night whilst Rod covered the day.

Back into retirement yet again, this time only about a month had passed, when Rod got another call. Vic also had a call but could not go in this time as he was going on holiday to Australia for a few weeks. The request was to carry out another Hazop, this he did with another ex British Gas mechanical engineer that they brought in to install a new heat exchanger and pipework. The site manager who incidentally was an ex British Gas engineer from the Isle of Grain site, asked if Rod would stay on working a three day week, which he agreed to, but ended up doing five.

About 18 months after purchasing the Terminal and carrying out alterations, the National Gas Co. which was owned by a John Ranson was sold to Calor Gas.

At this point he was asked to stay on by Calor. He agreed, but instead of being paid via a contract company, he formed his own company and remained at the terminal for a further eleven years, on a consultancy basis until he decided to retire at the age of 65. Rod still however visits the Terminal on occasions when requested, to give information on certain parts of the plant and also, running up to Christmas, to take out and return to storage the Rotary Club of Canvey Island Santa Sleigh, which Calor kindly lets them store in a warehouse on the site.