

## Valley Works

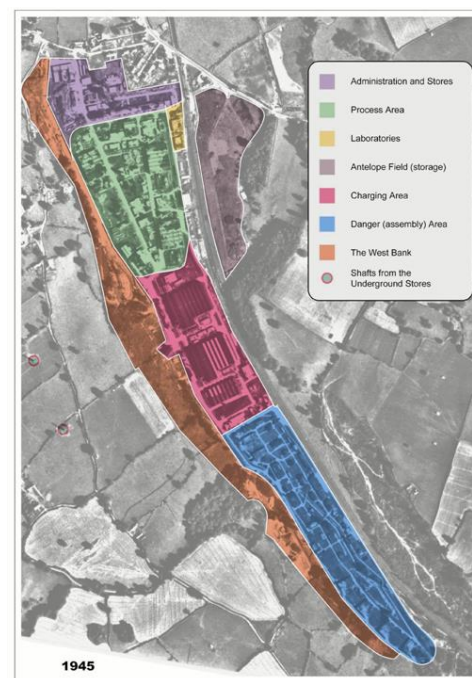
The Valley Works acquired its name 1939 when the Ministry of Supply instructed ICI's Special Products Division to construct a factory and storage area in the Alyn Valley close to Rhydymwyn. The factory was to manufacture mustard gas. In the years 1940-1959 it was involved in the manufacturing, assembly or storage of chemical weapons or mustard gas in bulk containers. During the years 1947-1959 the tunnel complex held the majority of the country's stock of mustard gas. In the post-war years major quantities of lower grade mustard gas was prepared for sea dumping.

The Alyn Valley at Rhydymwyn has good road and rail links, water from mines and the Alwen Reservoir (Birkenhead Water) but not from the River Alyn which flows for only four months each year. There was also ample electricity from the North West Power Company's Hawarden sub-station. On one side of the valley has a limestone hill. The valley was also in a flood plain with a meandering river coursing the valley. It is 6 miles from the tidal Dee Estuary but close to the chemical/industrial complexes of Runcorn/Widnes/Warrington. (1)



## Development

In the late 1930s the Chamberlain Government and ICI planned that we should be in a position at the beginning of any war to retaliate in kind if the Germans, as expected, utilised mustard gas. Plans were made to build three mustard gas manufacturing factories (later built at Randle, Valley and Springfields), one phosgene factory (at Rocksavage) and three factories to provide the constituents for the mustard gas factories (at Hillhouse, Royd Mills and Wade). A prototype 50 tons a week Runcol plant was completed at CRDE Sutton Oak. In 1937 the initial buildings of a first mustard gas plant were started at Runcorn on Wigg Island in the River Mersey, this factory was named Randle Works. Work progressed on a low priority until 1939 when the factory rapidly expanded to having two Runcol plants (R1, R2) capable of producing 100 tons/week and three Pyro plants (PI,2,3) capable of producing 216 tons/week. The mustard storage capacity at Randle was 500 tons in 100 sunken 5 ton tanks dispersed around the site. (2) It was considered that if the Germans did intend to use mustard gas it would attempt to bomb our production capability to preclude us from retaliating in kind. There was, therefore, an urgent need to find a concealed and bomb-proof shelter in a remote local area where mustard could be stored in bulk and some charging and manufacturing could take place. In April/June 1939 the Alyn Valley was surveyed by the Dept of Industrial Planning on behalf of ICI and the Ministry of Supply (MoS). The Treasury approved the sum of £546,000 for initial work on 27 August 1939 and work began on storage tunnels in the limestone hillside in October 1939. (3)



## The Site Construction

While the tunnels were being excavated temporary storage was made available by sinking twelve 65 ton tanks adjacent to the site on Antelope field. More permanent storage consisting of thirty 65 and 55 ton tanks and one static 250 ton tank was built at Woodside which is 3 miles away. These tanks were filled by the Randle mustard plants and delivery was made by road tanker accompanied by the Lancashire Constabulary. According to Sir Eric Driver, the civil engineer responsible, when the digging of the tunnels was taking place the first priority was to dig out a culvert to canalise the River Alyn. (4) It was possible to build in the valley bottom in 1939 on the limestone base before the river was diverted. Another major project was to construct an effluent disposal pit measuring 60 ft in diameter and 30 ft in depth whose pumps lifted the effluent 160 ft for 3,000 yards through a 15 inch pipe then dropped it to Oakenholt a further 4 miles away through a 12 inch pipe



discharging it into the tidal Dee Estuary. The River Alyn was canalised and diverted and the outage from the tunnels was used to fill in the redundant river course and level the valley floor. Two Runcol plants R3 and R4 were constructed to produce 100 tons per week followed by three Pyro factories P4, P5, and P6 with a potential production capability of 216 tons per week. P6 was never fitted out with production machinery and was converted for the testing of prototype gaseous diffusion cells for Tube Alloys. P4 and P5 were fitted out but never produced Pyro. P5 was used between 21 August 1944 and 13 November 1944 to convert mustard produced elsewhere to HBD. The buildings assigned to loading the mustard into the munitions and then bonding them K4, K4A and K5 were quickly completed. It was necessary to build a separate assembly area called the Danger Area (DA) where the charged and bonded munitions were fitted with explosives and fuses.



## World War Two operations

The first operations until 1941 took the mustard shipped from Randle to Antelope and Woodside and charged and bonded the munitions in the charging sheds K4, K4A and K5. After 24 hours bonding the munitions were transported to the DA where they were handed over to employees who fused, filled with explosive, painted with identifying colour bands before packaging and making them available for dispatch to the Maintenance Units (MUs). The charged munitions were dispatched by train and escorted by personnel trained in dealing with spillage and "leakers". The main source of these guards appears to have been from RAF Barnham. (6)



From January 1941 onwards the Runcol factories R3 and R4 began production and by 1945 had produced 15,477 tons. The constituent chemicals were shipped to the site by rail. The "syrup"(thiodiglycol) constituent came from Randle. The factory continued to weaponise the mustard shipped from Randle and in the later years Pyro was received from Springfields.

Bulk mustard, both Runcol and Pyro, was later shipped in rail tankers to the Forward Filling Depots (FFDs)



In 1943 there were circa 2,200 people working at Valley, the vast majority were directed to work there by the government and billeted with local families. There were 5.2 million munitions manufactured in the war years many of them smoke generators which were heavily utilised from D-Day onwards. The factory cost £3.2 million pounds and ICI received a £60,000 agency fee for its involvement. (5)

## Forward Filling Depots

The most common and cost effective mustard gas weapon was the 65lb light case bomb - an extremely fragile device and notoriously difficult to transport in quantity without incurring a number of "leakers". The provision of bulk storage of mustard gas close to the bomber stations solved this problem. After testing the system at Woodside five Forward Filling Depots were constructed from 1942 onwards, they were, FFD1 Barnham, FFD2 Melchbourne Park, FFD3 Norton Disney, FFD4 Lord's Bridge, FFD5 Escrick. Nos. 1 & 2 were under the control of the USAAF and were equipped with three tanks each filled with 500 tons of Runcol. They were designed to fill both the standard 65lb LC bomb, plus the M33 spray tank. The other three units were operated by the RAF and would be used only for the 65lb weapon. They were each fitted with two 250 ton tanks and were filled with 500 tons of Pyro in the case of Escrick and 250 tons each of Pyro and Runcol for FFDs 3 & 4. (7)



## The Atomic Bomb Connection

In December 1938 Otto Hahn and Fritz Strassman discovered that uranium when bombarded with neutrons emitted barium. It was subsequently discovered that this effect was caused when the uranium isotope U235 split into two parts (fission). When this happened at least two neutrons were ejected by the fission and this could lead to a chain reaction giving a large explosion. Uranium 235 occurred in the volume of seven parts per thousand in refined uranium. In February 1940 Rudolf Peierls and Robert Otto Frisch calculated that if you could separate U235 from uranium 238 as little as 1kg would be a critical mass sufficient to cause the large explosion. This information was considered by the MAUD Committee

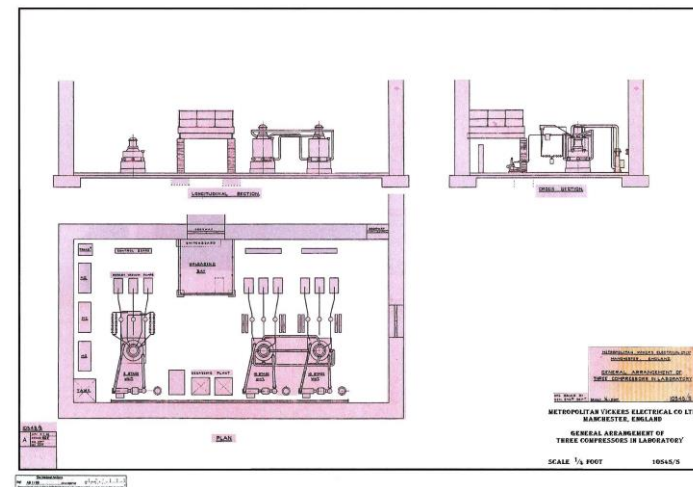


Otto Frisch

who reported in July 1941 that it would take 10-15Kgs of U235 to make a bomb which would explode with a force of 1,800 tons of TNT. The most promising method of separation of the isotope was by gaseous diffusion and the world authority was Franz Simon, an expatriate German working in Oxford. If uranium in a gaseous form was pressurised against a membrane in a sealed chamber the isotope should travel more quickly through the membrane than U238. This slight enrichment would be used as input through 1,700 stages in cascade giving 1Kg of U235 a day, sufficient to make two bombs per month. It would take two years to be in a position to start production at a cost of £50 million. It was decided that it was necessary to test the gaseous diffusion principle and Metropolitan Vickers at Trafford Park, Manchester were contracted to build four pilot gaseous units at a cost of £150,000. (8) Three of these cells were installed in Building P6 at Rhydymwyn in 1941. These units were tested by a team of about seventy under the guidance of Rudolf Peierls and his assistant Klaus Fuchs. The Quebec Agreement signed by Roosevelt and Churchill on 19th August 1943 committed all future development of the Atomic Bomb to the USA and Canada and 20 UK-based scientists joined the Manhattan Project. In December 1943 Peierls and Fuchs went to New York as consultants to the Kellogg Corporation who were building the K-25 gaseous diffusion plant at Oak Ridge, Tennessee. They never visited Oak Ridge and were excluded from all production details. In early 1944 Peierls left for Los Alamos where he ran the T1 section and Fuchs joined him in August 1944 to perfect the initiator for the plutonium device. (9)



Klaus Fuchs



When Peierls departed for the USA the gaseous diffusion testing program continued under the leadership of Dr Harold Schull Arms, an American ex-Rhodes Scholar, until January 1945 when the test equipment was sent to Didcot and Harwell. The only recorded radio-active material ever shipped to Valley was 2Kg of Uranium Hexafluoride and this was transferred to Harwell in 1945.

## Post WWII

After 1945 the UK did not manufacture any Mustard gas. Randle had the capability to manufacture both Pyro and Runcol and its plants were kept on standby into the mid-1950s with periodic inspections, maintenance and up-grades. Springfields which only ever produced Pyro was rapidly decommissioned, tidied up and handed over to the nascent Atomic Energy Authority to prepare uranium ore and to chemically separate the plutonium content of the output from the Windscale reactors. Valley also rapidly had its mustard plants decommissioned. The tunnels and the factory site were administered separately. The Antelope field site, whose tanks had been removed to the tunnels early in the war, was cleared for civilian use. The thirty tanks from Woodside were emptied and removed to the tunnels; its 250 ton tank was decontaminated and imploded and the site was returned to the farmer in 1949. The policy in 1945/6 was to collect the mustard in weapons and bulk in the various Maintenance Units and grade it I, II or III. The mustard in the FFDs was also categorised and any bulk grade II or III was shipped by rail to Valley for decanting into 52 gallon drums for sea dumping. The tanks in the FFDs were then filled up with Grade I mustard decanted from munitions. (10) The mustard in the munitions at the MUs was graded and if not grade I was burnt on site or dumped at sea. It was later the practice to ship all the mustard munitions remaining to Bowes Moor or Harpur Hill for mass destruction. On 4th June 1946 stocks in the UK were as follows; Springfields 1,000 tons, Valley 3,000 tons, RAF poor mustard 1,200 tons, Woodside 2,000 tons, RAF filled bombs 1,500 tons, RAF FFDs 4,500 tons. This gives 13,200 tons of mustard. (7)



By 1948 all of the mustard in the UK had been reduced to 5,000 tons in the Valley tunnels and 4,500 tons in the FFDs. A policy decision was made to destroy the mustard gas stocks as there were considered a costly irrelevance in a nuclear world and Major Ian Toler was tasked with destroying the stock located in the Valley tunnels at Randle by burning in the AOS machine. There was however a delay as it was decided to ship the 4,500 tons from the FFDs to Randle as Operation Pepperpot and Operation Spring Onion and to manufacture 10,000 one thousand pound new-style bombs. There was not sufficient mustard to achieve this in the FFDs and 2,000 were filled with Calcium Chloride. Between 1956 and 1958 the AOS burner ran non-stop for two years and destroyed all of the 5,000 tons Valley stock and the remaining mustard in various tanks and pots. (11) The Valley factory site was used until the early 1990s mainly as a buffer depot.

The site covers 86.8 acres, has seven miles of secure fencing and has always been "Secret". This has led to some bizarre conspiracy theories; it was never an alternate to Corsham that was Drakelow. The nation's art treasures were stored at Manod not Valley. There is no fourth tunnel; the footprint of the tunnels today is the same as in 1941. There is no evidence of any secret communications centre. No steam engines ran in the tunnels, there is a rational explanation. There is no evidence of food being stored in the tunnels by the EEC. There were, however, secret plans for the tunnels which were Projects Wellbright, Mallard and Trojan.

Project Wellbright was the plan to locate the NATO Oil Executive Board (NOEB) at Valley, Project Mallard the storing of the Bank of England gold and Project Trojan the utilisation of the tunnels as a safe haven in the case of nuclear attack.

## Reports and Recommendations

There have been a number of reports and desktop studies of the site over the last 25 years. The consensus opinion appears to be that although there are no overtly threatening issues, there are few records available for the latter war and post-war years when less stringent controls for handling mustard gas were the vogue. The toxic pits and the site generally are extensively monitored with on-site instrumentation. It is, however, unwise to permit digging around the site although it is eminently more benign than Randle which is a landfill area for Halton Council and a bird sanctuary. One solution at a cost of many millions of pounds would be to cover the whole 86.8 acres with concrete but the current solution is to maintain the seven miles of fencing and allow access on a managed basis. This also stops fly-tipping and the vandalism of the recently listed and scheduled buildings

## The Heritage Site

Valley has not been used since the mid-1990s. In the preceding post-war period many of the buildings were still in use, mainly as a buffer storage depot, but some were demolished because they were dangerous. In the 1980s the effluent disposal pit was filled in, the pipeline to the Dee Estuary was either removed or filled with concrete-based slurry and a number of buildings were made safe or demolished. In 2003 major remediation work took place when a large number of buildings were demolished, the toxic drains were filled in and any suspect areas were covered with membranes and a large number of monitoring points were installed. As part of this package a Visitor Centre was built on the site of the old gatehouse. The site is still guarded but managed access is encouraged. The valley is beautiful and the Pyro buildings have a gaunt and majestic presence seeming to create a time-warp. On the 20th September 2008 the Runcol and three Pyro buildings were made Grade II Listed Buildings and 21 buildings in the danger area including the tunnels were designated as Ancient Scheduled Monuments by Cadw. Visitors are encouraged to visit the site. North East Wales Wildlife is resident on the site and will welcome visitors from schools upwards. The Valley History Society takes visitors around the site and will take you into the threshold of the tunnels.



To visit contact the Bookings Manager on 01352-741591 or [help@rvsweb.org.uk](mailto:help@rvsweb.org.uk)

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11. C&M 1-77 Minutes of meetings held at Randle 1945-1957 (DEFRA Records Alnwick)