

Valley History Society



Vesicant Storage at Antelope Field and Woodside

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Abbreviations and acronyms found in this document

A.R.P	Air Raid Precautions	LPC	Light Protective Clothing
C & M	Care and Maintenance	Pyro, Pyro M	Forms of Mustard Gas
CCl ₄	Carbon tetrachloride	RAF	Royal Air Force
CID	Chemical Inspection Department	Runcol	A form of low-volatility mustard gas having a lower freezing point than Pyro
CKA	Castner-Kellner Works A	S.C.I.	Smoke Curtain Installation (Smoke Generator)
FPC	Full Protective Clothing	SPD	Special Products Division of ICI
HBD	A form of Pyro Mustard Gas containing Benzene	TK1 –TK4	Temporary Charging Buildings

HMD	A form of Pyro Sulphur Mustard Gas	U.K.	United Kingdom
ICI (I.C.I.)	Imperial Chemical Industries	US	Underground Storage in Valley tunnels
LCC	Lancashire County Constabulary	WS	Woodside

Dedicated to Paul Slater and his team at DEFRA Records, Alnwick, with thanks for his prompt support and provision of documents.

Vesicant Storage at Antelope Field and Woodside

The production in large quantities of vesicant at ICI Randle Works, Runcorn (Randle), ICI Springfields Works, near Preston (Springfields) and at Valley Works, Rhydymwyn (Valley) necessitated the construction of bulk storage facilities for the mustard produced at these factories. Valley's storage installations became the main United Kingdom bulk storage facility, their total nominal capacity being 5210 tons. This was divided between underground tunnel storage (of capacity 3120 tons), and Woodside Storage (2090 tons).

Valley received its first transfer of vesicant from Randle on June 19th 1940. Prior to the completion of the underground storage facility in the tunnels, vesicant was stored in underground tanks in the Antelope Field site (Antelope) adjoining Valley, but separated from it by the Mold-Denbigh railway line. This site was envisaged as a temporary storage facility for vesicant produced at Randle whilst Valley's tunnel storage was being prepared. Discussions took place and letters were exchanged between Sir Keith Price of the Ministry of Supply and Mr. H. Gaskell and others of ICI Special Products Division (SPD) between Saturday May 18th and Monday May 27th 1940 proposing that Antelope should be utilised in the short term. Whilst not affording the full protection from air attack, which the limestone surrounding the tunnels would provide, it was felt that buried tanks would be difficult to detect from the air since turf removed during excavation would be replaced over the tanks, once buried. However, it was noted that a direct hit on a full tank might stop work on the Valley site for two or three weeks. Since there was no data available on the effects such a hit and the consequent decontamination overhead this was, at best, a guess

A letter to Mr. F.C. Everett from SPD on May 20th 1940 indicated that consideration was being given to other locations for storage sites and mention is made of the Denbigh Moors as a possible alternate location, but Antelope offered a quick and comparatively easy solution to the storage problem (1). Mr. Gaskell estimated

that, utilising six tanks already on the Valley site and four whose delivery was imminent the site could be made ready in four weeks at a cost of £3,500. (2)

On May 24th, Mr. Gaskell reported that the field had been obtained and work was due to start on Saturday May 25th with the first three or four tanks available in about three weeks. (3). When replying, Sir Keith Price expressed the view that these tanks should be moved into the tunnels as soon as possible.

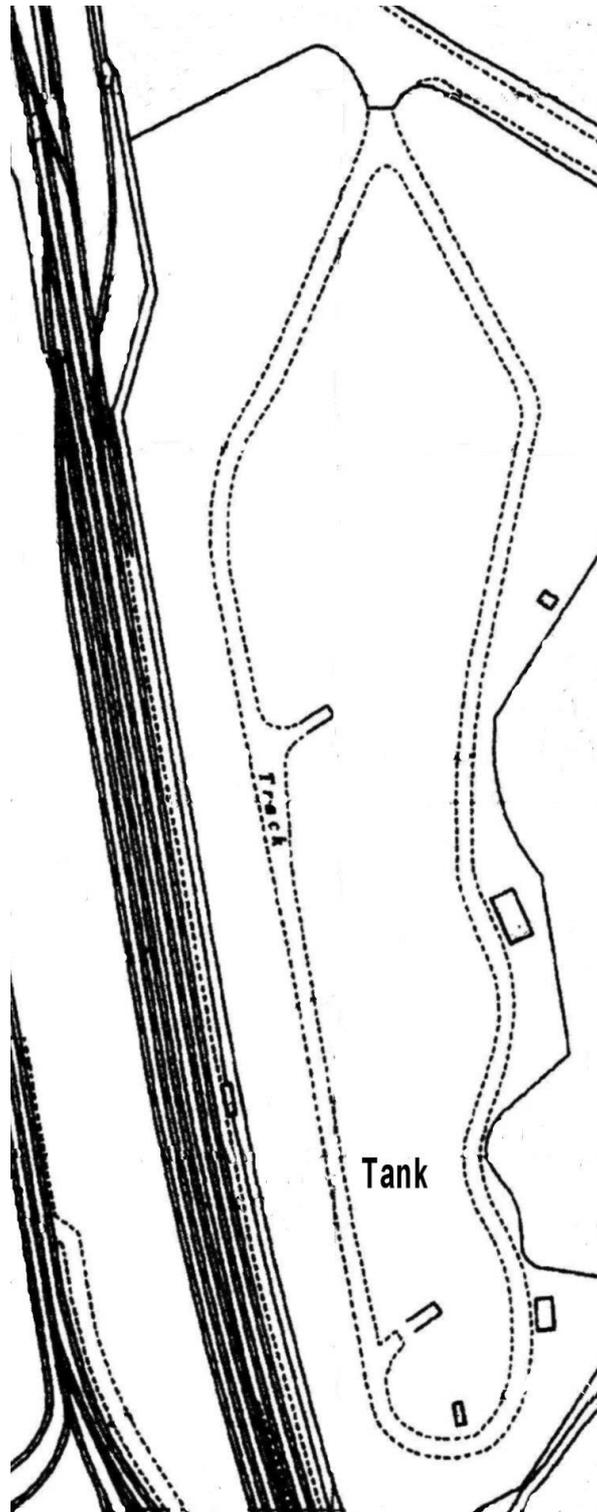
Storage Facilities at Antelope Field

The site was 10.53 acres in area with concrete roads and was enclosed by 1430 yards of unclimbable steel fencing of the type used in the Valley site. (4) Ten underground tanks were arranged in two rows of five, the tanks being 50 yards apart. They were of cylindrical construction with convex ends and were nominally 35ft 6 ins. in length and 9ft. in diameter, constructed from 0.625 in. mild steel lined with lead of thickness 0.25 inch. Their stated capacity was 65 tons although tanks were sometimes over-filled by an additional 3 tons without problem. They were buried with their long axis parallel to the ground surface. The tanks were equipped with two manhole lids, one of which was blank and was situated at the end of the tank furthest from the access road. The other, situated at the road end, was fabricated with four flanges, to which pipes for filling, venting, emptying or connecting to vacuum or pressure lines could be fitted. (5). Vesicant transfer into or out of tanks could be accomplished either by increased pressure or by applying a partial vacuum i.e. either blown in or sucked out, though tanks such as the Woodside concrete tank (see below) which were loosely lined with lead were unsuitable for transfer at reduced pressure because of the inherent risk of collapse of the lining under partial vacuum conditions. In these cases, compressed air had to be used to force out the contents.

The tanks were covered with about 1 ft. of earth but the manlid at the road end was surrounded by a brick enclosure approximately 2.5 ft. square and 1.5 ft. high. This enclosure was not supplied with a drain, thus it was possible that any spillage from the pipes entering or leaving the flanges might be confined to the enclosure itself. However, this construction increased the risk of water collection in the enclosure in rainy conditions, with further risk of possible contamination of the tank contents.

In addition to the storage tanks there were several associated buildings, including two temporary charging buildings (TK1 and TK2) which, though not normally in use, could be brought into service for the charging of munitions, should the facilities on

the main Valley site become unavailable for use. A second pair of buildings (TK3 and TK4) was constructed on the Woodside site (see below). Facilities were provided for washing and decontamination in the event of spillage or accidents. Space was provided for machines to charge 250lb. Light case bombs, 30 lb. bombs and S.C.I. smoke-producing bombs. The vesicant charged into these bombs was to be drawn directly from one of the buried tanks, the contents of which were to be replenished either from other buried tanks, by pipeline laid over the field surface, or by a tank wagon. (6) Two open-topped blast shelters offered some protection for road tankers in the event of air attack. In July 1942, when vesicant storage had been transferred to Woodside and the Valley tunnels, a 1250-ton tank for the bulk storage of carbon tetrachloride was constructed on the site. . Drainage took place via a dosing pit to soakaways.



Antelope Field Site, to the right of the railway lines (7)

(Though the position of the tanks is not known, the tanker blast shelter positions are evident as turnings off the long straight section of the road track)

The approximate position of the 1250-ton carbon tetrachloride tank is indicated.

Vesicant Transfers from Randle

It is recorded that the first transfer of Runcol took place on June 19th 1940 (8). A convoy of vehicles, (consisting of two Foden truck-hauled flatbed trailers, onto each of which was mounted a lead-lined cylindrical mild steel tank with convex ends containing approximately 8 tons of vesicant) set out on its journey from Randle under the supervision of the Lancashire County Constabulary (LCC). The convoy was often headed by a dark green Rover saloon car, with an MG sports car, both of the LCC, bringing up in the rear. In addition, there was a decontamination unit whose equipment included, amongst other items, several sets of Full Protective Clothing (FPC), respirators, chemicals for neutralising spills and sand for the subsequent clearing-up operations. Later convoys frequently contained more than one vesicant trailer but some were accompanied by only one police vehicle.

By June 24th 1940, Antelope field tank 1 was full of Runcol and by September 15th, six tanks had been filled with Pyro M and four with Runcol

When the tunnel storage complex was completed, the vesicant from the Antelope tanks was transferred to tanks in the tunnels by road tanker, the now empty tanks being disinterred and transferred to their prepared bases in the tunnels. Transfer took place in August and September 1941 using road tankers on loan from Randle. Initially, the charging machines in TK1 and TK2 were retained as an emergency standby facility, with two new lead-lined tanks of 12 and 20 ton capacities being provided as buffer storage for these machines. Subsequently, the machines were removed from TK1 and TK2 and transferred to the Valley charging buildings. (9)

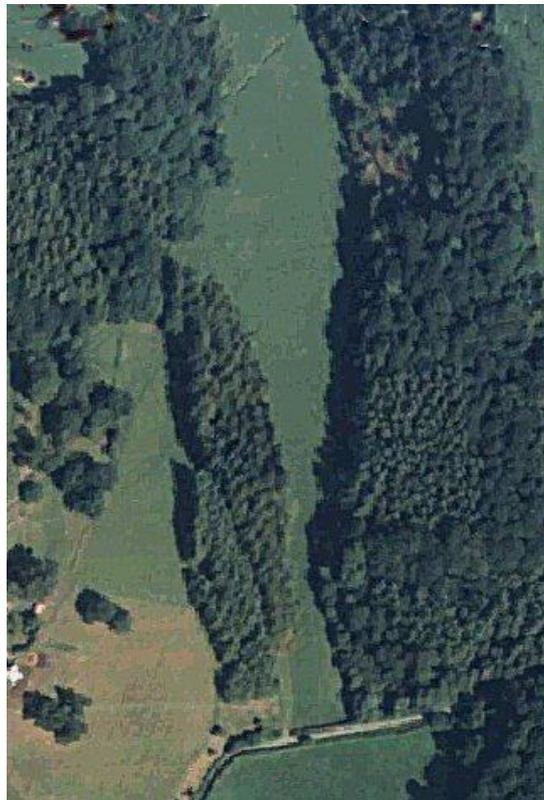
Woodside Storage Facility

When the Antelope Field storage was full, a second bulk storage site, intended to be of a more permanent nature, was proposed. This site, which became known as Woodside, was situated about 2.5 miles from Valley in a north-easterly direction, on an unclassified road linking the villages of Northop and Rhosesmor, approximately 1.5 miles from the centre of Northop Village. The site chosen was a valley with an even floor but having sloping, wooded sides which afforded a degree of natural concealment. However, the flat nature of the site was to give problems in adverse weather conditions.

Mains electricity was supplied by the North Wales Power Company and water was supplied by Holywell Water, though it was reported that the water supply was inadequate for hydrant purposes, several hydrants being supplied but the supply was insufficient to operate even one. However, it was adequate for the bathrooms and for swilling purposes (10)

Enclosed by a chain link fence 1758 yards long, the 10.76-acre site consisted of a loop road, some 15ft. wide, constructed on a hardcore base, surfaced with asphalt (11), around which were situated 30 mild steel storage tanks buried to depth of approximately 2.5 feet.

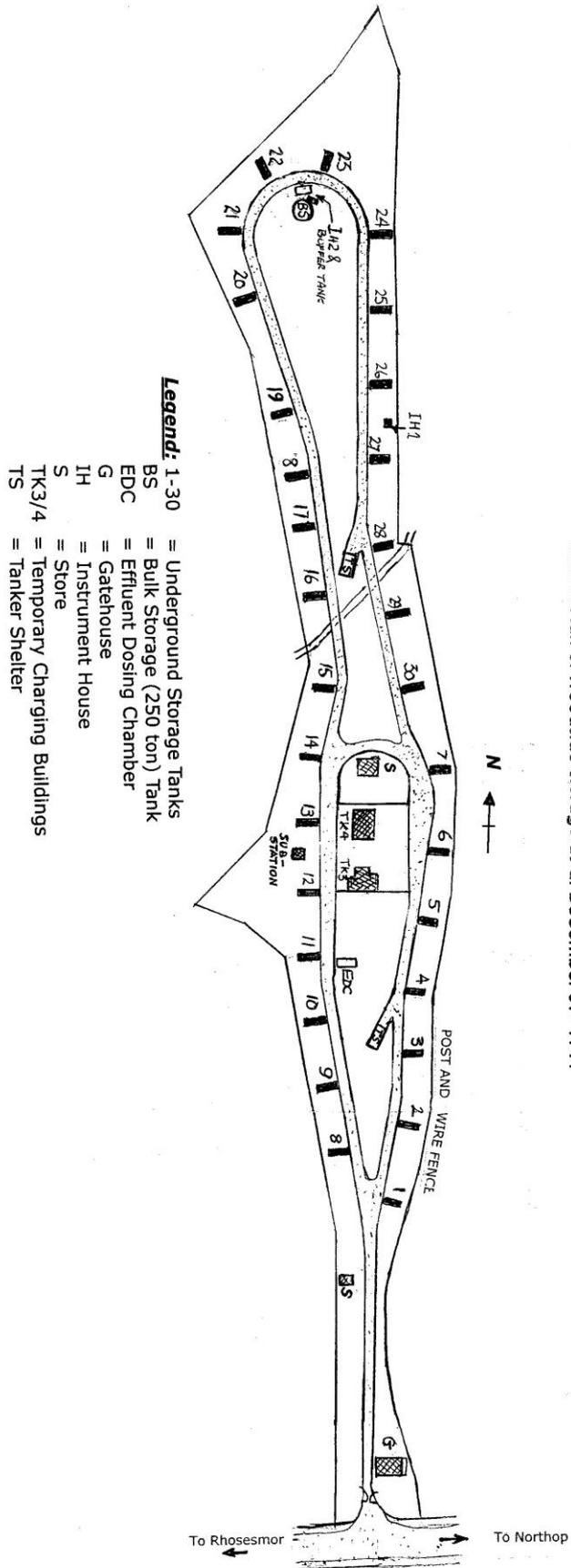
The vesicant was taken to and from Woodside by road convoy with police escort and was accompanied by a decontamination vehicle to deal with possible leakage of liquor in transit. Local residents recall that convoys travelled via the narrow unclassified lanes known as The Green and The Greenways, these lanes being closed by police for the duration of the passage of the convoy.



Southern end of Woodside Storage site at Gwern-y-Marl, Northop (12)

The site is the narrow field between the woodlands

Sketch Plan of Woodside Storage as at December 31st 1944



Based on ICI Drawing J42401 (13)

Buildings on the Woodside Site.

Though no buildings are still standing, it may be deduced from the 1944 inventory (14) that they were of similar construction to many of the buildings at Valley (of brick and reinforced concrete construction). There were at least ten structures, described below.

The Gatehouse (23 ft. 10 ins. by 18 ft. 6 ins.)

This building was divided into an office, A.R.P. shelter, shower room and calorifier room for the hot water supply, with an annexe containing two Elsan closets. It was heated by a hot water pipe and radiator system. There was a police presence at the site and this building was their base. It appears that this building may have been two storey (see later notes on Woodside clearance, dated August 7th 1947).

Store 1 (20 ft. 0 ins. by 7 ft. 9 ins. by 7 ft 0 ins.),

Store 2 (16 ft 6 ins. by 16 ft. 6 ins. by 8ft. 0 ins.),

Shelters for Road Tankers (2 of, 31 ft. 0 ins. by 11 ft 6 ins. by 10 ft. 4¼ ins, open topped, of 14 inch brick construction on a concrete plinth.

Sub-Station (4 ft. 0 ins. by 4 ft. 0 ins. by 7 ft. 2 ins.), and associated distribution board and switchgear.

Temporary charging buildings TK3 and TK4

TK3 (35 ft. 0 ins. by 17 ft. 0 ins. by 9 ft. 0 ins., with annexe 19 ft. 8 ins. by 12 ft. 0 ins. by 9 ft. 0 ins. and extension 21 ft. 3 ins. by 12 ft. 4½ ins. by 8 ft. 7 ins., as lavatory, fitted with 2 showers, comprising Charging Room, Engine Room and Bathroom).

TK4 (46 ft. 4 ins. by 30 ft. 8 ins. by 9 ft. 0 ins, comprising 2 Charging Rooms and Engine Room

Both TK buildings were fitted out with apparatus for the handling of munitions and charging these with vesicant, with associated ventilation and safety equipment and other apparatus. TK3 had two showers with a coke boiler and calorifier. They were built in the central area of the Woodside Site, to either side of a large concrete loading platform and storage raft (136 ft 0 ins. by 120 ft 0 ins.)

Though constructed and equipped, the charging facilities in TK3 and TK4 were never used. (15) It is possible that, together with the bulk storage tank, these buildings were intended as a prototype of the weapons charging system adopted in the Forward Filling Depots (FFDs).

Instrument House 1 (6 ft 6 ins. by 4 ft. 0 ins. by 6 ft 0 ins.)

The building was situated between storage tanks 26 and 27 and contained two temperature recording instruments linked to thermometers in these tanks, which were used to monitor the vesicant temperature.

Vesicant Storage Tanks

Contemporary records stated that there were 10 tanks of 55 tons capacity and 20 tanks of 65 tons, buried to a depth of 2 ft. However, the inventory of the site taken on December 31st 1944 (12) stated that there were eleven 55 ton tanks, each 8 ft. 2 inches in diameter by 35 ft.6 inches long and nineteen 65 ton tanks, each 9 ft. diameter by 35 ft. long. There was also a 250-ton lead-lined, reinforced concrete tank of 24-ft diameter cylindrical cross-section and 15 ft 6 inches depth, with its axis vertical. Its base slab, walls and domed lid were 2 ft. thick. Thus, depending upon which figures are accepted, the nominal storage capacity was either 2100 tons or 2090 tons, ignoring any additional capacity gained by over-filling. The latter figure is now accepted as being the nominal capacity of the Woodside tanks. These tanks remained at Woodside until late 1946 when they were transferred to Valley tunnel storage.



The last tank removed from Valley, signed by all involved in its removal
(Tom P. Woodward collection)



Unloading the tank on arrival at Runcorn. The position of the manlids and their securing bolts can be seen clearly.
(Tom P. Woodward collection)

Because of problems associated with vesicant freezing at low temperatures (in the winter of 1940-41 all the Woodside tanks froze), the tanks were fitted with two electric immersion heaters. Experiments conducted on the Antelope tanks in the summer of 1941 had shown that such heaters could raise the temperature of the vesicant by some 3°C, sufficient to prevent freezing in winter temperatures. When the tanks were used to store Pyro HBD mustard, the heaters could not be used because of the inflammable nature of this benzene-based vesicant. In cold weather, braziers were often lit in the vicinity of the road tankers used for vesicant transfer whilst they were unloaded, even in the tunnels. This was forbidden when they contained flammable vesicant. Hot water and steam jets were also used to prevent vesicant freezing during its transfer from road tankers.

The electrical immersion heaters were L-shaped and lead-sheathed and the heating element was contained in the horizontal limb of the L which rested on lugs at the bottom of the tanks. The heaters passed into the tank through the main manlid, sealed to prevent gas leakages. Fitting these heaters involved modifying existing manlids, which were removed by fitters in full protective clothing, (FPC), taken to Valley and decontaminated before being modified. On average, one lid was modified per day. The first heater was fitted to the Woodside tanks on December 20th 1941 and all tanks due to receive heaters had been modified by April 24th 1942. The first heater was used on January 13th 1942.

The failure rate of the electrical heaters was high, two had failed by the end of April 1942. Tests in September 1943 revealed that one heater in each of eleven tanks had failed and both heaters in tank 1 were non-functional. These were replaced when new heaters became available, except in tanks which contained HBD where their use was forbidden, so replacements were unnecessary. In all, 19 of the heaters failed because of defects in their lead sheathing.

Because of the greater capacity of the Bulk Storage tank, heating arrangements were different. This tank was fitted with two re-circulatory oil heaters, the oil being heated by electrical immersion heaters in a reservoir situated in the adjacent Instrument House 2 and circulated to the 250-ton tank by a pump.

Buffer tank (associated with the Bulk Storage Tank)

In addition to the 31 storage tanks there was a buffer or transfer tank, located adjacent to the 250-ton Bulk Storage tank and used only in vesicant transfer to and from that tank. This was of mild steel construction, 5 ft. 0 ins. in diameter and 18 ft. 6 ins. long, contained in a reinforced concrete pit, 24 ft. 6 ins. by 11 ft. 0 ins. by 7 ft 6 ins.

Both the 250 ton tank and the transfer tank were equipped with pneumerators (devices associated with measurement of the level of vesicant), air dryers and scrubbers.

Instrument House 2 (11 ft. 9 ins. by 5 ft. 9 ins. by 8 ft. 0 ins.)

This second instrument house was built close to the Bulk Storage tank at the northernmost end of the site. Unlike the other buildings at Woodside, this was of steel sheet construction and may indicate its construction at a later point than the main site buildings, contemporary with the construction of the 250 -ton tank in 1942.

Flooding Problems at Woodside and Antelope Field in November 1941

By mid-November 1941, nine tanks had been installed at Woodside, at the southern and south-eastern part of the site, of which 8 were full and one (tank 9) was being filled. The period from November 14th to 21st saw several torrential rainstorms, which caused flooding at Antelope and Woodside. On Thursday November 14th, rain had fallen to such an extent that the brick manhole chambers of some of the Woodside tanks were filling with water. Process staff from Valley was sent to Woodside to bale out the chambers but baling could not cope with the volume of water. On Sunday November 17th, after a brief period of improved weather, extremely heavy rain fell again and it was reported that part of the field surrounding Tank 5 was flooded across the site road. Two possible solutions to the flooding problem had been offered - either to concrete inside the brick manhole chambers (a quick but inefficient solution), or to drain the field properly. The latter option was chosen and, since members of the construction staff were on their weekend off, it was decided that drainage operations should begin on the morning of Monday November 18th. (16) Overnight, the rain became torrential and the situation deteriorated.

Work commenced on Monday as planned, with process workers shift-working 24 hours a day to bale out the manhole chambers. Drainage work consisted of trenching to carry away water and the eventual culverting of the brook which traversed the site into a concrete channel. Following an inspection, it was discovered that the manlid flanges on seven of the nine tanks (each of which should have been secured to the tank flanges by 44 bolts) did not have their full complement of bolts. Eight were missing on tank 1, six on each of tanks 2, 3 and 4 and smaller numbers on the other tanks. Only the manlids of tanks 5 and 9 were fully secured. The missing bolts were replaced as a matter of priority on Monday morning. Other deficiencies were also noted - tank 3 had three cracks in the lead covering of the lower flange of the main cover, gas was bubbling through the flood water covering one of the small flanges of tank 5 and gas was bubbling from the main cover of tank 6. (17) The filling of tank 9 was incomplete and the standpipe used in this operation was still in place.

When the flooding had subsided and the water levels had dropped below the levels of the tank flanges, the contents of the tanks were sampled for the presence of water. Tank 4 (the only tank containing HMD) was dry, as was the

Pyro M in tanks 1, 2 and 7. The remaining tanks all contained wet Pyro M. However, Valley process staff stated that only tank 9 was visibly wet and the Chemical Inspection Department (CID) stated that the wetness in tanks 6, 8 and 9 was similar to that they had encountered in Randle buffer pots. It was suggested that it was possible that no rain had entered these tanks, the presence of water being possibly due to the long storage period of the Randle product, which contained water when delivered. However, the official site history stated that the water in tanks 3 and 5, which were very wet, had entered the tanks during the period of very wet weather. Eventually, the vesicant in all the wet tanks was dosed to remove water contamination, with limited success. (18)

Water contamination of the vesicant had no simple solution. The easiest method of treatment was skimming off the water on the surface of the contents, and then treating the remainder with an anhydrous sodium sulphate and magnesium oxide mixture or with anhydrous calcium chloride. A second method involved removing all but 5 tons of the tank contents by means of a long dip pipe and transferring the vesicant to a dry, empty tank. The remaining wet 5 tons could then either be treated with either of these anhydrous chemicals or the wet residue could be transferred by tanker to Randle for treatment. (At that time, Valley had no facility for such treatment, though eventually this facility became available). The tank could then be decontaminated, dried and made ready for use once more. (19)

The flooding of the manhole chambers of the Woodside tanks raised concerns about the possibility of flooding at Antelope. An examination on Sunday November 17th revealed no evidence of water build-up and a second examination on Thursday November 21st gave the same result. However, that night saw the Fechas Brook, which skirted the Antelope field, rise to flood level and part of the field was flooded, including the floor of TK2. The possibility that this floodwater had contaminated the contents of the Antelope tanks necessitated sampling of their contents and a further examination of the manhole chambers. This revealed that seven bolts were missing from the manlid flanges and that water was present in some of the chambers, with evidence that its level had been higher than some of the main flanges. Bolts were tightened, the seven missing bolts were replaced and the vesicant was sampled for water contamination. This was found only in tanks 1 and 9, with CID again reporting that the samples resembled those from the wet Randle buffer pots.

The solubility of water in Pyro M decreases at lower temperatures, so tanks whose contents were reported as dry during the summer months became wet in winter as water came out of solution, and vice-versa.

Development of the Woodside Facility

Following the flooding late in 1940, no further mustard was received until February 1942. In the following six months, all the remaining tanks except tank 29 were filled, mainly with stock from Randle, though some was transferred from the Antelope tanks. Most Woodside tanks contained Pyro M but 32 tons of Randle-produced solvent Pyro (containing 15% carbon tetrachloride) was received and 21 tons of HMD was transferred from Sutton Oak. There is no record in the official site history of Runcol storage at Woodside; it seems that vesicant storage was confined to the various forms of Pyro.

The Woodside site was handed over to, and accepted by Randle on March 23rd 1942

May 7th 1942 saw the first delivery of HBD (Pyro B) from Springfield. The arrival of this benzene-containing flammable vesicant necessitated a change in working procedures at Woodside. "No Smoking" notices were posted 50 yards from the tank, non-sparking tools were used and tank heaters were switched off. Fire extinguishers were also provided. Eventually, permission was granted to store HBD in the tunnel storage facility and so Woodside HBD stocks were transferred to Valley. (20)

Problems were encountered in January 1942 following water leakage from a burst pipe. Because the manlid on tank 5 had not been properly secured, a large quantity of water entered the tank and so the tank was skimmed to remove the surface water, but with only limited success.

Routine Procedures

Tanks were routinely vented to equalise internal and external pressures on a monthly basis. Their contents were sampled and analysed by CID twice a year but surface sampling was also carried out on any tank whose contents were to be transferred, prior to the first removal of vesicant.

Vesicant temperatures were also monitored routinely throughout the year. The results were used to determine when first one and then both heaters were turned on in autumn or off in spring in all tanks except those containing HBD. However, because of the need for fuel economy, only one heater in each tank was used in the milder winter of 1943-44.

The Woodside 250 ton Bulk Storage Tank

Constructed during the summer of 1942, together with its 11.5 ton buffer tank, this tank was brought into service on October 4th 1942 by blowing out the contents of the adjacent tank 22 via an overground steel pipeline using compressed air. The same procedure was used to move the contents of tanks 21, 23 and part of tank 20 to the 250-ton tank until it was full. (21)

Decommissioning of Woodside Storage

The U.K. production of chemical warfare (CW) agents was a response to a perceived threat that Germany and its allies would use CW but, because this did not happen, the need for production of these agents decreased. In Valley reductions in weapon production resulted in a day work pattern replacing shift working in October 1943. Output was to decline thereafter and, with it, the need for storage of large quantities of vesicant.

The Woodside site continued to be used for storage until December 1946, by which time, all stocks of vesicant had been removed from the site, either into the tunnels or into containers in readiness for disposal by dumping at sea. Since the storage facilities at Woodside were no longer needed, decommissioning of the site and demolition of its structures began in 1946 and was completed by the end of 1947.

The time line for decommissioning is detailed both in the Minutes of the monthly Works Managers' Committee V-WM 84 -112, 1946-48 (22) and in Care and Maintenance (C&M) Minutes 1-77, 1946-56 (23) from ICI Randle.

Note: *Some parallel records exist from both sources. Where these have given supplementary information, both sources have been recorded but, where the information was identical, only the Valley minutes have been cited.*

EXTRACTS FROM ICI RANDLE CARE AND MAINTENANCE MINUTES (Woodside)

April 1945

Reference was made to maintenance of the Woodside (WS) tank heaters. Emergency charging machine motors had been removed for dry storage and the charging machines had been greased.

Monday June 26th 1945

Records show that dismantling of machinery at Woodside was in progress.

January 1946

Dismantling of Machinery in TK3 and TK4 was complete. A portable vacuum pump was overhauled in readiness for use at Woodside.

Wednesday April 17th 1946

It was stated that all Woodside buildings were considered unsuitable for farming purposes and would be demolished, with the possible exception of the Gatehouse, which was to be considered separately.

Friday April 26th 1946

Agreement was reached on site clearance. Special Products Division had been requested to provide a revised costing for returning the site to its former condition.

Wednesday May 8th 1946

It was decided that all buildings, including the Gatehouse would be demolished.

Wednesday July 10th 1946

The Bulk Storage tank had been decontaminated. Discussions took place on the best method of disposing of the liquid decontamination residues and it was decided to remove these to Valley and dispose of them "suitably".

Wednesday August 14th 1946

The Bulk Storage tank was being prepared for demolition and the residues of the decontamination process had been removed to Valley. Its lid, necking and all fittings were removed and dumped into excavations. The concrete apron surrounding this tank was being broken up and its buffer tank had been taken to Valley for decontamination.

Wednesday September 18th 1946

Demolition of the 250-ton tank was proceeding and preparations were in hand to blow up the top portion of the tank with explosives.

Wednesday December 11th 1946

The 250-ton tank had been completely buried and earthed over.

November 1947

It was reported that site levelling, fencing and hedging was complete and that ploughing had commenced on November 11th. Cross-ploughing, rolling and seeding of the now cleared ground was planned for spring 1948.

Wednesday December 31st 1947

The electricity supply to the site was removed.

March 1948

Final ploughing was in hand and arrangements were to be made for fertilising and seeding.

Wednesday May 5th 1948

Seeding had been delayed by the presence of stones and rubble from the buildings in the ground, a complaint about its state being received from the site owner's agent.

September 1948

Inspection revealed that the results of seeding were not quite satisfactory and that some patches were bare after heavy rain. Arrangements were proposed for a meeting between interested parties to give a settlement. This had still not been arranged by November 1948.

March 1949

The District Valuer had recommended compensation of £600 to be paid to the landowner to accept the land in its current state.

Tuesday March 31st 1949

The agent for ICI issued a "take it or leave it" offer for compensation.

Saturday November 11th 1950

Final repairs were made to fencing and ICI stated that it would accept no further responsibility for the Woodside Site.

EXTRACTS FROM ICI RANDLE CARE AND MAINTENANCE MINUTES

Antelope Field

January 1946

Dismantling was in progress and the 1250-ton mild steel carbon tetrachloride bulk stock tank, installed after the vesicant tanks had been removed to tunnel storage, had been drained. Two CCl₄ pumps were removed for overhaul and dry storage.

January 1947

The site owners were approached to ascertain what reinstatement they required. If reinstatement costs were likely to be high, an offer to buy the site was proposed.

November 1947

General site clearance and excavation of buried tanks had commenced and arrangements were in hand for the removal of the CCl₄ stock tank. Instruction had been received to mount 10 5 ton road/rail tanks required on site onto RAF trailers, which were being serviced.

January 1948

Plant from Temporary Charging buildings TK1 and TK2 was being removed. The large CCl₄ stock tank was being burnt up and two further buried stock tanks had been excavated and removed. Removal of associated pipework and its supports was proceeding.

March 1948

Reinstatement of the site was complete and the keys had been handed over to the District Valuer.

EXTRACTS FROM MSF VALLEY WORKS MANAGERS MINUTES (1946-1948)

Woodside Storage

Tuesday February 5th 1946

Arrangements for transferring the tanks and stocks of vesicant from Woodside to the tunnels were well advanced. Transfer of vesicant was due to commence in the next week and removal of the tanks was scheduled to commence on March 4th 1946.

The V1 road tanker had been overhauled in readiness for vesicant transfers from Woodside to the tunnels.

Preparations were in hand to enable a start to be made on the clearing of Woodside at a very early date. At Valley, steelwork to strengthen the ventilating duct at the entrance to A and B Chambers was being fabricated. The 32 R.B. Crane was to be taken to Woodside on Monday February 11th with other necessary gear.

Tuesday March 5th. 1946

Vesicant transfer operations, which commenced on February 20th, were suspended on account of weather conditions. The present position showed that 32 tons had been removed from No.7 tank and 21 tons from No.6 tank. The whole of the material had been charged into drums for sea dumping.

At Valley Works, construction work on supports to trenches and covers fitted into tunnels were ongoing, to enable Woodside tanks to be installed in the Underground Storage facility.

At Woodside, dip pipes were removed from Nos. 20 and 21 tanks and new manhole blanks were fitted in readiness for transit to Valley.

The electrical heaters on tanks 7, 4 and 3 were reconnected because of the exceptionally severe weather conditions.

Pipe trenches between TK (Temporary Charging) Block and Tanks 5 and 14 were demolished. TK3 was demolished, except for a small part retained as a petrol store. TK4 was reported as 25% demolished. The tanker blast shelter at the North end of the site had been demolished. Excavations had commenced at tank No. WS21. It was expected that this tank, the first tank to be removed, would be transferred from Woodside to Valley on March 14th 1946.

Thursday April 11th 1946

Woodside tanks Nos. 1, 6 and 7 were empty and 21.5 tons of vesicant had been removed from tank No. 5.

Material removed from underground storage and from Woodside Storage had been charged into 50-gallon American drums for sea dumping.

Dip pipes and heaters were removed from tanks No. 7 and 6., and blank transit manhole covers were fitted.

The portable compressor was overhauled and two coke scrubbers were put into service.

Holes left after removal of tanks 20 and 21 were back-filled. Tanks 5 and 6 were excavated on the South side to assist in removing material.

Excavation for removing No. 7 tank was in hand.

TK4 had been demolished and the adjacent loading platform had been partly broken up.

At Valley Underground Storage, two tanks (ex-Woodside) were complete at the north end of B chamber and two sets of plinths had been cast in chamber B North. Two sets of double plinths were cast in chamber A (South) and ramps were built to receive the Woodside tanks.

Monday May 6th 1946

At Valley Works, 928 x 250 kg. bombs charged with the German Nerve gas Tabun had been received and were being stored temporarily in buildings Nos. 1, 2 and 4 whilst transfers from Woodside were continuing. The bombs were to be transferred into the tunnels when transfer of tanks and vesicant to the tunnels from Woodside was complete. Bomb storage in these temporary locations had been completed by early June 1946.

An air compressor was being assembled for use in the tunnels in filling ex-Woodside tanks.

Permanent manhole covers were fitted to Tank No. 20.

A total of four tanks had been removed from Woodside and installed in the tunnels. A further two tanks were empty and were to be transferred from Woodside to the tunnels in the next week.

The spare portable vacuum pump was being overhauled and a catchpot was fitted to the working set.

Removal of dip pipes and fitting of manhole blanks on Woodside tank No. 5 continued.

The District Valuer, accompanied by the owner of Woodside, had inspected the site and requested that all buildings were removed and nothing left.

Monday 3rd. June 1946

In total, six tanks had now been removed from Woodside and installed in Valley Underground Storage. Four further tanks were empty and 25 tons of vesicant had been removed from tank No. 31 (the 250-ton concrete tank).

Dip pipe, heater and manhole cover removal had been completed on Tanks 4, 3 and 2, with tank 1 in the process of undergoing the same preparation.

A portable steam boiler was overhauled at Valley in readiness for use in tank decontamination at Woodside.

Monday 1st. July 1946

A further two tanks had been removed from Woodside and installed in the tunnels and two more tanks had been excavated at Woodside. Tank No. 31 was reported empty and drained and had been handed over for decontamination. Manhole covers had been changed on tanks 1 and 23 and steaming equipment was being prepared for tank 31 (the 250 ton concrete tank). The same tank had been fitted with an extended dip pipe to facilitate draining.

At Valley, refilling of ex-Woodside tanks commenced on June 23rd. By the beginning of July, 108 tons of Runcol had been transferred between existing underground storage tanks and those recently received from Woodside, and 110 tons of Grade 1 vesicant (ex. Springfield) had been transferred into the US tanks left empty after transfer.

Tuesday 6th. August 1946

At Valley, refilling of ex-Woodside Tanks with Runcol continued, a total of 276 tons being transferred in July. Tanks 4, 6, 8, 10, 12 and 33 had been refilled with vesicant and Tank 11 was part full with ex. Springfield stock.

Emptying of Woodside tank 12 was complete and tank 33 had also been emptied, its contents charged for sea dumping.

Tanks 23, 24, 25, and 26 had been emptied and tank 27 was being emptied. The manhole covers on tank 24 had been changed and brickwork from around the manhole covers of tanks 25 and 26 had been removed.

At Woodside, cleaning out of tank 22 in the decontamination area was continuing. Decontamination, steaming and disposal of the residues from tank 31 (the 250-ton lead-lined concrete tank) was complete. Dismantling of this concrete tank structure had commenced and its associated buffer tank had been removed, the records indicating that the buffer tank had been taken to Valley Works for decontamination. The large cover with dip pipes had been removed from the concrete tank and had been placed in a prepared pit.

Note: *There is no mention in the records available at the time this synopsis was compiled (09/2008) of the location of this pit, though there are notes in the inventory that the debris of the concrete tank was disposed of by burial on site after decontamination using steam.*

Monday September 2nd 1946

Tanks ex-Woodside now installed in the underground storage (US) tunnels were being filled with Runcol.

At Woodside, tanks 27 and 28 were now empty and 39 tons of vesicant had been removed from tank 29 for sea dumping. In the decontamination area, work on tank 22 was almost complete, though delays had been experienced as a result of heavy rain. Manlids had been changed on tanks 25, 26 and 27 and preparations had begun for removing those on tank 28. All gear had been dismantled from the Bulk Storage tank WS31.

Tuesday October 1st 1946

Refilling of US tanks ex-Woodside with Runcol was continuing.

The contents of tanks 18 and 19 had been transferred to US tanks 42 and 21 and tanks 29 and 30 had been emptied for sea dumping. Tanks 25-29 had been transferred to the tunnels, with WS30, 18 and 19 now empty and 17 being emptied. In all, 17 tanks (WS 1-7 and 20-29) had been moved to Valley.

Manlids had been changed on tanks WS28-30 and tanks 27, 28 and 29 had been raised to the surface, with excavation of tank 30 and demolition of the Bulk Storage tank continuing.

Tuesday November 5th 1946

Tanks WS 8, 9 15 and 16 were empty and the emptying of WS17 had been completed. Only 5 tanks remained to be emptied.

Tank 22, which was now in the decontamination area at Valley, had been inspected by CID and it had been decided to remove sediment still in this tank and then re-examine.

Manlids had been changed on WS17 and tanks 30, 19 and 18 had been excavated and placed in the tunnels. Demolition of the Bulk Storage tank had been completed and its debris covered with earth. Removal of the northern road loop adjacent to this tank had begun.

Tuesday December 3rd 1946

All stocks of vesicant had now been removed from Woodside, with some empty tanks awaiting removal to Valley. At Valley, WS22 still awaited further decontamination and decontamination of the buffer tank from WS31 was proceeding.

Rain and mud had delayed work, and flooding of the pits had interfered with the breaking up of the concrete tank plinths. Manlids had been changed on tanks WS15, 16 and 8-10 and tanks 17, 16 and 8 had been raised and awaited transport to Valley. Tank WS15 had been excavated. No further progress had been made with removal of site roads.

Tuesday January 7th 1947

Manlids had been changed on WS 11 and 12 and tanks 9-11 had been excavated and raised ready for transport to Valley. Tank 12 had been excavated and tanks 17, 16, 15 and 8 had been transferred to Valley tunnels. In all, 24 tanks had been removed and 6 awaited removal. Snow and ice had hindered transfer of tanks 9-11 to Valley. As all vesicant had been transferred, the vacuum pump and portable compressor used in its transfer were removed to Valley for decontamination and overhaul.

Tuesday February 4th 1947

Tanks 9-12 had been transferred to Valley. Only two tanks had still to be moved.

Friday February 28th 1947

The electrical power fuses were withdrawn.

Friday March 11th 1947

Tank WS22 had been cleaned out at Valley and inspected and a failure of the lead lining had been discovered.

Tuesday April 1st 1947

In the Valley decontamination area, a lead patch 1ft. by 2 ft. 6 ins. had been burned over the defective area in WS22 and blank manlids had been fitted in readiness for transfer into US. At Woodside, snow and floods had hampered progress, but tanks 13 and 14 had been raised to the surface in readiness for transfer to Valley and it was reported that 30% of the roads had been cleared.

It was proposed that police patrols should be removed from Woodside before April 12th.

Tuesday May 6th 1947

All storage tanks had now been removed to Valley tunnels and 60% of the roads had been removed and buried on site. All police patrols had ceased and responsibility for security had now been transferred to the site clearance contractors. The only buildings still standing were the gatehouse and the small store.

Tuesday June 3rd 1947

Removal of the roads was now 80% complete and 30% of the site had been levelled ready for ploughing. The North Wales Power supply connection had yet to be removed.

Tuesday July 8th 1947

Demolition of the gatehouse was 60% complete and 95% of the roads had been removed but, as a result of congestion in the area of the gatehouse road removal had been suspended. No arrangements had yet been made for ploughing. A Broom and Wade compressor, which had been used at Woodside, was transferred to ICI Rocksavage (Runcorn).

Tuesday August 7th 1947

Road removal was almost complete and the top storey of the gatehouse had been removed. The site had been levelled as far as the store, the only building still intact.

Wednesday September 3rd 1947

All roads had been removed and site levelling was complete except for a small area next to the North Wales Power transformer switch house at the centre of the site. Fencing had been removed; banks trimmed and new fencing was being erected. Ploughing had been contracted to the Flintshire Agricultural Committee, but work had not been started because the ground was excessively dry and hard.

Tuesday October 7th 1947

All Valley, labour had now been removed from the site and ploughing had been attempted after a period of rain but the ground was still too hard. Arrangements were made for the cross ploughing, fertilising and seeding to be done in the early part of 1948. It was planned to plant a Quickthorn hedge along the roadway in the next month. North Wales Power had removed the switch house and meters, but incoming feeder poles were still standing. It was hoped that these might be left for future use.

Tuesday November 11th 1947

No progress had been made with ploughing.

Tuesday December 9th 1947

Arrangements had been made for Mr. Webster, the tenant farmer, to be responsible for water charges.

1948

Tuesday April 13th 1948

Ploughing had been completed during the preceding month.

EXTRACTS FROM MSF VALLEY WORKS MANAGERS MINUTES (1946-1948)

Antelope Field

January 1948

Removal of mixing vessels was stated to be somewhat slow because of the mass of concrete surrounding the buried pots. Removal of the CCl₄ stock tank and buried pipelines had commenced. The mild steel tank was being burned up by workers from ICI General Chemicals Division CKA depot.

Tuesday March 9th 1948

Reinstatement was complete and the site was ready for return to its owners. The District Valuer and MS/CD had been informed.

Notes and Observations

This report is based on documents from various sources. The Wartime Managers History and the monthly management minutes of both Valley and Randle are the prime data, supported by the Report on Flooding and the 1944 Inventory with its attendant notes.

All of these documents were written over 60 years ago. We do not know what the local practices were at this time or if the record is strictly accurate, taking into account that all of the documentation tends to reflect the practices on the main Valley Site. It is almost certain that there were less rigorous controls in treating chemicals than is the case today.

Some evidence of the attitudes of ICI can be drawn from its reporting of its activities in the SUPP5/1003 to SUPP5/1011 series in the National Archive. This series of files tells the histories of the constituent manufacturing factories, the chemical weapons factories and the Forward Filling Depots. It reports in an unflinching and direct way and considers all facets of the day-to-day operation of the factories from accidents and injuries to social life and royal visits. There is a pervading feeling that they reported matters as they were or, perhaps, as they saw them. It is felt that they were also at pains not to expose themselves to being tainted with the label "War Profiteer" in the post-war years. The overall view must be that of highly professional men with a good attitude towards the workforce and its welfare. There is evidence that considerable efforts were made to decontaminate both Antelope and Woodside sites to the level acceptable in the post-war years; there was no incentive not to do so.

More recently, in 2006, a comprehensive three-volume report on the main Valley site by the Archaeology Section of Birmingham University was produced. This is an impressive work and must currently be the most comprehensive view so far but it did not consider the external sites under consideration in this document.

There have been several desk-top studies, where all of the identifiable documentation, contemporary and otherwise, is collected and re-examined with some interesting conclusions. The persuasive study of 1996 by AEA Technology offers suggestions as to investigating continuing contamination on both sites. (25) Subsequent documentation may modify that view, indeed it would seem that recently uncovered documents lend credence to the view that tanks associated with the Temporary Charging buildings TK1 and TK2 were removed from Antelope to Valley for decontamination in January 1948. It is a matter of record that the buffer tank for WS31 was removed from Woodside to Valley for decontamination and that a mobile steam decontamination unit was located at Woodside during the period the tanks were emptied, lifted and then moved to the Tunnel Storage at Valley. Further, there is evidence in the decommissioning records of Woodside that residues from the decontamination of WS31 were conveyed to Valley for safe disposal.

Some 60 years have now passed since these sites were decommissioned and, as mustard gas degrades slowly by hydrolysis in the presence of cold water, any residues which may have been left in the ground should have become more benign as time passes due to its reaction with ground water.

A Personal Note

The writer's interest in these two sites was stimulated because of personal knowledge of both sites many years ago. As a child in the early 1950s he walked with his family along the road at Woodside on many occasions. The only occupants in pre myxymatosis days were scores of rabbits. The site clearance appears to have been so thorough that there was then, and still is now, no identifiable evidence of the site having been anything other than a pleasant country field; indeed, it was only very recently that the writer discovered its wartime significance. The ring road around Antelope Field was used as a venue for motor cycle racing in the late 1950s and early 1960s and the writer spent pleasant family afternoons watching the races there. Now an industrial estate, no evidence remains of its wartime role and the public house which gave the site its name has recently closed its doors.

Acknowledgements

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The cover photograph is from the writer's collection.

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1 Letter to F C Everett from ICI Runcorn, ref. HSH/CL/V 20/05/40 (E. Lloyd Davies Collection)

2 Letter to Sir Keith Price from H. Gaskell 21/05/40

3 Letter to Sir Keith Price from H. Gaskell 24/05/40 (E. Lloyd Davies Collection)

4 Inventory for M.S./C.D. Factory, Valley, Rhydymwyn, Nr. Mold as at December 31st 1944, F. S. Bramwell, 30/3/45 (E. Lloyd Davies Collection)

5 ICI History of Factory Activities 1940-45 (The Thomas Report), p.64

- 6 History of factory and plant construction by Imperial Chemical Industries,
On behalf of Ministry of Supply and Ministry of Aircraft Production:
Randle, Springfield, Valley and forward filling depots (1944) The National Archive Supp5/1003
- 7 From undated PSA map of the Valley Works
- 8 Thomas, op. cit. p.150
- 9 Supp 5/1003, op. cit.
- 10 The Thomas Report, op. cit, p.143 and p.150
- 11 Inventory for M.S./C.D. Factory, Valley, Rhydymwyn, Nr. Mold as at
December 31st 1944 (F. S. Bramwell, 30/3/45), p.1
- 12 From photo mosaic of effluent pipeline route.
- 13 Sketch based on ICI Drawing J42401 of December 31st 1944 (DEFRA Records, Alnwick)
- 14 Inventory for M.S. /C.D. Factory, Valley, Rhydymwyn, Nr. Mold as at
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