

# FORWARD FILLING DEPOTS

BY

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- ❖ F.F.D.1 – Heath Site - Barnham
- ❖ F.F.D.2 – Lake Site - Melchbourne Park (RAF Riseley)
- ❖ F.F.D.3 – Triangle Site - Norton Disney
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## ***1. Evolution***

In 1938 during the build up to the up and coming war with Germany the British government expected chemical warfare to be used from the outset by both sides. The Government also thought that the prelude to an invasion by the Germans would involve a knockout blow delivered by the Luftwaffe upon the Government, RAF airfields and war factories. This caused Government Departments in discussion with ICI; to examine ideas for the dispersion of the bulk storage of mustard gas along with facilities for the filling of munitions with this gas, at various sites around the country, away from the manufacturing base and heavily populated areas, to ensure continuation of supply. In September of 1938 ICI had prepared and submitted a scheme that included 1500 ton lead lined concrete storage tanks, with the tanks compartmentalised into four 375 ton sections. This scheme was not developed any further at this time, and the bulk storage remained local to the vesicant production factories.

In 1940 the war cabinet and chiefs of staff still believed that Germany would resort to the use of chemical weapons and would therefore not permit a reduction in the rate of production. This coupled with the unforeseen problems of leakage, and rapid deterioration of the filled weapons, led to the need for more bulk storage. This was highlighted in a letter from ICI sent to the ministry of supply, stating that it is evident that until gas warfare breaks out it is going to be difficult to keep our factories working, even to minimum capacity, unless you can arrange further bulk storage facilities in the immediate future. In a letter to ICI dated 18 July 1940 the Ministry justified its acceptance of the company's demand for more storage capacity, stating:

“The basic idea behind the emergency storage is that if the enemy decide to use gas, then it is highly probable that he will first attempt to disable Randle by air attack, and the services feel that the possession at other places of stocks of gas might in certain circumstances prove extremely important.”

This authorisation led to the bulk storage satellite site at Woodside adding 540 tons of additional storage in nine 55 ton lead lined steel tanks. ICI also suggested that Woodside be supplied with an emergency charging unit, and on this request the approval was given in September 1940, and the installation was carried out consisting of four temporary charging units. Woodside went through further expansion adding another nine 55 ton units and nineteen 65 ton tanks along with two 55 ton tanks for the storage of Larmine. With Woodside operational the problem of filled weapons had been addressed but the strategic bulk storage of vesicant was still based in one geographical location and not dispersed.

Whilst Woodside was being expanded the idea of the dispersed storage and filling site again arose, and the subject was discussed at a meeting held in London in December 1941, following this meeting, in January 1942, the first proposed Forward Filling Depot site was surveyed, this was a satellite to the Barnham Air Ammunition Park (AAP) near Thetford.

By 1942 the relatively small supply of corrosive resistant steel manufactured in Britain, of the type used in the construction of the bulk storage tanks of the chemical manufacturing factories and at Woodside, had been diverted to other high priority purposes, and the production of the vesicant had almost come to a standstill due to the lack of more containers for bulk storage. The chances of sourcing the chemical tanks in the United States were slightly better, but with space on ships at a premium stringent shipping priorities forbade the shipment of empty containers. In the month of February the Woodside satellite to the Valley Works received approval for a further expansion of its storage capacity by means of one number 250 ton tank. This was to be constructed in concrete and then lead lined to provide a seepage proof seal. The importance of this tank was not just being the capacity of 250 tons but the lead lining that solved the steel shortage issue and made the scheme viable. This tank was regarded as experimental and along with the installed pressure charging units that worked by gravity filling, not vacuum filling as carried out in the factories; formed the basis of a forward filling Depot and showed that the idea could work, on the basis of the above. Following the production of preliminary plans for the Barnham site produced in April 1942, a scheme was produced and costed for an emergency charging station, and submitted although the site to which the scheme related was unspecified. In the October of this year costings were presented to the Air Ministry and the approval was granted for three sites, namely: Barnham, Melchbourne Park and Norton Disney. In November and December 1942 schemes and cost estimates for Lords Bridge and West Cottingwith were submitted and approved. Construction began at the Barnham site on 5th November 1942, Melchbourne Park started two days later on the 7<sup>th</sup>. Further revised cost estimates for Lords bridge and West Cottingwith were approved in February 1943, and on the 18<sup>th</sup> February work started on Norton Disney. The 16 March 1943 saw the start of the work on Lords Bridge, with the 5<sup>th</sup> and final site at West Cottingwith starting on 28 March.

With the operation of both FFD1 and FFD2 coming under the control of the USAAF Service Command these sites required additional works that intern would incur additional costs; this additional expenditure was approved in August 1943.

It should be noted that in 1942 Britain supplied a quantity of chemical warfare materials to the Americans, even though this was small in quantity and only token deliveries had been made, from July 1942 until the following July the American gas warfare retaliatory potential in Europe depended totally on British resources. The measure of Britain's contribution to the US Chemical Warfare Service was gauged in terms of their willingness to co-operate, along with their readiness to provide both technical and operating experience information, just as much as the provisions of supplies under reverse lend-lease.



## 2. The Sites

Of the five forward filling depots four sites F.F.D.1,3,4,5 were selected by the Air Ministry, F.F.D.2 was selected by Colonel Kellogg of the USAAF and Lt. Col. Albert H. Hooker, Chemical Officer, 8<sup>th</sup> Army Air Force Service Command who also chose to supply the airfields around Thetford from the Barnham site F.F.D.1. The construction of the two USAAF depots would be carried out by the British under reverse lend-lease authorisations.

All where to be positioned close to or within existing weapon storage areas and all where within close proximity to the forward bomber Airfields. The benefits of this being:

A) The reduced supply chain from the existing method that involved the supply of filled weapons directly to the Air Ammunition Parks, from the factory at Randle or from MSF Valley/Woodside. If as was thought gas would be used, the quantities involved would have completely overstretched the existing supply chain. Supply now via the F.F.D's, enabled filling and distribution close to the Bomber Airfields.

B) The dispersal of the filling sites reduced the possibility of disruption to the supply if attack or accident rendered the main bulk storage sites inoperable.

### 2.1. Forward Filling Depot 1

The Little Heath site at Barnham was 3.5 miles south of Thetford, South of the existing Air Ammunition Park (AAP) that served Bomber Command off of the Elvedon Road. This was designated Forward Filling Depot 1, and codenamed Heath Site by the British. Construction work commenced on 5<sup>th</sup> November 1942. The depot was served by a small rail spur off of the Thetford – Bury St. Edmunds Railway Line. The USAAF took control of the depot on the 29<sup>th</sup> January 1944 and assigned it US Army Air Force (AAF) Number 517. The principle units assigned over its WWII operational life being the 754 Chemical Depot Company (Aviation) and the 765 Chemical Depot Company (Aviation).



Picture taken of the same spot in 2010 the emergency bath house and the fencing on both sides have gone and the position of the pot is now a depression since the removal of the pot. © by Graham Smith 2010

The US referred to their depots as Advanced Chemical Parks and not Forward Filling Depots.

F.F.D 1 - The building shown is the emergency bathroom, to the right is the Bonding shed with the entrance for the rail trucks just visible, to the left of the emergency bathroom on the far side of the fence is the rail line for supply of the vesicant for the pots, the position of the middle pot can be made out in the foreground. Picture courtesy of Major Toller, After the Battle No 79.







Of the five sites, FFD2 was the only one that was not served directly by rail but from a dedicated siding on the North side of the line, on the East side of the B660 from Kimbolton Station, on the Kettering to Cambridge Railway Line. It is understood that the mustard gas tanks used for the transportation of vesicant from the manufacturing plant, were specially designed road/rail tanks supplied in 1943 by the USAAF, they arrived at the siding mounted on flat bed rail wagons, were lifted by a dedicated gantry over the siding, and traversed onto the adjacent flat bed road trailers at the secure siding, and transported by road under 'special precautions' to the FFD.

**2.2.1. Kimbolton Siding**

The siding itself ran off of the main line and then split itself into two lines. At the side of each line running approximately 50% of the branch were concrete roads topped with black Asphalt. These roads start as one at an entrance off of the B660, on entry to the site on the left is a brick built guard house with the same pre cast roof beams as used upon the FFD buildings with the 'U' shaped side of the beam facing down in the non-splinter proof construction method. After passing the guard house the road splits either side of the two lines and continues approximately 50% of the rail siding, at the end of the two roads are turning circles for the trucks and just before this were the steel gantries that held the lifting equipment, these gantries ran across both rail lines and the roads. These were used for the unloading of the tanks onto the trucks for transport to the F.F.D.



Kimbolton – Dedecated Road/Rail siding for transfer of CW and Vesicant to FFD 2 © by Graham Smith 2010



Kimbolton – Picket Post/Office at the entrance to the site from the B660 in 2009 © by Graham Smith 2010

Kimbolton – Remnants of brick bases from the unloading gantries 2No the remnants of the train line can be seen between the first pair. © by Graham Smith 2010

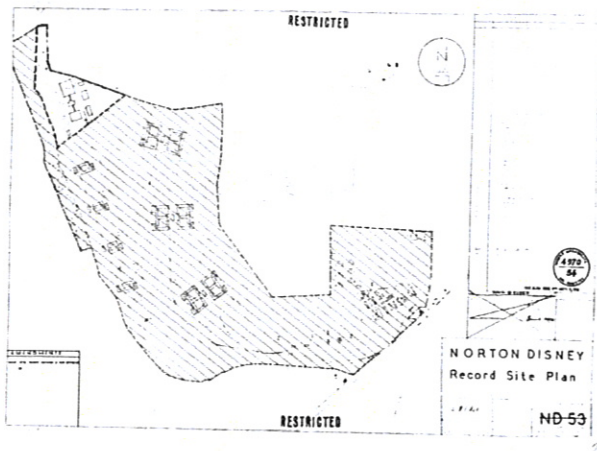


Melchbourne House played host on 21<sup>st</sup> July 1944 to Glen Millar and the American Band of the Supreme Allied Command who played a concert for 750 men, Glen Millar was to fly out of RAF Twinwoods Farm an airfield close to Melchbourne Park on 15<sup>th</sup> December 1944 never to be seen again

### 2.3. Forward Filling Depot 3

The Norton Disney site was 8 miles South West of Lincoln again positioned within an existing AAP. This park served 5 Group and began its life in August 1939 as RAF Swinderby after the railway station of the same name. It was re-named Norton Disney in 1940 following the establishment of the Airfield RAF Swinderby that opened in August of 1940 (The RAF named their airfields after the nearest Railway station even though the airfield was closer to Norton Disney and the AAP was at the side of the railway station). The site was operated by 93MU. In March 1943 a sub site at Spalford Wood, just south of Spalford village and south west of RAF Wigsley, for the storage of chemical weapons was opened.

The Forward Filling Depot was designated FFD3 and codenamed triangle site. Construction work began on the 18<sup>th</sup> February 1943 and was handed over to 93MU on 21<sup>st</sup> April 1944. It was positioned at the northern end of the AAP and was served by the existing spur off the Nottingham to Lincoln



line that branched off at Swinderby Station into the existing AAP. A gated entrance to the north of the site gave access off Lower Wood Lane.

Left - Site Layout from 1957 with the original RAF Norton Disney Air Ammunition Park shown hatched and already sold off. The F.F.D 3 site is shown in the top left corner still in MOD hands. Courtesy The RAF Museum, Hendon

### 2.4. Forward Filling Depot 4

Lords Bridge was 5 miles South West of Cambridge, within an existing AAP that served 2 and 3 Groups that had been opened since 16<sup>th</sup> November 1939. Lords Bridge also supplied three sub depots at Meldreth, Riseley (Melchbourne Park) and Bourne and had a detachment of USAAF

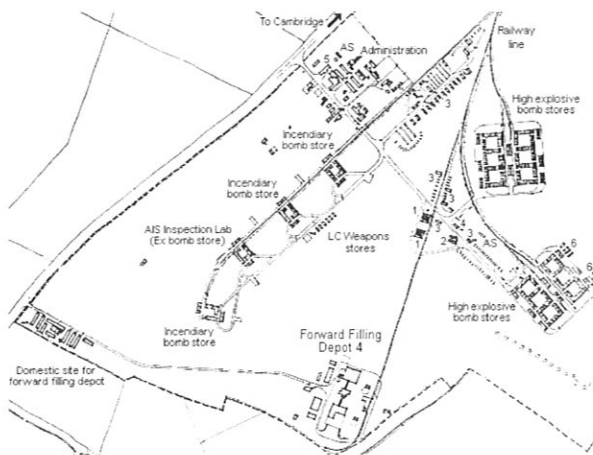


personnel on the site and was therefore also given an AAF number by the USAAF of AAF 599.

Left - F.F.D 4 Bridge Site – Viewed from the site entrance. To the left in the foreground is the Guardhouse/office to the rear can be seen one of the two re-clad bonding buildings, the brick building attached is the covered walkway coming from the charging building that is just visible on the right. © by Graham Smith 2010



The Forward Filling Depot on this site was designated F.F.D. 4 codenamed Bridge Site and served by an extension of the existing spur off of the Bedford to Cambridge Railway Line, that branched off at Lords Bridge Station into the AAP. Construction work began on 16<sup>th</sup> March 1943 and it was handed over to 95MU on 30<sup>th</sup> April 1944 although both ‘pots’ were filled by the 22<sup>nd</sup> March. The F.F.D. site was on the southern end of the AAP with the entrance being at the end of a 500 yard road running off of the A603. The domestic site was situated on the southern side of the road vehicle entrance road at its junction with the A603.



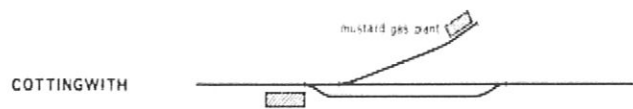
Left - Air Ministry Drawing No 4619/44 Dated 1944 showing the AAP Lords Bridge site layout F.F.D 4 can be seen at the southern end of the site. Courtesy of RAF Museum London

### 2.5. Forward Filling Depot 5

The last was West Cottingwith, this was 8 miles South of York and approximately 4 miles south east of the existing AAP at Escrick. This Forward Filling Depot was designated FFD5 and codenamed Station Site. Construction commenced on 28<sup>th</sup> March 1944 and was completed and handed over to 80 Sub MU on 1<sup>st</sup> June 1944. The depot was served by the Derwent Valley Light Railway Line, and was situated on the north side of Common lane, Cottingwith station was situated on the south side of the road. This line had been closed to passenger trains in 1926 and was a line dedicated to freight transport. This depot came under the control of 80 Sub Maintenance Unit



Above – View of the Derwent Valley Railway Line from Cottingwith Station showing the F.F.D 5 siding veering off to the left into the site, the F.F.D’s fencing can also be seen. (Picture by K.P. Plant) taken from The Industrial Railway Record No51, by R.R. Darsley



Layout 1943 Showing the F.F.D 5 rail siding and Cottingwith Station. Courtesy The Industrial Railway Record No51, by R.R. Darsley

Following the selection of these sites they were surveyed by employees of ICI and it was ICI that approved their suitability for the purpose.

### **3. Construction**

ICI's Special Products Department prepared both the civil engineering and the mechanical drawings for all five FFD's in their own drawing office. Only the drawings relating to the structural steelwork and specialist items of mechanical equipment were produced by the relevant specialists.

Due to the speed of build required on FFD1 & FFD2 (the first two approved sites) the civil engineering contracts for them were placed on a Prime Cost Basis, this entailed the contractor invoicing as the quantities used with a percentage added for overheads and profit. The contracts for these were placed with J. B. Edwards & Co. The contracts for the remaining three sites were placed with J. Morgan & Co on the basis of Measured Bills paid in accordance with Ministry of Works Standard Schedules, this entailed the contractor pricing quantities set against the Standard Schedules.

The bulk of the mechanical works for all of the sites was carried out by one contractor, that being Hadens Ltd. ICI fitters were responsible for the installation of all of the charging units and instruments.

All of the above works came under the supervision of ICI engineers.

#### **3.1. The Storage Tanks**

The bulk storage capacities consisted of the following:

FFD1 and FFD2 had three number lead lined concrete storage tanks (pots) each of 500 ton capacity, whereas FFD3,4 and 5 each had two number 250 ton capacity, the reason for the increased capacity on the USAAF sites arose from the initial requirement for the simultaneous charging of four USAAF weapons, the M47 100 pound bomb that was available in small quantities, the 400lb "Flying cow" spray tank, the British 65lb LC, and the 30lb LC bombs. The USAAF were sceptical about the performance and usefulness of the last two weapons, they also did not form economical operational loading within American aircraft. The final decision was later altered to charge two types: the 65lb LC bomb with a rated charging capacity at the depots of 1000 weapons per day and the M33 spray tank at 240 weapons a day charging capacity of unthickened vesicant. The RAF requirement was for the charging of the 65lb LC bomb only again at 1,000 weapons per day capacity.

The tanks were all below ground and constructed as follows, excavation of the holes required the need for drag line excavators and in the case of FFD1 a tractor and scraper was also required. Where required de-watering plant had to be installed to prevent flooding within the holes during excavation. A reinforced concrete base was cast followed by the erection of the walls, these were pre-cast units covered with a lead lining and positioned to form a circle on the base, the space between the wall units and the wall of the excavation was filled with concrete. The roof of the tanks

was formed with steel shuttering on which the lead lining had been fitted. The base of the tank was covered with lead and lead joints within the tanks were burned together to seal the joints. The burning of the lead joints in the tanks was carried out by ICI on four of the sites. The 500 ton tanks were 34ft 10in inside diameter and 15ft 6in deep. The 250 ton tanks are thought to be 25ft diameter and 15ft deep. Because the vesicant was prone to freezing at low temperatures the tanks were oil heated. A brick building was constructed at the side of each of the storage tanks to house the instruments and plant for the monitoring and heating of the tanks.

Each of the tanks had a designated reference these being:

FFD1 three tanks Designated A, B and C 500 tons each

FFD2 three tanks Designated D, E, and F 500 tons each

FFD3 two tanks Designated G and H 250 tons each

FFD4 two tanks Designated I and J 250 tons each

FFD5 two tanks Designated K and L 250 tons each

During their operational periods the types and quantities of vesicant stored was

FFD1 1,500 tons Runcol

FFD2 1,500 tons Runcol

FFD3 250 tons Runcol

250 tons Pyro BD

FFD4 250 tons Runcol

250 tons Pyro BD

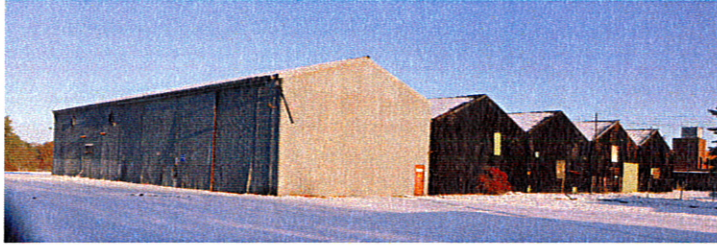
FFD5 500 tons Pyro BD

Runcol (HT) was produced by reacting thiodiglycol with hydrochloric acid and was the more expensive of the two types to produce. Pyro (HS) was produced by combining ethylene with sulphur dichloride; less expensive to produce, however it did not store well when charged in munitions.

### **3.2. The Buildings**

The building types and the methods of construction employed were similar on all five sites although the shapes, sizes, and orientation of them differed. The largest building on the site was the empty storage building. These were steel framed and clad with corrugated sheets. The building at FFD1 consisted of 4 bays (a fifth shed appears to have been added at a later date.) FFD3 also appears to have had four bays whereas FFD2, 4 and 5 had empty storage buildings consisting of two bays. In all cases the buildings were built on a raised raft type base forming on one side a large loading bay which enabled the empty weapons to be loaded into the building from their delivery trucks.

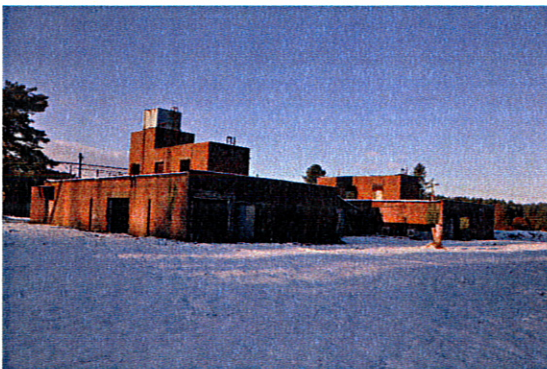




Left - Empty storage building at F.F.D 1 Heath site showing 5 bays, the bay on the left appears to be a later addition. © by Graham Smith 2010

The empty storage building was linked to the charging building by a covered way constructed with brick walls and corrugated steel arched roof. The decision by the USAAF to charge the 65lb LC bomb and the 400lb spray tanks required alterations to the original plans and required the need for an additional charging building that also required a covered way. Reference is also made in official US history documents that charging of both toxic and incendiary bombs was to be carried out at F.F.D 1 and 2

The charging buildings were constructed in brick, the openings spanned by cast onsite concrete lintels, the roof consisted of pre cast concrete beams spanning across the building at the shortest distance, supported inside the buildings by steel RSJ beams and stantions. A brick built first floor housed the tanks for the vesicant charging with holes cast through the floor for the pipes to pass.



At FFD1 and 2 one charging building was of two storey height with the second building reaching three storeys in height with a water tank placed on the roof.

Left - F.F.D 1 – This picture shows the two charging buildings, the covered walkways from both buildings have been demolished. © by Graham Smith 2010

The charging building roofs had the pre-cast concrete beams placed the opposite way up compared to the rest of the brick buildings. Therefore the 'U' shape was facing upwards, the planks were then grouted and the 'U' shaped channels were filled with concrete giving a more robust and splinter proof construction.

The sizes and shapes of the charging buildings differed from site to site and in the case of FFD1 the two charging buildings differed in size, layouts of FFD2 indicate that both charging buildings were the same size.

The vesicant was transferred from the bulk storage tanks, to the charging buildings via pipelines by pump and therefore under pressure, this simpler method was a departure from established factory practice that used vacuum transfer. The pressure transfer method permitted the installation of less complex equipment at the FFD's than the main factories and the charging units installed were based on the units developed at MSF Springfields incorporating JR heads. Having considered that JR may refer to a measuring container "Just Right" dose for the 65lb LC bomb, it is clear that the charging machine had at its top a measuring jar encased in a metal hold fast with a sighting window in the front.



Left: A View inside from inside one of the charging buildings showing the stations and steel beams, also visible in the roof adjacent to the closest beam are three holes where the vesicant pipes fed through from the tank above. © by Graham Smith 2010



Right : Holes for vesicant pipes  
© by Graham Smith 2010

Left : The brick 1<sup>st</sup> floor building of one of the charging buildings that housed the vesicant prior to charging into the weapons showing the 3 No pipe holes feeding through to the charging equipment below. . © by Graham Smith 2010



Filling of the weapon was carried out by connecting the LC bomb to an 'In' and 'Out' pipe. In the middle of the can was an open viewing cap. The valve was Opened to fill the JR head to just above sight line, this valve was then closed and the valve to fill the LC bomb was opened, when fully charged the valve was closed and the viewing cap was lightly put on then passed to inspection. The LC was then inspected for correct fill, then the viewing centre cap fixed in place.

The official American history of chemical warfare states that at a later date (actual dates are not indicated) the two American advanced chemical parks, F.F.D.1 and 2 had installed by the 8<sup>th</sup> AFSC American toxic and incendiary filling equipment, what is not clear is whether these machines had been installed to complement the charging units already installed by ICI or the original units had been de commissioned and removed before hand. To add credence to this the latest de commissioning to take place at F.F.D.1 in 2009 found buried on the site 65lb LC bombs, 400lb flying cow spray tanks and 100lb M47 US aircraft bombs.

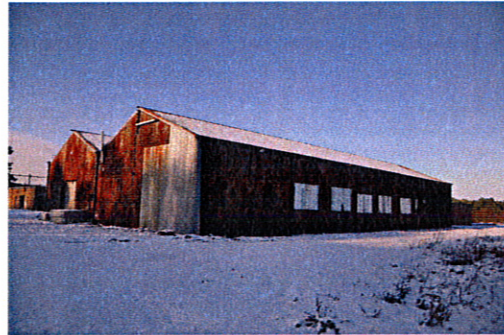
When the weapons had been charged they left the charging building via the opposite end of the building and through another covered way of the same design as the first into the bonding building. As with the entry covered ways at F.F.D.1 and 2 they both had an additional exit and entry covered way.

The bonding building was a steel frame metal clad building that again varied from site to site, F.F.D.1 was a two bay rectangular shaped with an internal loading bay that the train would back its wagons through. F.F.D.2 was a two bay rectangular structure the same as F.F.D.1; but F.F.D.2 had no rail head and would have a loading bay for Lorries. F.F.D.3 again had the same design as the previous two. F.F.D.4 had an L shape layout with one bay of full length and the second bay being approximately a quarter of the length of the large building and an external loading bay for lorries,



there is no evidence of a train line running along the side of the loading bay. The layout of F.F.D 5 is similar to that of F.F.D 4 and the writer believes that the loading bay was for trucks and Lorries but did not accommodate rail wagons.

Right - F.F.D 1 – Bonding building viewed from the South West, the light coloured cladding covers the original exit for the wagons or trucks © by Graham Smith 2010



Ancillary buildings consisted of a guard house at the site entrance although at F.F.D.3 the guardhouse was included within the site office. All other sites had a dedicated office, a store, a workshop and store building, a mess room that accommodated both toxic and non toxic operatives, toxic change and bath house. Steam was provided via the boiler house that contained a boiler of

2000lb/hour capacity at 105lb working pressure. In the case of FFD2 the boiler was of 2500lb/hour.



Left - F.F.D 1 – In the foreground is the Personnel de-contamination and changing room behind that is the toxic and non toxic mess building and at the rear is the office block. © by Graham Smith 2010



Left - F.F.D 1 – The roof structure in the personnel de-contamination and changing room indicating the roof beams with 'U' section facing down in the non splinter proof construction method © by Graham Smith 2010

Right – F.F.D 1 – The roof structure in one of the two charging buildings with the roof beams with 'U' section face up, this was then filled with concrete to form a more robust 'splinter proof construction'. © by Graham Smith 2010



Water was supplied on F.F.D. 1, 3 and 4 by means of boreholes and pumped to the surface, in the case of F.F.D.3 the bore hole reached a depth of over 1000 feet. The water at F.F.D.2 was sourced from an RDC supply or from an air ministry main. The process water was pumped from a neighbouring lake. At F.F.D.5 the domestic water was obtained from an R.D.C main but the process water was sourced from a borehole, a building was constructed on the sites to house the pump and



equipment required to extract the water from the boreholes. All of these buildings were of a brick construction again with cast onsite concrete lintels over openings, the windows are metal and the pre cast concrete roof beams forming a flat roof, the beams on all of these buildings differed from the charging buildings in that they had been placed in the non splinter proof position speeding and cheapening the build.



Left - F.F.D 1 – Boiler house © by Graham Smith 2010

Emergency water supply tanks were also constructed partly below ground within brick lined walls and sika rendered internal face of 2000/2500 Gallon capacity. All sites had constructed just outside of the perimeter fence a brick mixing chamber that collected the untreated effluent from the sites, here it was treated until it passed sampling, from where the effluent was discharged to either soakaways or neighbouring drainage ditches.



Right - F.F.D 1 – Brick mixing tank used for the collection of effluent for treatment prior to discharge to soakaways. © by Graham Smith 2007

Electricity required on the sites was obtained from the nearest supply Company with the incoming supply varying from site to site, between 6,600 and 11,000 volts. The sites installed capacities range from 200 to 250 KVA.

#### 4. The Build Programme

The programme of build on all of the sites overran from the original completion dates. On the 12<sup>th</sup> April 1942 the USAAF commanding General, Major General Henry. H. Arnold submitted Operation Bolero for authorisation. Operation Bolero was the codename for the US military buildup in the UK that had been planned and produced by the operations Division of the War Office and the USAAF, and involved the movement and housing of over a million men and the basing of 36 bomb groups, 17 fighter groups, 6 observation groups and 8 transport groups, initial workforce required for the immense number of construction projects was to be supplied by the UK workforce. Also at this time men were being conscripted at a rate of 20,000-25,000 per month (early 1942) and was to increase again by another 15,000 per month. This caused a major drain on manpower and in December 1942 the Minister of Production Oliver Lyttelton, recommended a complete cessation of new works not required for Operation Bolero, the War Cabinet accepted this. The national emergency that arose from the threat of a German invasion of the UK had by 1942 diminished but the belief that the

Germans would use chemical weapons against the Allies in the defence of Europe was still a concern. Therefore the Construction of the F.F.D's continued. A secrete memo by Winston Churchill dated 6<sup>th</sup> July 1944 stated:

"It may be several weeks or even months before I shall ask you to drench Germany with poison gas and if we do it let us do it one hundred percent. In the meanwhile, I want the mater studied in cold blood by sensible people and not by that particular set of Psalm-singing uniformed defeatists which one runs across now here now there" WW2 Bombing by Burgdorff & Habbe

It became impractical for the Controller of Building Construction and the Ministry of Supply to provide the adequate labour, also what it did provide was of poor quality. The dates of which the individual sites were handed over to their relevant USAAF or RAF authorities are listed below.

F.F.D.1	29-1-1944
F.F.D.2	30-6-1944
F.F.D.3	21-4-1944
F.F.D.4	30-4-1944
F.F.D.5	01-06-1944

During construction the workforce peaked in June 1943 at a total for all sites of 925 and approximately 1,700,000 man hours of direct labour had been used in getting the Depots completed.

The charging of weapons under test conditions was carried out in 1944 at F.F.D's 1 and 5 and was deemed satisfactory.

At the time of the final report being produced by the Ministry of Supply SUPP5/1003 the final cost estimates of the Depots approved by the Ministry of Supply was as listed below, also shown are the actual expenditure and commitments as of 30<sup>th</sup> June 1944.

Depot	Cost Estimate	Expenditure and Commitments to 30-6-1944
F.F.D.1	£217,000	£208,425
F.F.D.2	£230,000	£219,000
F.F.D.3	£98,200	£104,000
F.F.D.4	£97,500	£102,000
F.F.D.5	£104,400	£99,000

The expenditure and commitment costs for F.F.D.3, 4 and 5 were estimated because final bills for the construction had still to be agreed.

In 1948 a Final account statement issued by ICI relating to the costs for all 5 F.F.D's was

F.F.D.1	£211,114
F.F.D.2	£221,067
F.F.D.3	£106,585
F.F.D.4	£102,219
F.F.D.5	£108,770

Added to the cost of construction was the cost of keeping them at a state of readiness and the compliments of men on each of the USAAF depots was as follows:-

F.F.D.1	31 <sup>st</sup> March 1944		
	Officers	9	
	Enlisted	180	
	Total	189	
F.F.D.2	31 <sup>st</sup> March 1944		
	Officers	12	
	Warrant Officers	1	
	Enlisted	255	
	Total	268	

The British depots were operated under the parent AAP's and therefore personnel levels for the specific F.F.D's are not available.

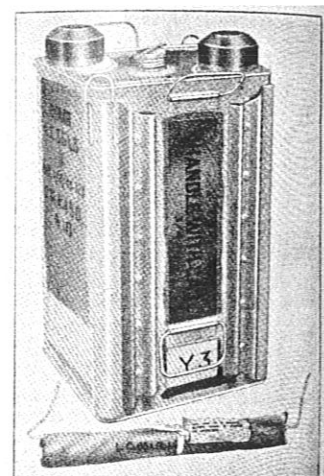
Provisions of hard standings and Romney huts were constructed at each of the USAAF depots providing storage provisions for 4,000 tons of chemical ammunition and 6,000 tons of incendiaries.

## 5. The Weapons

### 5.1. The British 65lb Light Case bomb.

This was a slightly strengthened 4 gallon kerosene/petrol can that had fitted on one end a long rectangular flag that provided the tank stability when in flight. The dimensions consisted of 12.5 x 13 x 22 inches with a 59lb charging. The design of the bomb ensured that it would break up from any height and on any surface from water, sand to concrete. This weapon was throughout the war the "standard UK gas weapon". As mentioned earlier this weapon did not suite the

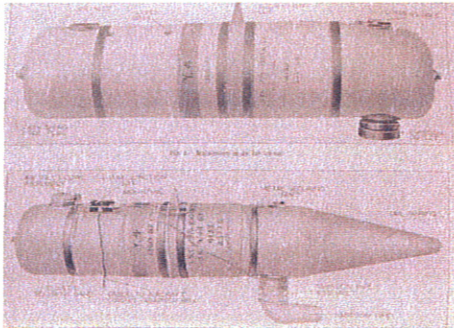
MkII 65lb Light Case Bomb with rolled rectangular flag.





Americans and appears to have been rejected and replaced by the M47A2 100lb aircraft bomb.

### 5.2. The 400lb smoke curtain installation (flying cow spray tank).



TOP - Flying Cow Spray Tank in its transportation state prior to fitting on the aircraft. Courtesy The National Archives

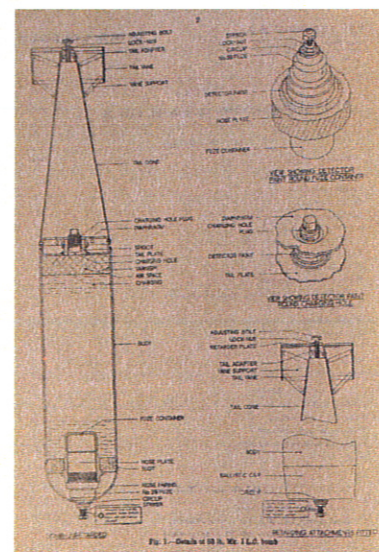
BOTTOM - The tank with detachable pipe fitted ready for use. Courtesy The National Archives.

The flying cow was another British weapon. It was designed to spray the mustard gas with the primary purpose of direct anti personnel attack; this weapon could also be used to eject smoke and was supplied to the USAAF under reverse lend-lease terms. The tank was fitted with an emission pipe that consisted of two parts, one a short steel pipe welded to the tank and the second an aluminium detachable pipe. A bakerlite disc was fitted at the air inlet that was triggered by the pilot, when operated this forced the vesicant out of the tank via the emission pipe. Original operating instructions to the pilot were to return to his base with the empty tank for de contamination and refilling for re-use, though these instructions were later amended which instructed the jettisoning of the tank following use.

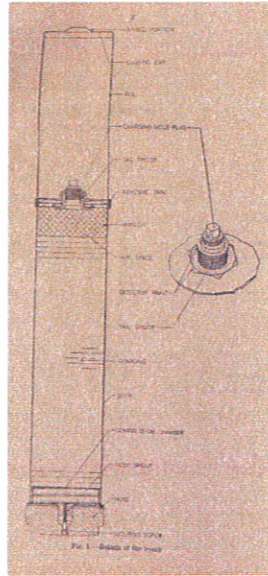
### 5.3. 30lb MKI and MKIILC Bomb.

The MKI was constructed of a heavier gauge material than the 65lb LC bomb and was fused so that on impact with the target the body is disrupted and the charge was distributed over the surrounding area. The MKII functioned also by breaking up on impact with the target but was constructed with the same thinner gauge material as the 65lb LC bomb this type was not fused. Both types were designed for carriage in a 250lb small bomb container and were to be released in clutches of four bombs at a time. The MKI had a length of 32.81 inches maximum to 32.76 Inches minimum whilst the MKII was set at 32.81 long and both were 5 inches approx in diameter the MKI terminal velocity un-retarded was 930ft per sec and retarded of 380ft per sec, the MKII terminal velocity was 430ft per sec. The MKI was to be used against buildings and would penetrate reinforced concrete of approximately 4inches. The MKII was designated for use against hard ground targets such as barracks, factories and supply depots. To protect against corrosion by the vesicant charge that filled 90% of the body, the inside of the body and the outside of the compression chamber was coated with a Bakerlite varnish.

Right - Shows details of the 30lb MKI LC bomb. Courtesy of The National Archives.



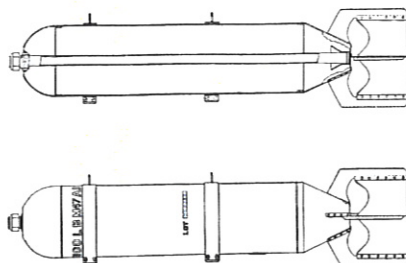




Right – The 30lb MKII LC Bomb casing and details. Courtesy of The National Archives

#### 5.4 The M47A2 100lb aircraft bomb.

This was a weapon manufacture in and by the United States. The bomb was developed to meet the requirements of the Air Forces for a chemical weapon to be delivered by air bombardment. The body of the M47A2 was an improved version of the earlier M47 model with the casing thickness increased from 1/32" thick steel to 1/16" sheet metal rolled and lap welded into a cylinder of 8" in diameter. The M47 walls were deemed too thin and corrosion along with rough treatment caused numerous leakers, the nose and tail fin were welded to the body and this gave an overall length of 45" excluding the fuse, the burster well was screwed into the body of the bomb by pipe threads to ensure a gas tight seal at the nose, around the body two suspension bands were fitted 14" apart, these provided the lugs for suspending in the aircraft. The fuse was a M108 (Nose) and a M4 Burster with tetryl charge when used with mustard gas (H) Filler. When fully loaded with mustard gas the weapon weighed 93 pounds of which 73lb was the vesicant. The bomb was painted blue grey in colour, when charged with vesicant (H) it received two green bands and was stencilled in green. Only the M47A2 was to be charged with vesicant as this was designed to receive the charge without leaking. It was coated on the inside with special oil and had a pressure resistance of 400lb, the M47A1 had a pressure resistance of just 100lb. In practice the M47A2 was subject to leaks but not to the extent of the earlier models and was allowed to be filled with H vesicant as emergency filler.



Left : USAAF M47A 100lb Aircraft bomb – These bombs where to be charged at both the USAAF Depots. Courtesy US Army of Engineers.

## 5.5 M33 Smoke Tank.

This was manufactured in the United States and was at first only available in small numbers hence the supply under reverse lend lease of the British 400lb 'flying cow' smoke tank to the USAAF. The M33 was capable of expelling smoke as well as mustard agent. The tank had a capacity of between 750 and 1120lb of mustard agent if required and this would be expelled through a detachable pipe at the rear of the tank similar to the 'flying cow'.



Above – Members of the Australian Air Force filling a spray tank in the Far East. Courtesy of Mustardgas.org

## 6. Transportation to the FFD's

Transportation of the vesicant from the manufacturing plant/bulk storage site to the F.F.D's or in the case of F.F.D.2 to the dedicated siding at Kimbolton Station, was under "special precautions", with a Decontamination Unit travelling in a passenger carriage or Guards van, and was escorted by a Non-Commissioned Officer and two or three Other Ranks from the RAF or the USAAF.

## 7. Closure

As history shows the Germans chose not to use chemical weapons in defence of the allied assault of Europe, or even in the defence of their homeland. Possibly due to the total air superiority held by the Allies, but more likely due to their knowledge (as they were often reminded by Churchill) that we had stocks of chemical weapons, and he will use them. With the bombing of cities being carried out daily by the USAAF and nightly by the RAF the repercussions for Germany would have been too severe. Therefore as the hostilities of WW2 came to an end the Forward Filling Depots were closed and so the problems of decommissioning began, in October 1945 the first delivery of mustard gas weapons from the F.F.D's was received by RAF Bowes more.

## 8. De-commissioning

### 8.1 The First Decommissioning

After the war the USAAF held stocks of M33 spray tanks exceeding 9,000 in quantity in semi-open storage at Coppice Wood within the grounds of the Melchbourne Park Air Ammunition Park. By the summer of 1947 the condition of these tanks had deteriorated to a very worrying condition and disposal of them was required urgently. The Air Ministry approved what was considered the safest way of disposal and the operation was codenamed Inkpad. This involved shallow pits being excavated in an area of the Coppice Wood just north of the F.F.D site. These pits, eight in number were lined with concrete; the vesicant was decanted from the spray tanks into the pits via long pipes. The mustard gas was dissolved in benzene to make the vesicant flammable and then burnt. The burning of such large quantities of the vesicant produced vast amounts of oily black smoke that

covered the area for the eight months of the process. Scientists from the Ministry of Supply attempted to alleviate any concerns of risk to public health by informing the press that the process was perfectly safe. The speed of the incineration process was slower than the Air Ministry had expected and therefore the remaining tanks were inspected, those that were deemed safe enough to survive transportation were transported to Cairnryan in south west Scotland for dumping at sea. When the incineration at Coppice Wood was complete in March 1948 the empty tanks were decontaminated by a specially designed furnace and this was completed by January 1949. As Operation Inkpad was being carried out, a similar operation was carried out at F.F.D. 5 for the 65lb LC bombs that had been retained by the RAF but had over time started to deteriorate.

## **8.2 A New Lease of Life**

In 1948 tension began to rise in Germany between the West and the USSR and in response to this the decision was made to ensure that the filling capacity of the F.F.D's would be retained and overhauled. After inspections had been carried out it was discovered that the only depot that could be made operational without requiring replacement equipment or spares was Lords Bridge. The storage pots at F.F.D.1 only held 300 tons of vesicant, the pots of the remaining depots were full. The new lease of life was short lived and by June 1949 the disposal process began again.

## **8.3. The Second Decommissioning**

In early 1953 the decision was made that all of the F.F.D's would be decontaminated. The code-name for this operation was 'Pepperpot.' F.F.D.1 was to be the subject of the first stage and this began on 14<sup>th</sup> July, after preparatory work taking several months, in October of 1953, the first of the special tanker trains began the transfer of the 1500 tons of vesicant from the 3 pots to the manufacturing plant at Randle where it was to be reprocessed. On 21<sup>st</sup> October this train started its journey from Barnham to Randle complete with an armed military escort. The following transfers had to be suspended due to initial problems decanting the 'Y3' vesicant due to the cold winter weather and it wasn't until the following spring that the transfers began again. Two train loads in April completed the emptying of Pot 'A', Pots 'B' and 'C' were completed in the May with a total of five train loads being required. The pipework, equipment and plant was dismantled and broken up, decontaminated with copious amounts of bleach and then placed as scrap metal into the empty pots and then the pots were sealed with a concrete capping. The whole of the site was ploughed to a depth of eighteen inches, sprayed with bleach solution and then declared by the Ministry of Supply in November 1954 to be 'SAFE'

The decommissioning of F.F.D.5 began in the summer of 1954 the first train load containing 124 tons of vesicant was delivered to Randle on 12<sup>th</sup> August with the second delivery arriving on the 29<sup>th</sup> August, the same process was applied as that used at Barnham with the plant and equipment being broken down and dumped into the pots then the lids resealed and capped with concrete, the surface was ploughed this time to twelve inches and treated with bleach and again declared 'SAFE'.

F.F.D.3's decommissioning began in August 1954 but was not completed until July 1957. The land received the same treatment as the previous depots yet the plant was removed and transported to Randle to be decommissioned instead of being dumped into the pots.

The decommissioning of F.F.D.4 did not run as smooth, emptying of the pots began in December 1954 with the dismantling of the equipment commencing in January 1955. On the morning of 11<sup>th</sup> January the workforce were cutting up the steel pipe work using oxy-acetylene torches in close proximity to the storage pots. The vesicant at Lords Bridge was 'Y25' this was mustard gas diluted with benzene, the benzene making the gas more effective in penetrating the skin, benzene also made the vesicant extremely explosive and at 10 o'clock pot 'K' erupted in an enormous explosion. The top of the pot was ripped off and thrown several yards and the top of the tank was shattered, a fire erupted immediately following the explosion that produced vast amounts of black toxic smoke over the surrounding area. The RAF fire fighting team donned their anti gas equipment and rushed into action. The NCO in charge of fire fighting at the depot, Corporal John Saunders stood over the edge of the shattered remains of 'K' tank for 30 minutes directing a jet of foam over the flames until they had been quelled. For this act of outstanding bravery he was awarded the George Medal, the citation stating that he had undoubtedly prevented what may well have been a major disaster from the spread of vapours over a wide area, fortunately no fatalities or injuries were received by servicemen or the civilian population. The site commander, Flight Lieutenant Edward Campbell was awarded the MBE (Military Division) for his "high degree of courage and valour directing his men and searching for survivors". For several weeks following the incident both civilian employees and local residents thought to have been at risk had to undergo stringent medical checks, the results of these showed that no ill effects had arisen. Checks were carried out on the environment and no contamination was found present in either the ground or water courses.

The damage to pot 'K' was substantial, 20 tons of vesicant had been destroyed and the pot was leaking, to contain any vapour from the remaining vesicant in the exposed pot a thick layer of foam was maintained on the top until the process of pumping it into the adjacent pot 'J' was completed. Then pot 'K' was decontaminated with bleaching powder. The remaining decontamination process on the depot was completed without incident.

The last of the F.F.D's to be de commissioned, Melchbourne Park was carried out between July 1957 and December 1958, so concluding the F.F.D story however these things are never so simple.

The Air Ministry started to air concern as early as 1954 over the decontamination techniques used at RAF Norton Disney. The ground contamination at the Coppice Wood site at Melchbourne Park was so high that it was thought the area would remain under Air Ministry control indefinitely. In March 1958 a sub-site to RAF Lords Bridge at Marsh Close was found to be heavily contaminated with mustard gas and treatment involving bleach paste was introduced to remediate although no investigation was carried out to find the source of the contamination.



#### 8.4. Operation Coleman Keg

Following the problems mentioned above the Government installed a schedule of regular inspections to be carried out by Government scientists on all 5 former sites. As a result of one of these inspections in the Autumn of 1986, water and soil samples at Melchbourne Park were taken by Harwell Laboratories, these proved to have high levels of toxic materials and therefore the decision



Left - Shows work being carried out on one of the pots at F.F.D 2 during operation Coleman Keg . Picture courtesy of Major Toller, After the Battle No 79.

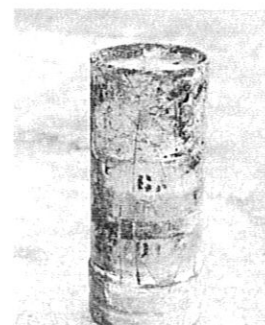


Right - Shows a person in Personnel Protective Equipment inside one of the pots at F.F.D 2 during operation Coleman Keg . Picture courtesy of Major Toller, After the Battle No 79.

was taken to break open the pots that had been sealed during the first decommissioning exercise carried out 30 years earlier, to investigate the contamination. The name given to the operation was 'Coleman Keg'. The Coleman being the company name of the country's most recognised manufacturer of the condiment named mustard, the operation was carried out by both the RAF and a detachment of 33 Royal Engineers Regiment during the summer of 1988. When the lids of the three pots were removed one pot was found to contain, 80,000 gallons of water, solid waste that filled seven skips and 83 flasks of vesicant, the next pot contained 15,000 gallons of water two skips full of waste and 33 flasks of vesicant, samples taken of the water were taken and analysis showed that it was contaminated with various concentrations of vesicant. The final pot when opened up held 5,000 gallons of water, seven vesicant flasks and enough waste material to fill two skips. Upon the emptying of the waste from the pots, they were thoroughly decontaminated, and left in a clean and empty condition.



Left – A view of the lid to one of the pots after removal of the earth covering (the size can be gauged with the two men working by the lid. Picture courtesy of Major Toller, After the Battle No 79.



Above – One of the mustard flasks removed during Operation Coleman Keg. Picture courtesy of Major Toller, After the Battle No 79.

#### 8.5. Further De-Commissioning

In January 1989 a further commitment was made to clear the five F.F.D sites to make them available for disposal. The pots at Melchbourn (now referred to as MOD Riseley) and Norton Disney sites were now to be demolished and the works would be carried out by a civilian contractor under the control of the Property Services Agency (PSA). The work was scheduled to take place in the spring of

1989 and the cost of the works was estimated at £150,000, further decontamination trials were to be carried out at the Bows Moor storage site and on the 4<sup>th</sup> January 1989 financial approval was granted for the sum of £200,000 to be allocated in the 1989/90 financial year, £420,000 1990/91, £630,000 1991/92, £735,000 1992/93, £210,000 1993/94 and £105,000 for the 1994/95 financial year for the clearance of the five F.F.D's and RAF Bowes Moor.

At Riseley three options were considered for the works these being:-

- a) Total removal
- b) Partial removal and smashing the bases.
- c) Reducing the tanks to below deep ploughing depth.

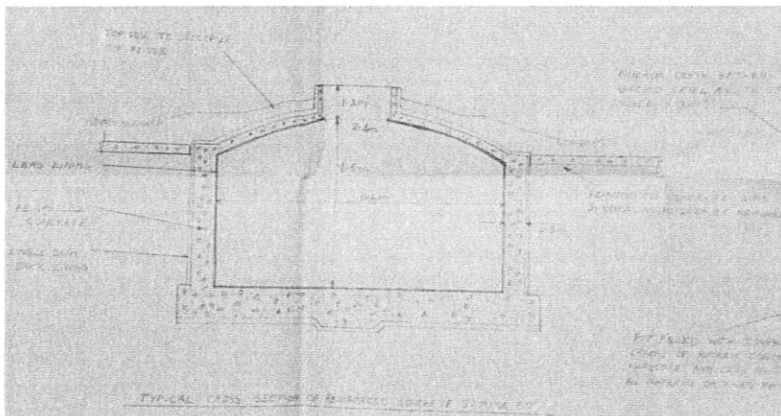
Option a, was dismissed due to the cost of removing the concrete pots

Option b, was dismissed due to the substantial thickness of the base would have required the roof to be removed completely and this would still constitute working in an enclosed space. The high water table level at Riseley would have caused the pots to have filled up with water via the hole in the base rather than drain down.

Option c, was chosen because of the three it was the cheapest and quickest. The additional advantages were, the least amount of work was required around the pots and although the tanks had been carefully decontaminated in previous operations and investigations since then had shown no contamination, there was a slight possibility that vesicant could have entered in between the lead lining and the concrete.

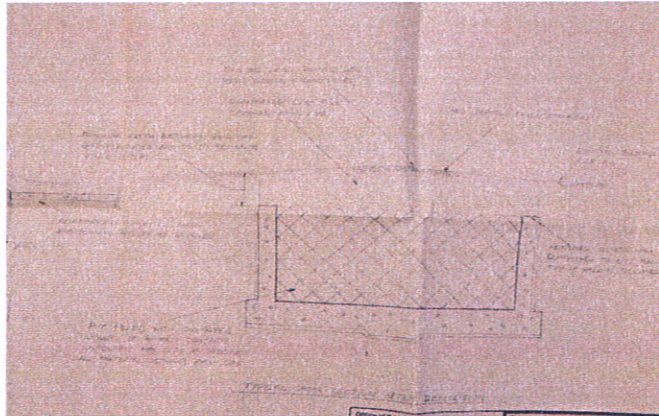
In April 1989 the PSA sent out invitations to tender for the Riseley works, the details of the works read:-

The demolition of three buried reinforced tanks to 0.5m below top of vertical wall. Demolition of brick storage building and various reinforced concrete slabs (adjacent to the tanks). Deposit all materials into the remainder of the tanks, backfill, compact and grade site.



Left – Details of the pots at F.F.D 2 taken from drawings issued at time of tender shows the tanks prior to the works. Courtesy The National Archives.

Right – Detail of works to be carried out on the pots and covering with topsoil on completion from tender drawings. Courtesy The National Archives.



The approximate value was put at £25,000-£50,000 and to last 5 weeks.

At the time of tender the only drawings found of the pot's were sketch plans from ICI of which the dimensions were confirmed from investigations at both Norton Disney and Riseley, Harwell were to be on hand to give technical advise during the operation.

The final specification consisted of the details of works mentioned above with the exception of the tanks being demolished to 0.9m below top of vertical wall.

Any water present in the tanks was to be pumped out; the fill material was to be compacted in layers of 600mm. Alternating between layers of 100mm compacted clay. The 900mm **below the vertical wall** was to be of compacted as dug clay in 300mm layers. The top was to be spread with topsoil. All material was to be sourced from the site and no material was to be taken off of site.

Four companies tendered for the works and prices ranged from £7,800 to £19,200, the cheapest at £7,800 by Franklyn-Jay Ltd of Rayleigh, Essex was accepted in July 1989. The works was carried out in accordance with the specification and the Certificate of Completion was issued by the Department of the Environment on 22<sup>nd</sup> September 1989.

#### 8.6. REMOVAL OF POTS

In 1991 the RAF returned to all of the sites yet again and this time the lids of the pots were removed the contents were excavated along with the pots, the holes were backfilled and a further decontamination was carried out.

### 9. The Organisation for the Prohibition of Chemical Weapons (OPCW)

The Organisation for the Prohibition of Chemical Weapons (OPCW) is the implementing body of the [Chemical Weapons Convention](#) (CWC or Convention). The OPCW is given the mandate to achieve the object and purpose of the Convention, to ensure the implementation of its provisions, including those for international verification of compliance with it, and to provide a forum for consultation and cooperation among States Parties.



All of the sites were until the late 1990's subject to inspection by members of OPCW on a regular basis. In 1997 inspections were carried out at all of the UK's eight former chemical weapons production facilities and it was confirmed by the team that they could never again be used for the production of chemical weapons. In 1998, the OPCW issued certificates of destruction for Barnham Heath, and West Cottingwith, re inspections were carried out at Lords Bridge and Norton Disney following this in 1999 the OPCW issued certificates of destruction for Lords Bridge, and further inspections were carried out at Norton Disney, 2000 again saw Norton Disney being inspected.

## 10.The Legacy

The Heath site at Barnham remained in the hands of the MOD until April 1997 when it was then handed over to the Defence Land Agent to be marketed for sale. The 1.7 acre site is now owned by the Elveden Estate and had been the site for a museum until recently the site was also used as a store for old car tyres. At the time of writing the museum had moved out and the whole site had been cleared and put up for let. Although the site is classed as clean and decommissioned it is still subjected to regular checks for contamination. One investigation carried out in 2009 by the MOD core project team led by Defence Estates including the Defence Science and Technology Laboratory titled Project Cleansweep, resulted in the removal of:-

Four jars of mustard

42 munitions consisting of 100lb M47 bombs, 65lb LC bombs, 400lb 'Flying cow' spray tank.

27 bins of contaminated soil.

7 bins of scrap metal.

The Heath site along with Lords Bridge are the most complete sites standing today. With the Auxiliary buildings, the empty storage building with an additional bay added on the charging buildings and the loading bays still standing, although the covered ways have been partially removed the original site security fencing consisting of pre cast concrete posts remains, the train line that once ran into the depot has been totally removed except for part of the line crossing the access road.

The Lake site at Melchbourne, this was renamed RAF Riseley after the war has been totally removed with the exception of one of the original store buildings, the site has been completely obliterated from the area, where all of the brick buildings, charging, empty storage, bonding and loading bays once stood is now an empty field.



Left – F.F.D 2 the sole remaining building on the site at time of writing this being the emergency de-contamination building . © by Graham Smith 2010

The Coppice Wood area is a different case though and the whole area used for the burning of vesicant is still fenced off with an area of approximately 1.5-2.0 meter sterile area cleared around the outside of the perimeter fencing. The MOD warning signs are also fixed to the fence warning of poisonous gas, this area the writer believes is still under the ownership of the MOD.



Left – Perimeter fencing and Warning signs on the inside of the Coppice Wood burning site. © by Graham Smith 2010

Right – Picture taken outside of the Coppice Wood perimeter fence showing the 1.5-2.0m clearance of vegetation to allow the fence to be checked. © by Graham Smith 2010



On 7<sup>th</sup> April 1998 MOD Riseley was again mentioned in Parliamentary questions regarding mustard gas removal with Mr John Spellar MP response being!

*“We have a number of sites which are being steadily cleared up. Contaminated areas are fenced off, warning signs are put up, and we are in a steady programme of eliminating those chemicals on those sites. It is a fairly expensive business. The estimates I see for Riseley are something over £5 million, but it is part of a steady programme.”*

Triangle site at Norton Disney was sold in 1997 and until early in 2000 the buildings were still standing. These have since been demolished and the site is cleared and used for aggregate storage. The original gate at the entrance to the depot from the AAP still stands. The revetments and cast insitu concrete entrances to the standard bombs stores still stand in various states of condition.



Left – F.F.D 3 remnants of the loading bay at the end of the original bonding building. © by Graham Smith 2009

Right – F.F.D 3 remnants of the loading bay at the entrance to the Empties storage shed. © by Graham Smith 2009

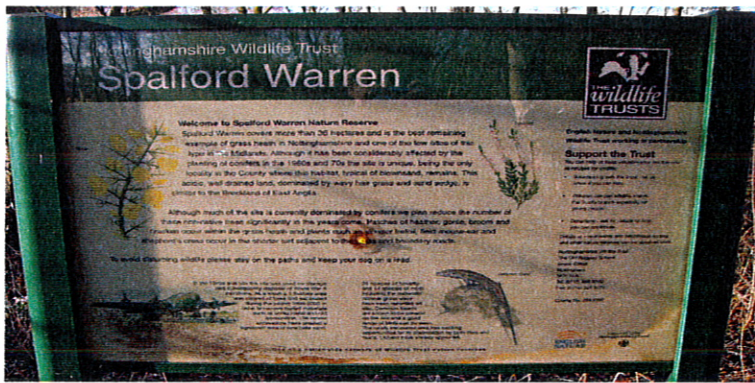




Right – The original entrance gate taken from the AAP looking north into the F.F.D site. © by Graham Smith 2009

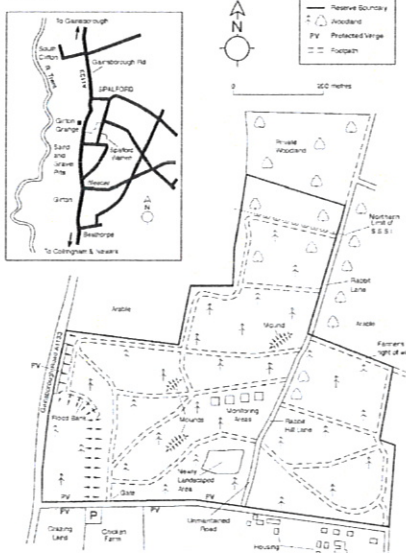


The Spalford Wood site satellite to F.F.D 3 was subjected to Explosive Ordnance Disposal (EOD) in 1998 this has led to the whole site being declared completely clear and has now been turned into the Spalford Warren Nature Reserve.



The information board at the entrance to Spalford Warren indicating its history as an RAF Bomb Storage Depot – But no mention of the chemical weapons!  
© by Graham Smith 2007

Spalford Warren Nature Reserve  
SK 832680



Left – Spalford Warren Nature Reserve indicating footpaths that mirror the original roads of the former sub-site shown on the right. Left Courtesy Spalford Warren Nature Reserve. Right Courtesy RAF Museum London



The Bridge site at Lords Bridge is largely complete; the AAP site was closed in 1957 and sold to Cambridge University where the Cavendish Laboratory established the Mullard Radio Astronomy Observatory. The F.F.D site was not used by the University and in 1993 it was used as a store and



proving ground for fireworks. The area around the bulk storage pots was retained by the RAF until July 1997 when it was handed over to the Defence Land Estate Agents, who gifted the site to the University. The Bedford to Cambridge railway line and Lords Bridge Station closed on 1<sup>st</sup> January 1968.



F.F.D 4 Lords Bridge – Viewed from the south looking North East, the two bays of the building on the left is the roof of the empty storage building whilst the two on the right are of the bonding building, the small building on the far right is new and to the far left are two of the MRAO radio telescopes. © Graham Smith 2009

The Station site at West Cottingwith wasn't declared safe until the 1990's when the pots were removed. In 1995 operation Capsicum Jar was carried out where during the decommissioning operation a cache of live bombs was discovered, some of which were leaking, the clearance operation took a total of 728 man hours to carry out. At the time of writing this paper only three of the buildings remain on the former site these being the personnel decontamination and changing room block, the toxic and non toxic mess rooms and the office block. They are in a dilapidated state and used as farm buildings. The concrete base of the empty storage and bonding buildings are identifiable and the loading dock is still extant. The train line has long been removed and a capping of approximately 1.5m – 1.8m of soil and rubble from the demolished buildings covers the area to the east of the site where the Pots had once been. The Cottingwith train station is also long gone.



F.F.F 5 – Remains of the office building in the foreground followed by the toxic & non toxic mess and then the decontamination & changing room block – © Graham Smith 2010



F.F.D 5 – This picture taken from the site of the former Cottingwith station shows the three remaining buildings to the left whilst to the right is the spoil heap extending the length of the site covering the positions of the former bulk storage 'pots'. – © Graham Smith 2010

## 11. Epilogue

The F.F.D's existed from a concept originating in 1938, and approved in 1942, with the work commencing in 1943 and completed on all sites prior to the D Day invasion in 1944. When the final account was agreed in 1948 the cost of construction had been £749,755 and they were never used in anger. Since closure the sites have been de-contaminated on numerous occasions. As shown in operation Cleensweep carried out at Barnham Heath in 2009 they were still producing some shocking discoveries in respect of chemical weapons, they have to date also cost several millions of pounds in tax payers money to make 'safe'. After 1940 when operation Sealion (the German planed invasion of Britain) was postponed and the need for chemical weapons to defend the beaches had reduced, if operation Barbarossa (the German invasion of Russia) had succeeded in 1941, then the invasion of Britain would have again been on the drawing board. When D-Day was planed the allies thought that the Germans would use gas to repel the invading forces from the beaches, again when the allies crossed the Rhine into Germany it was again thought that they would resort to chemical warfare. These sites were a very important part of the military build up to ensure that in retaliation the allies could respond, and with the Forward Filling Depots operational the supply of chemical weapons was streamlined to ensure a speedy and sustained response. There are numerous theories on why chemical weapons were not used by the Germans even though they also had large chemical weapon stockpiles, some state that Adolf Hitler himself was opposed to the use of gas due to his experience during WW1 when he was a casualty of gas warfare. The horrors of the first world war were still vivid in the minds of the populations of both sides and using gas in any aggressive nature would have caused shock and disgust. Also gas warfare was not a part of the German blitzkrieg type of fast moving warfare.

When the tables had turned and the Allies were landing on the beaches of Normandy the defensive use of gas would have brought about an unimaginable retaliation with the Allies having complete control of the skies and with Germany being bombed both night and day. But if we had not had the infrastructure in place and the Germans had been aware of this then maybe there defensive tactics would have been different and included the use of gas? Winston Churchill was so mindfull of the deterrent we possessed, he reminded Germany of this often, together with his intention to retaliate, this is the most compelling reason for the non use of gas in WWII.

Between 1980 and 1998 a total of six surveys had been carried out at Riseley and five at Norton Disney these surveys included revalidation of earlier studies, radiological and chemical surveys and land quality assessments.

'During 2000 in the UK there where, 532 actual or suspected old chemical weapons finds that where transported to the Defence Evaluation and Research Agency (DERA) at Porton Down for evaluation and secure storage prior to disposal and during that year 712 items of old chemical weapons were destroyed'. *Annual Report of 2000 on the Operation of Chemical Weapons Act 1996*

With regards to decontamination of the sites, as time goes on the acceptable standards get more stringent and knowledge improves therefore again reference must be made to the Hansard Report of 7<sup>th</sup> April 1998 when it was stated that 'Former Chemical Weapons (CW) sites, which have been disposed of, will have been remediated before sale to a standard acceptable at that time. Should

CW be found subsequently, the Ministry of Defence would respond by providing specialists to investigate and undertake clearance work.

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