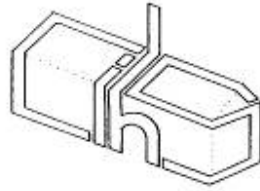


Cumbria Industrial History Society



BULLETIN

No. 97

[www. Cumbria-industries.org.uk](http://www.Cumbria-industries.org.uk)

APRIL 2017



CONTENTS

Page 3	CIHS Activities .
page 4	Photograph ID.
Page 5	Maps and Apps.
	Kiln dried logs and their link with the past.
Page 7	Phosphoric acid manufacture at Marchon.
Page 16	Committee members details.
.	

EDITORIAL

Hello and welcome to the latest edition of the Bulletin. I have to start with a number of alterations to the programme. We have suffered a number of problems with the speakers for the spring conference Nigel Catterson has unfortunately had to withdraw with health problems and Charles Rowntree will now give a talk on 'aspects of mill engineering'.

Also the June evening meeting had the wrong day advertised in the last Bulletin the correct date is THURSDAY 15TH JUNE.

We have now been informed by Gilkes that they are no longer able to accommodate site visits anymore and we are therefore looking for ideas for other site visits.

Now to a bit of good news!!!. You should have all received a copy of latest Industrialist volume 9. The book using Mike Davies-Shiel's photos is about ready to go to the publishers for laying out and printing. And finally we have been given a copy of a diary by the owners of the cardboard mill at Little Salkeld. This runs from the late 19th Century through to after the 2nd World War and contains a vast amount of information on both setting up the mill, its daily running and the problems faced during 2 world wars. If anyone out there has any knowledge of the cardboard/paper making industry and feels they could help with the interpretation please get in touch.

We have been given a set of Bulletins from issue February 1986 to December 2013. If anyone would like them please contact me and I will arrange to get them to you.

FRONT COVER: WHEEL PIT AT GREENBURN MINE.

SOCIETY EVENTS 2017

Saturday 22nd April 2017 SPRING CONFERENCE AND AGM. THE POWER OF WATER 9.30am.

Programme and booking form on the website. Places still available

Saturday 20th May 2017 WALK AROUND MARYPORT. 11.00AM.

Meet at Wave Center GR NY 033 364 **NOTE CHANGE OF VENUE**. For a walk lead by Chris Wadsworth. New contact Dai Powell 01900605449. Free street parking in the area also pay and display at the centre..

****THURSDAY**** 15th June 2017. EVENING MEETING TO LOOK AT GREENBURN MINE. 6.30PM. **NOTE CORRECTION TO DAY**

meet at 6.30pm in the small car park opposite Blea Tarn. The car park is on the right hand side if you are travelling from Little Langdale. From there we can squeeze into a smaller number of cars and park on the roadside near the divide between the Blea Tarn road and the Wrynose Pass. There is parking for five or so cars there. We can then walk up to site and have an hour and a half on site and then be down by 9.00pm. Lead by Jamie Lund NT archaeologist.

Saturday 8th JULY 2017 VISIT ST BEES BY TRAIN AND TOUR PRIVATE RAILWAY MUSEUM.

If interested in attending please let Helen know so we can tell museum approx. numbers.

Meet St Bees station between 1pm and 1.30pm Train from south arrives 1pm and North 1.24pm. Hopefully descriptions of what to see from the train will be available on website shortly.

Return trains both direction 4.45pm.

Sunday 24th September 2017 WALK AROUND THE ORIGINS OF BARROW. 11.00am.

Meet at the Dock Museum Car park.

Saturday 14th October 2016 AUTUMN CONFERENCE INDUSTRIES OF THE CALDBECK AREA. 9.30AM.

In Caldbeck village hall. Programme to be announced.

November 2017 RIFLE RANGES OF THE LAKE DISTRICT.

At Greenodd Village Hall. Talk on rifle ranges by Jeremy Rowan Robinson. Date to be announced.

PHOTOGRAPH ID?

Bridget who runs the bookstall at the conferences has acquired an old photograph album. Below are three photos thought to be in Cumbria which are proving difficult to identify the exact location.

If you have any ideas please contact the editor.



Photo 1



Photo 2.

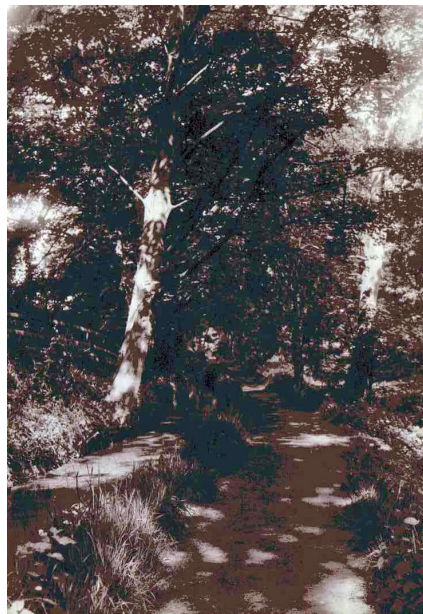


Photo 3

MAPS AND APPS

For a number of years, Art Gene – the community arts people based in Barrow – have been working on a commission from the Morecambe Bay Partnership. The work has involved creating a series of maps of the land and sea around the bay, and producing a number of trails that can be downloaded to your smartphone to guide you around places of interest. All the maps and apps have been developed by involving local people as well as experts and organisations with specialist knowledge of particular subject areas. There are five maps in the “Seldom Seen” series – an updated version of The Islands of Barrow and new ones covering the Furness Peninsula, the Cartmel Peninsula, the Arnside-Silverdale area, and the Morecambe-Heysham area. Each one is double sided with a copiously annotated map on one side and more information and photos on the other. An unbelievable amount of information is included on each one, including a lot on industrial topics, and all for the princely sum of £4.99. A small price to pay for what to me is a limited edition work of art.

The apps guide you around five sites including the Ulverston Canal and Backbarrow. They can be found in your App Store by searching for ‘Seldom Seen’ and downloaded for free.

Roger Baker

P.S. I would tell you more about the apps but I don’t have a smartphone to try them out on, and the grandchildren didn’t stay long enough at half-term for me to borrow theirs!

KILN-DRIED LOGS AND THEIR LINK WITH THE PAST

What’s the link between the log burner in our sitting room and 17th century lead smelting? The answer – kiln dried logs!

Since the log burner was installed a couple of years ago now I have been buying what South Lakes Biomass advertise as kiln-dried logs. Their very low moisture content means that I don’t have to store them for a year or two before use in a space I haven’t got, and they give out lots of heat.

About the same time as we got the log burner I was part of the team working on the digitisation of Mike Davis-Shiel’s slides. Something I came across then that was new to me was his 20 or more photos of “chopwood Kilns”. I wondered what they were at the time but filed the thought away in the ‘find out about later’ section.

Then – this year – I bought one of the many Shire albums, a relatively new publication on Woodland Industries. In it is a mention of making fuel for metal smelting, especially lead. The fuel was dried wood known as ‘white-coal’ or ‘chop-wood’. Small lengths of coppice wood were dried in a kiln until all the moisture was driven out. It was then mixed with charcoal to fire the lead smelter – charcoal on its own gave too high a temperature, chopwood on its own too low. Or chopwood was used alone to smelt the ore with charcoal used to re-heat the slag. Remains of the chopwood kilns can be recognised as large depressions or craters in the woods, anything from 3 to 5 metres in diameter, with a

noticeable ‘flue’ at one end, facing downhill. In use they would have been stone-lined pits, roughly circular and around 2 metres in diameter.

Their use is confirmed in another Shire album – Lead and Lead Mining. It describes the development of the lead smelter which, until the adoption of coal-fired reverberatory furnaces in the 1700s, “relied on wood, dried in a kiln, for fuel, together with a certain amount of peat, if available”.

Janis Heward of the Upper Wharfedale Heritage Group describes the production process on their website: a fire in the pit roasted the coppiced wood which was stacked on a platform of heavy timber baulks above (supported on the walls of the kiln), to remove all the moisture. The entrance allowed the fire to be controlled to prevent the baulks from catching fire.

Chopwood kilns can easily be confused with potash kilns. The main difference is in the working technique, although potash kilns tend to be much taller. From the evidence of his slides it is clear that MDS thought that some of his examples could be either potash or chopwood kilns, and that others were converted from one use to the other.

On his list of Potash & Chopwood Kilns for Cumbria compiled in December 1990 there are just 47 chopwood kilns out of an incredible total of 416. Eleven of these are associated with an early lead smelter on the fell top above Gawthrop. Others are recognisable as being in lead mining areas such as Hoggett Gill, Patterdale and Elfhow, Staveley (built 1694). Others may just have been places where the chopwood was produced for smelters elsewhere. All of them can be seen on the Cumbria Archive’s on-line catalogue.



Elfhow chopwood kiln MDS collection June 1973.

Roger Baker.

PHOSPHORIC ACID MANUFACTURE AT MARCHON

Why?(And some site history)

The Babylonians are reputed to have first made soap in 2800BC by mixing animal fats with wood ash. Soap was used for bathing, medicinal purposes and the washing of clothes. Such uses continued for thousands of years until during World War 1 strains on the German economy led to shortages. The French had, in the 19th century, produced synthetic detergents on an experimental basis and necessity required that they be produced on an industrial scale by Germany to overcome the shortage of traditional soaps.

Synthetic detergents typically consist of a surface-active agent (surfactant) which offers good cleaning properties and, unlike soaps, does not react with minerals in wash water to form a scum. The earliest such detergents based on alkyl naphthalene sulphonates were only moderately good and were used primarily in hand dish-washing and fine fabric laundering. In the 1930's technology became available to enable the manufacture of fatty alcohols which, when sulphonated, were found to be more effective surfactants than their predecessors.

In 1946 an important breakthrough discovered that surfactants used in laundering became even more effective when combined with a 'builder' enabling the cleaning of even heavily soiled materials. One such builder was sodium tripolyphosphate (STPP) which was made by neutralising phosphoric acid with either caustic soda (sodium hydroxide) or soda ash (sodium carbonate), spray-drying the resultant liquor to powder form followed by calcination at high temperatures.

By 1953 sales of synthetic detergents in the USA had surpassed those of soap having all but supplanted the use of soap-based products in laundering, dish-washing and household cleaning. Closer to home Marchon had been manufacturing sulphated fatty alcohols shortly after moving from Hensingham via Newtown to the cliff-top site at Kells in 1943. These were used in toiletry formulations.

After World War 2 production of such surface-active agents increased at Marchon (using plant purchased from the former Ordnance factories at Sellafield and Drigg). These agents were supplied as toiletry preparations to leading manufacturers and also for use in the textile industry, leather processing and for foodstuffs.

Frank Schon visited the USA on business in 1949 returning with a plethora of technical reports and drawings for a jet spray-drying tower. A spray-dryer based on these plans was built at Whitehaven and used to produce powder detergents which were supplied to a major international customer for the manufacture and packaging of heavy duty detergent powders.

A second, larger spray-dryer was built soon afterwards allowing greater quantities to be produced and further manufacturing contracts to be signed. At this time, however

Marchon was buying in all of the raw materials utilised in the manufacturing process and it became apparent that the company should become more self-sufficient. It was in these circumstances that, in the early 1950's, the decision was taken to manufacture sodium tripolyphosphate (STPP) at Whitehaven. The first such plant was commissioned in 1952 although reliance was still placed on purchases of phosphoric acid. (At the same time the decision had also been taken to manufacture fatty alcohols, the principal raw material for surfactants production and the first such plant was opened in 1954).

Marchon decided to manufacture its own phosphoric acid and the 'wet process' route was chosen whereby phosphate rock is reacted with sulphuric acid to make phosphoric acid (H_3PO_4) which, as noted above, is a necessary precursor to STPP. Alan Routledge's book¹ shows the F1 phosphoric acid plant under construction in 1954 and its subsequent commissioning would be timed to coincide with the on-site availability of sulphuric acid. As noted in a previous article the sulphuric acid used in the manufacture of phosphoric acid had been purchased from external suppliers but as production tonnages increased such supplies were going to be inadequate. Following the fortuitous realisation that Anhydrite lay beneath the Marchon site kilns were erected for the on-site manufacture of sulphuric acid and the first of these came on-stream in 1955. The ready availability of increasing large tonnages of sulphuric acid enabled increasing amounts of phosphoric acid and, subsequently, STPP to be produced.

Some (basic) Chemistry

Phosphate rock, which is widely distributed around the world, occurs mostly as apatite, Calcium Phosphate. The so-called 'wet process' used to manufacture phosphoric acid, as at Marchon, requires that the rock is reacted with a mineral acid to release the phosphate species. These mineral acids are usually either nitric, hydrochloric or, most usually, sulphuric acid - as at Marchon.

Most of the phosphate rock used at Marchon was, as described in a previous article, purchased from Morocco. As phosphate deposits went the quality (as measured by the absence of species which could adversely affect production efficiency and end product quality) of the Moroccan deposits was pretty good. So not only was Morocco the closest commercial source of phosphate rock to Marchon but the quality was reasonable too.

In simple terms the reaction between calcium phosphate (a solid - rather like coarse sand) and sulphuric acid (a liquid) results in a slurry of calcium sulphate crystals and phosphoric acid. This slurry is separated into its individual components by filtration through polypropylene cloth usually assisted by the application of a vacuum. The calcium sulphate filter cake is washed countercurrently with successively weaker solutions of phosphoric acid and, finally, with water to maximise P_2O_5 recovery. At Marchon the calcium sulphate was of no use and so was discharged into the Solway Firth whilst the phosphoric acid was used internally.

However, like most things in life, what may appear to be simple was anything but. For optimum efficiency the calcium sulphate crystals had an aspect (length:width) ratio of

about 2:1. Alternatively crystals of needles which aggregated together around a central nucleus (called a 'hedgehog') also filtered well. In such happy circumstances filtration would occur readily benefiting both production throughput and efficiency. Operating the process with a slight excess of sulphuric acid was found to be most beneficial in this regard but experience showed that this acid needed to be introduced in a separate part of the reaction system to the rock.

Unfortunately phosphate rock does not consist solely of calcium phosphate. (The Moroccan deposits typically contained some 70-77%). Most deposits contain virtually every element under the Sun in varying proportions. The presence of such impurities has significant effects on not only the production efficiency but also on the quality of the product phosphoric acid. Thus, significant concentrations of the species fluoride and aluminium were well-known to have a detrimental effect on the calcium sulphate crystal habit resulting in poor production rates and efficiency - and, in the case of fluoride, on plant corrosion. In reality it was wiser to believe that the objective of the exercise was to grow good crystals of calcium sulphate rather than the production of phosphoric acid. Attempts were made to ameliorate the effects of the fluoride if the silica content of the rock was deemed to be too low by adding diatomaceous earth (dicalite - silicon dioxide) to the reaction vessels. Its effectiveness was sometimes questionable but it had at the very least a placebo effect soothing the production manager's nerves.

Another impurity in the rock which had potentially unwanted effects was carbonate. When acidified it released carbon dioxide which, particularly if stabilised by humic acids (a term used by the analysts when precise characterisation of the organic matter was beyond them) present in the rock, could result in the formation of a 'head' (rather like on a pint of beer) on the surface of the reaction mixture. In the worst cases the amount of foam could severely reduce the effective volume of the reactor. Foam control was effected by the use of judicious amounts of, in the early days, Fish Fatty Acids (rather smelly and of dubious origin) and later by ethoxylated fatty alcohols produced in-house. The problem of foaming continued sporadically until the change was made to a different Moroccan phosphate rock which had been calcined at high temperature. This calcination not only broke down the offending carbonates but also destroyed the humic acids which had stabilised the troublesome foams.

The end product phosphoric acid was a rather attractive green colour; this colouration was caused by the presence in the finished product of dissolved metals such as iron and chromium - which like the other species mentioned above had also originated from the phosphate rock. (Life would have been so much simpler if these had been the only contaminants present but, alas, this was not the case).

1. Alan Routledge (2005); 'Marchon - The Whitehaven Chemical Works' Tempus Books ISBN 0 7524 3572 8

History of the Phosphoric Acid Plants

In acknowledgement that the product phosphoric acid needed to be separated from the co-produced calcium sulphate by filtration all of the 5 plants which were eventually to be operated at Marchon were given the title 'Filter House'. Very quickly the short form of F1 through to F5 was adopted colloquially. The first plant (F1) was opened in about 1955 but my own knowledge of this and its successor F2 is extremely limited since both were but a distant memory when I joined Marchon as an R&D Chemist in 1974. Part of the F1 plant was re-used as a phosphoric acid concentrator commissioned in 1976 assisted by the R&D department using a wooden garden shed as a temporary laboratory.

What can be said is that each 'new' plant was of greater capacity than its predecessor (although the old and new were invariably operated side by side). The increases in capacity were driven by the increasing demand for detergents and were enabled by the increasing availability of sulphuric acid produced on-site by Solway Chemicals. The F2 plant was opened shortly after 1955 and the total annual production capacity from these two early plants was then some 40,000 tons of P_2O_5 . (One of the historic foibles of the phosphate industry was to use this terminology. This was equivalent to some 55,000 tons expressed as H_3PO_4 - although the gross tonnage was much more since the acid was produced at a strength of about 29% P_2O_5 . The acid density was measured in degrees Twaddell but this need not distract us!).

As demand for detergents continued to increase capacity at the Solway sulphuric acid plant was expanded accordingly allowing increasing amounts of phosphoric acid to be produced over the years. The opening of the F3 plant in 1961 allowed the two original plants to be shut down.

Plant	Process type	Annual Capacity (t P_2O_5)	Date opened	Closure date
F3	Prayon	80,000	Dec 1961	Late 1979
F4	Kellogg-Lopker	85,000	Oct 1968	Mid-1980's
F5	Fisons HDH	150,000	Late 1979	Sept 1992

F3

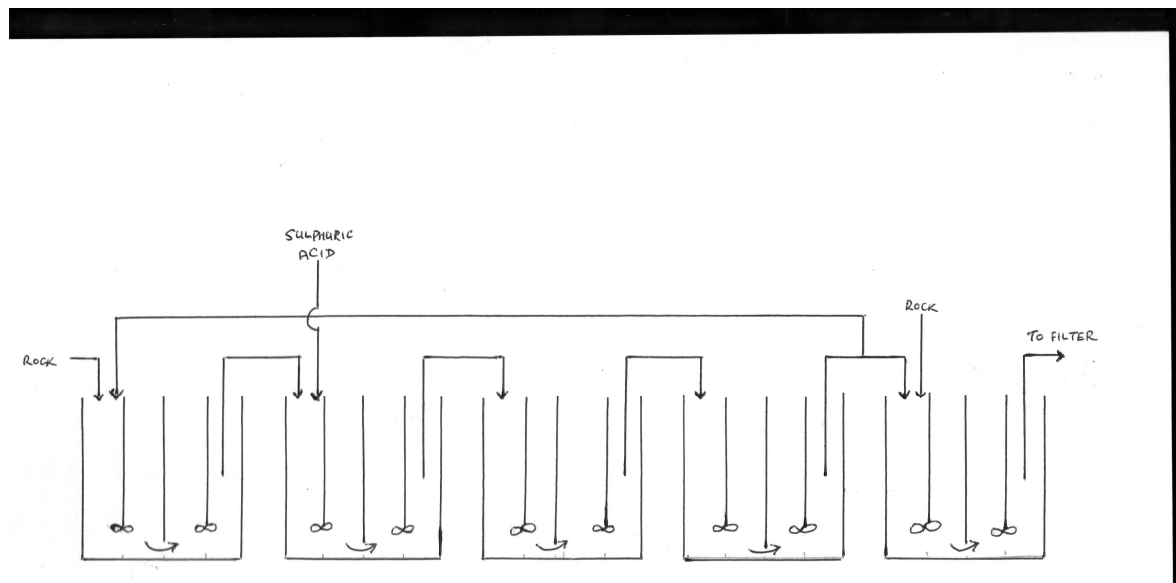
This plant consisted of 5 reaction vessels operating in series. Each was subdivided into 2 sections fitted with an agitator - giving a total of 10 reaction compartments. An opening in the bottom of the central dividing wall of each reactor allowed the reaction slurry to flow into the second compartments from which it was pumped to the first compartment of the succeeding reactor. Finely milled (somewhat akin to talcum powder) phosphate rock was introduced into Compartment 1 of Reactor 1 (C1R1) while 77% sulphuric acid was added into Compartment 1 of Reactor 2. As described the reaction slurry flowed and was pumped through the succeeding reactors. A slight excess of sulphuric acid was maintained by careful control of the relative amounts of feedstock and continuous analysis using an ingenious machine developed in-house. The process operated at 70-72°C.

About 90% of the reaction slurry was recycled back from Compartment 2 of Reactor 4 to C1R1. The remainder flowed into Compartment 1 of Reactor 5 where a small additional amount of phosphate rock was added to reduce the concentration of excess sulphuric acid. Slurry was pumped from compartment 2 of reactor 5 to a tipping pan filter where the product acid at a strength of 28-30% P_2O_5 was separated from the by-product calcium sulphate.

The F3 plant was generally reliable but the continually increasing demand for STPP and, in later years, for technical grade phosphoric acid (obtained by solvent extraction purification) required yet another increase in production capacity. Besides which F3 was now 18 years old and was ready for retirement after its sterling service in arduous reaction conditions. The commissioning of F5 in 1979 meant that this faithful old servant could finally be pensioned off.

In collaboration with the process engineering companies Kellogg and Lopker work commenced in December 1966 on a pilot plant intended to develop a new process for manufacturing phosphoric acid. Its capacity was 60tpd P_2O_5 and this sizeable rate leads me to suspect (although I am unable to substantiate this) that use was made of some of the formerly redundant reaction vessels of either the F1 or F2 plants. Piloting was

Representation of F3 Phosphoric Acid Plant



F4

completed in August 1968 although confidence in the new process was clearly high since the F4 plant was opened in October 1968 and its construction would have taken rather longer than 2 months.

This plant consisted of 2 interconnecting vessels operating at 70-72°C between which the reaction slurry was circulated at high volumes. Phosphate rock was introduced into the

'dissolution' vessel and the 77% sulphuric acid pumped into the 'evaporation' vessel. As in F3 a slight excess of sulphuric acid was maintained in the reaction mixture to encourage optimum growth of the calcium sulphate crystals. A portion of the reaction slurry was bled out of the circulatory system and fed to a 'desulphation' vessel to which a further quantity of phosphate rock was added in order to reduce the excess sulphate content.

The 'desulphated' slurry was fed to 3 Landskrona belt filters operating in parallel and to which a partial vacuum was applied in order to effect filtration of the product acid from the by-product calcium sulphate.

The supposed advantages of this process over and above those of the Prayon system used in F3 were;

- lower capital investment
- lower power consumption
- lower operating costs
- ease of filtration of the product slurry
- low P_2O_5 loss

As ever some of these claims have to be taken with a pinch of salt. Since there were fewer reactors only one of which (the desulphation vessel) required agitators and their associated motors the first three bullet points were probably reasonable. As for the latter two - my experience was that F3 was just as efficient if not more so in these regards. One advantage of F4 not advanced by its developers was that there were 3 belt filters so if one had to be taken out of use for maintenance plant operations could continue unlike F3 where operations had to cease if the one tipping pan filter was out of commission.

It had also been determined that F4 could handle coarser phosphate rock than could F3 and so the pre-handling was limited to screening over a system of sieves with the oversize material either being rejected or fed to a hammer mill for size reduction. In practice this led to higher P_2O_5 losses than for F3 but these could be off-set by the energy savings made by not milling all of the rock feed.

It was intended that with the advent of the new F5 plant that F4 would gradually become redundant and could be decommissioned. However operating problems which nagged F5, particularly in its early years, meant that F4 had to continue full operations to provide the shortfall in acid production. F5's problems were gradually (if only partially) being overcome and production rates of F4 could steadily be reduced until, finally, it just seemed to fade from memory.

A little more chemistry

Calcium sulphate exists in three states of hydration. These are;

- Anhydrite $CaSO_4$
- Hemihydrate $CaSO_4 \cdot 0.5H_2O$
- Gypsum $CaSO_4 \cdot 2H_2O$

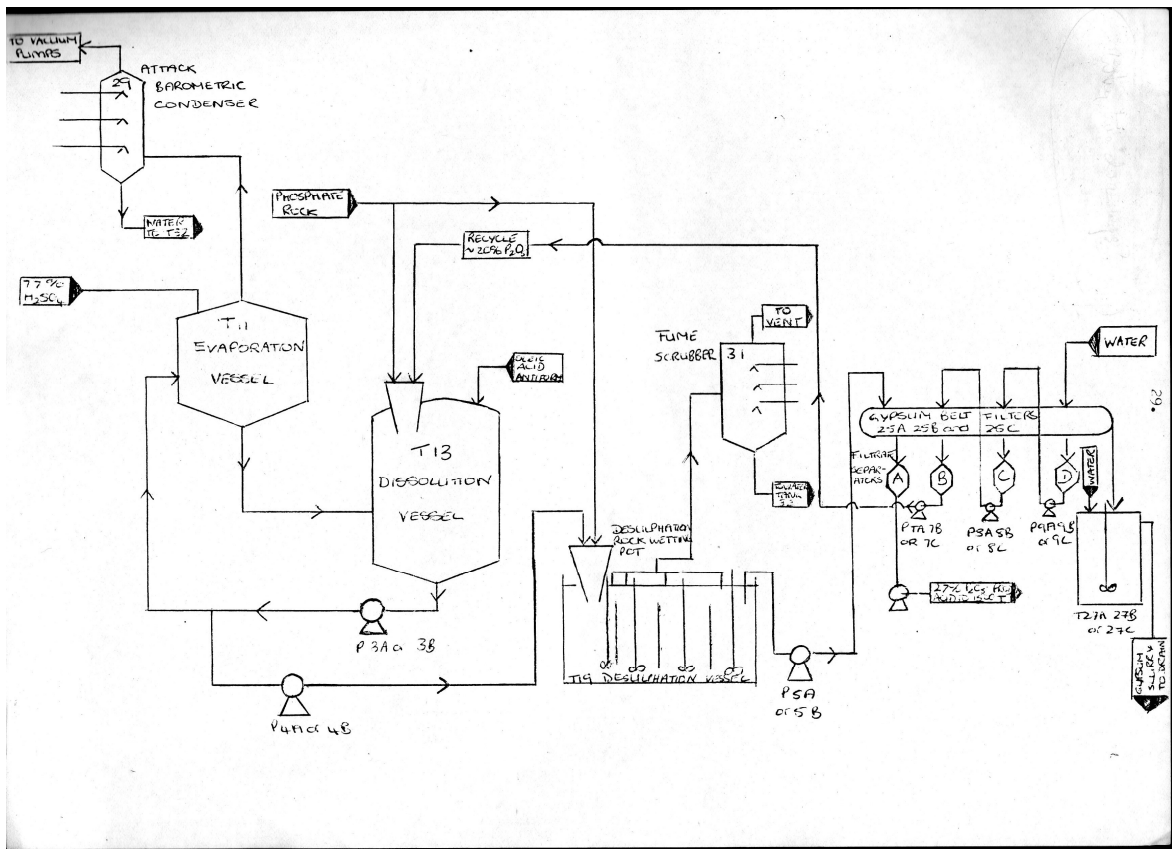
When phosphate rock reacts with sulphuric acid the precise form of the calcium sulphates which crystallises from solution depends upon;

- System acidity
- Reaction temperature

In the F3 and F4 plants reaction conditions were such that the calcium sulphate crystallised as gypsum. Such systems are relatively simple to operate but some of the phosphate present is lost due to co-crystallisation in the gypsum crystal structure. In F5 the reaction conditions were such that the hemihydrate species crystallised out. This still contained co-crystallised phosphate but recrystallisation to gypsum (see below) released this into the liquid phase enabling (in theory at least) greater P_2O_5 recovery

No commercial processes involving the crystallisation as anhydrite are known to have existed.

Representation of F4 Phosphoric Acid Plant



F5

The ever-increasing demand for STPP and technical grade phosphoric acid (produced by solvent extraction purification) allied to the increasing age and unreliability of F3 led to A&W's decision to invest £11.4m in a new phosphoric acid plant. The process chosen

was Fison's HDH which had been piloted in Holland in the 1960's and the first commercial plant had been built in the former Yugoslavia in 1975. F5 was to be of much greater capacity than either of these, being designed to produce 150,000 tpa P_2O_5 at 45-48% P_2O_5 .

As ever the purveyors of the process felt obliged to spell out the advantages of their invention;

- use of a coarse rock feed
- lower capital costs
- production of high strength phosphoric acid
- lower variable costs
- production of product acid containing lower levels of impurities
- improved efficiency of P_2O_5 recovery
- purer gypsum by-product suitable for building purposes

It would be interesting to have a legal opinion as to whether or not the Trades Description Act was applicable to chemical processes. From day one F5 gave problems. HDH stood for Hemihydrate-Dihydrate - although I expect that the plant operators quickly came up with alternative interpretations!

The first stage of F5 comprised 2 reaction vessels the second of which was divided internally. Phosphate rock was added to the first reactor whilst 98% sulphuric acid was added to the first compartment of the second vessel. Use of such strong acid and a working temperature of 95-98°C was designed to precipitate the calcium sulphate in the hemihydrate form while the product phosphoric acid would be produced at 45-48% P_2O_5 . The reaction slurry was fed to an enormous tipping pan filter for separation. The product acid was pumped to storage while the filter cake was fed to the 'Transformation' vessel for further P_2O_5 recovery. Reaction conditions in this vessel were of much lower acidity (8% P_2O_5 and 6% H_2SO_4) temperature (60-70°C) and the hemihydrate re-crystallised to gypsum thereby releasing further P_2O_5 into the liquid phase. This slurry was fed to 2 Delkor belt filters operating in parallel. The gypsum cake was discharged to sea and the recovered acid was recycled to the tipping pan filter as a wash liquor.

When discussing F5's problems it is difficult to know where to start. It was a new process to the Whitehaven site and even the most skilled plant operators necessarily took time to get to grips with it. The plant wasn't computer-controlled and the hemihydrate had a tendency to set everywhere like Plaster of Paris. After several months of trying the plant was starting to perform reasonably well when the order came to shut down and clean the place up in readiness for the official opening of the plant by HM Queen Elizabeth II on March 21st 1980. After the ceremonials it was back to Square One!

I was still working in R&D at this time and my new immediate superior had just been transferred to Whitehaven from A&W's Oldbury Works (near Birmingham). He decided that the quickest and best way to make his name was to help provide technical solutions

to F5's ailments. Cue deep sighs of relief from the rest of the department! (Although in truth most of the troubles were mechanical rather than chemical).

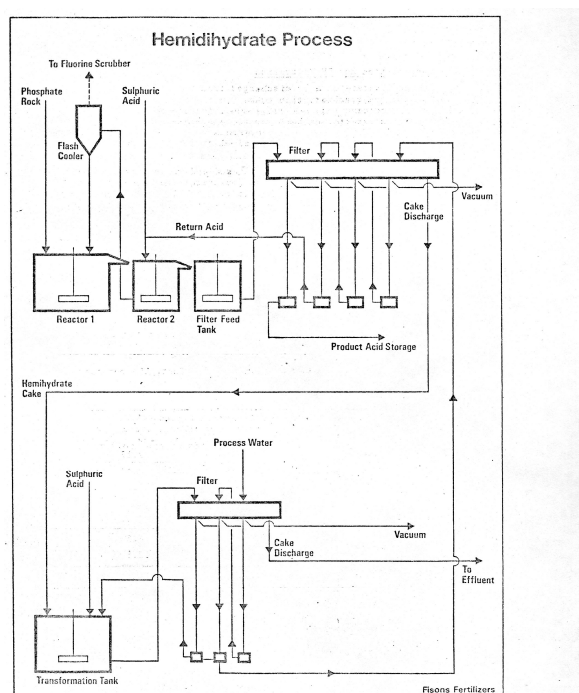
The plant personnel stuck manfully to their task and gradually things began to improve enabling F4 to collect its well-earned pension. One of the solutions had been to reduce the product acid concentration to closer to 40% P_2O_5 rather than Fison's projected 45-48%.

However by 1990 storm clouds were brewing. Emissions from the site including the discharge of gypsum into the Solway had attracted the attention of Greenpeace leading to a court case at Whitehaven Magistrates which the company lost. By this time not only was F5 showing its age but so too was the sulphuric acid plant. Considerable capital expenditure was going to be needed in both areas. Increasingly tight emissions standards (particularly with regard to cadmium) were also unlikely to be met.

In Morocco the state-owned phosphate operation, OCP, which had originally concentrated solely on exporting phosphate rock had for some time also been manufacturing phosphoric acid on its own account. The Albright & Wilson board concluded that it would be more cost-effective to buy in this acid thereby saving the eye-watering expenditure otherwise necessary at Whitehaven. F5 (and much of the sulphuric acid plant) therefore ceased operations in September 1992 and phosphoric acid of similar quality was purchased from Morocco and shipped to Workington's Prince of Wales Dock from where it was hauled by road tanker to Marchon. This brought down the curtain on some 40 years of phosphoric acid manufacture at Whitehaven. By way of final insult F5's reaction vessels were converted to store the Moroccan acid before downstream use on-site.

Brian Quayle

Representation of F5 Phosphoric Acid plant



COMMITTEE MEMBERS DETAILS

Roger Baker,
3 Sun St
Ulverston
Cumbria
LA12 7BX
mbarb@freenetname.co.uk

Geoff Brambles, Chairman
21 Derwent Drive
Kendal
LA9 7PB

Mrs Helen Caldwell, Secretary
Low Ludderburn
Cartmel Fell
Windermere LA23 3PD
lowludderburn@btinternet.com

Mr Dan Elsworth, Publicity Officer
6 Town Street
Ulverston
LA12 7EY
dwelsworth@cooptel.net

Mr Robin Yates Membership Secretary
Glenrae
Brigsteer Rd
Kendal
LA9 5DX

Bill Myers
20 Lord St.
Millom
Cumbria
LA18 4BL
bill.myers@nwemail.co.uk

Graham Brooks, Bulletin Editor
Fairhurst
Aglionby
Carlisle CA4 8AQ
solwaypast@yahoo.com

Hilary Corton Treasurer.
27 Fountain St
Ulverston
LA12 7EQ
hilarycorton@aol.com

Dr Ian Hill
5 Parkside Drive
Arnsdale
Cumbria LA5 0BU
fi.hill@btopenworld.com

Mr David Beale, Minutes Secretary,
Low Row
Hesket Newmarket
Wigton
CA7 8JU



LIMEKILN NEAR IREBY SUBJECT OF THE OCTOBEWR CONFERENCE.