Cumbria Industrial History Society

BULLETIN

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CONTENTS

EDITORIAL

What a glorious summer we have had so far and I hope everyone has been making the most of the weather to get out and look at the sites both within the county and further afield. Despite the problems caused by the late change of venue for the spring conference I think we can happily say that it was a great success at the Lakes Gateway Hotel, Penrith and we have rebooked the venue for the spring 2019 conference on April 27th, make a note in your diary. The committee are working on the subject and speakers but are happy to hear of people's ideas for subjects for meetings, speakers and venues for visits.

This edition of the Bulletin contains an article by Geoff Brambles on the industries and industrial monuments of Kendal that have disappeared or have been altered since the Society was formed. Presumably a similar article could be written for any of the towns and even some of the villages in Cumbria. Is there any offers?

On a similar theme Roger Baker draws our attention to the loss of our industrial heritage with the removal of weirs from rivers in south Lakeland in the name of environmental improvement and increasing fish spawning. It is a peculiar fact to me that fish seem to have managed to pass these weirs when they were operational. But now they can't get past semi-derelict weirs!!!

If you hear of any industrial sites due for demolition or alteration then let a member of the committee know. Those sites that have an importance outside the county we can notify to the AIA who campaign nationally on the subject.

Finally no doubt you are all sick of the new General Data Properties Regulations (GDPR), but to meet our legal requirements Robin, the membership secretary, has worked hard on our behalf to put the Society's position in to understandable terms and there is a short explanation in this Bulletin.

FRONT COVER. A GORDON GILKES 18, INCH DIAMETER, PELTON WHEEL ON SHOW AT THE SMALL MINING MUSEUM AT LAXEY ISLE OF MAN. IT WAS INSTALLED IN 1937 IN THE SULBY WATER TREATMENT WORKS IN SULBY GLEN, IOM, TO ACT AS A BACKUP POWER SUPPLY TO THE AGITATORS ON THE SAND FILTER BEDS WHEN BEEN BACKWASHED. IT WAS TAKEN OUT OF USE IN 1981.

SOCIETY EVENTS 2017

WEDNESDAY 15TH AUGUST 2.00PM ABBEY HORN WORKS.

Holme Mills, SD 524 779. Roadside parking. Limited numbers, so **essential to book** with Geoff Brambles on 01539 728605, who will supply further information.

SATURDAY 15TH SEPTEMBER WARWICK BRIDGE CORN MILL. 10.45 am.

Meet at Down a Gate Community Centre car park NY 47264 56575. Short walk to the mill for a guided tour of a large manorial mill. It is at present undergoing conservation and hopefully at the time of the visit will be working. Bring packed lunch. Afternoon walk around village to look at large textile mill etc. Also possible short trip to wetheral to view mill and viaduct.

To help the mill arrange guides etc. Can you please let me know if you would like to attend by 7th September Graham Brooks 07876417695

SATURDAY 13TH OCTOBER CONFERENCE WARCOP, INDUSTRIES OF THE UPPER EDEN VALLEY

Booking form included

TUESDAY 20TH NOVEMBER, 7.30 P.M. NOVEMBER EVENING TALK GREENODD VILLAGE HALL

Julia Parks of Signal Film & Media will talk about Digitising the Sankey Photographic Collection. The Sankeys, based in Barrow, took thousands of b&w photos, many of which were sold as postcards, including places and events of industrial interest.

INDUSTRIAL CHANGE IN KENDAL, 1986 – 2018

by Geoff Brambles

The publication of the 100th edition of the C.I.H.S.'s Bulletin provides us with a convenient point of reference from which to look back and consider some of what has changed since the society's inception. Bracketed numbers refer to the 1938 O.S map and show the location of features referred to in the text.

It is ironical that the two most important manufacturing companies bearing the "K" of Kendal in their name, 'K. Socks' and 'K. Shoes', have gone. Socks and shoes!... you couldn't make it up.

'K. Socks' has been obliterated utterly. It is doubtful that the youth of the town are even aware that Kendal once clothed a goodly proportion of the nation's feet. The firm's two large factories, Bridge Mills (1a), situated by the river, just upstream of Stramongate Bridge, and the factory that fronted onto Sandes Avenue (1b), are both long gone. The former was replaced by a much taller office block, and the latter by a block of flats. The prominence of both sites ensured that the new buildings were faced with limestone.

Of the once extensive 'K. Shoes' (2) empire of riverside buildings, all that survives is a modern distribution warehouse on the southern periphery of the town. The firm's most prominent building, a mildly brutalist monster of 1925, survived K. Shoes's conquest by 'Clarks' through its re-birth as 'K. Village' (Mark 1), a successful 'factory outlet' store.

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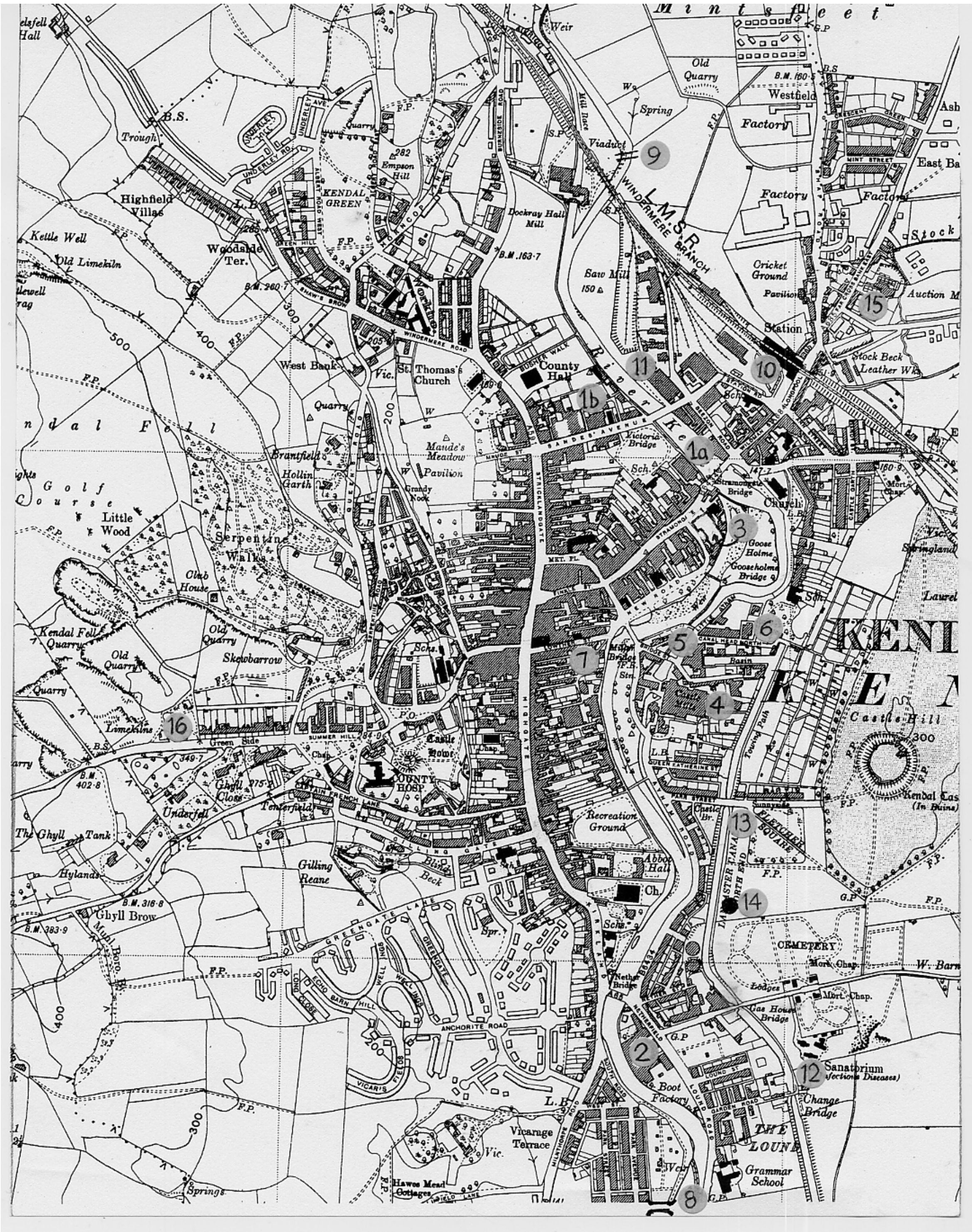

Such success, on a prominent riverside site in the Lake District's very own 'gateway' brought about the anticipatory licking of predatory lips in other parts. It's a familiar tale.

The business was bought, the site flattened in 2007 and a new and larger behemoth erected, ‘K. Village’ (Mark 2), its factory outlet shops topped by apartments

Having, alas, miscalculated the demand for rooftop accommodation, the appeal of their retail wares and the willingness of visitors to pay the ransom demanded for parking their cars, the developers went bust to the tune of £50 million or so. New owners, thrilled by their acquisition, have yet to thrill the public.

Unlike ‘K. Socks’, though, the memory of ‘K. Shoes’ remains strong. The survival of the brand, the continuing presence of a ‘K. Village’ (Mark 2) and the collective memory of the hundreds of surviving former workers have ensured that ‘K. Shores’ has joined mint cake, Alfred Wainwright and Henry VIII’s last wife as part of the essence of Kendal in the imaginings of the nation at large.

The premises of the two other big casualties of the C.I.H.S. era have a different tale to tell, for they both survive.

Provincial Insurance (3), something of a minnow in the world of financial services, yet a commercial success over several decades, was in 1994 scooped up by the French firm U.A.P., then, in short order, U.A.P. was gobbled up by Axa (November 1996). Four years later the site was evacuated and flogged off.

The older, limestone buildings are Kendalian in spirit, comprising a Webster house of 1827-8 and a 1926 pretty well seamless extension added by the growing Provincial Insurance. That company’s post-war extensions were, by contrast, metropolitan, if not internationalist in style, and would be contenders in any contest to nominate Kendal’s most unlovely building. These newer bits were converted into flats and the exterior subjected to a makeover that did nothing to soften its grating presence, overlooking Stramongate Bridge and the weir.

For Goodacres Carpets (4), the writing appeared on the wall in 2001 when it went into administration. Bailed out by Mealbank Properties in 2002, it staggered on until 2005, when, in a two-stage operation four of the eight looms were transferred to a Polish collaborator, followed a few months later by the rest.

The Goodacres site is of great historic significance. It encompases the location of the original manorial corn mill and housed one of Kendal’s major textile enterprises during the 18C and 19C. It is adjacent to Canal Head and together with Gilkes, the Brown House snuff works and the former textile factory now used by a wholesaler, it forms an industrial quarter not only rich in history, but nowadays unusual by its survival in the heart of a small town.

In contrast to the preceding tales of woe, Gilkes (pronounced ‘Jilks’) (5) continues to be a success story. ‘Gilbert Gilkes and Gordon’ to give it its Sunday name, enjoys an international reputation for engineering excellence, its turbines being found on every continent. The company’s chief frustration is its restricted site, which started with the

defunct Canal Head warehouses in 1856, and expanded bit by bit so as to cover every available particle of land, including the infilled canal basin and its adjacent wharves.

If you add to the death of carpet-making the expansionist ambitions of Gilkes and then remember the longings of the canal restoration interests, all of this coming together just before the 2010 banking calamity, you have three of the sparks that ignited the most grandiose development scheme ever envisioned for Kendal.

This paradisial dream featured a new bespoke factory for Gilkes, the canal re-excavated, offices, flats, 200 houses, shops, a new bridge over the Kent, a 100 bed hotel, 650 parking spaces and 500 new jobs – all on 20 acres around Canal Head and a snip at £130 million. None of this happened. But Gilkes did manage to find a small pot of Government gold and redeveloped the south-western section of their site in 2015-16.

The former Goodacres buildings have been colonised and adapted for use by a variety of commercial and industrial enterprises. The Canal Head area, therefore, has changed very little in character and we can celebrate this outcome.


Gilkes' Main Front 2006

Nevertheless, the two arched doorways through which goods passed to and from the canal warehouses on horse-drawn waggons have now vanished from public view, hidden by the recent modifications to Gilkes' works. The insatiably curious among you, however, have only to go into the spanky new entrance lobby on some pretext or other in order to get an excellent view of the carefully restored northern arch.

Across the road from Gilkes' another casualty stands intact but neglected. The Brown House (6), a snuff mill, all limestone and still sporting its original stone chimney, suffered the same fate as the other stone-built snuff mill in Lowther Street (7), which closed in 2009. The Brown House lasted until 2015 – its machinery was famously old, but despite hopes that it might become a snuff museum, nothing has happened. The brass nameplate on the front door, polished to within a whisker of illegibility, has gone, one hopes licitly. It is good to be able to report that the nameboard and trade sign – a newish replica of the original Turk/Saracen – of the abandoned Lowther Street works remain in place, being safely elevated and beyond the casual reach of passing wrongdoers.

A third mill, at Helsington Laithes, just south of the town, closed in 1991. It was the UK's last working water-powered snuff mill, and its demise was doubly resonant for aficionados of Kendal buildings, for the mill building had been erected by Francis Webster père as one of a pair for the cutting and polishing of 'marble', in 1799. 'Marble' is an elastic term in the stone trade and it encompasses not only real marble, but any limestones that will take a polish, such as those that occur widely across south Cumbria

The NE corner of the bonded warehouse

2001

2006

. The bulk of the output from the ‘Marble Mill’ was probably not the polished finery that went into fireplaces and fonts, though there was plenty of this, but the ashlar limestone blocks used as facing stone on town houses and other high-status buildings.

Sometimes a change brings almost universal approval. This was the case with the 1990 insertion of a new road bridge over the Kent. Romney Bridge (8) replaced the existing footbridge, a development inevitably, but vainly, opposed by the residents of Romney Road, on the west side of the river, who were unenthusiastic about having their quiet street turned into a hectic, fume-filled artery of vehicular circulation. The width to which the Edwardian Romney Road had been built suggests that the developers had anticipated a future road bridge, and there is no question but that its opening was welcomed by that army of travellers heading north on Milnthorpe Road and wishing to get to the A65, a journey that up to that time had involved an unappetising exploration of the one-way system.

The suspension footbridge that was taken down had been a popular adornment to the riverscape of Kendal and when a few years later a doppelganger appeared, linking the unlovely industrial estates of Dockray and Mintsfeet and christened Dockwray Bridge (9), it was put about that this was the old Romney Bridge brought out of dismantled retirement. Whatever the truth, the bridge’s present status as the most northerly of Kendal’s river crossings neatly echoes that of the old bridge, which had been the most southerly.

At about the same time the suspension bridge began its seeming peregrinations, the 1861 railway station building (10), a neglected, even forlorn, shadow of its former self, was dramatically altered by the demolition and rebuilding, inevitably to a greater height, of the greater part of the main structure. The present building, faced with the re-used original stone, has no connection with railway operation. Modern travellers are left to shiver in the ‘bus shelter’ that was put in to protect the Windermere-bound from meteorological inclemencies.

About a decade later, the large railway bonded warehouse (11) was bought, gutted, lengthened (harmoniously, it has to be said) and reborn as a Homebase store.

The restoration of the canal into Kendal, a hope that is unlikely ever to die, shows no sign of coming to fruition, but the two canal bridges nearest to Canal Head have both received welcome attention.

Change Bridge (12), the only roving bridge in Cumbria was restored by the Civic Society. Rampant damaging tree growth, weathered stonework and the ugly service pipe attached to the entire width of the south face were all put right and the bridge now looks happy.

Castle Bridge (13), comprising the original 1819 Rennie bridge and an adjoined widening of c. 1890 built in a different style, was tidied up about twenty years ago. The original bridge was sound, but the later part, built to accompany the construction of houses on

Sunnyside, needed extensive restoration, during which its original scalloped brick and girder arch lining was lost to modern simplicity

Just south of Castle Bridge the bulkiest occupier of the Kendal skyline, the gas holder (14) was removed at about the same time as the C.I.H.S. was born, though its circular footprint can still be viewed in the National Grid enclosure to the eastern side of the towpath.

A more recent disappearance is the Appleby Road auction mart (15). Its replacement is to be found by junction 36 of the M6, on a patch of former agricultural land that has become a large clump of farming-based premises, a case of semi-urbanisation of the countryside in the interest of agriculture It will come as no surprise to readers to discover that the Appleby Road site was immediately cleared and colonised by houses.

I will end with the rescue of the limekiln (16) at the top of Greenside in 2009. This was organised by the Civic Society. It is a fitting memorial to the part limestone played in the physical and economic growth of the town, and is a vantage point from which to contemplate the evolution of industrial enterprise in the Auld Grey Town.

SODIUM TRIPOLYPHOSPHATE (STPP) MANUFACTURE AT MARCHON WORKS WHITEHAVEN

by Brian Quayle

Introductory Remarks

The increasing popularity of synthetic detergents in the post-war years required increased production of phosphoric acid (H_3PO_4) as described in a previous paper. This acid was an essential precursor in the manufacture of STPP which was an essential ingredient as a builder in such detergents. Its presence enhanced their effectiveness by acting synergistically with the surfactants used in their formulations. In simple terms the phosphoric acid was neutralised using an alkali such as sodium carbonate (soda ash Na_2CO_3) or sodium hydroxide (caustic soda NaOH). The resulting sodium orthophosphate liquor was spray-dried to powder which was calcined at high temperature to give the end-product STPP.

More (basic) Chemistry

The term sodium orthophosphate is actually an oversimplification since three such compounds exist depending upon the amount of 'neutralisation' which actually takes place. Thus, using sodium hydroxide as the neutralising agent in the example below the reaction can result in the formation of three different orthophosphate products depending upon the ratio between acid and alkali;

$$NaOH + H_3PO_4 \text{ --> } NaH_2PO_4 + H_2O$$
$$2NaOH + H_3PO_4 \text{ --> } Na_2HPO_4 + 2H_2O$$
$$3NaOH + H_3PO_4 \text{ --> } Na_3PO_4 + 3H_2O$$

At the risk of introducing further (but essential) complications the sodium orthophosphate liquor required as the intermediate in STPP manufacture was actually a mixture of two of these orthophosphate salts. The ratio of phosphoric acid to alkali (either soda ash or caustic soda) was carefully controlled as shown in the chemical equation below;

$$5NaOH + 3H_3PO_4 \text{ --> } NaH_2PO_4 + 2Na_2HPO_4 + 5H_2O$$

This solution of 2 parts of disodium orthophosphate to 1 part of monosodium orthophosphate ('neutral liquor) was that which was spray-dried to give the feedstock into the kilns where calcination to STPP took place. (Similar principles to that set out above applied if soda ash was used as the alkali instead of caustic soda but it is not essential to bore the reader with a plethora of chemical equations).

The Alkalis

Despite what is set out above for many years the alkali used was actually 'light grade' soda ash purchased from ICI Mond Division and was delivered to the Whitehaven site by

either road tanker or in specially designed rail-cars, 22 of which each carriying 19 tons of material, made up a train. These trains terminated at Corkickle sidings and the rail-cars were hauled up to the site using the 'Corkickle Brake' and transported into the site from the summit using Marchon's own locomotives (steam in earlier days replaced later by diesels). Empty vehicles took the return journey down the Brake, usually (but not always) staying on the tracks on the tight curve at the bottom. In 1982 some 70000 tons of soda ash were used on the Marchon Works.

The soda ash was stored prior to use in one of four concrete silos adjacent to the rail-lines; off-loading into these silos was effected using compressed air at 10psig, assisted by ability of the tanker or rail-car to tip towards the vertical during this operation.

In later years caustic soda (47% NaOH), also purchased from ICI, was used either to supplement or supplant the soda ash based purely on commercial rather than technical considerations (whichever was the cheaper at the time!). This material could also be delivered either by road or rail. Road tankers drove straight up Monkwray Brow to deliver directly into storage tanks on the works. Deliveries by rail were off-loaded from a siding adjacent to Corkickle station into one of three (if memory serves correctly) large storage tanks. Road tankers were loaded from these tanks for final delivery up the hill and into the works.

The Corkickle brake closed in November 1986 due to economic considerations (running costs plus the cost of refurbishment). However rail deliveries of caustic soda to Corkickle continued until the storage tanks were decommissioned in the early 1990's. Thereafter all deliveries were made directly by road from ICI.

A little history and some nomenclature

All of the processes described in the following paragraphs fell collectively within the term 'Wet Salts' - and the floor of the plant often lived up to its name. After the neutralisation stage the processes fell within the remit of 'Dry Salts' (DS) and each of the rotary kilns associated with eventual conversion to STPP was assigned chronologically an identifying number. DS1 had been and gone by the time I joined the company in 1974 but I believe that it commenced operations in 1952.

DS2 of 1962 and DS3 of 1966 were, however, going strongly and they were joined in 1976 by DS4 giving the Whitehaven site a nameplate capacity of 250,000 tpa of STPP - not that this figure was actually achieved since it was pointless to produce more product than the customers (principally P&G and Unilevers) wished to buy.

DS4 was fed with technical grade phosphoric acid which had been purified by solvent extraction and so was not burdened by the laborious processes necessary if 'green' acid was the feedstock. For convenience the DS4 plant will be described separately from DS2 and DS3 since there was a closer working relationship between the latter.

Further Complications

To the uninitiated the chemistry set out above may seem complex. Regrettably it tells barely half the story and things must necessarily get rather messy! As noted in the paper about phosphoric acid manufacture phosphate rock contains most of the elements under the Sun and many of these pass into solution in the phosphoric acid after reaction with sulphuric acid. At Whitehaven the Moroccan phosphate rock used resulted in the product acid being a rather fetching shade of green due to these dissolved impurities (and known colloquially as 'green' acid). During neutralisation of green acid with either soda ash or caustic soda many of these impurities precipitate out of solution requiring separation by filtration or, if still remaining in solution, could end up in the product STPP.

As discussed in the manufacture of phosphoric acid the filtration step(s) is invariably the most problematic and can result in being an effective 'bottle-neck' in the whole process. The significant impurities in the green acid were Fluoride, Heavy Metals and other metal ions such as Calcium, Magnesium, Iron and Aluminium the presence of all of which could affect either the production rate or the quality of the finished STPP product (or both!).

The presence of all of these impurities required the development of some quite complicated multi-stage neutralisation steps to remove as many of the impurities as possible and to achieve the best possible final product quality. The following paragraphs describe these steps in outline (the chemistry involved was much more complex than set out in school text-books). Everything become much simpler with the eventual availability of sufficient 'technical' grade phosphoric acid purified from the crude 'green' acid by solvent extraction. This availability meant that all of the laborious processes described below which were both high maintenance and resulted in a product of inferior quality could be dispensed with. However this was not the case until the mid 1980s or so when the life of a process worker became much simpler and cleaner.

Fluoride Removal

Green phosphoric acid produced at a strength of 28% P_2O_5 on the F3 and F4 phosphoric acid plants contained about 1.25% F^- (Fluoride). Direct neutralisation of acid containing this amount of fluoride to yield the orthophosphate mixture required (and set out above) would result in the formation of a gelatinous precipitate of poor filterability with deleterious effects on the production rate. To overcome this potential problem the fluoride (or, rather, most of it) was precipitated from the green acid as Sodium Silicofluoride by means of a partial neutralisation of the acid at 55-60^oC (to a Na:P ratio of 0.15) using sodium orthophosphate neutral liquor from further downstream.

The sodium silicofluoride precipitated out of solution as coarse crystals which could be removed quite readily. The defluorinated acid was fed to an 'Eimco' thickener in which the crystals start to settle out. The thickened slurry taken from the bottom of the Eimco was fed to a Davy Paxman rotary drum filter; filtered liquor was returned to the Eimco while the filter cake was slurried with water and discharged to drain. Clarified

defluorinated acid overflowed form the surface of the thickener into a concentric trough from which it was fed to further processing downstream.

Heavy Metal Removal

Clarified, defluorinated acid overflowing from the Eimco thickener was fed to two sulphide treatment tanks operating in series. These tanks were fitted with agitators and ferrous sulphide plates, supplied by Laportes of Widnes, were added to the first of these at a rate of 0.5% based on the P_2O_5 content of the acid. The temperature in these reactors was, typically, 50^{o}C and treated acid was pumped from the second reactor to the downstream neutralisation vessels.

The ferrous sulphide reacted with the green acid to evolve hydrogen sulphide gas which was extracted via a duct which also served the downstream neutralisation vessels and up the main plant stack. The reaction resulted in changes to the oxidation state of some of the dissolved metallic impurities present in the green acid. Thus, for example, it was found that vanadium and uranium would precipitate more completely at the subsequent downstream neutralisation stage. If these metals were still present in the finished product the STPP would have been unacceptably yellow. (While this was unlikely to have a detrimental effect on the efficacy of any detergent powders into which it was incorporated try telling that to the housewife of the day who expected that her whites would come out 'whiter than white'!).

Arsenic and other heavy metals were also precipitated out of solution by reaction with the ferrous sulphide thus further improving the quality of the end product. These precipitates were removed by filtration after the neutralisation stage.

Hydrogen sulphide gas (H_2S - 'rotten eggs') is an extremely toxic gas and I cannot move on without mentioning that two men engaged in cleaning out one of the sulphide reactors lost their lives when cleaning out one of them. It seems likely that during cleaning they disturbed a pocket of gas which was trapped under the residue at the bottom of the reactor and were overcome. Above 100 ppm concentration loss of smell can occur and above 500 ppm death can occur quite quickly. I believe that this tragedy occurred in the 1960's (before I joined the company) and so have no further information.

Neutralisation of the Acid

Neutralisation of the acid took place in three agitated mild steel vessels operating in parallel and each of which was fitted with a stainless steel coil for steam heating. Additional heating was provided by passing the reactor contents through external heat exchangers supplied with low pressure steam. The reactors were thereby maintained at 95-98^{o}C; the relatively large heat input was required to balance the heat lost by carbon dioxide evolution (when using soda ash) and water evaporation.

Given that the 'green' acid contained numerous metallic impurities (such as Calcium, Iron, Magnesium, Aluminium, Chromium, Vanadium and Uranium) precipitated out of

solution as solids during neutralisation to pH7 forming a slurry in the neutral sodium phosphate liquor. (Not to imply that these were the only ones!). It was essential that the green acid feed to the neutralisers contained 0.8-1.0% calcium, expressed as CaO; at this level the calcium precipitated to act as a filter aid. At lower levels of calcium a slimy, gelatinous filter cake which restricted production rates would arise.

Filtration of 'Neutral Slurry'

The variability of the feedstock and possible loss of control of the reaction conditions during neutralisation meant that this was the rate-determining step of the wet salts process. Neutral slurry was fed to a series of rotary drum filters in order to remove the filter cake from the product liquor. Four such filters were utilised in parallel for primary filtration, two were dedicated to secondary filtration, one to tertiary and one to quaternary filtration. A vacuum was applied to each drum filter to effect filtration. Filter cloths of either polypropylene or terylene were fitted to the drums; most of the drums had a cloth area of $300ft^2$ but the 'Jumbo' primary filter had a surface area of $600ft^2$. In contrast the surface area of the 'Bimbo' (no political correctness in those days) filter used for quaternary filtration was only $70ft^2$.

Liquor filtered out of the slurry at the primary stage was fed forwards for downstream processing. The filter cakes discharged from the primary filters was slurried in dilute neutral liquor and the resulting slurry fed to the secondary filters and the process was repeated to the tertiary and quaternary filters. Filter cake discharged from the Bimbo filter fell down a chute into lorries waiting below for sale as a (very) low-grade fertiliser ('Phossac') for grassland. (The rate of fall down the chute could vary between rapid and hardly at all depending upon the nature of the cake). Liquors recovered from the secondary and succeeding stages was recycled back upstream for eventual recovery.

Carbon Treatment of Neutral Liquor

Activated Carbon treatment of liquor in order to improve the colour (ie of acceptable whiteness) of the product STPP was often required; the process worked by removing coloured contaminants of organic origin which would not have been removed during filtration. The grade of carbon used was Actibon SMB23 supplied by Norit-Clydesdale Ltd of Glasgow. The carbon was slurried into water and this slurry was mixed into the awaiting neutral liquor. Following this treatment the carbon (and any remaining neutral filter cake) was removed using Niagara pressure filters of which 3 were available.
The filtered carbon-treated liquor then had to be concentrated to a higher strength ($32\%P_2O_5$) than its 19% P_2O_5 prior to spray-drying and this was achieved using two Nordac submerged flame evaporators working in parallel. These were fired using natural gas but gas oil could also be utilised.

Thankfully sufficient 'technical' grade phosphoric acid became available from the upstream solvent extraction plants to replace 'green' acid as the feedstock.

Spray-drying of 'neutral' liquor (DS2 &DS3)

The concentrated neutral liquor was pumped to the top of the spray dryers on the DS2 and DS3 plants. Each had a diameter of 34ft and internal volume of 23000ft^3 and they operated in parallel. The liquor was atomised on a disc spinning at 6900rpm and the droplets were flash-dried in a co-current flow of combustion gas (at 410-460^{o}C for DS2 and 435-475^{o}C for DS3) provided by burning natural gas in air. The resulting solid orthophosphate ('ortho bead') fell down the chamber of the spray-dryer and was drawn through a bottom bend and upwards into one of four cyclones operating in parallel and designed to separate out the dried bead from the gas stream. Each dryer could evaporate some 16000-18000lbs of water per hour and this discharge gave rise to the distinctive white plume of steam customarily seen from the stacks.

The ortho bead collected in the cyclones was discharged into a screw conveyor which fed material at 150^{o}C into the rotary kiln. Each spray-dryer provided material to its own dedicated kiln. Each kiln was of mild steel and 90ft long with an internal diameter of 12ft. Lifting and mixing flights were located inside each kiln to ensure mixing of the contents as the kiln rotated. The kilns were inclined at a slope of 1 in 48 to assist movement of the contents to the outlet end. Heat was provided by burning natural gas in air and feeding the hot gases produced at 700-900^{o}C into the outlet end of the kiln so that the gas stream and solids passed counter-current to each other. During heating a condensation reaction took place resulting in the ortho bead being converted into STPP as shown below.

$$NaH_2PO_4 + 2Na_2HPO_4 \text{ --> } Na_5P_3O_{10} + 2H_2O$$

The STPP was discharged from the kiln at a temperature of 450-500^{o}C depending upon the precise grade required. Typical average production rates from each kiln were 10tph giving a typical residence time of 105 minutes..

As an aside at least one of these kilns was fired with natural gas supplied on an interruptible tariff which, although very economical, meant that when national gas supplies were in short supply the plant had to be shut down. The mechanism involved receipt of a Fax from British Gas requiring that the plant be shut down by a given time. Severe financial penalties accrued in case of non-compliance with this order. The Shift Manager was required to confirm to British Gas when shut-down had been implemented but even so remote monitoring of the gas supply gave assurance to the supplier that it had actually occurred.

Product discharged from the kilns was gradually cooled as it was conveyed through a series of 'Holoflite' cooling screws through whose jackets cold water was circulated. The cooled STPP was conveyed to a series of storage silos from which it could be fed either to a milling circuit to produce a fine powder (somewhat akin to talc) or fed to a series of sieves if granular products were required.

DS4

This plant opened in 1976 to coincide with the opening of the first solvent extraction plant at Whitehaven (the MO Plant) and to take advantage of the technical grade of phosphoric acid which it would produce - obviating the need for the laborious, cumbersome and high maintenance associated with the old Wet salts process upon which DS2 and DS3 depended.

The essential chemistry of the plant was much the same as on DS2 and DS3 but it was a much simpler operation with the requirement for only a single neutralisation vessel, a spray-drier and a rotary kiln and associated equipment. During plant commissioning the life of one of my friends was saved by the hard hat he was wearing when he was hit on the head by a stray bolt which fell from the top floor. He sustained a headache and recovered after a day or so but his helmet fared much worse being shattered by the impact.

The 58-59% P_2O_5 technical grade acid was neutralised at 114-116^oC using caustic soda (47% NaOH) needing no further concentration prior to being spray-dried. The spray-drier was of 40ft diameter and in 1976 was the largest of its type in Europe. After separation in the cyclone the ortho bead was fed into the DS4 rotary kiln of similar dimensions to those on DS2 and DS3 where a similar condensation reaction to STPP took place.

The self-contained nature of DS4 lent itself to the production in later years of food-grade STPP when phosphoric acid of that quality became available from the solvent extraction plants. It was also used on one occasion for the trial manufacture of sodium pyrophosphate ($Na_4P_2O_7$) which was being considered by one potential customer as a source of heat retention within domestic radiators. Nothing came of this proposal.

Product Despatch

STPP was sold to the customers either in bulk or in packages. Bulk material was shipped out either by road tanker (19t) or by rail-car (18t) until closure of the Corkickle Brake in November 1986. After that date all shipments were made by road.

Packaged sales were in either 50kg sacks or 1000kg 'Big Bags'. In 1981 sales could be broken down as follows;

Packages 59000t
Bulk 136500t

The principal customers were Proctor & Gamble in Newcastle-upon-Tyne and Unilevers in East Thurrock and Port Sunlight. They used the STPP in the formulation of the multitude of washing powder brands they produced and many of which became household names. A small proportion of the STPP was also used internally on the S4 plant in the production of own-label washing powders for British supermarkets. (Hence the usual query whenever any-one discovered that you were employed at Marchon was 'Can you get me some cheap washing-powder?)

The decline of STPP

For many years STPP production was the mainstay of Whitehaven phosphate operations and, it may be argued, supported Albright & Wilson through the lean years. However there was a problem of eutrophication (growth of algal blooms) in many slow-moving inland bodies of water including the Great Lakes of North America and European lakes and waterways (especially Switzerland).

The evidence pointed to excess amounts of phosphate being a contributory factor and considerable pressure was placed on legislators by environmental lobbyists along the lines of 'something has to be done'. The phosphate manufacturers, including A&W, put up a spirited defence. They pointed out that some 20% of the phosphates causing eutrophication did indeed come from laundry products. They also pointed out, however, that some 30% originated from human sewage and 50% from agricultural fertiliser run-off. They also argued that by spending money (investment in modern parlance) phosphates of laundry and human origin could be removed during sewage treatment.

The legislators took their usual course of action and targeted the polluter with the least public standing regardless of their actual contribution to the problem and starting limiting or even banning the use of phosphates in laundry products. This unsurprisingly had a detrimental effect on phosphate producers world-wide including the Marchon Works. There was suddenly a surfeit of STPP within Europe and to continue making sales the price had to be cut to the bone with knock-on effects to jobs and future investment. Some sales were actually declined by A&W since the price demanded by the customers was below cost.

The environmentalists, in their usual spirit of not thinking things through, by getting the use of phosphates either limited or banned solved one problem and introduced another. The P&Gs of this world searched for an alternative to phosphate in their laundry formulations and one of the most popular was Zeolite. These are aluminosilicate minerals and introduced aluminium salts into the environment when wash waters were discharged from washing machines. (Those with a long memory may remember the effects on the local population at Camelford when a 20t load of Aluminium Sulphate was accidentally off-loaded into the wrong tank at a Water Treatment Works).

The use of another STPP substitute introduced in the USA had to be discontinued due to concerns over possible toxicological effects. Other phosphate substitutes were also used but none was anywhere as effective in laundry formulations as STPP. The housewife (sorry it's non-PC) simply used more of the product (is that what environmentalists really wanted?) in a vain attempt to improve the cleaning results. The phrase 'own-goal' springs to mind.

Following the takeover of Albright & Wilson by Rhodia in 1999 all phosphate operations on the Whitehaven Site were closed down by the end of 2002 and the plants were demolished over the following couple of years. The detergent operations, by now operated by the American firm Huntsman, closed during 2005 and those plants were also demolished.

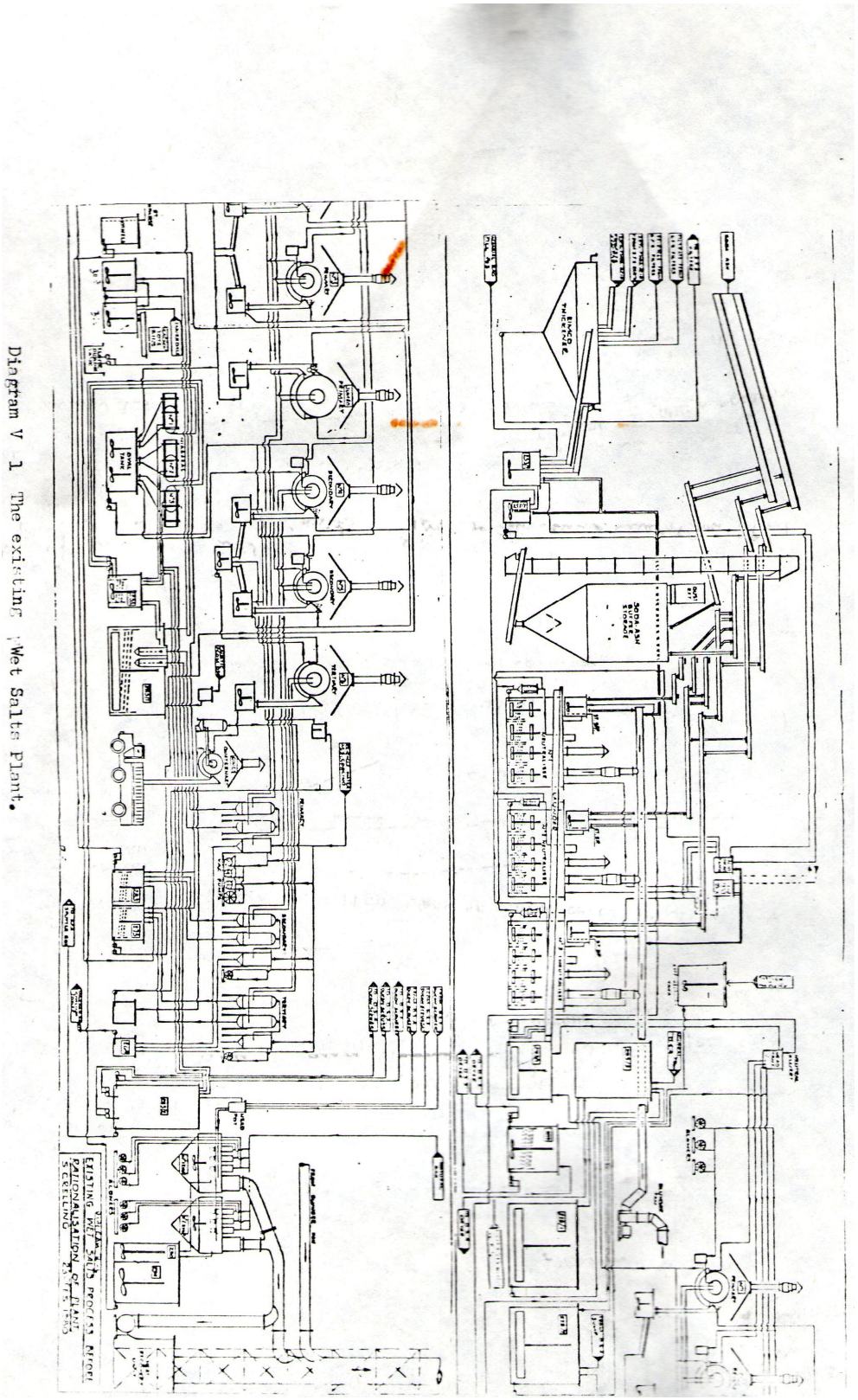

Diagram V 1 The existing Wet Salts Plant.

REQUEST FOR HELP OR INFORMATION.

Recently we have had a number of requests from both members and non members with their research and the e-mail group has not produced the answers.

1) I am looking at shipbuilding in the Cartmel peninsula during the late 17th and early to mid 18th centuries. What started as trying to verify the activity mentioned in Stockdale's Annals of Cartmel has led to me building a picture of around a dozen ship's carpenters with at least three having 'yards' on the peninsula. I have also found records of some of the vessels built. To put some context around my findings I am trying to find written works (published or academic) which describe the basis of small-scale ship building at the period. So far the only references I've found covered the whole of northern Europe or to Naval shipbuilding but nothing specific to British merchant vessels. Whilst there may have been permanent ship yards at Whitehaven and eventually at Lancaster in this period, I'm trying to establish whether the smaller 'yards' were less permanent and if the master ship's carpenters were peripatetic, building wherever there was a demand and perhaps only part-time.

2) I am trying to research how slates from the quarry at Elterwater, would have been transported for use at Wentworth Woodhouse in the 18th century and wonder whether you would be able to point me in the direction of any useful info on the subject. I am enquiring as we currently working as architects on the restoration of the building and a putting together the story of the building's construction.

3) A request from a descendant of William Coulthard to help produce a history of William Coulthard and Co. A Carlisle company started in 1858 and made pressure diecast machines (some of which were used to make 'Dinkey Toys' and later high pressure lubricators used on ships engines etc. The family archive is still in private hands and the business is still active in the Carlisle area.

If you have any information on either of the above request or would like to help with the history please contact Helen lowludderburn@btinternet.com

DILAPIDATED AND REDUNDANT? INDUSTRIAL HERITAGE IN A WORLD HERITAGE SITE.

The trouble with being interested in industrial history is that things that are now "dilapidated and redundant" are what fascinates us. So I was alarmed to see those words used – and not in a complimentary way – in a notice giving advance warning of a now current planning application (7/2018/5372) to demolish Sunny Bank Weir across Torver Beck on its approach to Coniston Lake.

Sunny Bank weir was built about 200 years ago to divert water to power the bobbin mill downstream via a waterwheel and turbines until it closed about 1934. The "simple weir and headrace" are recorded in the National Park's Historic Environment Record, and form an integral part of the whole site.

The South Cumbria River Trust's application to demolish the weir is part of a lottery funded project to generally improve the freshwater environment in the Rivers Duddon, Crake, Leven, Kent, Gilpin, Bela and their catchment areas – virtually the whole of South Lakes. A worthy cause no doubt, but not in this case when it comes at the expense of the area's industrial heritage.

The SCRT have many other plans, and indeed have already carried out some damaging work elsewhere. Not all of it will require planning permission. Can I ask all our members living in South Lakes to keep an eye open for anything that affects its industrial heritage, especially along our rivers and becks? I happened to spot the notice about Sunny Bank in the back pages of the Westmorland Gazette. If you let Helen Caldwell (CIHS Secretary) know of any concerns then we can investigate and challenge if need be.

Roger Baker

GENERAL DATE PROTECTION REGULATIONS (GDPR) AND THE SOCIETY'S PRIVACY POLICY

The General Data Protection Regulations, that came into force in May 2018, require all organisations to have policies in place showing what personal data is held, how and why it is collected and used, how it is secured and member's rights in regard to that information. This is known as a Privacy Policy and what follows is the Society's statement that aims to answer those questions:

Our membership data list records: names, postal and email addresses and telephone numbers that you provided on your membership application. Information regarding subscriptions, when and how paid, when and how contact has been made and joining information is also kept.

This data is used solely for the purpose of communicating with you regarding your subscription and in sending periodic publications. Additional, members may request to receive information about news and events that we have heard about, and to circulate requests for information that have been sent to us by researchers.
We will not send you anything which is not relevant to the Objects of the Society.

The data is stored in password protected files on the computers of limited number of officers who, by virtue of their roles in the Society, have need of it. Membership data is not shared with any person or organisation outside the Society and will not be without your express consent. Data is kept only for so long as it has relevance to the Society.

Members have the right to request a copy of all the data held and to instruct as to how and when the Society communicates with them. Members can request that the Society does not send them any or particular communications with the exception that the Society is legally required to advise them of the Annual General Meeting.

Finally, the Bulletin, and all other printed matter, membership leaflets, programmes etc., needs to carry the inscription "You can unsubscribe from this publication at any time by contacting the membership secretary"

The Society's current rules already go some way the satisfying the GDPR requirements but will need to be amended to accommodate the GDPR and to fit with the proposed Privacy Policy. A formal proposal to this effect will be put to members at the next Annual General Meeting.

Robin Yates Membership Secretary.

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A REMAINING PYLON ON THE ARIAL ROPEWAY THAT BROUGHT BARYTES DOWN FROM SILVERBAND MINE ON THE UPPER SLOPES OF GREAT DUN FELL.

A POSSIBLE TOPIC FOR NEXT SPRING CONFERENCE.