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Water: Its Problems in a Laundry and What To Do About It!

There is now greater attention paid to product quality when items are being washed and hygiene as well as safety is given much more attention than perhaps even the customer appreciates. In general the amount of water available is reducing and its price increasing and we must use our technological skill to be as economical as possible with its usage. There is an increasing awareness of environmental conservation and we have a duty to conform with legislation regarding the quality and quantity of effluent we discharge into our sewers. The quality of raw water supplied by the water authorities is considered high in terms of purity for human consumption, but there are however, few waters which can be used for washing in laundry terms without some form of additional treatment.

Water falls in the form of rain, or snow, on to the ground soaking into it, or trickling over it, to form streams and rivers. On this journey the water comes into contact with many different types of rock formation, any of which may be water soluble. Water which flows very slowly, or stagnates, has an opportunity to dissolve other kinds of impurity, for example the products of decaying vegetation. From these examples it can be seen that no water that is available from natural sources can be said to be pure, although the presence of these impurities does not render it unfit for human consumption.

In terms of washing some of the impurities acceptable in drinking quality terms can have detrimental properties when applied from a laundry view.

Iron, or compound of iron, can be dissolved from certain types of rock and the effect in a washing process is to turn white items yellow and to produce discoloration on coloureds. In the case of woolens the yellow and discoloration can occur at very low levels of iron contamination. It is quite common to find naturally occurring soft waters containing iron, and this requires a special treatment or aeration and filtration.

As the water is heated, any calcium and magnesium bicarbonates present decompose to form the carbonates and carbon dioxide. The impurities present in a water for laundry use are important from two points of view. In the first place they decide whether the water is suitable for use without treatment; if it is not, they also decide the kind of treatment that is required.

Hardness is probably the most important impurity. It is now generally recognised that the laundry use of water with a hardness greater than 6-7 degrees (100 ppm) is indefensible, both from the points of view of the quality of work obtainable and also of economy. All hard water can be softened, and the softening process always makes for real economy, since hard water causes such great waste of washing materials in the washing process. Hard water does not give a precipitate with synthetic detergents but it gives rise to a chalk-like loading with the usual laundry alkalis. **Iron** is most objectionable in water for laundry use, and if it occurs in quantities much **greater than two parts per ten million** steps must be taken to treat the water for its removal. If the water contains appreciable hardness, the installation of a water softening plant know has a **lime-soda plant** will automatically remove the iron during the process of softening but, as It is quite common to find naturally occurring soft waters containing iron, other treatments are often necessary. Filtering will remove particles of iron rust but dissolved iron or a colloidal suspension, in the absence of hardness, requires a special treatment of aeration and filtration, possibly preceded by a chemical dosing. Filtration through a bed of material specially prepared for the purpose will sometimes be sufficient and the plant rather resembles a zeolite softener. The iron which accumulates in the bed is removed by back-washing; chemical regeneration is not normally required. The use of a zeolite softener for the removal of small amounts of hardness from an iron-contaminated water is a dangerous procedure; iron is capable of causing serious deterioration of the zeolite, irremediable if the latter is an artificial product **Rust in water** often arises from the corrosion of iron pipe lines, storage tanks, etc., and is

Example of a Zeolite softener

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specially liable to occur with soft waters that are slightly acid (e.g. moorland waters), and some zeolite- softened waters. The installation of copper or polythene pipes completely prevents the objectionable results of rust on the work, but if iron pipes are installed and have rusted, the work may be stained locally or generally with iron. In serious cases, the tanks and piping will have to be renewed and it may be worthwhile having the water analysed to see whether it is desirable to adopt some form of regular treatment which will reduce the corrosive properties. In milder cases sodium silicate (water glass) may be used to check further corrosion and to anchor existing rust more firmly to the piping. The treatment consists of filling the tanks and pipes with a solution containing sodium silicate (or sodium meta silicate) in the proportion of 112 grams per 4,500 litres of water and allowing them to stand over a weekend. If, as is usually convenient, the solution is made up in the main water storage tank or tanks, some water should afterwards be drawn from each valve, so that the silicate reaches all parts of the system before finally shutting down for the weekend. This treatment may be sufficient to prevent further trouble for a period but it will probably be necessary to repeat it every month or so. An alternative to its repetition is the continuous addition to the soft water storage tank of a solution of silicate equivalent to 14 grams of silicate per 4,500 litres of water. This addition has no appreciable effect on the water as regards its use for washing, and it may therefore be continued for a week or so at a time to effect a more permanent result. With some waters the effect is more lasting than others, and this point must decide how often the silicate treatment is given.

When this treatment is used, care should be taken to ensure that none of the treated water enters the boiler feed system as silicates form extremely hard scale in the boiler.

Suspended Matter of Objectionable Colour

If the water is sufficiently hard for the employment of a lime-soda softener, this will remove the colour in the normal course of softening. Where a lime-soda plant is not suitable, filtration must be resorted to. This alone may be insufficient to remove a coloration, in which case it is necessary to dose the water with aluminium sulphate or sodium aluminate before filtering. The former tends to make waters acid and the latter is alkaline. Small quantities of alkali can be tolerated in laundry waters but where aluminium Sulphate is used it may be necessary to add soda ash in sufficient quantity to neutralise the acidity.

Alkalinity of Water

Temporary hardness in water causes it to be alkaline, but with naturally occurring waters the term "alkalinity" is usually restricted to that due to dissolved salts not causing hardness; sodium bicarbonate, often present in well waters, is the most common. Natural alkaline waters are as a rule very similar to those which have been zeolite softened, which they may well have been by percolation through a subterranean bed of a natural zeolite. Their hardness is therefore always low, and any treatment they require on account of their alkalinity is as a rule best given by special methods employed in a plant of the lime-soda type. **The Choice of a Water Softener**

There are two main methods of softening water; one is to run the supply through a bed of some exchange material, which will remove calcium and magnesium replacing them with sodium in equivalent quantity, and the second is the lime-soda treatment in which lime and soda are added in strictly controlled quantities so as to precipitate substantially all the calcium and magnesium.

Originally, the base-exchange softeners contained a naturally occurring sand called zeolite which had the power of removing hardness-forming metals and replacing them by sodium. When the bed of mineral was exhausted it was treated with common salt solution which reversed the process, leaving the zeolite in a state in which it would soften a further supply of water. Artificial zeolites of approximately similar composition were later introduced and had a rather higher exchange capacity than the natural zeolites weight for weight. Later still, carbonaceous materials derived by the chemical treatment of coal were introduced and this type was followed by synthetic resins. The most recent exchange material to come on the laundry market is a polystyrene resin which has a considerably higher exchange capacity, bulk for bulk, than any of the earlier materials. In addition to these exchange materials which are regenerated with common salt, there are some which are regenerated with acid and which remove from water any calcium, magnesium or other metallic ions replacing them with hydrogen ions, thus leaving the water acid. By running this acid water through another type of synthetic resin bed having the power of absorbing acid from water. it is possible to obtain purity approximating to that of distilled water. Although water of this purity is not normally required for laundries, it may sometimes be of interest in the case of boiler of a very high output in proportion to their size, where specially pure feed water is needed.

There have also been developments in connection with Lime Soda softeners and there are special types in which precipitation of calcium and magnesium is especially rapid or complete. Since lime-soda plants give an output water which contains a small but definite degree of hardness, there have also been plants in which a lime-soda softener was combined with a zeolite softener, the lime-soda plant removing the majority of the hardness and the alkalinity while the zeolite plant removed residual hardness. These plants again are not of importance to laundries, where the choice in general still remains that between a lime-soda and a base-exchange type softener.

No general statement can be made that one method of treating water is better than another.

The Lime-soda Plant is economical to operate but it requires considerable ground space, regular attention and very strict control. It is inefficient with waters of less than about 8' hardness and even with harder waters it will reduce the hardness to only about 2°-4°.

It will, however, remove iron and suspended matter at the same time. It is often difficult to operate successfully with waters containing much magnesium. Normally it yields water of a low total alkalinity (but sometimes of rather high pH value), in most cases quite suitable for washing and also suitable for most boilers. The disposal of the chalk sludge and the cleaning of the filter often present difficulties. Careful handling and regular attention are required if the plant and its surroundings are to be kept clean and free from splashes of sludge.

It is mainly in use in very large laundry operations with the space and staff to look after it.

The Zeolite Plant is more expensive in materials and with water of high hardness, (over 20º total), is of the two comparisons uneconomic but is the most popular in use because of its ability to work almost without too much attention. The plant is compact and very simple to operate, requiring the minimum attention. It softens water completely, irrespective of what the hardness may be, but is intermittent in action as it must be stopped for regeneration and this necessitates a storage tank for soft water or a duplicate plant (two tower plant). The softened water has an alkalinity equivalent to the temporary hardness of the raw water. When this is high the softened water may be unsuitable for the washhouse, and even more unsuitable for the boiler. All the effluents from the plant may be put down the ordinary drain, and the plant is quite clean in operation and is very automatic requiring only attention to the adding of salt to the brine tank.

Zeolite Softeners: Decreased yield: It occasionally happens that the yield of soft water between regenerations falls to a figure considerably below the stated capacity of the plant. There are many possible reasons for such a drop in yield and can be explained as follows:-

Checks on what to do to remedy the cause of decreased yield;

1. The Hardness of the Raw Water Supply has Increased. A Zeolite softener can only be guaranteed to yield a definite amount of soft water provided the hardness of the supply is constant. If the latter rises, the yield of soft water decreases proportionally. Thus a change from 14° total hardness to 18° would reduce the yield to 14/18 or 78 per cent of the original.

Determine the hardness of the raw water by a soap test and note any change from the original figure on which the plant was estimated. Calculate what yield the new hardness should give; if the figure does not agree with the actual yield from the meter, there is another explanation of the change in yield.

Regeneration is Incomplete

This may arise in three ways:

(a) Insufficient salt is used: with most exchange materials the output of softened water obtained between regenerations depends on the amount of salt used per regeneration. If more salt is used a longer run is obtained. The manufacturer's recommendations represent in general the optimum conditions, an increase in the amount of salt giving a longer run, but at the cost of using disproportionately more salt per kg of calcium removed from the water. The use of less salt gives greater economy in salt per kg of calcium removed from the water, but involves more frequent regeneration and consequently a greater consumption of water for rinsing.

If the manufacturer's recommendations are not available then an approximation to the amount of salt required per regeneration for natural or artificial zeolites is given by:-

thousands of litres softened water x hardness of raw water x $\frac{3}{7}$

Thus, a plant yielding 32,000 litres soft water from a supply of 16° hardness will require approximately:

$32 \times 16 \times \frac{3}{7} = 26$ kg. salt.

Check by such a calculation that sufficient salt is being used.

Polystyrene resins operate with less salt and two-thirds of the amount calculated by the formula above should prove adequate.

(b) Channelling: channelling of the zeolite bed may allow the brine to trickle through in certain places only; in this way the bed does not get fully regenerated.

Give the plant a vigorous backwashing to lift and redistribute the bed; regenerate again and see if the yield is restored. If back-washing is not successful, the plant will have to be opened and the bed removed, broken up and returned.

(c) Broken salt distributor: this may lead to local regeneration by allowing the brine to trickle through in one or two places only. The salt distributor frequently gets badly corroded by brine. Open plant and inspect brine distributor; if necessary replacing corroded portions.

(3) Deterioration of the Zeolite

This may occur from five causes:

(a) Organic suspended matter, mud, etc.: even when present in the raw water only in minute traces, suspended matter may accumulate in the bed which acts as a filter. The zeolite grains may become so coated that they are no longer in contact with the water and cannot soften it. Suspended matter can be removed by efficient and regular backwashing, although when the bed has been allowed to get badly choked a special treatment may be necessary.

Give the plant a vigorous backwashing, observing whether this removes much sediment, etc., and wash till clear. In special cases it may be useful to destroy organic matter by filling the plant with a cold bleach liquor, using sodium hypochlorite at strength 50-100 grains per gallon, and leaving it in overnight. This treatment must be followed by backwashing, thorough rinsing, and a good re-generation before re-use of the plant; it may effect an improvement in yield.

(b) Iron: may accumulate in the zeolite bed in very much the same way as suspended matter. Both soluble and insoluble iron in the water will give the same effect. Not only does a reduction of yield of soft water occur, but occasional outbreaks of iron stains on the work may arise. These are due to flushes of iron, washed out of the zeolite bed, getting into the soft water supply. Removal of the iron deposits from the bed provides the only remedy, but that is not always possible; for instance, with artificial zeolites. It is because of the danger of irreparable damage which may be caused in this way by iron that waters containing more than 5 parts per ten million should not be passed through zeolite softeners.

Vigorous backwashing, continued till the effluent is clear, will remove the bulk of the iron particles contaminating the bed. With waters known to contain iron, backwashing should be a regular procedure at each regeneration in order to prevent an accumulation of iron. With artificial zeolites a very vigorous backwash is the only step possible once accumulation has occurred, short of replacing the whole or part of the zeolite bed. With natural zeolites
a special process using acid can be employed but it is best given by the plant manufacturer.

(c) Acid water: the continual flow through a bed of artificial zeolite of acid water causes deterioration of the softening capacity, loss of yield therefore occurs with waters containing **free carbon dioxide**. A treatment with sodium silicate may restore the yield.

Regenerate in the usual manner and then fill the plant with a cold solution of sodium silicate, made up in the proportion of 1kg of waterglass (sodium silicate $Na_2(SiO_2)_nO$) in 40 litres of water. Allow this to remain in the tank overnight, rinse well and then regenerate as usual.

(d) Over-running: often causes a temporary loss of yield

The practice of over-running a plant is bad from another point of view, for it entails the delivery of hard water to the washing machines: thereby upsetting processes and leading to bad work until the water is soft again, Zeolite plants should not be run on a time basis (regenerating, say, at lunch time or in the mornings or both).

But should be regenerated when a test shows that the water is beginning to run hard. In this way
over-running and its consequences are avoided. There are automated systems, with more than one
resin tower, that change over at regeneration time to ensure a full soft water supply is possible.

If the plant has been over-run, a proper regeneration should be given, followed by a second complete regeneration using the full quantity of salt. Yield lost through over-running will be restored by this treatment.

(e) Use of hot brine: causes decrease of yield by damaging the zeolite.   Damage of this type is likely to occur very seldom as hot water is never used for dissolving the salt. There are cases, however, where the use of an inefficient steam injector (if that is the system) blowing the brine into the plant, has heated the liquor to well above 38ºC. This temperature is too high for safety with most zeolites, although there are some synthetic resin exchange materials which will stand much higher temperatures. The fitting of a steam ejector on the outflow of the plant, so as to suck the brine into the plant, will avoid warming the brine as it enters the zeolite bed.

(4) Loss of Zeolite Material

This may occur in course of time through the gradual powdering away of the zeolite grains (a slow process) or through backwashing so vigorously as to blow the material out of the plant. To guard against this latter form of loss it is an excellent plan to fit a catch box or screen arrangement under the outflow waste pipe in which material may be caught or at least seen.

The yield of a plant is obtainable directly from the quantity of zeolite that it contains and the capacity of the zeolite expressed as the number of litres of raw water of a specified hardness that can be softened per cubic metre of the material. As a rule a figure for capacity can be obtained from the makers of the plant and it is
therefore possible to calculate how much zeolite should be in the plant for a given yield or,
conversely, how much yield can be expected from the measured volume of zeolite in the plant.

Open the plant, measure the diameter, and estimate the depth of the bed. Calculate the volume of zeolite and hence the yield for raw water of the particular hardness. Alternatively calculate how much zeolite the plant ought to contain for its proper yield-the measurements may show considerably less in which case zeolite has been lost.

Lime-Soda Softeners

If these plants are to deliver uniformly softened water, regular testing of the water, regular inspection and cleaning of the moving parts of the plant, and periodic attention to the condition of the filter are absolutely necessary. It is most commonly because these points are not sufficiently watched that lime-soda softeners are found to yield water either too alkaline or insufficiently softened.

Quantities of Lime and Soda

In starting up a lime-soda plant the dosage must be calculated from the analysis of the water.
Another system for softening water is **Reverse Osmosis** which uses an applied pressure gradient across a semi permeable membrane to overcome osmotic pressure and remove water molecules from the solution with hardness ions. The membrane has pores large enough to admit water molecules for passage; hardness ions such as $Ca2+$ and $Mg2+$ will not fit through the pores. The resulting soft water supply is free of hardness ions without any other ions being added. Membranes are a type of water filter requiring regular cleaning or replacement maintenance therefore not found with favour in laundries.

Water in the Boiler

As the water is heated, any calcium and magnesium bicarbonates present decompose to form the carbonates and carbon dioxide These carbonates precipitate (except for the small quantities remaining in solution) giving rise to scale on the boiler surfaces or sludge.

The formation of scale is a complex and little understood process, but it is apparently associated with the presence of other substances in the water such as silicates and calcium sulphate. Scale is a bad conductor of heat and a thick layer results in an inefficient boiler with heavy wastage of expensive fuel. It is difficult and costly to remove. Sludge is more easily dealt with but is still a nuisance. Sodium bicarbonate breaks up in accordance with the following equation:

$$2NaHCO_3 = Na_2CO_3 + H_2CO + CO_2$$

The sodium carbonate remains in solution making the water alkaline.

As the water evaporates to form steam the dissolved solids remain behind in solution except the bicarbonates which decompose as above. As more and more water enters the boiler and evaporates the concentration of the dissolved solids increases. If the water entering the boiler contains much dissolved matter the concentration of the boiler solution may become very high. A significant quantity of sodium bicarbonate or sodium carbonate in the feed water soon results in a strongly alkaline solution.

Being hot, such solutions are highly corrosive and may dissolve the glass of the gauge glass tube, eat into the copper and brass of the water gauge, cocks and fusible plug valves, pit plates, etc. A high concentration of permanent hardness producing substances or otherwise harmless salts such as sodium chloride, sodium sulphate, etc., may lead to foaming and priming. Then water, or even sludge, may be carried over from the boiler and cause much difficulty in the steam system.

If the alkalinity or concentration of the boiler water threatens to become too high some of it must be run off and replaced by fresh feed water. The boiler water is said to be "blown down." Some sludge is removed at the same time. It is a necessary operation to be avoided as much as possible because it involves the loss of much heat.

As pointed out above, carbon dioxide may be released from the boiler water. If dissolved gases are present, such as nitrogen and oxygen, they too come out of solution. Such oxygen is very corrosive, particularly in association with acid water, such as water containing dissolved carbon dioxide and water contaminated with iron. The gases evolved may have an appreciable volume and, as they pass out with the steam, collect in blind corners like steam chests, calenders, presses, etc., and interfere with steam flow. The gases will also redissolve in condensed steam to produce corrosive condensate. Clearly, the water to be used in the boiler should be as pure as possible. In the laundry, lime-soda softened and zeolite softened are usually the best available. Lime-soda softened water is usually slightly alkaline and contains relatively small amounts of dissolved solids; such water is evidently well suited to laundry boiler use.

Zeolite softened water is usually of 0° degrees hardness, of an alkalinity equivalent to the temporary hardness of the raw water, and the total solid content is frequently rather high. If the raw water fed to the softener is contains much temporary hardness, concentrated liquors of high pH may develop quickly in the boiler and be accompanied by corrosion, priming and foaming. Frequent boiler blow down is then essential to reduce both alkalinity and the total amount of solids present.

Water Hardness unit conversion.						
	1 mmol/L	1 ppm, mg/L	1 dGH, °dH	1 gpg	1 °e, °Clark	1 °fH
mmol/L	1	0.009991	0.1783	0.171	0.1424	0.09991
ppm, mg/L	100.1	1	17.85	17.12	14.25	10
dGH, °dH	5.608	0.05603	1	0.9591	0.7986	0.5603
gpg	5.847	0.05842	1.043	1	0.8327	0.5842
°e, °Clark	7.022	0.07016	1.252	1.201	1	0.7016
°fH	10.01	0.1	1.785	1.712	1.425	1

The various alternative units represent an equivalent mass of calcium oxide (CaO) or calcium carbonate ($CaCO_3$) that, when dissolved in a unit volume of pure water, would result in the same total molar concentration of Mg^{2+} and Ca^{2+}. The different conversion factors arise from the fact that equivalent masses of calcium oxide and calcium carbonates differ, and that different mass and volume units are used. The units are as follows:

Parts per million (ppm) is usually defined as 1 mg/L $CaCO_3$ (the definition used below).[21] It is equivalent to **mg/L** without chemical compound specified, and to **American degree**.

Grains per Gallon (gpg) is defined as 1 grain (64.8 mg) of calcium carbonate per U.S. gallon (3.79 litres), or 17.118 ppm.

a *mmol/L* is equivalent to 100.09 mg/L $CaCO_3$ or 40.08 mg/L Ca^{2+}.

A *degree of General Hardness (dGH* or 'German degree (°dH, *deutsche Härte*))' is defined as 10 mg/L CaO or 17.848 ppm.

A *Clark degree (°Clark)* or *English degrees (°e or e)* is defined as one grain (64.8 mg) of $CaCO_3$ per Imperial gallon (4.55 litres) of water, equivalent to 14.254 ppm.

A *French degree (°fH or °f)* is defined as 10 mg/L $CaCO_3$, equivalent to 10 ppm.

One other factor of concern in washing is that of the pH of the water. The pH of a solution is its degree of acidity, or alkalinity, with a level of 7 being considered as neutral with those lower being acidic of increasing concentration and those higher than seven being alkaline with increases in alkalinity with the even higher numbers. The pH scale is 1- 6 acid and 8 - 14 being alkali. In a washing process both soap and synthetic detergents have better cleansing powers when in an alkaline solution. Soiling, especially of a fatty nature, can combine with alkali when in a hot solution and even have a cleansing power in the absence of added soap or detergent as it combines with fatty acid to form its own soap. This technology is not new as there is archaeological evidence that the Phoenicians were aware of this over 5000 years ago. When in solution soaps tend to hydrolyse (breakdown) to produce fatty acids combination of fatty acid and soap known as 'acid soap'. Additions of an alkali to the solution maintain the stability of the soap keeping it in a form which will wash. It is true **dirt often contains some acid** which destroys soap unless it is neutralised by the addition of an alkali.

Alkali can have a detrimental effect on animal fibres, such as wool, and when setting up a wash programme it is important to consider what implications there is likely to be when selecting the type of detergent and wash programme to be used. One of the characteristics of acids is that they will dissolve a wide range of metal compounds and they are therefore used for the removal of metal stains of which the most common is iron mould, or rust. Textiles can vary in their susceptibility to damage by acid, and therefore vegetable fibres such as cotton and linen are more readily damaged than are animal fibres. Nylon is also susceptible to acid conditions and care should be taken. Care should also be taken if an acid is used for stain removal because if it is not removed completely before the article is dried the drying process concentrates the acid and damage to the fabric is then inevitable. If heat is applied the damage can be all the greater.

An acid that can have a place in a washing cycle is a product, available known commercially as 'Calgon', a substance whose chemical name is Sodium Hexametaphosphate (NaP03) with a pH value below 7 when in 0.2 solution. The alkalinity of this product is higher in practice because it is mixed with sodium carbonate and sodium bicarbonate to pH of around 8.5. This product has a benefit to the laundry process in two ways. The use of slightly hard water in the first rinse can cause the soap carried over from the high temperature wash to be destroyed, losing the suspending power and any lime soaps could adhere to the load, trapping dirt particles with it. Therefore it is a dispersing agent, or deflocculating agent.   A dispersing agent prevents flocculation, or the combining of suspended matter into aggregates large enough for gravity to accelerate their settling out. This may lead to a deterioration of the colour of the washed work, but if Sodium Hexametaphosphate is added to this first rinse then the destruction of the soap will be avoided. Also, bath towels and hand towels collect considerable quantities of lime soap during use in districts of the country where the domestic water supply is hard. In hot solution Sodium Hexametaphosphate will slowly attack lime soap loadings on these towels improving both the colour and feel of these items. This product is added to built detergents for the laundry industry and this is how it is carried over from the wash to aid suspension in the first rinse cycle.

The synthetic detergents, in use today, are not 100% pure and compared to soaps, which have a purity of 70% to 95% that a lower purity from about 20% to 35% is normal. Soap less (Synthetic) detergents are sub-divided into three groups; anionic, cationic and non-ionic. Anionic Detergents: this type is almost completely biodegradable and is stable over a wide pH range. They are built with alkalis, which are used as builders and in the past phosphates, as well as an oxidising bleach (sodium perborate) and optical brightener and also carboxy methyl cellulose (known as cmc) to prevent redeposition, blended into a powered detergent product. However, the main areas of legislation affecting detergents that have taken place, particularly in the late 1980's and early 1990's are: A reduction in the amount of sodium tripolyphosphate (STPP) used in detergent builders and switch to 'alternative' non-phosphate based builders. Measures to reduce the use of STPP based detergents in the EU included the introduction of laws or voluntary agreements to change to Zeolite A as the builder for laundry detergents. As a result STPP consumption has decreased substantially since the early 1980's.

Good washing and finishing starts by having the right sorting and classifying prior to loading your machine. A basic understanding of the different types of fibre, how these are made into fabric and dyed, will help to ensure launderers and dry cleaners treat the items and select the most appropriate cleansing and finishing methods. There is a reference book, obtainable from the Guild, entitled 'Textiles for Dry cleaners and Launderers', which is an excellent reference guide covering most fabrics, finishes, with help and hints. For any soil to be removed it must be soluble, either in water, detergent solution (which is alkali), an acid, or a solvent. Marks and stains become more difficult to remove each time they are processed. They will 'set' during the first wash unless they are recognised and the correct removal procedure applied, and although it may be possible to remove them at a later stage it will be by expensive special processes, or at the risk of damage to the fabric.