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Water Pollution Abatement Through Regulation of Content and Use of Detergents*

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THE ROCHESTER COMMITTEE FOR SCIENTIFIC INFORMATION  
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Chemical and Water Pollution

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Water Pollution Abatement Through Regulation of  
Content and Use of Detergents

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This special bulletin is prepared in response to many requests for a completely non-technical explanation of the troubles facing both our lakes and the detergent industry. Three R.C.S.I. bulletins have contributed parts of this report: No. 111 (W), No. 119 (C & W) and No. 120 (W). Earlier R.C.S.I. bulletins document the increasing pollution of our waters over the last seven years.

Summary and Conclusions

Phosphates from detergents are an important kind of pollutant in many lakes. Reduction of phosphate in waste water treatment is partial, therefore the content in detergents must be drastically reduced. Labelling of phosphate content on detergent containers has been ineffective as a control measure because useful information is difficult to obtain from complicated labels in fine print. The use of phosphate-free detergents or soap, either by law or voluntarily, is found to be a reasonable control measure. Phosphate-free detergents now marketed do not pollute. Some of these are highly alkaline and constitute a personal safety hazard, and some have not cleaned effectively. Nevertheless, the products are improving, and already both safe and acceptably effective phosphate-free detergents and soaps are available. It is further concluded that the use of phosphate in detergents is a resource waste and that the salvage and production of fats and oils for soap should be encouraged.

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1. PHOSPHATES ARE FERTILIZERS WHICH INCREASE PLANT GROWTH ON LAND AND IN WATER. Rapid, unregulated growth of rooted plants and algae in water have filled lakes in recent years and caused taste and odor problems. Finally, over-abundant plant growth results in injury and death of many organisms through consumption of oxygen by their own respiration or by bacteria as they decay.
2. OVERFERTILIZATION OF WATERS IS POLLUTION. WHILE THE EFFECT RESEMBLES NATURAL AGING, IT IS A DISTORTED PROCESS WHICH RAPIDLY DEGENERATES LAKES. The degeneration can be controlled in the Great Lakes and in the Finger Lakes by a drastic reduction in the amount of phosphate being put into them as the logical first step.
3. NITRATES AND OTHER FERTILIZING MATERIALS MAY ALSO NEED TO BE CONTROLLED. Heavy domestic pollution supplies so much phosphate that nitrogen may be exhausted before phosphorus as growth occurs in the receiving water. This appears to be the case in the surface waters of Irondequoit Bay in mid-summer, for example. However, as the Bay and other heavily polluted waters begin to recover, PHOSPHATE REMOVAL BECOMES CRITICAL FOR THE RESTORATION OF A HEALTHY ENVIRONMENT.
4. MUCH OF THE POLLUTING PHOSPHATE IS FROM DETERGENTS. Reasonable estimates of the total amount are between 30 and 70%.
5. PHOSPHATES ARE ONE TYPE OF WATER SOFTENER USED IN DETERGENTS. Three other common water softeners are sodium carbonate (washing soda), sodium silicate (similar to water glass) and borates (borax).
6. WATER SOFTENERS FREQUENTLY MAKE UP OVER HALF OF THE TOTAL WEIGHT OF THE DETERGENT FORMULATION. This is true for both phosphate-based and phosphate-free types.
7. "DETERGENTS" CONTAIN SURFACTANT (the "cleaning agent"), WATER SOFTENERS, and other active materials. BIODEGRADABLE means only that the cleaner can be decomposed by bacteria. All present day surfactants in the consumer trade are more or less biodegradable.

PHOSPHATE POLLUTION COMES FROM THE SOFTENER. Therefore, "Biodegradable" and "Non-Polluting" ARE NOT THE SAME.

8. NTA (nitrilotriacetic acid) has been tried as a substitute for phosphate softeners. NTA-containing detergents are not now being manufactured. They were not withdrawn from commercial channels, but are not replaced as stocks are exhausted. Complete substitution for phosphate would add no more than 5% nitrogen to receiving waters according to industry spokesmen. This amount of nitrogen would not be critical in many environments, but it would be critical in mid-summer in the surface waters of Irondequoit Bay and in similar situations.

NTA may be responsible for a second kind of pollution, which has received less attention than the fertilizing action. Undecomposed NTA in lake bottoms may free undesirable nutrients and poisons into the water. Such evidence is being considered seriously by the Canada Centre for Inland Waters.

NTA has also been associated with birth defects under special conditions, but tests on health hazard have continued. Quietly, industry is making a major effort to have NTA cleared for use, since their investment in it is very high. Clearance for NTA in approximately a year is still a distinct possibility.

9. OTHER SUBSTITUTES FOR PHOSPHATE SOFTENERS WOULD NOT RESULT IN POLLUTION.
  - a. The amounts of carbonates and silicates which would be added if everyone used them, would be small in relation to the amount present in the receiving environments.
  - b. Borates are poisons, but at the present rate of use little environmental harm occurs. Preliminary evidence suggests inhibition of a few selected plants. Nevertheless, a massive switch to borates might result in significant poisoning.
10. SOME OF THE PHOSPHATE-FREE DETERGENTS ARE HIGHLY ALKALINE AND MAY CAUSE RASHES ON SENSITIVE SKIN. Commercial laundries have long used alkaline products because of their effectiveness. Indeed, two generations ago every housewife used alkaline washing products routinely. Properly operated laundries handle them quite safely, and safe domestic use is possible as well. Contact of strong solutions with skin should be avoided, and clothing should be well rinsed.
11. THE ADDED ALKALINITY IS NOT AN ENVIRONMENTAL THREAT. It does constitute a reason for personal caution in the household both for personal safety and protection of cloth from deterioration. Other products such as liquid bleach and household ammonia require the same cautions.
12. NO DETERGENT OF ANY KIND IS SAFE IN EYES OR NOSE OR MOUTH.
13. SOME PHOSPHATE-FREE DETERGENTS ARE NOT SUBSTANTIALLY MORE ALKALINE THAN THOSE WHICH CONTAIN PHOSPHATE. Therefore, they are no more likely to cause skin troubles.
14. SOME PHOSPHATE-FREE PRODUCTS DO CLEAN ADEQUATELY. New formulations are being produced rapidly, and a conspicuous improvement has been noted during the past six months. Unfortunately, the distributing system and the process of selection is slow, so the better products are not well-known.

Attacks on phosphate-free products have capitalized on the poorer one, and ignored the better ones.
15. AT THIS TIME, MOST OF THE HIGHLY RATED PRODUCTS ARE PHOSPHATE-BASED, NOT PHOSPHATE-FREE. Effectiveness is a surprisingly complex and subjective quality to judge. The variables include fabric type, water chemistry, and kind of soil - and most importantly, the expectancy of the user. Reported tests vary enormously. At one end of the scale the Terg-O-meter tests rate all products as poor except for the most highly effective. This produces a strong bias without giving credit for products almost as good. At the other end of the scale of tests, the phosphate-based detergent with the highest sales record in the country was matched by plain water in careful tests run at Milwaukee and entered in the Congressional Record by Representative Henry Ruess.
16. OPTICAL BRIGHTENERS ARE PRESENT IN BOTH TYPES OF DETERGENTS. These counteract yellowness and make the clothes appear brighter, but have no effect on soil removal.

17. **COST VARIES WIDELY AMONG BOTH TYPES OF DETERGENTS.** R.C.S.I. Bulletin #111 (W) reported that there was little relationship between cost and effectiveness of either type of product. Some phosphate-free products are less expensive than typical phosphate-based products, some more expensive.

The housewife cannot readily compute the cost/washload for granulated products because they are sold by weight but used by volume. The cost of liquid products can be figured quite directly since they are sold in liquid ounces (volume).

18. **MORE SEWAGE TREATMENT PLANTS WILL NOT REMOVE THE PROBLEM OF PHOSPHATE POLLUTION.**

- a. In the foreseeable future much sewage will not receive tertiary (phosphate reducing) treatment.
- b. Plants now being built or planned do not REMOVE phosphate, they reduce the amount, but enough remains to constitute a serious pollution threat.

19. **THERE ARE SOME AREAS, NOTABLY ESTUARIES AND OCEANS, WHERE PHOSPHATES DO NO HARM.** Phosphate-based detergents can be used in their watershed without hurting their waters. THEREFORE, IT IS NOT NECESSARY TO HAVE A NATIONAL PROHIBITION OF PHOSPHATES IN DETERGENTS, BUT A UNIFORM POLICY MAY PROVE NECESSARY.

- a. Regional policies might be established. For example they could be prohibited in the Great Lakes Basin and allowed in the Hudson River Drainage. Enforcing a "patchwork" may be difficult.
- b. Choice by informed users is possible. With informative labeling, an educated public might simply solve the problem by self-control.
- c. The detergent industry feels that "tailor-made" formulations would be a very expensive solution to the problem, but there are "tailor-made" regional formulations in other nationally distributed products. Gasoline is blended for different regions, and even detergents were compounded in regional formulas at one time.

20. **NEW YORK STATE HAS A LAW THAT REQUIRES THE PHOSPHATE CONTENT TO BE WRITTEN ON THE BOX.** To use the present label, LOOK FOR THE AMOUNT OF "PHOSPHORUS" AND IGNORE THE OTHER FIGURES. MORE THAN 8.7% PHOSPHORUS MEANS A HIGH-PHOSPHATE DETERGENT, ACCORDING TO STANDARDS ESTABLISHED IN AKRON AND CHICAGO. Canada permits detergents to have only a content of approximately 6.7 phosphorus. No phosphate or phosphate-free is best for lakes.

The statement seen on some labels, that "this product does not contain trisodium phosphate" is merely misleading. Ignore it. The product has some other phosphate.

The labeling law will probably be changed to make the information easier to understand.

21. **PHOSPHATE SHOULD BE RECYCLED.** Phosphate is mined as a mineral and processed with a large expenditure of energy. Approximately 12% of the product goes into detergents and most of the remainder goes into fertilizer. Ultimately, most of the phosphate that was taken from the mine finds its way to water, and this is both a waste of resources and a source of pollution.

To recycle phosphate, soil must be managed to prevent runoff of fertilizer; minerals from animal and human wastes must be returned to the soil. PHOSPHATE IS BEST PUT INTO SOIL, NOT WATER.

Soap can be used for cleaning as an alternative to phosphate-free detergents. A demand for additional soap should stimulate fat salvage, encourage domestic growing of oil seed crops, and help the underdeveloped countries of the world which grow such crops.

R.C.S.I. bulletins may be found in the Rundel Public Library of Rochester and in Monroe County Branch libraries. They are available in the libraries of the State University College at Geneseo, Geneseo Community College (Batavia), Alfred State College (Alfred Station), Jamestown Community College, Monroe Community College.