

## History of the Phosphate Detergent Ban in Indiana<sup>1</sup>

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Public Law No. 174, adopted by the Indiana State Legislature on April 9, 1971, limited the amount of phosphate in laundry detergent formulations that could be sold in the state. This action and similar regulations taken by a number of states and cities brought forth a considerable public response protesting the law. Many considered this to be one of a number of actions taken by the then current environmental action movement. Jesse Steinfeld, then Surgeon General of the U.S., said, "In an emotional atmosphere of excessive and unproved statements, the nation recently got caught up in a controversy over clothes-washing that has become a classic case of environmental extremism and governmental ineptitude" (44). Norman Borlaug, Nobel prize winner, called such legislation "ridiculous" and "idiotic" (8). A professor from Rutgers University said, "... this absurd campaign is nothing short of a gigantic public 'put on'" (8). The Indianapolis Star referred to this action as "the Phosphate Bugaboo" (6). Two writers in Canada declared "We Hung Phosphates Without a Fair Trial" and said that "this may prove to have been the most incredible scientific/political hoax in the history of Canadian and American relations" (27). Robert R. Jones, who describes himself as an "Institutional Laundry Consultant", wrote to the Fort Wayne Journal Gazette, "Your defenses of the state phosphate law are based on misconceptions shared by laymen everywhere, phosphate pollution being in the esoteric realm of organic chemistry. You and the public have over-reacted in an area understood best by technical experts. Few ecologists qualify" (26).

Few people are aware that the study of the relation of algae to phosphates goes back over 50 years and that the decision to limit or ban phosphates in detergents is in part the result of international agreements made by representatives of Canada and the United States, duly appointed at the top level by both governments. It is the purpose of this paper to document and relate some of the significant events leading up to the Indiana law.

### Early Research on Phosphorus and Algae

One of the first papers to draw attention to the relationship of algae growth and dissolved phosphates in water was the work of Atkins in 1923 (9). He pointed out that in natural waters phosphates were found in minute quantities and the presence of much phosphates was considered evidence of sewage contamination. Atkins demonstrated both in laboratory cultures and in field studies that as plankton algae increased in numbers, the phosphate content of the water decreased. Recognizing the small quantity of phosphates required by the algae, he calculated that one gram of  $P_2O_5$  is sufficient to produce 900 trillion diatom cells.

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Since that time many papers on phosphorus in freshwater have been published by limnologists in many parts of the world. After summarizing much of this literature in 1957, Hutchinson concluded:

Phosphorus is in many ways the element most important to the ecologist, since it is more likely to be deficient, and therefore to limit the biological productivity of any region of the earth's surface, than are the other major biological elements (20).

This is essentially the conclusion reached 25 years earlier by Einar Naumann, of the University of Lund in Sweden, in his "Grundzüge der regionalen Limnologie" published in 1932 (31). The culture of plankton algae to determine their growth requirements was reported in 1927 by Schreiber (42) and in 1932 by Franzew (17). Much work has been done since then to determine the nutrient requirements and growth pattern of algae. A major contribution was a study by Wilhelm Rodhe of the University of Uppsala in Sweden, "Environmental Requirements of Freshwater Plankton Algae", published in 1948. Rodhe demonstrated that phosphate requirement for growth can vary considerably among different types of algae (38).

It has long been known that much material that supplies plant nutrients is generated by human activities and flows into lakes and rivers, stimulating plant growth. This was pointed out as early as 1947 by Sawyer in a paper titled "Fertilization of lakes by agricultural and urban drainage" (41) and by Hasler in the same year in his paper "Eutrophication of lakes by domestic sewage" (18). Sawyer used the phrase "domestic eutrophication" while Hasler called it "cultural eutrophication". Sawyer concluded that "all the evidence obtained in the Madison (Wisconsin) survey lends support to the belief that phosphorus is a key element in determining the biological activity in a body of water".

Mortimer in 1937 observed that algae growth was proportional to the amount of phosphorus flowing into a lake from the outside (30). Pearsall in that same year (1937) said a way to control algae growth was to "remove nitrogen and phosphorus from the inflowing water" (33).

#### Detergents Implicated

After World War II, algae problems became rapidly more serious in lakes in the U.S. as well as in Europe and Japan. This was clearly associated with an increase in the rate of phosphate loading in the lakes after 1945.

As the problem of excess algae growth became more pronounced, a number of seminars and conferences were sponsored by various agencies and organizations to bring together experts from all over the world to discuss this world-wide problem. Some of the more important of these meetings are:

1960. Seminar on ALGAE AND METROPOLITAN WASTES, sponsored by the Department of Health, Education and Welfare, Cincinnati, Ohio (3).

1962. ALGAE AND MAN, a NATO Advanced Study Institute held at Louisville, Kentucky (24).
1966. A Symposium on ENVIRONMENTAL REQUIREMENTS OF BLUE-GREEN ALGAE, sponsored by the Federal Water Pollution Control Administration and the University of Washington, Seattle, Washington (4).
1967. INTERNATIONAL SYMPOSIUM ON EUTROPHICATION, sponsored by the National Academy of Science—National Research Council, at Madison, Wisconsin (39).
1967. ALGAE, MAN AND THE ENVIRONMENT, an International Symposium sponsored by Syracuse University and the New York State Science and Technology Foundation, at Syracuse, New York (25).
1971. SYMPOSIUM ON NUTRIENTS AND EUTROPHICATION, sponsored by American Society of Limnology and Oceanography, the E.P.A., the Institute of Water Research, Michigan State University, and the federal Office of Water Resources Research, at Michigan State University (28).
1971. Symposium on NUTRIENTS IN NATURAL WATERS, sponsored by American Chemical Society, at Los Angeles, California (2).

From these studies and conferences there has emerged a strong consensus that in many, if not most, cases of excess algae growth in lakes the cause has been chiefly an increase in the input of phosphorus into the lake system. The definitive statement is the paper on the "Role of Phosphorus in Eutrophication" by A. F. Bartsch, head of the National Environmental Research Center at Corvallis, Oregon (12).

In 1957 a short paper was published which reported that in this study the algae growth could not be accounted for on the basis of the quantity of orthophosphate measured by standard tests (1). Therefore the algae must be using phosphorus from larger, more complex phosphate compounds that were not being measured. This provided a clue for researchers to look for complex phosphate compounds, and they found the polyphosphates from synthetic detergents.

A. F. Bartsch, speaking at the 1960 Seminar mentioned earlier, said, "As the quantity of sewage increases, its character changes also in many ways. One is the per capita increase in phosphorus content traceable to the recent popularity of phosphorus bearing detergents. Most of it finds its way to the sewer" (11).

In 1963, Leon W. Weinberger, chief of the Basic and Applied Sciences Division of Water Pollution and Supply, HEW, speaking before the Natural Resources and Power Subcommittee of the Committee on Government Operations, said:

Foaming has been the principle objectionable feature associated with water pollution by ABS, although the phosphates that are present in the synthetic detergents may turn out to be of greater significance than the ABS in that they provide nutrients for algae growth (45).

In 1963, the New York State Legislature was dealing with a report from its Commission on Water Resources Planning, which said in part: "The detergent problem and the algae problem may be related. They may have a common denominator. Phosphates which are present in the former and which serve as fertilizers or nutrients to induce growth of the latter" (55).

#### The Crisis Year, 1964

One of the consequences of excess algae growth in a lake is the reduction in dissolved oxygen at the bottom of the lake due to the decomposition of the dead algae cells that have settled to the bottom. The amount of oxygen consumed in this way is proportional to the quantity of algae produced. For a number of years it had been observed that the oxygen concentrations in the deep water of Lake Erie had been declining. In August of 1964 the oxygen completely disappeared at the bottom of the large central basin in an area of about 2,600 square miles, roughly one fourth of the total lake area (46). This triggered a series of events in both the United States and Canada which dealt with the problem of eutrophication in lakes and rivers, especially Lake Erie and the Great Lakes.

In October, 1964, both the United States and Canadian governments asked the International Joint Commission to study the problem in the boundary waters, especially the Great Lakes, and to report recommendations on the pollution of Lakes Erie and Ontario. The I.J.C. is an international advisory body created by treaty between the U.S. and Canada in 1909 (10).

The Federal Water Pollution Control Administration established a "Lake Erie Enforcement Conference Technical Committee" which was to make its report in June of 1967. But in the meantime in 1965 a very significant study was released by the President's Science Advisory Committee titled, "Restoring the Quality of our Environment". In relation to eutrophication and the algae problem, the committee said:

Polyphosphate detergents, after domestic or industrial use, are carried in sewage effluents into rivers, lakes and estuaries, where the phosphate is readily taken up by algae and other aquatic plants. If present in sufficient quantities, such detergents can give rise to obnoxious algal blooms. . . . Investigations of the chemical composition of the effluents of sewage plants indicate that the phosphorus concentrations are considerably higher than was common in sewage effluents 20 years ago. This increase is attributed to detergents. . . . At some locations, as much as half the phosphorus in sewage effluents comes from detergents . . . if phosphate from detergent products is a major contribution to the problem, a non-phosphate additive should be sought (34).

W. Q. Kehr of the Federal Water Pollution Control Administration issued a paper in July of 1966 titled, "Statement on Phosphate—The Critical Nutrient in the Water Pollution Control of Lake Erie and the Great Lakes". This paper was prepared primarily for the Com-

mittee on Government Operations that was holding hearings at that time on Water Pollution in the Great Lakes. In this paper, Kehr calls for "research on substitution of other chemicals for phosphate in detergents, (which) could provide further reductions in phosphate inputs" (46).

The Lake Erie Enforcement Conference on June 1, 1967, adopted the report of its Technical Committee, which recommended the "Promotion and encouragement of accelerated research and development of a suitable product solution to the detergent-phosphate problem" (5). This recommendation (and many others) was approved by representatives of each of the states involved in the Lake Erie Conference, *including Indiana*.

On August 23, 1967, the Committee on Government Operations recommended that "The soap and detergent industry should expedite and expand its research efforts to find suitable substitutes for the phosphate used in the manufacture of detergents" (47, 48).

On August 4, 1967, the then Secretary of the Interior Stewart Udall had announced the formation of a "Joint Industry/Government Task Force on Eutrophication". The Task Force was made up mostly of representatives of companies that manufacture detergents or produce phosphates for use in detergents (49, 50).

One of the original objectives of the Task Force was "To recommend a cooperative research program on controlling eutrophication of lakes, including the role of phosphates and their possible replacement" (49). In a re-statement of the objectives of the Task Force in 1969, all reference to phosphate substitutes had been deleted. Evidently the industry representatives on the committee (who held almost a 2 to 1 majority over the government representatives) had won the rest of the committee over to their view that it is preferable to take the phosphates out at the sewage treatment plant rather than out of the detergents.

In fact, the detergent industry and their suppliers must have convinced the FWPCA that they would in fact be the most logical agencies to research methods of taking phosphates out of sewage wastes, because in 1968 and early 1969 the Dept. of the Interior made grants of over \$500,000 to the Soap and Detergent Association, FMC, General Mills, and the W. R. Grace Co., for this purpose (49). No grants were made to any detergent company to develop phosphate substitutes. In fact, only one grant was made at all to an independent laboratory for this purpose up to 1969. A second grant to develop non-phosphate detergents was made in 1970. Both laboratories later reported favorable and optimistic results of their research (21, 36, 43).

The International Joint Commission made its first report in 1969. The Commission, addressing its recommendations to the governments of the United States and Canada, urged "immediate reduction to minimum practical levels of the phosphorus content of detergents and the amounts of phosphate-based detergents used" and "complete replacement of phosphorus compounds in detergents with environmentally less harmful substitutes as soon as possible, but not later than 1972" (10, 51).

With this urging from an international commission, acting on the request and authority of both governments, Congressman Henry S. Reuss introduced a bill into the U.S. Congress (H. R. 12435) on June 25, 1969, which would prohibit the import or manufacture of any detergent containing phosphorus after June 30, 1971. To solicit public response to this bill, Congressman Reuss, chairman of the Conservation and Natural Resources Subcommittee of the Committee on Government Operations, held hearings on December 15 and 16, 1969, on Phosphates in Detergents and the Eutrophication of America's Waters (49).

The Canadian government acted in July, 1970, to limit phosphorus in laundry detergents to not more than 8.7 percent, effective in August of that year. The phosphorus content was to be further reduced to about 2.2 percent in 1972 (51, 54).

When the U.S. Congress failed to act on this matter, the various states which surround the Great Lakes and some local communities passed legislation limiting the phosphorus content of detergents that could be used in those areas. Both Indiana and New York passed such laws in their 1971 legislative sessions. The New York law reduced the phosphorus content to 8.7% by January, 1972, and to only a trace by July 1, 1973 (13, 14).

The Indiana law limited phosphorus to about 5% (12% phosphate) after January 1, 1972, reducing it further to 3% phosphate after January 1, 1973. In the 1972 legislative session, the law was changed to read 8.7% phosphorus after January 1, 1972, and the permissible level of phosphorus after January 1, 1973, was changed to zero percent. Indiana thus became the first state to prohibit phosphorus completely in laundry detergents (23).

Numerous efforts were made in 1973 to repeal or amend the Indiana law, but it was changed only to exempt certain specialized cleaners and to allow up to 0.5% phosphorus traces incidental to the manufacturing processes. In 1974 another effort was made to repeal the law by the House, but the Senate did not even consider the measure.

In addition to Indiana and New York, laws limiting phosphorus in detergents were enacted by Florida, Maine, Michigan, Minnesota, Connecticut and Oregon, as well as in Chicago, Akron (Ohio) and Dade County (Florida) (14).

### **The Detergent Industry Responds**

In the late 1960's when there was pressure for the detergent companies to reduce the content of phosphorus or even eliminate it entirely, only Procter and Gamble of the major producers seemed reasonably supportive in that direction. The reason seemed to be that P & G had been using NTA (nitrilotriacetate) to replace part of the phosphate as early as 1966 (40). By 1970 they were using NTA to replace 25% of the phosphate in one-third of their company's laundry detergent production. A widely circulated full page ad that appeared in many of the nation's newspapers in the spring of 1970 declared:

Procter and Gamble is engaged in an all out effort to reduce—and eventually to eliminate—the phosphate content of its detergents. We have not waited for ‘proof’ that the elimination of phosphates from our products will have any significant effect one way or the other on lakes and streams. Neither are we waiting for proper sewage treatment facilities which could answer this and other problems. Our position is that if there is any possibility that our detergents are contributing to the excessive growth of plant life in lakes and streams, we want to correct this situation. We are working toward that end with all possible speed (35).

On September 15, 1971, the Surgeon General of the United States, apparently with the concurrence of the EPA, the CEQ, and the FDA, declined to approve NTA as a phosphorus replacement in detergents and advised housewives to go back to using phosphate detergents (51, 52).

Following this “about-face” by government agencies, the Soap and Detergent Association, now with the full support of Procter and Gamble (who produces more than half the nation’s detergents) attacked the legality of all restrictive legislation, including the law in Indiana. All such laws were upheld by both state and federal courts (37). The Chicago regulation was overturned by a court in 1973 after a second attempt by the industry, primarily because the sewage effluent from Chicago flows away from Lake Michigan through the Illinois River, so that detergent restrictions in Chicago would not have any effect in Lake Michigan (14, 19, 32).

The industry also launched a massive campaign against any legislative regulation of the detergent industry, both on the national and state levels. At least three federal bodies held extensive hearings on this matter in 1971 (51, 53). Many of the “outside” experts who supported the view that it was inadvisable to remove phosphates from detergents were actually paid by the industry. F. Alan Ferguson, an industrial economist, wrote an article titled “A Nonmyopic Approach to the Problem of Excess Algae Growths” which has been widely quoted (15). The Soap and Detergent Association paid Dr. Ferguson \$5,000 to write the article (49).

Dr. Daniel Okun, an environmental engineer from the University of North Carolina, who appeared in two of the federal hearings in 1971 and had his written statement presented at the other, declared that only 15 percent of the U.S. population live anywhere close to where eutrophication could ever become a problem, and it has never been shown to be a problem for most of these, therefore it will do no good to take phosphates out of detergents (51, 53). For his services over a several month period Procter and Gamble paid him “\$5,850 plus out-of-pocket expenses” (51).

Two researchers from the University of North Carolina, Francisco and Weiss, cultured algae in waste water from laundry using non-phosphate detergents and in waste waters from laundry using conventional detergents but from which the phosphate had been removed by “tertiary treatment”. They concluded that “simply removing detergent

phosphates from wastewater would have no practical significance in eutrophication control" (16). Their research was paid for by Procter and Gamble. Many other similar examples could be given.

### The Current Situation

After failing in their efforts to repeal or modify restrictive laws through court actions and lobbying in legislative sessions, the detergent manufacturers finally began producing and marketing non-phosphate detergents. Procter and Gamble was the last of the major companies to give in. With the detergent companies now profitably engaged in selling non-phosphate detergents, the only losers are the suppliers of the phosphate chemicals. Business Week magazine said in 1972, ". . . it could mean a 50% drop in phosphate sales in the next 18 months. The major U.S. producers of phosphates are Monsanto Co., FMC Corp., and Stauffer Chemical Co" (7). The FMC Corp. has been especially active since 1973 in trying to force the repeal of the Indiana law (29).

The International Joint Commission has just recently issued their second annual report on Great Lakes Water Quality. They report improvement in water quality since 1971 and "RECOMMEND that the U.S. Government seek legislation similar to Canadian law which limits the amount of phosphorus in detergent formulations" (22).

On August 29, 1974, the International Society of Limnology, meeting at their 19th Congress at Winnipeg, Canada, adopted the following resolution:

Because of the critical role of phosphorus in the rapid eutrophication of inland waters, be it resolved that in addition to the secondary treatment of sewage, it is necessary to control additions to this element to any inland waters. This should be done by any means available, including:

1. Restrictions on the use of cleaning products that contain phosphates, or other potentially harmful substances.
2. Removal of phosphate at sewage treatment plants discharging effluents into such waters.
3. Control of drainage from feedlots, agricultural areas, septic tanks and other diffuse sources of phosphates.

Control measures for nitrogen should be considered as well in basins where there is evidence that such controls are appropriate.

This is the first time in its more than 50-year history that this distinguished international body of aquatic scientists has gone on record as supporting a particular course of action that is eventually politically determined.

No doubt there will continue to be much activity, both pro and con, centered around this issue. But it is hoped that this review of the long history of events leading up to the present action (and inaction) will enable the interested and concerned individual to make a more accurate evaluation of the current state of events.

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