



# The Phosphorus Detergent Ban

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## Background

The phosphorus detergent ban was implemented in the Bay signatory jurisdictions in the mid to late eighties. This action occurred at the heels of the ban's implementation in the late 1970's in the Great Lakes areas where it proved to significantly reduce phosphorus discharges from wastewater treatment plants there. During the early eighties, a flurry of studies, by federal, state and local governments in the Bay jurisdictions, as well as by industry and environmental organizations were performed to determine the pro's and con's of a phosphorus detergent ban. Many theories were developed but after the ban's implementation, it became clear that 1) the ban resulted in a significant reduction of discharge in phosphorus from wastewater treatment plants 2) the ban did not cost the consumer money, and 3) the ban often resulted in O&M cost savings for the wastewater treatment plants.

Phosphorus is used in laundry detergents to control water hardness and to improve cleaning power. Phosphorus "bans" limit, to trace amounts, the amount of phosphorus that can be used in detergents and other cleaning products. Because the ban reduces the amount of phosphorus coming into wastewater treatment plants, it reduces the amount of phosphorus discharged by these plants. As numerous studies predicted and were later confirmed by actual data, advanced treatment plants that are already required to remove phosphorus to a specified limit, realized a reduction of O&M costs for sludge disposal and chemical precipitants and increased compliance with permit requirements. It became evident that the benefits of a ban are realized in two areas: the reduction in phosphorus discharges and the reduction in wastewater treatment plant operating costs.

In the early 1970's, the phosphorus content in laundry detergents was about 11%. At that time, detergent contributions of phosphorus to wastewater treatment plants equaled approximately 50 - 70%. By the late 1970's, the P content was cut to 5.7% (close to the current dishwasher detergent P content which is not subject to the ban's restriction). Typical P pre-ban concentrations into wastewater treatment plants were about 7.3 mg/l. After the P ban, the influent concentrations dropped by 2.3 mg/l to 5.0 mg/l. The ban was primarily directed at laundry detergents bought by the consumer. There are certain exemptions for hospitals, veterinary hospitals, health care facilities, food processing plants, dairy operations, and metal cleaner agents.(1) **Note: this ban**

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only refers to laundry detergent, and dishwashing detergent still contains phosphorus.

### **Implementation**

After a host of studies generally predicted that the ban would reduce phosphorus coming into the bay and that it would not be cost prohibitive, legislative action resulted in the phosphorus detergent bans being implemented in the Bay signatory jurisdictions by the following dates:

- **Maryland: 12/85**
- **District of Columbia: 9/86**
- **Virginia: 1/88**
- **Pennsylvania: 3/90**

### **Phosphorus Regulation**

However, the phosphorus ban was not the only action that limited the discharge of phosphorus into the Bay waters. In most of the signatory states phosphorus water quality standards were required in many areas. The Upper Chesapeake Bay Phosphorus Limitation Policy was approved in 1979 and extends from the confluence of the Susquehanna and Juniata Rivers in PA to the southern edge of the Choptank River in MD. It requires all new or modified plants above a designated flow to meet a 2.0 mg/l phosphorus effluent limitation. Similarly, a 1988 Policy for Nutrient Enriched Waters in VA requires facilities greater than 1.0 MGD in designated nutrient enriched mainstem and tidal tributaries to meet an effluent standard of 2.0 mg/l TP. Additionally, Virginia's 1971 Potomac Embayment standards require an effluent limit of 0.18 mg/l TP in the effluent of wastewater treatment plants discharging into the VA Potomac embayments. MD's Nutrient control strategy for the Patuxent River includes a goal of 1 mg/l TP be met from all of its wastewater treatment plants.

### **Phosphorus Ban Benefits**

Thus, many wastewater treatment plants were already required to remove a certain amount of phosphorus even before a ban. Removing phosphorus requires the addition of chemicals into the wastewater during the treatment process which binds with the phosphorus and causes it to precipitate. The phosphorus is then removed in the sludge. Chemicals to remove the phosphorus include ferric chloride and alum. The advantage of the P ban (which as described, reduced the influent concentration by an average of 2.3 mg/l) to these facilities was a considerable savings in O&M costs due to the fact that a reduction of required chemicals and sludge production resulted. In fact, it has been shown that discharge limitations of 1.0 mg/l P could be achieved with little need for chemicals provided the ban was in effect (1).

The P ban resulted watershed wide in a reduction of influent P concentrations of 25 - 30% to wastewater treatment plants. Interestingly enough, this 30% of reduction influent P would often result in a chemical savings of 50 to 60% due to molar ratios and uptake mechanisms in the treatment process. Cost saving alone for MD showed a \$4.4 million reduction in treatment costs for 1987. (2)

Studies also showed that, contrary to many industrial detergent manufacturer's study results, the costs of phosphorus free detergents were cost competitive to detergents with phosphorus and that additional cleaning agents were not necessary as soap making technology quickly caught up with environmental standards.

### **Resulting Load Reductions**

As the accompanying pie charts indicate, phosphorus loads to the bay declined by 6 million pounds per year between 1985 and 1996. And as the accompanying graph indicates, 4.5 of this 6 million pounds was due to point source reductions over that same time period. Not only did the P ban reduce the amount of phosphorus coming to treatment plants, but it allowed these plants to operate more cost effectively, and realize additional reductions in the effluent as well. Certainly improved removal technology over these years has also contributed to the reduction of Phosphorus from wastewater treatment plants.

### **References**

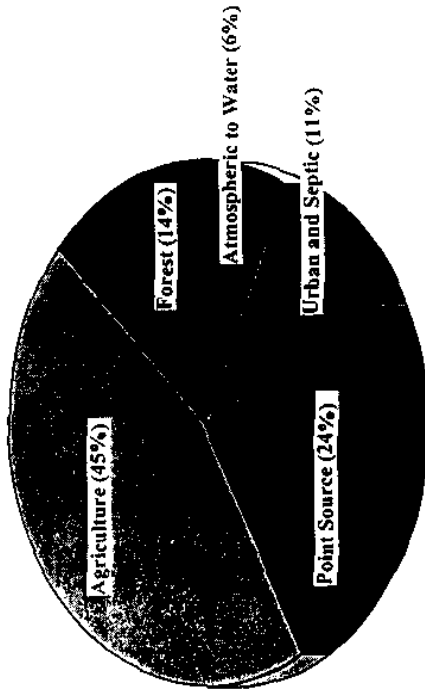
- 1) "MD's Phosphate Detergent Ban - History and Early Results", Jones et al., Journal WPCF, Vol 58, #8m, August 1986.
  - 2) "Effects of Phosphate Detergent Ban on Treatment Plants in MD", June 1987
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# Sources of Nutrient Loads to the Bay

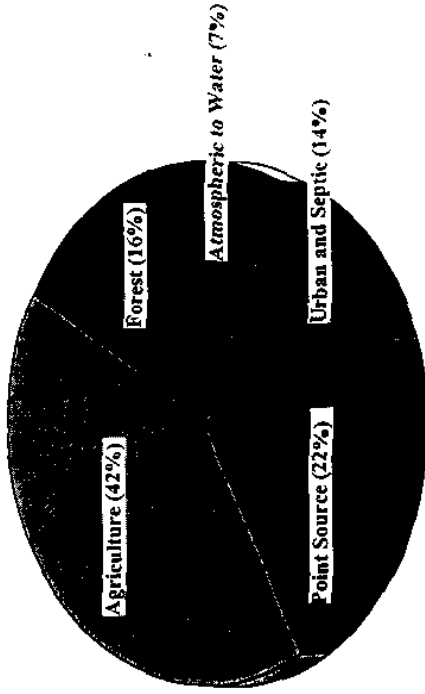
1985

1996

## Nitrogen

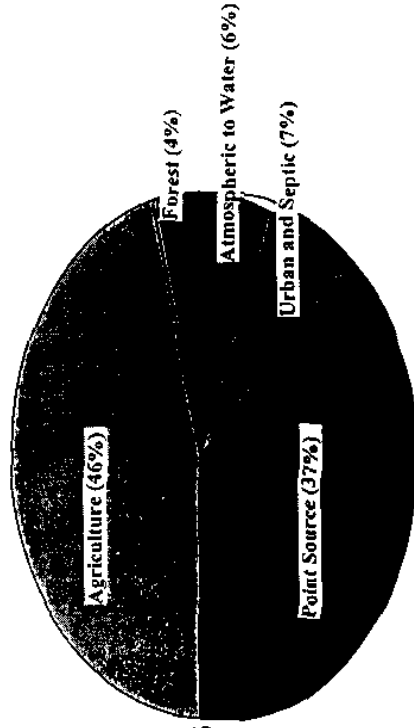


Total Load: 359 million pounds

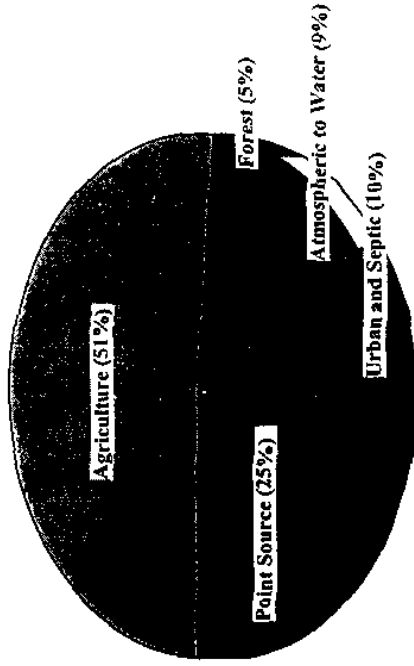


Total Load: 331 million pounds

## Phosphorus

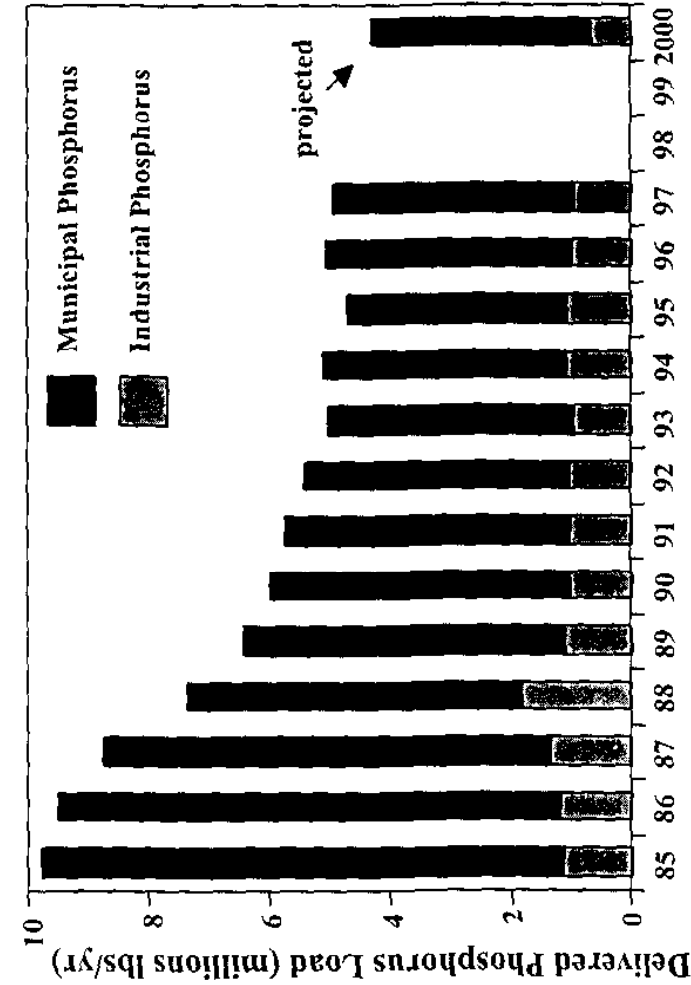


Total Load: 26 million pounds



Total Load: 20 million pounds

# Point Source Phosphorus Loads Delivered to the Bay



**GOAL:** Reduce point source phosphorus loads to support achievement of the nutrient reduction goal.

**STATUS:** Phosphorus loads declined 49% between 1985 and 1997, as a result of improved treatment capability and implementation of phosphate detergent bans (MD: 1985, DC: 1986, VA: 1988, PA: 1990).

An additional 15% reduction is expected by 2000, due primarily to general treatment efficiency improvements, BNR implementation, and industrial reductions.

