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## ENVIRONMENTAL PROTECTION AGENCY

**[40 CFR Part 129]**

**[FRL 585-8]**

### WATER PROGRAM

#### Proposed Toxic Pollutant Effluent Standards for Polychlorinated Biphenyls

Notice is hereby given that the Environmental Protection Agency, pursuant to the authority contained in section 307(a) of the Federal Water Pollution Control Act (the Act) as amended by the Federal Water Pollution Control Act Amendments of 1972 (Pub. L. 92-500, 86 Stat. 816, 33 U.S.C. 1251 et seq.), proposes additional sections to Part 129, setting forth proposed effluent standards for polychlorinated biphenyls (PCBs). On June 10, 1976, the Agency proposed a new Part 129, setting forth proposed effluent standards for the following toxic pollutants: aldrin/dieldrin, DDT (DDD, DDE), endrin and toxaphene, 41 F.R. 23576 et seq. On June 30, 1976, the Agency proposed effluent standards for benzidine, 41 F.R. 27012 et seq. Those five pollutants, as well as polychlorinated biphenyls (PCBs), were included on a list of toxic pollutants previously published by the Agency pursuant to Section 307(a)(1), 38 F.R. 24342 et seq. (September 7, 1973).

Section 307(a)(2) of the Act provides as follows:

> Within one hundred and eighty days after the date of publication of any list, or revision thereof, containing toxic pollutants or combination of pollutants under paragraph (1) of this subsection, the Administrator, in accordance with section 553 of Title 5 of the United States Code, shall publish a proposed effluent standard (or prohibition) for such pollutant or combination of pollutants which shall take into account the toxicity of the pollutant, its persistence, degradability, the usual or potential presence of the affected organisms in any waters, the importance of the affected organisms and the nature and extent of the effect of the toxic pollutant on such organisms, and he shall publish a notice for a public hearing on such proposed standard to be held within thirty days. As soon as possible after such hearing, but not later than six months after publication of the proposed effluent standard (or prohibition), unless the Administrator finds, on the record, that a modification of such proposed standard (or prohibition) is justified based upon a preponderance of evidence adduced at such hearings, such standard (or prohibition) shall be promulgated.

The regulations proposed at this time establish effluent standards for manufacturers of PCBs and manufacturers of transformers and capacitors which contain PCBs. Standards are proposed for both existing and new sources.

The following, together with the materials and information hereinafter referred to and incorporated by reference, sets forth the basis and purpose of the effluent standards proposed at this time.

### Summary of Principal Features and Benefits of the Proposed Regulations

The regulations here proposed would establish effluent standards for all manufacturers of PCBs and manufacturers of transformers and capacitors who use PCBs and who discharge directly into the navigable waters. Standards are established for both existing and new sources. Owners and operators of facilities which discharge into publicly owned treatment works, as defined in section 212 of the Act (sometimes referred to as "indirect dischargers"), are not covered by the standards herein proposed. However, the Agency will propose pretreatment standards in due course for such indirect discharges pursuant to the authority contained in section 307(b) of the Act following proposal of these standards.

The term polychlorinated biphenyls refers to a family of organic chemicals which have been produced and marketed in this country for approximately 45 years. These organic chemicals are synthetically made and consist of a number of chlorinated biphenyl isomers. They are highly stable compounds and are used primarily as dielectric and heat transfer fluids, though they have other uses as well. PCBs have been conclusively demonstrated to produce lethal and sublethal toxic effects at low dose levels upon a wide range of fish, mammals, and other wildlife, and have also demonstrated adverse health effects to humans. Moreover, they are highly mobile and persistent in the environment, and bioaccumulate greatly in tissue.

The sole manufacturer in the United States, Monsanto Industrial Chemicals Company, currently produces approximately 40 million pounds of PCBs per year. Imports of PCBs currently amount to about 0.4 million pounds per year. Since 1970 Monsanto has voluntarily restricted its domestic sales of PCBs to use in transformers and capacitors (closed systems). Consequently Monsanto and the manufacturers of transformers and liquid-filled capacitors are significant sources of further contamination or potential contamination resulting from the discharge of domestically manufactured PCBs into the aquatic environment.

The proposed standards include a prohibition on discharge of PCBs by any PCB manufacturer. With respect to any manufacturer of transformers or capacitors, a prohibition of any PCBs in any effluent discharge of process wastes is proposed, with limited exceptions, and an average daily concentration limit per month of 1 µg/l is proposed for any other discharge. For new sources, a prohibition on discharge of PCBs in process wastes in conjunction with an average daily concentration limit per month of 0.1 µg/l for other discharges is proposed.

Regulation of discharges under the Act cannot, by itself, guarantee an ample margin of safety for all organisms and human health even if all point source discharges were prohibited, in light of the serious environmental problem which already exists. Data available to the Agency indicate that the standards proposed at this time will however result in maximum feasible progress, within the inherent limitations of point source discharge control, towards the degree of protection for aquatic and other organisms and human health envisioned under the Act, and are technologically achievable by industry. The Agency will continue to review the standards established in this rulemaking as additional data become available to determine whether further protection, including more stringent standards, is necessary and feasible.

### I. Background

#### A. PCBs in the Environment

PCBs are a class of organic compounds manufactured by the chlorination of biphenyl with anhydrous chlorine using iron filings or ferric chloride as a catalyst. The biphenyl molecule has a total of ten carbon-hydrogen bonds at which chlorine substitution can be accommodated. In the manufacture of PCBs, anywhere from one to ten chlorine atoms may be located on the biphenyl molecule. Depending upon the location of these substitutions, theoretically as many as 209 separate compounds, or isomers, of the chlorinated biphenyl family can be manufactured.

The PCBs manufactured by Monsanto are marketed under the trade name Aroclor, followed by a four digit number, with "biphenyl" represented by the first two digits "12", and the approximate chlorine percentage represented by the second two. Thus, Aroclor 1242 is a mixture containing approximately 42 percent chlorine. The principal Aroclors which have been marketed over the past decade by Monsanto are 1221, 1232, 1242, 1248, 1254 and 1260, although at this time there is no active marketing of 1232, 1248 or 1260. In addition, Aroclor 1016 (an exception to the previously identified nomenclature system) is being marketed, and bears approximately 41.3 percent chlorine. For an extensive discussion of the chemical and physical properties of PCBs, see O. Hutzinger, S. Safe, and V. Zitko, "The Chemistry of PCBs." CRC Press, 1974.

The unique physical and chemical properties of PCBs include low vapor pressure at ambient temperatures, resistance to combustion, remarkable chemical stability, high dielectric constant and high specific electrical resistivity and low water solubility. At the same time, PCBs are lipid soluble and hence the potential for absorption into fatty tissue and into the liver is high. Thus once ingested PCBs are retained by most organisms rather than excreted. The qualities of persistence which make PCBs useful for many industrial purposes greatly aggravate their potential for harm in the ecosystem.

Although the principal uses of PCBs today are in "closed" electrical systems (transformers and capacitors), PCBs have been used over the years for a variety of more "open" uses resulting in greater direct contamination of the environment. These other uses include an additive in investment casting waxes, lubricant additives, hydraulic and com-



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pressor fluid, carbonless copy paper, plasticizers, paints, heat exchange fluids, certain types of paper and sealants. Most of these uses have been substantially curtailed, but the PCBs which have entered the environment as a result of these uses, and which continue to be placed in the environment, will be there for many years. Some of these uses are resulting in effluent discharges which are not subject to the standards proposed at this time owing to insufficient data. As such data become available, however, the Agency expects to take appropriate measures to control such discharges pursuant to the Act or other applicable statutory authority.

It is estimated that over the past 45 years approximately 1.4 billion pounds of PCBs have been produced in the United States, of which 1.25 billion have been used in this country and the balance exported. Of this 1.25 billion pounds, approximately 960 million pounds have been used in electrical equipment. In addition, it is estimated that only approximately 50 million pounds have degraded, that 750 million pounds are presently in service, and that 450 million pounds are in landfills (ostensibly as a result of disposal) and in air, water, soil and sediments.

In contrast, it is estimated that discharges to the aquatic environment each year from the approximately 37 manufacturers of capacitors and transformers, plus Monsanto, probably do not exceed 10,000 pounds, with direct discharges from these sources accounting for less than one-third this amount. Although efforts to reduce substantially and eventually eliminate this source of environmental contamination will have a relatively minor effect on the overall PCB problem as it currently exists, such efforts are likely to have a more significant impact in reducing future environmental contamination and in alleviating the specific environmental problems in the immediate receiving waters. Consequently the Agency believes that the standards proposed at this time will constitute an important element in the overall effort to reduce and ultimately eliminate any further addition of PCBs to the environment.

### B. PRIOR REGULATORY ACTION AND RELATED EFFORTS TO REDUCE ENVIRONMENTAL EXPOSURE

Because of the demonstrated toxicity of PCBs and the human health threat posed by ingestion of PCBs through the food chain, the Food and Drug Administration (FDA) of the Department of Health, Education and Welfare established temporary tolerances for PCBs in food pursuant to the Federal Food, Drug and Cosmetic Act. 21 CFR 122.10 (July 6, 1973). These tolerances included, for example, 5 parts per million (ppm) in the edible portion of fish and shellfish, 2.5 ppm in milk and dairy products, 5 ppm in poultry, 0.5 ppm in eggs and 0.2 ppm in infant and junior foods. On February 26, 1976, FDA announced that it is actively considering a lower temporary tolerance for fish in light of recent toxicological data concerning PCBs, 41 FR 8409. FDA has also banned PCBs for use in food and feed processing.

The American National Standards Institute has issued guidelines for industry on the use, disposal and labelling of PCBs, and is currently considering more extensive guidelines for the handling, servicing and disposing of existing equipment containing PCBs.

The General Services Administration (GSA) has banned PCBs in carbonless copy paper purchased by the Federal government and the Department of the Interior (DOI) has prohibited the use of PCBs in offshore oil operations.

The Environmental Protection Agency (EPA) has proposed regulations pursuant to section 311 of the Federal Water Pollution Control Act to control spills of numerous identified hazardous substances, including PCBs. These regulations are intended to establish reporting requirements, to establish harmful quantities, and to fix civil penalties for spills. The Agency further anticipates use of its authority under section 311 to require industry to prepare spill prevention control plans.

The Agency, in October, 1975, issued in draft form a set of water quality criteria pursuant to section 304(a) of the Act recommending maximum permissible concentrations in the ambient water for numerous pollutants, including PCBs. The concentration level proposed at that time was 0.001 $\mu g/l$ for PCBs. That document is currently being reviewed prior to final publication.

On April 1, 1976, the Agency issued recommended procedures for disposal of PCBs by industrial users, pursuant to section 204(b) of the Solid Waste Disposal Act, 41 FR 14134.

On July 6, 1973, the Agency published in the FEDERAL REGISTER a proposed list of nine toxic pollutants pursuant to section 307(a)(1) of the Act, 38 FR 18044. The nine substances were: aldrin/dieldrin, benzidine, cadmium, cyanide, DDT (DDD, DDE), endrin, mercury, polychlorinated biphenyls and toxaphene. Following receipt of public comment, the list was promulgated on September 7, 1973, together with a discussion of the Agency's selection criteria and a response to comments received on the proposed list, 38 FR 24342 et seq. The promulgated list consisted of the same nine substances previously proposed.

On December 27, 1973, the Agency proposed toxic pollutant effluent standards for each of these nine substances, together with a summary of the factors considered in setting the standards, and a list of point source categories of discharges proposed for coverage, 38 FR 35388 et seq. In accordance with section 307(a)(2) of the Act, a formal rulemaking hearing on the proposed standards was scheduled. A prehearing conference was held on January 25, 1974, followed by a thirty day evidentiary hearing held during April and May. During the course of those hearings, which were held under severe time constraints, the Agency became aware of certain gaps in its data base. As a result, the Agency determined at the conclusion of the hearings that the record did not contain sufficient evidence on which to promulgate responsible and defensible standards. Accordingly, the Agency decided to gather additional data and repropose its standards, supported by an expanded data base. The standards proposed at this time thus supersede the PCBs portion of the proposal of December 27, 1973.

The Agency's decision to gather additional data and to repropose standards was discussed at considerable length in the Preamble to the Notice of Proposed Toxic Pollutant Effluent Standards for Aldrin/Dieldrin, DDT, Endrin and Toxaphene, published in the FEDERAL REGISTER on June 10, 1976, 41 FR 23576, to which the reader is referred and which is hereby incorporated into this PCB statement of basis and purpose by reference.

## II. THE PROPOSED STANDARDS

### GENERAL PROVISIONS

The notice of proposed rulemaking published on June 10, 1976, proposed provisions of general applicability to all standards issued under section 307(a). These were set forth as §§ 129.1 through 129.8. Those Sections are promulgated will be applicable to standards established hereunder for polychlorinated biphenyls. Owners and operators of facilities which are or may be subject to the standards proposed herein are expressly referred to that notice of proposed rulemaking for provisions relating to scope and purpose, definitions, abbreviations, compliance procedures (including notification to the Regional Administrator or State Director of an approved NPDES permit program, as appropriate), of any discharge subject to these standards, requirements and procedures for establishment of a more stringent effluent limitation than that established in these proceedings, and compliance date.

### THE STANDARDS FOR POLYCHLORINATED BIPHENYLS

In the notice of proposed Toxic Pollutant Effluent Standards published June 10, 1976, standards were proposed for aldrin/dieldrin, DDT (DDD, DDE), endrin and toxaphene in Sections 129.100 through 129.103 respectively. In addition, the Agency has proposed to add a new § 129.104 containing effluent standards for benzidine, 41 FR 27012 (June 30, 1976).

The standards proposed herein would add a new Section 129.105 to provide coverage for PCBs for new and existing sources in the following industrial categories: Manufacturers of PCBs, manufacturers of transformers, and manufacturers of capacitors. Coverage is provided for both new and existing sources, and for purposes of these standards, a new source is defined as any source on which construction is begun following the date of this proposed rulemaking, if standards are subsequently promulgated pursuant to this proceeding. The Agency's data indicate that these standards will cover at least three plants manufacturing transformers, and at least



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seven plants manufacturing capacitors, all of which are existing direct dischargers.

Each section includes specialized definitions of the point source category covered and prescribes acceptable analytical methods. In addition, provision is made for determination of weights and concentrations. In cases where a discharge is allowed, the standard will be specified as an average monthly concentration limit and a maximum concentration at any time.

In developing the standards proposed herein the Administrator has given careful consideration to each of the factors enumerated in section 307(a)(2). These factors include "the toxicity of the pollutant, its persistence, degradability, the usual or potential presence of the affected organisms in any waters, the importance of the affected organisms and the nature and extent of the effect of the toxic pollutant on such organisms." In light of the Act's manifest concern for public health, which is reflected both in the statute and the legislative history, the Administrator has also considered available data concerning human health effects attributable to PCBs. The data considered by the Administrator relating to these factors of toxicity and environmental effect are set forth in a "Criteria Document." The Agency was assisted in the preparation of this criteria document by Ian C. T. Nisbet, Ph.D., of the Massachusetts Audubon Society, a nationally recognized expert on the toxicology of PCBs. This document is hereby incorporated by reference as a part of the statement of basis and purpose for the standards hereinafter proposed.

In addition, the Administrator has considered the availability of various methods of control and related technology by which discharge of PCBs might be eliminated or reduced. His authority to consider technology as well as economic impact is discussed in detail in the preamble portion of the Notice of Proposed Toxic Pollutant Effluent Standards published on June 10, 1976, to which the reader is referred.

In order to obtain relevant data for this function, the Agency engaged the services of Versar Inc., of Springfield, Virginia, who are recognized experts in the study of wastewater treatment technology and the control of pollutants emitted by industrial sources. Versar Inc. has prepared and submitted a report to the Agency concerning industrial discharge of PCBs and the assessment of wastewater management and treatment technology, including technologies which are actually in use or which are or may be available to industries to control or eliminate the discharge of PCBs. This report is entitled "Assessment of Wastewater Management, Treatment Technology, and Associated Costs for Abatement of PCB Concentrations In Industrial Effluents." and is hereby incorporated by reference as a part of the statement of basis and purpose of the standards herein proposed, along with a supplement thereto entitled "PCBs Water Elimination/Reduction Technology and Associated Costs, Manufacturers of Electrical Capacitors and Transformers; Addendum to Final Report, Task II."

Copies of the aforesaid criteria document and reports and supporting materials, as well as other materials which form a part of the basis and purpose for these standards and which are listed on Appendix A below, are available for public inspection and copying at the U.S. Environmental Protection Agency, Public Information Unit, Room 2922 (EPA Library), 401 M St., SW., Washington, D.C. 20460, during normal business hours. Copies of the criteria document and technology report and supplement may also be inspected and copied at libraries in each of the 10 EPA regional offices.[1]

The approach utilized in arriving at the standards herein proposed may be generally stated as follows.

First, because the most important element in setting the standards is the toxicity considerations enumerated in section 307(a)(2), the starting point is the development of the criteria document, which sets forth extensive data with respect to the environmental effects and behavior of PCBs. A principal objective of the criteria document is to seek to arrive at an ambient level of PCBs based upon the data which will provide an ample margin of safety for all important aquatic organisms and others up the food chain, including man, who may become exposed to it. This ambient water criterion is expressed as a concentration of the pollutant in the water in terms of micrograms per liter ($\mu$/l) (1 $\mu$g/=one part per billion). For substances such as PCBs where the data indicate that chronic toxic effects may occur at extremely low conentrations, it becomes virtually impossible to state with confidence that any number above zero provides an ample margin of safety for man. In such cases any criterion level chosen should be appropriately qualified to reflect these circumstances.

The toxicity data used in developing these proposed standards were derived from laboratory studies as well as field observations on the effects and behavior of PCBs. These studies have been conducted on a variety of organisms including invertebrate, vertebrate, and mammalian test species, and are well documented in the scientific literature. These studies provided extensive acute and chronic toxicity data based primarily on feeding experiments for a wide range of aquatic organisms and consumers of aquatic organisms.

Studies documenting bioaccumulation in the food chain organisms and bioconcentration by organisms directly from the water provided an important additional component data base. Appropriate human toxicity data and studies of mammalian carcinogenesis, where available, were also considered, as were data on persistence and degradability.

Data on toxic effects of pollutants are not available for all species that may be exposed to toxic pollutants in the complex ecosystem. There is a vast number of species throughout the entire ecosystem, and it would be impractical to try to gather test data on every one, or even most of them. Because such data are not available on all species, the range of sensitivity of a smaller number of tested species is used to provide a measure of the range of sensitivity of all species. The Agency's criterion for PCBs is based upon a wide range of toxicity data for a phylogenetic cross section of organisms as well as species representative of a wide geographic distribution.

Section 307(a) requires consideration of the importance of organisms likely to be affected. Ecological importance of an organism is dependent on the role the organism plays within the ecosystem and upon its relationship to the food chain within the aquatic community and the consumers of aquatic life, including man. Thus, toxicity data for the carnivores at the top of the food chain in a given ecosystem, as well as economically important species such as trout, salmon, menhaden and shrimp are properly considered in the development of a protective criterion level. Toxicity data for organisms such as diatoms, crustaceans and aquatic insects are also important since these organisms are a food base for higher consumers and are representative of plants and invertebrate species found in most waters of the United States.

On the basis of the foregoing data, a concentration level is sought which, it is believed, will provide that degree of safety required by the Act for all important organisms likely to be affected by it assuming a continued or chronic presence of the pollutant at that level in the water. In the case of PCBs, as discussed below, this proved to be an extremely difficult task in view of the already dangerously high levels of PCBs in some water bodies.

After arriving at an ambient water criterion, the Agency examined feasible control technology to ascertain what concentration levels industrial dischargers might be able to achieve in their effluents, the availability of substitute products for PCBs, and other factors relevant to the setting of standards. This process is discussed more specifically below (see "Rationale for Standard"), after the following summary of the Agency's consideration of the available data base.

(1) *Composition, chemical and physical characteristics of PCBs.* The commercial mixtures of PCBs have been reasonably well characterized. Each mixture contains 10 to 20 major components and a number of minor components; more than 80 of the 209 chlorinated biphenyl (CB) isomers have been identified in the commercial mixtures. After release into the environment the constitution of the mixtures changes as some components are degraded while others persist. Since

[1] The Agency also intends that the criteria document and technology report and supplement be made available through the National Technical Information Service in Springfield, Virginia.



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some components are more toxic than others, this complicates the evaluation of the hazards posed by environmental residues.

Highly toxic impurities, polychlorinated dibenzofurans (PCDFs), are present in small quantities in the range of 1 to 33 milligrams per liter (mg/l) in most commercial mixtures. Products manufactured overseas frequently contain more PCDFs than American-made Aroclor mixtures. There is evidence that PCDFs may be formed from PCBs both in service, and in the environment by photochemical and metabolic processes. Accordingly, the toxicity of PCB mixtures is variable and environmental residues are sometimes more toxic than freshly manufactured products. However, it is not possible to separate the toxic effects of PCDFs and PCBs satisfactorily, and the environmental hazards of both must be considered together.

PCBs are viscous liquids or waxes. They are freely soluble in organic solvents and in lipids (fats), but have very low solubility in water. In general, those PCBs with fewer chlorine atoms per molecule are more soluble in water and more volatile than those with greater chlorine atoms per molecules. Accordingly, the mixtures are differentiated during volatilization and solution, the lower CBs being more mobile. PCBs are strongly adsorbed onto surfaces and particles. In the aquatic environment their behavior is often controlled by the presence and movement of sediments.

(2) *Relevant use and wastewater characteristics*—(A) *Manufacturing of PCBs*. The sole domestic manufacturer of PCBs is the Monsanto Industrial Chemicals Company ("Monsanto"), whose manufacturing operations are conducted at its William G. Krummrich plant in Sauget, Illinois. Aroclors 1321 and 1016 are used by capacitor manufacturers as dielectrics. Aroclors 1242 and 1254 are used as principal ingredients in formulating the Askarels used by transformer manufacturers.

Monsanto discharges its effluent to the Sauget POTW, and therefore is not covered by the standards proposed at this time. The Agency expects in due course to propose pretreatment standards applicable to this facility and to any other facility which may in the future manufacture PCBs. A brief discussion of Monsanto's operations and wastewater characteristics is appropriate here, however, in view of the fact that standards are proposed at this time for direct dischargers for the PCB manufacturing category for existing and new sources, Monsanto's ability to achieve zero direct discharge was also considered in proposing those standards.

The Krummrich plant has a design capacity to produce 48 million pounds of PCBs per year. In 1974, Monsanto produced 40,466,000 pounds, of which 34,-406,000 pounds were sold domestically. Approximately two-thirds of 1974 domestic sales were of Aroclor 1016 with most of the remaining production evenly divided between Aroclors 1242 and 1254. Only small quantities of Aroclor 1221 were produced.

The raw wastes from the manufacturing area at Monsanto consist of the liquor from the scrubber, the condensate from the steam jet ejectors, water used for showers and eye baths, miscellaneous floor wash drains, waste oil collected in drip pans and drums, and so-called "montars" which are the bottoms from their stills. The composition and quantities of the individual waste streams are not monitored. All effluent streams generated in the manufacturing area are collected in sumps located in this area. Reportedly the aqueous discharges amount to 750 ug/l PCBs in 0.432 million gallons per day ("MGD") or 2.7 lb/day.

The raw wastes generated in the incinerator area at Montanso consist of the venturi scrubber liquor and the waste phase from the oil-water separator sump. Reportedly the aqueous discharges from this area amount to 15 ug/l PCBs in 0.288 MGD or 0.36 lb/day. The total plant uses a maximum of 0.389 MGD of water principally for cooling and a maximum of 360,000 lbs of steam.

In addition to the aqueous discharges, it has been estimated that about 25 lbs. of scrap oil and "monstar" are produced per ton of PCB produced, that about 5½ lbs of PCB in contaminated solids per ton of PCB produced are landfilled daily and that less than 1 lb/day of PCBs is lost as air emissions.

(B) CAPACITOR MANUFACTURING

There are nineteen plants operated by seventeen companies manufacturing PCB impregnated capacitors in the United States. At the present time approximately 95 percent of all liquid-filled capacitors manufactured in the United States are of the PCB impregnated type. The two most frequent applications of these capacitors are for phase corrections on power lines connected to electrical motors and for use as ballast for fluorescent lighting systems. The PCB usage in this category was approximately 22,000,-000 lbs. in 1974 with most of this being Aroclor 1016. At least seven of the nineteen capacitor manufacturing plants have direct discharges to the navigable waters and are therefore covered by the standards proposed at this time.

Most plants manufacture either large power capacitors or small industrial type units but not both. The large capacitors are either flood filled or manifold filled. All small capacitors are flood filled either in a vacuum tank or in an automatic "carousel" arrangement.

The raw wastes originating from these plants consist of scrap PCBs collected in sumps, drums and drip pans; contaminated vacuum pump oils; the fractionator bottoms from the trichloroethylene recovery; the caustic bath used at some plants, for purposes of paint stripping; spent detergent wash and rinse water from capacitor or component cleaning operations; rinse water used in the welding and plating operations; steam condensate from jet ejectors; the seal water used in vacuum pumps; water used in phosphatizing and fluoride bath; water spray used in paint booths; boiler blowdown; and cooling tower blowdowns.

Effluents from plants in this category range between 2,500 gallons per day to 1.26 MGD. These effluents are discharged into the navigable waters or are introduced into POTWs without any treatment directed toward PCB removal. Effluent information obtained for 14 plants indicated that average effluent PCB concentrations ranged from less than 10 $\mu$g/l to more than 6,000 $\mu$g/l. Average mass emissions of PCBs from these plants ranged from less than 0.01 lb/day to nearly 2.5 lb/day.

(C) TRANSFORMER MANUFACTURING

There are eighteen transformer plants operated by thirteen companies which manufacture transformers using PCB-containing Askarel dielectric fluids. Askarel transformer oils are blends of 60 to 100 percent Aroclor 1254 or 1242 and trichlorobenzene. This type of transformer constitutes only five to ten percent of these plants' transformer manufacturing volume. The remaining manufacturing volume uses mineral oil as the dielectric fluid, and there is some manufacture of air-cooled or gas-cooled transformers as well. Askarel transformers are used when other types are unsatisfactory because of design limitations or where flammability is a problem. The PCB usage in this category was approximately 12,000,000 lbs in 1974. At least three of these plants have direct discharges and are therefore subject to the standards proposed at this time.

There are two principal types of transformers produced: electrical distribution transformers which are used to step down voltages, and power transformers which are primarily used to step up voltages. Distribution transformer applications include use in networks, pad-mounted and pole-mounted, and special precipitator power supplies located in closed, proximity to hot gas stacks. Quantities of Askarel used in transformers of this type range from 500 to 5,000 lbs each. Many of these transformers have provisions for venting with spring loaded venting devices or diaphragm rupture discs.

Askarel power transformer applications include use in primary and secondary substations, industrial furnaces, rectifiers, rail transportation, and for reactance and grounding functions. Quantities of Askarel used in transformers of this type range up to 19,000 lbs.

Various transformer assembling and filling procedures are being practiced throughout the industry. In general, the transformer assembling and filling operations consist of a predrying step for removing moisture from the transformer interiors, several stages of Askarel filling and topping, addition of electrical connections and bushings, electrical testing and sealing.

Water is not an essential component of transformer manufacturing. In general, the process raw wastes from these plants consist of waste Askarel collected in sumps or pans at the filling stations, contaminated vacuum pump seal oil, contaminated kerosene-like petroleum distillate, and contaminated Askarel used



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for transformer interior flushing. PCB wastes which reach water streams at these plants are due to occasional loss during handling and residuals accumulated around drainage systems from past operations when insufficient precautions were taken against PCB losses.

Based on information from five plants, effluents from plants in this subcategory ranged from 13,500 gal/day to nearly 1.9 MGD. These effluents (predominantly cooling water) are discharged into the navigable waters or are introduced into POTWs without any treatment directed toward PCB removal. Average effluent PCB concentrations ranged from less than 2 $\mu$g/l to nearly 30 $\mu$g/l. Average mass emissions of PCBs from these plants range from less than 0.002 lb/day to nearly 0.1 lb/day.

(3) *Toxicity*. PCBs inhibit growth and cell division in certain species of phytoplankton (single-celled aquatic plants). Some sensitive species are affected at very low concentrations (0.1 $\mu$g/l). The effects are particularly marked in mixed cultures, where sensitive diatoms are replaced by resistant green algae.

PCBs are toxic to aquatic insects, crustaceans, and other invertebrates at concentrations down to a few $\mu$g/l. Reproduction and growth in aquatic invertebrates are adversely affected at concentrations as low as 0.4-0.5 $\mu$g/l. PCBs affect the settlement of larvae and reduce the diversity of marine invertebrates communities at concentrations as low as 0.1 $\mu$g/l.

PCBs are acutely toxic to estuarine aquatic organisms. For Aroclors 1016, 1242 and 1254, the 48-hour LC50 values for brown shrimp, pink shrimp, and grass shrimp fall in the range between 9 and 32 $\mu$g/l. In longer-term bioassays of two weeks or more, Aroclor 1254 is toxic to the commercially valuable penaeid shrimp and grass shrimp at concentrations as low as 0.9 to 1.4 $\mu$g/l. Arthropods are affected at 0.1 $\mu$g/l.

Rainbow trout have been killed by exposure to Aroclor 1248 at concentrations of 3.4 $\mu$g/l in 25 days, and by exposure to Aroclor 1260 at 5 $\mu$g/l in 10 days. Spot and pinfish died when exposed for 14 to 45 days to 5 $\mu$g/l of Aroclor 1254. The longnose killifish has been killed by long-term exposure to Aroclor 1254 at a concentration of 1 $\mu$g/l.

PCBs have adverse effects on survival, growth, and reproduction of fish at concentrations as low as 1 $\mu$g/l. In one case, eggs from fish exposed to only 0.1 $\mu$g/l failed to hatch after being placed in PCB-free water. A variety of other sublethal toxic effects have been observed on a wide range of freshwater and marine fish present in waters thoughout the country, and these are set forth in detail in the Agency's criteria document for PCBs.

PCBs generally have low acute toxicity to birds and mammals, but long-term dietary exposure leads to a variety of chronic toxic effects.

Rats are relatively resistant to PCBs and usually do not show the characteristic lesions of the skin and stomach induced in several other mammals. The most characteristic effects in rats are enlargement of the liver, induction of hepatic microsomal enzymes and porphyria. Reproduction is adversely affected at dietary levels at and above 20 parts per million (ppm; 1 ppm is comparable to a liquid measurement of 1 milligram per liter (1 mg/l)).

Rhesus monkeys are extremely sensitive to PCBs, which induce skin lesions and gastric ulceration. Monkeys exposed to 2.5 ppm suffered reproductive dysfunctions and some died after exposure to only 3 ppm. Adult female Rhesus monkeys fed 25 ppm of Aroclor 1248 not only accumulated the PCBs in their adipose tissue, but the PCBs were transferred across the placenta of one female which gave birth and concentrated at high levels in the fat and adrenals of the infant.

Mink are also very sensitive to PCBs. In one experiment, most females died on a diet containing 10 ppm and none produced young at 5 ppm. In another test 0.64 ppm caused total reproductive failure and a few deaths.

(4) *Carcinogenesis*. On prolonged exposure of rats and mice, PCBs cause a variety of morphological changes in the liver, including hypertrophy, hyperplasia, adenofibrosis and nodular hyperplasia. At high dose levels (100 ppm and above) PCBs induce hepatomas, neoplastic nodules and carcinomas in rates and mice and therefore pose a presumptive carcinogenic risk to man. In one experiment, PCB-treated rats also displayed an increased incidence of pituitary tumors.

Metabolism of PCBs in mammals and birds proceeds primarily through arene oxide (epoxide) intermediates, which are biologically active and believed to be highly toxic and carcinogenic. PCBs also have immunosuppressive effects in rabbits and guinea pigs. In several experiments treatment with PCBs has increased the susceptibility of animals to various diseases.

(5) *Human health effects*. Humans occupationally exposed to PCBs sometimes suffer from an occupational disease known as chloracne, characterized by long-lasting skin lesions and sometimes systemic disturbances.

In a large-scale poisoning incident in Japan in 1968, more than 1,000 persons became sick with Yusho disease after ingesting rice oil contaminated with both PCBs and PCDFs. Their symptoms were similar to those of occupational chloracne, but also included hyperpigmentation of the skin, persistent eye discharge and gastric disturbances. Children were affected not only by direct ingestion of the contaminated oil, but also prior to birth by transplacental passage and in one case a child was contaminated by its mother's milk. The affected persons have improved only slowly since 1968 and there are already indications of excess cancer incidence.

The Rhesus monkey provides an important indication for human sensitivity to PCBs and, as noted above, is extremely sensitive to low levels of exposure. The symptoms following exposure appear similar in many respects to those observed among the population contaminated in the Yusho incident.

(6) *Persistence, mobility and degradability*. PCBs have a long life in the environment, often in excess of 25 years, but components with three or less chlorine atoms disappear rapidly. Mono-, di, and tri-CBs are to some extent degraded or metabolized by bacteria, but higher PCBs are resistant to microbial degradation. Tetra-chlorinated PCBs can be metabolized by birds and mammals, but penta-chlorinated PCBs are resistant and higher CBs are metabolized only very slowly. Most environmental residues have been reported in the form of tetra and higher chlorinated PCBs.

PCBs are mobile in the environment and are carried freely in the air and the water attached to airborne or waterborne particles. Conventional incineration and other disposal techniques do not completely destroy PCBs.

(7) *Bioaccumulation and biomagnification*. PCBs are strongly concentrated ("bioaccumulated") from water into aquatic invertebrates and fish. Bioaccumulation factors (concentration of PCBs in organisms compared to concentration in water) for these organisms are commonly in the range of 20,000-274,000 after prolonged exposure in the laboratory. However, where measurements of concentrations in natural waters are available, bioaccumulation factors in fish and invertebrates are generally larger than those measured in the laboratory. There have been reports that certain animals captured from the aquatic environment have apparently bioaccumulated PCBs in their flesh to levels of between 3 and 10 million times that of the water concentration in which the animals were captured. It is important to note, however, that the level of PCB contamination in the food of the captured aquatic life, as well as the concentration of PCBs in which these organisms resided for the predominance of their life periods, are unknown.

Fish in Escambia Bay, Florida, had PCBs levels in their flesh 670,000 over the ambient water in which they were captured. PCB levels in the waters of Lake Michigan average around .01 $\mu$g/l. However, PCB levels in fish in Lake Michigan range in the 2 to 20 ppm range, wet weight (16-200 ppm, lipid weight) indicating an apparent bioaccumulation factor ranging up to at least 2,000,000 in whole fish. Levels of PCBs in some whale and seal blubber were found to be in excess of 1 million in the ambient water concentration in which the animals were taken.

PCBs are further concentrated (biomagnified) from the food of birds and mammals into their tissues, especially into their fat. Biomagnification factors (ppm in organisms/ppm in food) are often in the range 1 to 10 after prolonged exposure in the laboratory, but are often as high as 10 to 100 in wild animals and birds. Humans store PCBs in their fat more efficiently than any animal for which precise measurements have been



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made. This leads to greater exposure to sensitive organs and tissues in humans than in animals exposed to the same concentrations of PCBs in the diet. The data indicate, in particular, that Aroclors 1016 and 1242 are widely present in fish in the United States. This in turn leads to substantial exposure of humans and other fish-eating animals.

(8) *Ambient water criterion for effects on natural systems.* The foregoing summary briefly highlights the extensive data base set forth in the criteria document. This data base demonstrates that PCBs pose a serious threat to a wide range of aquatic and other food chain organisms, as well as to human health, at very low concentration levels. There appear to be some variations in the toxic effects for different isomers. Thus, the more highly chlorinated isomers appear to be somewhat more persistent in the environment, while the lower chlorinated isomers appear to be somewhat more acutely toxic. These differences are relatively minor, since all isomers which are significant constituents of commercial mixtures of PCBs are highly persistent and mobile in the environment, and all isomers display a degree of toxicity which is a matter for grave public concern. Moreover, the composition of PCB mixtures changes as they are transported through the environment. There is also evidence that toxic metabolites, or breakdown products, may be formed, so that the chemical species distribution in a water body may not be the same as the species distribution of the substance discharged. For all these reasons, there appears to be no sound basis for setting different criterion numbers or standards for different isomers, and accordingly, the criterion and standards herein proposed are for PCBs generically.

A criterion level of 0.001 µg/l would appear to avoid adverse effects to most aquatic organisms, based upon an analysis of both laboratory and field data. This level is based primarily on the bioaccumulation properties of PCBs. Fish have been shown to accumulate PCBs by factors as high as 274,000 in the laboratory, while considerably higher factors appear to occur in their natural environments. Based upon a bioaccumulation factor of 274,000 a concentration of 0.001 µg/l could result in bioaccumulation to 0.274 ppm in flesh, which is below the dietary levels which have been shown injurious to aquatic birds and mammals who may feed upon them. In addition, however, there is evidence that in some waters some fish bioaccumulate at rates roughly ten times this, and in waters where the chronic level generally exceeds .001 µg/l, such as Lake Michigan, there is evidence of sublethal toxic effects on the fish.

In proposing this ambient water criterion the Agency recognizes the possibility that such water quality level may not provide absolute safety for all organisms in all waters. Indeed there probably is no numerical concentration level above zero which one can at this time say with great confidence provides an "ample margin of safety" for all organisms under all circumstances. However, the data do establish, at this time, that an ambient water quality level of .001 µg/l should not be exceeded.

To assess risks to humans, the most critical toxic effects of PCBs are those observed in mammals at the lowest exposure levels. These include:

(i) Mortality and reproductive failure in mink at a dietary level of 0.64 ppm.

(ii) Increased liver weight in weanling rats in the second generation of animals exposed to 1 ppm, and liver pathology (including nodules) in the second generation exposed to 20 ppm.

(iii) Stomach nodules and ulcerations in dogs at a dietary level of 1 ppm: Stomach lesions have also been reported from other species including monkeys, pigs and mink.

(iv) Reproductive failure, dermal and stomach lesions in Rhesus monkeys exposed to 2.5 ppm and deaths at 3.0 ppm.

(v) Increased activity of hepatic microsomal enzymes in rats fed at 0.5 ppm for 4 weeks.

(vi) Carcinogenic effects in rats and mice at dietary levels of 100 ppm and above.

(vii) Apparent increase in incidence of pituitary tumors in rats at dietary levels of 1 ppm and above.

(viii) Widespread presence of PCBs in fish and other organisms regularly consumed by humans.

All of these effects are relevant in weighing potential adverse effects of PCBs on humans. In particular, the symptoms of poisoning in monkeys, including dermal and gastric lesions, are parallel to those observed in man; enzyme induction is a basic biochemical effect which has been observed in many species; carcinogenic effects in rodents are generally used to predict potential carcinogenicity in humans.

It is difficult to use the results of these experiments to establish acceptable levels of exposure for humans: (a) Because many of the listed effects were reported at the lowest dietary levels investigated; (b) because humans are exposed for much longer periods (including prenatal exposure) than the experimental animals; and (c) because humans are known to store PCBs in their tissues more efficiently than the experimental animals. These data do, however, further support the proposition that an ambient water quality level of .001 µg/l should not be exceeded, and, beyond this, that every reasonable effort should be made to limit discharges of PCBs in order to minimize human exposure.

(9) *Control technology available.* At the present time there are no direct discharges of PCBs from a PCB manufacturer and thus no in-place technology to evaluate. The only U.S. manufacturer, Monsanto, discharges to the Sauget, Illinois POTW. With respect to process waste effluents from PCBs users, water is unnecessary to the processes involved in the manufacture of liquid-filled capacitors or transformers. Consequently for process waste (with certain specified exceptions), a prohibition on discharge is achievable based upon currently available technology and handling methods.

Based upon detailed plant inspections and examinations of the process steps in the use of PCBs in the manufacture of capacitors and transformers it has been determined that the characteristics of these wastes are sufficiently similar so that the same kinds of control and treatment technologies are applicable.

The wastewater characteristics for manufacturers of capacitors and transformers have been described above. Data available to the Agency indicate that water can be eliminated from most if not all of the manufacturing-related processes, with the result that potential effluents can be sufficiently reduced in quantity so that they can be incinerated or otherwise disposed of so as to reduce greatly or eliminate any discharge of process wastes to the navigable waters. Where large volumes of water are used, treatment and subsequent recycling can reduce quantities of unavoidable blowdowns to amounts suitable for treatment by activated carbon and discharge or by incineration.

With respect to capacitor manufacturing wastes, the scrap PCBs collected in sumps, drums, and drip pans, as well as fractionator bottoms from trichloroethylene recovery, are small in amount, and can be incinerated. The same is true for contaminated vacuum pump oils and any caustic baths used for paint stripping. With respect to capacitor and component cleaning operations, cleaning solvents rather than water can be used, and then incinerated following use. Water used in phosphatizing and fluoride baths by some plants can be eliminated, along with the entire process, by use of aluminum containers.

Capacitor manufacturers who use steel containers generally paint their products, which produces a waste resulting from water spray used to control paint particles and fumes. This process can be eliminated through use of aluminum containers which need not be painted. If painting is nevertheless desired, effluent discharge can be avoided by use of an air or electrostatic system instead of a waterfall for trapping paint particles and fumes.

Aqueous discharge from cooling tower blowdowns can be reduced by use of a recycling system based on demineralization or, alternatively, by incineration of blowdown. Any solid waste residue, which will not include PCBs, can be disposed of by landfill. Boiler blowdown, which is not likely to contain any PCBs, can be sealed in drums and landfilled or treated by the activated carbon treatment system.

With respect to transformer manufacturers, as with capacitor manufacturing, all scrap PCBs collected in sumps or pans can be incinerated. Contaminated vacuum pump seal oil, petroleum distillate, and askarel used for transformer interior flushing can also be incinerated. Each of these controls has been demonstrated by use by at least one of the covered plants.



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Several potential sources of process-related waste may in some cases result in effluents which cannot be avoided feasibly in the near term: Rinsewater used in welding, painting or plating operations, and scrubber and quench water from incinerator operations.

These categories of process-related discharges, as well as non-process related effluents, including plant washdown, noncontact cooling water, and runoff from stormwater or spills, can be treated by carbon adsorption as described below.

It should be noted that EPA-sponsored investigations have revealed that there are no in-place processes being employed whereby dissolved or sorbed PCBs in water streams are being either extracted from those streams or destroyed within them. In general, these waste streams contain concentrations of PCBs of less than 1 μg/l up to about 500 μg/l with many instances occurring in the 10 to 50 μg/l range. While several of the plants have practiced PCB segregation to keep the quantity of contaminated wastewaters as low as possible, none has installed full scale terminal PCB removal facilities.

The EPA through its contractor, Versar, Inc., has identified a technology which will reduce the PCB concentration in wastewaters to 1 μg/l or less and which is capable of being installed within one year. The identified system is based upon activated carbon adsorption, following primary treatment consisting of sedimentation, filtration, and skimming. The feasibility of achieving the 1 μg/l or less level has been demonstrated in laboratory tests conducted cooperatively between Versar, Inc., and two activated carbon suppliers, Carborundum Company and ICI-U.S. The system consists of an equalization-settling tank and mixed media filtration followed by carbon adsorption. Floatables and sludges from the equalization-settling tank and spent carbon are disposed of by incineration. Carbon adsorption has also been successfully used in full-scale operation to achieve removal of pollutants other than PCBs down to comparably low levels.

Based on work performed cooperatively between Versar, Inc., and Houston Research on one system and Westgate Research on another system, it was indicated that systems employing ozonation in conjunction with ultraviolet radiation can be designed to achieve any desired effluent PCB concentration. Preliminary comparisons of the capital costs between the ozone-UV system and activated carbon system show at least a 100 percent greater cost for the ozone-UV system. When pretreatment costs are included the ozone-UV system is only about 10 percent higher than activated carbon. It is doubtful however, that the ozone-UV system could be installed within one year, the maximum period of time between promulgation and the effective date of these standards.

Other systems evaluated included adsorption by polymeric resins, catalytic reduction and catalytic oxidation. Insufficient information was available to evaluate these systems.

(10) *Economic impact.* The Agency recognizes that there may be significant costs and economic impacts associated with the standards proposed at this time. The Agency has made a preliminary assessment of costs and economic impact, which is summarized below. Preliminary cost estimates, as set forth in the report submitted by Versar, Inc. (See Appendix A hereto, item 4), indicate that compliance with the proposed standards may result in additional costs of production equal to or greater than five percent of the selling price of the products (transformers and capacitors), thus identifying this regulation tentatively as a major action requiring the preparation of an Inflation Impact Statecmnt (IIS) pursuant to Executive Order 11821. A more detailed assessment is currently being prepared by the Agency, and will be accompanied by an IIS, if necessary. The availability of these documents upon their completion will be announced in the FEDERAL REGISTER, and public comments thereon will be invited. These documents, together with all public comments thereon which are received by the Hearing Clerk postmarked not later than thirty days following the aforesaid notice of availability of these documents, shall be made a part of the record of these rulemaking proceedings (see Public Participation in Rulemaking Process, below). The standards are being proposed at this time prior to completion of the economic impact assessment in light of the order and decree entered by the United States District Court in *Natural Resources Defense Council et al. v. Train*, Civ. No. 2153-73, and consolidated cases, on June 9, 1976, requiring proposal of these standards by July 14, 1976.

The Agency's preliminary assessment of costs and economic impact suggests that transitional impacts may be significant. The preliminary estimate of the cost of compliance indicates aggregate capital costs for the direct dischargers of $12 million and total annual costs of $7 million (based on a 3-year depreciation schedule). The annualized costs represent 5 to 21 percent of current selling prices for transformers and 3 to 17 percent for capacitors, the indicated ranges resulting from the types of transformers and capacitors produced. These costs may be of sufficient magnitude to induce closures of some small and/or marginal plants and conversion to substitute materials for others. It is not certain that such conversions could be carried out in the one year allowed by the Act without causing disruption of the supply of transformers and capacitors. Additional analysis will be carried out to assess more completely these types of impacts, as well as to identify other types of economic effects.

In addition, the EPA is currently engaged in issuing NPDES permits pursuant to section 402 of the Act applicable to point sources which will be covered by those proposed standards. In some instances the limitations being proposed in those permit proceedings are less stringent than the limitations which would be required by these proposed standards under section 307(a). The Agency invites comments on the comparative technology, costs, and resulting economic impacts associated with those limitations as compared with the standards hereinafter proposed. If interested persons believe that a modified standard is preferable to that proposed, they should take appropriate measures to develop and enter into the record the appropriate supporting data and information (see Public Participation in Rulemaking Process, below).

(11) *Rationale for standard.* In discussing the establishment of an ambient water criterion number above, it was emphasized that a concentration of .001 μg/l should not be exceeded and, in addition, that every reasonable effort should be made to limit discharges of PCBs in order to minimize human exposure. Indeed the data suggest that to provide an "ample margin of safety" for human health, and possibly for some other organisms as well, an ambient water criterior far lower than .001 μg/l may be required, though at this time one cannot confidently identify any specific number above zero.

At the present time, even if every point source discharge were prohibited, PCB concentrations in the water would remain for a long time not only above zero, but in some water bodies, above .001 μg/l. Moreover, since the capability does not exist presently to measure PCB concentrations below 0.001 μg/l with any reasonable degree of reliability, no useful purpose would be served in establishing a criterion number below this.

In light of the foregoing considerations, the Administrator has weighed carefully the desirability and feasibility of imposing a prohibition on any discharge of PCBs from any point source. In the case of existing manufacturers, this can be done since the only present PCB manufacturer does not have a direct discharge. A similar requirement is imposed upon new PCB manufacturing sources, who would be required in effect to either achieve a completely closed system or discharge into a POTW. With respect to transformers and capacitors, both these industries provide important products to the United States economy for which there are no presently proven substitutes. Moreover, the best reduction levels which available technology can acheive with respect to an effluent discharge containing PCBs appear to be 1 μg/l through the use of carbon adsorption treatment. This exceeds the ambient water criterion by three orders of magnitude.

Discharge of relatively modest amounts of a pollutant into the water at many times the ambient water criterion may be allowed, however, without necessarily failing to provide safety for affected organisms. First, the actual discharge concentration does not normally remain the ambient concentration. In fact, the effluent disperses following discharge and becomes greatly diluted. The area of di-



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lution is often referred to as a "mixing zone", and will vary in size and shape from one body of water to the next and from one discharge to the next. The result of this phenomenon is that once the effluent reaches the outside of the mixing zone, the pollutant concentration may have become diluted by a factor of several hundred or more, and indeed may not even be detectable by the most sophisticated monitoring equipment. Concededly, in some instances there may be adverse effects on some organisms in the immediate vicinity of the outfall. However, for chronic effects to be observed, the exposure time would have to be quite lengthy—perhaps a lifetime. Even acute toxic effects, which normally occur at much higher dosage levels than chronic effects, are generally recorded based upon a 96-hour exposure. Because of the extraordinary persistence of PCBs reliance on mixing zones, while of assistance in the immediate future, cannot be regarded as a long-term solution to the problem.

In developing the proposed standards, the Agency also considered the availability of substitutes for PCBs in transformers and capacitors. Several companies have developed products which they believe are an adequate substitute for PCBs in transformers and efforts are under way to develop substitutes for PCBs in capacitors as well. At this time, however, it is still too early to determine with confidence whether the substitutes are not only functionally effective but, in addition, are safe in terms of potential fire hazard and other safety considerations, and are environmentally safe. The Agency has concluded that it cannot at this time set a toxic pollutant effluent standard, or prohibition on discharge, upon the assumption of the ready availability of a substitute product. However, the Agency is pursuing an active policy to encourage industry to develop as rapidly as possible feasible substitutes for PCBs.

Because of the absence of any proven satisfactory substitute for PCBs in certain transformers and capacitors, it must be recognized that to impose a prohibition on all PCB-containing effluents at this time would probably cause a severe impact on the transformer and capacitor manufacturing industries which utilize PCBs, and deprive the nation of the future availability of products which utilize such transformers and capacitors. Accordingly, in the proposed standards the Administrator is requiring that discharges be prohibited where possible, and that other discharge comply with the very best results which available technology can achieve. For the manufacturing of transformers and capacitors, the standards are based on the following tabulation:

| *Wastewater type* | *Type of technology applied* |
|---|---|
| Non-contact cooling water. | Cool in closed radiator system and recycle. |
| Steam jet condensate. | Replace steam jets with mechanical pumps. |
| Detergent washing water. | Replace with solvent vapor degreasing. |
| Boiler blowdowns. | Filter, demineralize, and recycle. |
| Incinerator scrubber water. | Pretreatment and carbon adsorption to 1 $\mu g/l$ or less. |
| Process-associated wastes.[1] | Pretreatment and carbon adsorption to 1 $\mu g/l$ or less. |
| Sanitary waste waters. | To POTW. |
| Rainfall runoff.... | Enclose areas or pretreatment and carbon adsorption. |

[1] Includes hot solder dip rinse water, phosphatizing bath wastewaters, tin plating bath and rinse waters, fluoride bath and rinse waters and painting water spray. These are small in volume and may occur in only a single plant.

Using this technology results in a prohibition on discharge of PCBs from any point source to the navigable waters involving solely process wastes with the exceptions noted in the above table, which would be treated with activated carbon to the 1 $\mu g/l$ level or lower. This technology substantiates a standard of a prohibition of PCBs in process wastes (except for certain specified wastes) and treatment of other discharges with activated carbon, reducing PCBs to 1 $\mu g/l$ or less. Although occasional deviations are unavoidable, at no time may any such allowed discharge exceed 5 $\mu g/l$ for samples representing a working day.

For new sources, where further technology advances can be reasonably expected, a more stringent limitation may be set to take such expected advances into account, including advances in control technology and in substitutes for PCBs. Limitations of 0.1 $\mu g/l$ on the daily average per month and 0.5 $\mu g/l$ maximum at any time should be achievable (the ozonation-UV data so indicate) and are therefore proposed as new source standards for non-process wastewater discharges from transformer and capacitor manufacturers, and from discharges resulting from scrubber and quench water from incinerator operations. For the reasons discussed above, no new source discharge of PCBs will be allowed which result from jet ejectors or rinsewater from welding or plating operations.

The maximum daily permissible concentration is based upon an application factor of five times the maximum average monthly concentration factor. This is provided to take into account the fact that occasional daily concentrations may exceed the required maximum monthly average. They should not be allowed at any time to exceed the lowest feasible ceiling, however, and the Agency's information with respect to carbon absorption and analogous treatment techniques indicate that a variability factor of five is achievable and reasonable.

Translating an ambient water criterion number to an end-of-the-pipe standard is at best an imprecise calculation. The dispersion and dilution factors discussed above are expected to result, in most receiving waters, in the achievement of the degree of protection envisioned by the Act. The Agency recognizes, however, that there may be a few cases where, because of local receiving water conditions, notably with respect to hydrology, sufficient dispersion and dilution may not take place. To deal with such cases, § 129.7 of Subpart A (the general provisions of Part 129; see standards proposed on June 10, 1976, 41 FR 23576) allows the applicable NPDES permit issuing authority to impose such more stringent effluent limitations as may be required in order to achieve or approach the ambient water criterion level, in this case .001 $\mu g/l$, at least beyond the boundaries of any reasonable mixing zone. In addition, more stringent levels may be imposed to meet any applicable water quality standard, see § 129.5(e). It is possible that an exercise of these provisions could result in a plant closure.

However, by allowing some consideration for technology in the initial standard-setting, even though consideration of ecological and health effects are paramount, the approach taken under these standards makes it reasonably probable that if there are to be any shutdowns, they will occur only after a site-specific examination, and only because of a failure to meet the safety requirements of section 307(a).

Finally, it is recognized that to allow a discharge at the proposed levels may pose some risk of adverse effects to some organisms, particularly those located near the outfall, and possibly to the consumers thereof. However, based upon preliminary information, this risk is deemed to be outweighed at this time by the social and economic benefits represented by not setting a standard which would force widespread closures of plants manufacturing capacitors and transformers, which would in turn be likely to sharply curtail the nation's supply of these essential products, or lead to importation of products containing dielectrics which are even more environmentally hazardous.

(12) *Subsequent review of standards.* It continues to be the goal of the Agency to reduce the presence of PCBs in the environment to the greatest extent possible as rapidly as feasible, for all of the reasons outlined above. Indeed, as additional data become available to the Agency, it may be necessary to revise in subsequent proceedings both the standards and the ambient water criterion established pursuant to the present rulemaking in the direction of greater stringency in order to provide the degree of safety required by the Act.

The Agency is obligated to review and where necessary, revise its section 307(a) standards at least every three years. The Agency intends to review the proposed standard one year following promulgation, with the expectation that industry will have made significant strides towards the development of reliable substitutes for PCBs, as well as in the field of control technology, so that a prohibition on all discharges of PCBs in any industrial effluent can be considered at that



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time, including sources not covered by the standards proposed at this time.

### III. Public Participation in Rulemaking Process

A public hearing to consider the proposed effluent standards will be held pursuant to section 307(a)(2) of the Act commencing on August 20, 1976, at 10:00 a.m. in Room 2409, Waterside Mall, U.S. Environmental Protection Agency, 401 M Street, SW., Washington, D.C. In accordance with the Agency's rules of practice governing public hearings on effluent standards for toxic pollutants, 40 CFR Part 104 as amended, 41 F.R. 17898 et seq. (April 29, 1976), the first hearing day shall include a prehearing conference at the above time and place. All persons interested in participating in those hearings as objecting parties should refer to the amended rules of practice, 41 F.R. 17898 et seq., and should not rely on previous editions. Any person who has any objection to any standard proposed herein may file with the Hearing Clerk (A-100), Room 1019 WSME, U.S. Environmental Protection Agency, 401 M Street, SW., Washington, D.C. 20460, within 25 days of the date of this notice, a statement of objection in triplicate which shall meet all of the requirements of 40 CFR 104.3 (a) and (b). These Sections require, among other things, actual receipt by the Hearing Clerk of any objection within the aforesaid time. The presiding officer may refuse to permit any person to participate in said hearing who fails to comply with any of the provisions of those sections.

In addition to the foregoing, any person interested in this proposed rulemaking but who does not participate as a party in the formal hearing may submit written comments to the Agency on the proposed rulemaking. Such comments should be filed in triplicate, if possible, and should be addressed to: Hearing Clerk (A-100), Room 1019 WSME, U.S. Environmental Protection Agency, 401 M Street, SW., Washington, D.C. 20460. All comments which are received by the hearing clerk and which are postmarked on or before August 20, 1976 shall become a part of the hearing record in the manner prescribed in 40 CFR 104.3(d) and shall be considered by the Administrator prior to the promulgation of final standards.

In addition, in accordance with the discussion above concerning economic impact of the standards proposed at this time, the Agency will publish in the Federal Register approximately ninety days following the date of publication of this notice of proposed rulemaking an announcement of the availability of the Agency's economic impact assessment with respect to the proposed standards. The document or documents setting forth this assessment shall be made part of the record of the rulemaking proceedings on these proposed standards, together with all comments directed specifically thereto which are received by the Hearing Clerk at the above address, and which are postmarked not later than *thirty days following the aforesaid notice* of availability. All parties to the public hearing on the proposed standards shall be allowed a reasonable opportunity to examine this economic impact assessment and any comments therein, and to respond thereto on the record. To this limited extent and for this limited purpose only, I hereby waive the time deadline requirements for the filing of public comments under § 104.3(d) of the Agency's Rules of Practice for Public Hearings on Effluent Standards for Toxic Pollutants, 40 CFR Part 104, as amended, 41 FR 17898 (April 29, 1976), so as to allow the filing of materials and comments described in this paragraph within the time period herein set forth, and I accordingly direct the presiding officer at the public hearings to be conducted on these proposed standards to ensure that the record includes all materials which are filed in conformity with this paragraph. The Agency has the legal authority to modify or waive strict compliance with its rules of practice in exceptional circumstances such as the foregoing when the ends of justice require. Cf, *American Farm Lines v. Black Ball Freight Service*, 397 U.S. 532 (1970) and cases cited therein.

Dated: July 14, 1976.

Russell E. Train,
*Administrator.*

### Appendix A

1. Criteria Document for Polychlorinated Biphenyls (EPA, Ian C. T. Nisbet, Ph. D., 1976), including general introduction.
2. PCBs in the United States Industrial Use and Environmental Distribution (Doc. No. EPA 560/6-76-005 February 25, 1976).
3. Assessment of Wastewater Management, Treatment Technology and Associated Costs for Abatement of PCBs Concentrations in Industrial Effluents (Doc. No. EPA 560/6-76-006 February 3, 1976).
4. PCBs Water Elimination/Reduction Technology and Associated Costs, Manufacturers of Electrical Capacitors and Transformers; Addendum to Final Report, Task II (July 2, 1976) (supplements item 3).
5. Conference Proceedings of the National Conference on PCBs (Doc. No. EPA 560/6-75-004; Conference held November 1975; proceedings published March 1976).
6. Notice of Proposed Rulemaking: EPA Proposal of Toxic Pollutant Effluent Standards for Aldrin/Dieldrin, DDT (DDD, DDE), Endrin and Toxaphene, 41 FR 23576 (June 10, 1976).

1. In 40 CFR Part 129, Subpart A (as proposed at 41 FR 23576 (June 10, 1976) and amended at 41 FR 27017 (June 30, 1976) the table of contents is further amended to read as follows:

## PART 129—TOXIC POLLUTANT EFFLUENT STANDARDS

#### Subpart A—Toxic Pollutant Effluent Standards and Prohibitions



Authority.—Secs. 307, 308, and 501 of the Federal Water Pollution Control Act Amendments of 1972 (Pub. L. 92-500, 86 Stat. 816, 33 U.S.C. 1251 et seq.).

2. Subpart A of Part 129 is further amended by adding new paragraph (f) to § 129.4 to read as follows:

**§ 129.4 Toxic pollutants.**

* * * * *

(f) Polychlorinated Biphenyls (PCBs)—polychlorinated biphenyls (PCBs) means a mixture of compounds composed of the bipenhyl molecule which has been chlorinated to varying degrees.

3. Subpart A of Part 129 is further amended by adding new § 129.105 to read as follows:

**§ 129.105 Polychlorinated biphenyls (PCBs).**

(a) *Specialized definitions.* (1) "PCB Manufacturer" means a manufacturer who produces polychlorinated bipenyls.
(2) "Electrical capacitor manufacturer" means a manufacturer who produces or assembles electrical capacitors in which PCB or PCB-containing compounds are part of the dielectric.
(3) "Electrical transformer manufacturer" means a manufacturer who produces or assembles electrical transformers in which PCB or PCB-containing compounds are part of the dielectric.
(4) The ambient water criterion for PCBs in navigable waters is 0.001 $\mu$g/l.
(b) *PCB Manufacturer*—(1) *Applicability.* (i) These standards or prohibitions apply to:
(A) All discharges of process wastes;
(B) All discharges from the manufacturing or incinerator areas, loading and unloading areas storage areas, and other areas which are subject to direct contamination by PCBs as a result of the manufacturing process, including but not limited to:
(*1*) Stormwater and other runoff;
(*2*) Water used for routine cleanup or cleanup of spills.
(ii) These standards do not apply to stormwater runoff or other discharges from areas subject to contamination solely by fallout from air emissions of PCBs; or to stormwater runoff that exceeds that from the ten year 24-hour rainfall event.
(2) *Analytical Method Acceptable.* Environmental Protection Agency method specified in Part 136 of this chapter, except that a 1 liter sample size is required to increase analytical sensitivity.
(3) *Effluent standards*—(i) *Existing sources.* PCBs are prohibited in any discharges from any PCB manufacturer.



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(ii) *New sources.* PCBs are prohibited in any discharge from any PCB manufacturer.

(c) *Electrical capacitor manufacturer*—(1) *Applicability.* (i) These standards or prohibitions apply to:

(A) All discharges of process wastes; and

(B) All discharges from the manufacturing or incineration areas, loading and unloading areas, storage areas and other areas which are subject to direct contamination by PCBs as a result of the manufacturing process, including but not limited to:

(*1*) Stormwater and other runoff; and

(*2*) Water used for routine cleanup or cleanup of spills.

(ii) These standards do not apply to stormwater runoff or other discharges from areas subject to contamination solely by fallout from air emissions of PCBs; or to stormwater runoff that exceeds that from the ten year 24-hour rainfall event.

(2) *Analytical method acceptable.* Environmental Protection Agency method specified in Part 136 of this chapter, except that a 1 liter sample size is required to increase analytical sensitivity.

(3) *Effluent standards*—(i) *Existing sources.* (A) PCBs are prohibited in all process wastes discharged with the following exceptions:

(*1*) Water used in welding, plating or painting operations; and

(*2*) Scrubber and quench water from incinerator operations.

(B) All other discharges (including each of the exceptions set forth in the preceding section (A)) from a capacitor manufacturer shall not contain polychlorinated biphenyls concentrations exceeding an average per working day of 1 $\mu$g/l calculated over any calendar month; and shall not exceed 5 $\mu$g/l in sample(s) representing any working day.

(ii) *New sources.* (A) PCBs are prohibited in any process wastes discharged with the exception of scrubber and quench water from incinerator operations; and

(B) All other discharges from a capacitor manufacturer shall not contain polychlorinated biphenyls concentrations exceeding an average per working day of 0.1 $\mu$g/l calculated over any calendar month; and shall not exceed 0.5 $\mu$g/l in sample(s) representing any working day.

(4) The standards set forth in this Subsection shall apply to the total combined weight or concentration of PCBs, excluding any associated element or compound.

(d) *Electrical transformer manufacturer* — (1) *Applicability.* (i) These standards or prohibitions apply to:

(A) All discharges of process wastes; and

(B) All discharges from the manufacturing or incineration areas, loading and unloading areas, storage areas, and other areas which are subject to direct contamination by PCBs as a result of the manufacturing process, including but not limited to:

(*1*) Stormwater and other runoff; and

(*2*) Water used for routine cleanup or cleanup of spills.

(ii) These standards do not apply to stormwater runoff or other discharges from areas subject to contamination solely by fallout from air emissions of PCBs; or to stormwater runoff that exceeds that from the ten year 24-hour rainfall event.

(2) *Analytical Method Acceptable.* Environmental Protection Agency method specified in Part 136 of this chapter, except that a 1 liter sample size is required to increase analytical sensitivity.

(3) *Effluent standards*—(i) *Existing sources.* (A) PCBs are prohibited in any process wastes discharged, with the following exceptions:

(*1*) Water used in welding, plating or painting operations; and

(*2*) Scrubber and quench water from incinerator operations.

(B) All other discharges (including each of the exceptions set forth in the preceding section (A)) from a transformer manufacturer shall not contain polychlorinated biphenyls concentrations exceeding an average per working day of 1 $\mu$g/l calculated over any calendar month; and shall not exceed 5 $\mu$g/l in sample(s) representing any working day.

(ii) *New sources.* (A) PCBs are prohibited in any process wastes discharged, with the exception of scrubber and quench water from incinerator operations; and

(B) All other discharges from a transformer manufacturer shall not contain polychlorinated biphenyls concentrations exceeding an average per working day of 0.1 $\mu$g/l calculated over any calendar month; and shall not exceed 0.5 $\mu$g/l in sample(s) representing any working day.

(4) The standards set forth in this subsection shall apply to the total combined weight or concentration of PCBs, excluding any associated element or compound.

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