United States Environmental Protection Agency
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# Chesapeake Bay Basinwide Toxics Reduction Strategy Appendices

Chesapeake Bay Program

APPENDICES

to the

CHESPEAKE BAY BASINWIDE TOXICS REDUCTION STRATEGY
An Agreement Commitment Report from the
Chesapeake Executive Council

Appendix A. Toxics Requirements Under the 1987 Amendments to the Clean Water Act

Appendix B. Signatory Appendices:

Commonwealth of Pennsylvania
Commonwealth of Virginia
District of Columbia
State of Maryland
U.S. Environmental Protection Agency

Appendix C. Scientific and Technical Advisory Committee Toxics Research Plan

# APPENDIX A

## Toxics Requirements Under the 1987 Amendments to the Clean Water Act

State and Federal Toxics Identification
and Control Actions Required Under the
1987 Amendments to the Clean Water Act

## A. Introduction

The Chesapeake Bay Basinwide Toxics Reduction Strategy identifies the presence of harmful levels of toxic pollutants as a significant problem in the Chesapeake Bay. This appendix to the Strategy describes three major statutory requirements of the Clean Water Act which support the need for a long-term strategy to deal with the identification, assessment, and control of toxics in the Bay. The role of the Act requirements within the larger strategy framework will be described.

The Clean Water Act was amended in 1987 by adding two sections dealing with toxic pollutants, Sections 304(1) and 303(c)(2)(B). Section 304(1) specifies specific deadlines to accelerate State action in controlling certain toxic discharges to surface water where water quality is now impaired. Section 303(c)(2)(B) adds specific requirements for adoption of standards under certain conditions for toxic pollutants. The Act was also amended to include Section 319 which sets out requirements for development of nonpoint source management plans by the states.

## B. Statutory Requirements for Identifying Impaired Waters and Controlling Toxics

Section 304(1) of the Clean Water Act requires States to develop lists of impaired surface waters, identify point sources and amounts of pollutants they discharge that cause toxic impacts, and individual control strategies for each such point source. These individual control strategies are designed to achieve applicable water quality standards no later than June 1992. Applicable water quality standards are those State standards that exist on February 4, 1989 including both numeric criteria for Section 307(a) toxic pollutants and narrative "free from" standards. The general effect of this new section is to focus national surface water quality protection programs immediately on addressing known water quality problems due entirely or substantially to point source discharges of Section 307(a) toxic pollutants.

The term 307(a) toxic pollutants refers to the list of 126 "priority" pollutants listed in connection with Section 307(a) of the Clean Water Act. EPA's water pollution control program has historically concentrated on the 126 priority pollutants as a subset of the 65 classes of compounds formally published as a list by EPA as required by Section 307(a). This list of 126 pollutants has been the focus of both the national water quality criteria and the national effluent guidelines development processes. The original list of 65 classes of compounds included thousands of individual chemicals.

## C. Clean Water Act Listing Requirements

The States are currently developing the three lists required by the Act:

(i) A list of waters the State does not expect to achieve numeric water quality standards for Section 307(a) toxic pollutants after technology-based requirements have been met, due to either point or nonpoint sources of pollution (the "long list");

(ii) a comprehensive list of waters impaired by point source discharges of toxic, conventional, and nonconventional pollutants (the "short list"); and

(iii) a list of waters the State does not expect will achieve "applicable standards" after technology-based requirements have been met, due entirely or substantially to point source discharges of Section 307(a) pollutants (the "mini list").

For each stream segment or waterbody listed by the States in (iii), each State is required to identify the specific point sources discharging any Section 307(a) toxic pollutant and the amount of each such pollutant discharged. All of the signatory states submitted draft lists to EPA in April 1988. The final lists are due to the Region III office by February 4, 1989. EPA issued final guidance on executing this statutory requirement in March 1988.

**D. Individual Control Strategies**

For each stream segment or waterbody on list (iii) above (specifically Section 304(l)(B) of the Clean Water Act), the States are also required to develop individual control strategies by February 4, 1989, to reduce the discharge of toxic pollutants from each identified point source. Individual control strategies are defined as NPDES permits with effluent limits and schedules for meeting these limits that assure, in combination with existing nonpoint source controls, the attainment and maintenance of applicable water quality standards for toxic pollutants and toxicity. Applicable water quality standards in existence on February 4, 1989, must be achieved in the listed waters no later than June 4, 1992.

Section 304(l) requires that individual control strategies be established in accordance with Section 402 of the Clean Water Act. This is the provision establishing the National Pollutant Discharge Elimination System (NPDES) permit program. Because water quality impairment due to toxicity may be present in stream segments or waterbodies other than those that must be listed under Section 304(l)(B), EPA is requiring States to develop water quality-based permit limits for any stream segment or waterbody that is not achieving applicable water quality standards due to any pollutant that causes toxic effects, not simply the Section 307(a) toxic pollutants.

**E. EPA Responsibilities**

EPA Region III must approve the lists of waters and individual control strategies within 120 days after the February 4, 1989 deadline. If either are disapproved by EPA, then EPA must develop the lists or controls within one year, or by June 4, 1993. Within the 120 day review period, EPA should provide the States and the public with the opportunity to respond to any deficiencies which would cause a list of individual control strategy to be disapproved. States should also provide the public with an opportunity to comment on the lists before submittal to EPA.

## F. Relationship to Other Programs

As described in Appendix B of the Toxics Reduction Strategy, the signatory states are actively undertaking the necessary actions mandated by this new requirement. The amendments to the Act specifically address pollutants listed under Section 307(a). Other existing statutes of the Clean Water Act require that all known toxics problems (due to any pollutant) be controlled as soon as possible, giving the same priority to controls for non-Section 307(a) pollutants as to controls where only Section 307(a) pollutants are involved.

The Clean Water Act provides broad statutory authorities in Sections 301, 303, 304, 306, 307, 401, and 402, which have long mandated that programs be implemented to control the discharge of pollutants to surface waters. Under these sections of the Act, the States and EPA are required to develop and implement both technology-based and water quality-based controls of conventional, non-conventional, and Section 307(a) toxic pollutants for point source dischargers. Through the use of technology-based effluent guidelines, State water quality standards, and the NPDES permitting process, significant reductions of pollutant loadings to the Nation's receiving waters have been achieved.

The timeframe for achieving Section 304(l)requirements and the Toxics Reduction Strategy's emphasis on near term control and reduction of toxics requires the States and EPA to address problems identified through review of existing and readily available data on toxics. However, as indicated throughout the Toxic Reduction Strategy, States and EPA must continue to collect new toxics data as an ongoing obligation to assure that changes in water and sediment quality are identified and any important data gaps in existing data are filled to provide a reasonable basis for identifying, assessing, and controlling other sources of toxics impacting the Chesapeake Bay.

## G. Clean Water Act Requirements for Toxics Standards Adoption

Within a rather broad framework established by EPA, States develop their own system of use classifications and choose what pollutants and at what levels are to be included in the State water quality standards rules. A significant change in the optional nature of this program occurred with the passage of the Water Quality Act of 1987. This Act amended the Clean Water Act by adding a new Section 303(c)(2)(B) which directed, for the first time, States to adopt standards for certain pollutants listed as toxic under Section 307(a) of the Act. At this time there are 126 pollutants listed. EPA has published criteria recommendations for 25 pollutants for the protection of aquatic life and 109 for the protection of human health. Specifically, States

> "...shall adopt criteria for all toxic pollutants listed pursuant to section 307(a)(1) of this Act for which criteria have been published under section 304(a), the discharge or presence of which in the affected water could reasonably be expected to interfere with those designated uses adopted by the State, as necessary to support such designated uses. Such criteria shall be specific numerical criteria for such toxic pollutants. Where such numerical criteria are not available, whenever a State reviews water quality standards...or

revises or adopts new standards pursuant to this paragraph, such State shall adopt criteria based on biological monitoring or assessment methods consistent with information published pursuant to section 304(a)(8)."

To carry out these requirements, whenever a State revises its water quality standards, it must review all available information and data to first determine whether the discharge or the presence of a toxic pollutant is interfering with the use. The state must then adopt a numeric limit for the specific pollutant. A State may be unsure whether a toxic pollutant is interfering with, or is not likely to interfere with the designated use and therefore is unsure that control of the pollutant is necessary to support the designated use. In these circumstances, the State should undertake the necessary efforts to develop sufficient information upon which to make such a determination. Presence of facilities that manufacture or use the Section 307(a) toxic pollutants or other information indicating that such pollutants are discharged strongly suggest that such pollutants could be interfering with attaining uses. In order to determine whether waters are attaining designated uses, and to develop total maximum daily loads, wasteload allocations, and NPDES permits to meet applicable water quality standards, a State must also consider pollution from nonpoint sources since both point and nonpoint sources may contribute to exceedences of water quality standards. EPA issued final guidance on executing this statutory requirement in December 1988.

Unlike some other requirements added to the Clean Water Act by the amendments of 1987, this directive to the States to adopt standards for section 307(a) toxic pollutants is a continuing requirement, not a one-time effort. It is also an indication of Congressional concern with the national progress towards the identification, assessment and control of toxic pollutants.

One major action required by the amendments of the Clean Water Act in 1987 involves developing individual control strategies for point sources identified as causing exceedences of water quality standards. Developing such control strategies is done but once and then the requirements of the Act have been met. However, the requirement to ascertain if toxics are interfering with designated uses and adoption of standards where necessary is continuous and is not fulfilled by one action on the part of a State.

This statutory requirement provides a strong base for the implementation of the Toxics Reduction Strategy for the Chesapeake Bay basin. The Strategy identifies certain base information for short term actions and details plans and informational needs to deal with future toxics problems. As such, the Toxics Reduction Strategy clearly supports the Act by incorporating statutory requirements as the foundation for the strategy. Although the amendments to the Act reference Section 307(a) toxic pollutants, the existing provisions of the law allow the States to adopt standards for any pollutants the State deems necessary, including other toxic pollutants not on the Section 307(a) list.

**B. Section 319 State Nonpoint Source Management Plans Requirements**

State Nonpoint Source Management Plans developed in compliance with Section 319 of the Clean Water Act, identify statewide management programs designed to quantify, control and limit the effects of nonpoint source pollution on the attainment of water quality goals. These plans provide some identification of annual reportable units with which progress towards the achievement of identified goals can be measured. The Toxics Reduction Strategy components focused on nonpoint source controls and the Toxics Loading Inventory should incorporate information found in these plans and the programs they reference.

**I. Future Actions**

The development of the lists is expected to be an ongoing activity as States continually collect and analyze new information and additional toxics problems for identification in the State 305(b) reports. The specific requirement to develop individual control strategies is a one-time action. In the future, the normal process of revising water quality standards and issuing or revising NPDES permits will establish controls necessary to address point source toxics problems.

Section 304(l) references water quality standards in existence on February 4, 1989. EPA is interpreting the term applicable standards to mean both numeric criteria for the Section 307(a) toxic pollutants and narrative "free from toxicity" standards. While all the signatory States have the narrative free from standard, the coverage of numeric criteria for toxic pollutants varies significantly. A limited number of numeric toxics currently in a State's standards likely will have several impacts. First, the initial 304(l)(B) list may be rather short. Second, the State will be required to interpret its narrative "free from toxicity" standard as to how that standard is to be applied to NPDES permits and to decide if it is being violated in a waterbody for purposes of the 304(l) listing requirements. For the longer term, with the amendment of the Clean Water Act to include section 303(c)(2)(B) a State will need to adopt a formal procedure for translating its narrative standard into numeric limits.

APPENDIX B

Signatory Appendices:

Commonwealth of Pennsylvania

Commonwealth of Virginia

District of Columbia

State of Maryland

U.S. Environmental Protection Agency

COMMONWEALTH OF PENNSYLVANIA

# SUMMARY OF TOXICS PROGRAMS IN THE CHESAPEAKE BAY BASIN

## A. Toxic Problem Areas (Section 304(1) list)

Section 304(l)(1), Paragraph (A)(i) of the Clean Water Act (as amended, 1987) requires a list of waters for which a State does not expect to achieve water quality standards for Section 307(a) toxic pollutants after the requirements of applicable technology-based standards have been met due to either point or nonpoint sources of pollution.

The following tables list the river and stream segments within the Chesapeake Bay drainage reported as degraded by toxic pollutants. The lists were compiled utilizing the Water Quality Assessment Summaries input to the computerized Assessment Database. The lists only include identified problems reported for input to the database. Other toxics problems may not have been reported and some segments with toxics problems may not have been assessed as yet.

Entries from the Assessment Database were retrieved using all of the pollutant codes for toxics. The codes used were:

| CODES | DEFINITION |
|---|---|
| METALS | HEAVY METALS |
| METALS HWC* | HUMAN HEALTH - METALS IN WATER COLUMN |
| METALS HFT** | HUMAN HEALTH - METALS IN FISH TISSUE |
| PEST/HERB | PESTICIDES OR HERBICIDES |
| PEST HWC* | HUMAN HEALTH - PESTICIDES OR HERBICIDES IN FISH TISSUE |
| OTHER ORG | OTHER ORGANICS |
| ORG HWC* | HUMAN HEALTH - ORGANICS IN WATER COLUMN |
| ORG HFT** | HUMAN HEALTH - ORGANICS IN FISH TISSUE |
| PH-METALS | COMBINED PH-METALS PROBLEM |

*Used when levels exceed Safe Drinking Water Act levels or otherwise may endanger public health. This includes all streams including those without public water supply intakes.

**Used when levels in fish tissue exceed FDA Action Levels, when a fish consumption advisory has been issued, or when levels may endanger public health.

As can be seen from the pollutant codes, the assessments considered human health impacts in addition to fish and aquatic life uses.

These lists do not fully comply with the Section 304(1) requirements because the lists are not limited to segments which will not support uses after the implementation of technology-based controls. The records from the Assessment Database are the result of monitoring and are based on actual field data. These records do not take into account technology-based limitations. For this reason, the lists in this section contain the stream segments known (monitored) to be impacted by toxic pollutants. The issue of technology-based versus water quality-based effluent limitations will be examined on a case-by-case basis as these problems are addressed during the permitting process.

Tables 1 and 2 present the stream segments impacted by toxic pollutants within the Chesapeake Bay drainage include the stream name, the segment location, the miles affected, and the causes and pollutants responsible for the reported degradation. The lists are tabulated on a watershed basis, that is, grouped by State Water Plan (SWP) subbasin (Figure 1). It is possible that all toxics impacts have not been reported in the form of Water Quality Assessment Summaries.

Two lists were prepared in order to separate the impacts of abandoned mine drainage from toxics impacts due to other causes. Degradation due to abandoned mine drainage is a major problem in the Commonwealth. Table 1 lists the stream segments affected by heavy metals introduced by mine drainage. Table 2 presents the list of reported toxics problems caused by other sources.

As part of its effort to comply with the Section 304(l) requirements, the Department is conducting a series of Total Maximum Daily Load/Waste Load Allocation (TMDL/WLA) screenings. The screenings are being conducted on a watershed basis, and are designed to:

Inventory readily available information on the nature and extent of toxics discharges from Publicly-Owned Treatment Works (POTW's) and industrial discharges;

Evaluate the impact that these discharges are having or may have on the receiving water body;

Determine the parameters of concern associated with each discharge that may require Water Quality Based Effluent Limitations (WQBEL's); and

Determine where potential discharge interactions may require additional field data collection and multiple discharge wasteload allocations.

The TMDL/WLA screening procedure used by DER is simple and straightforward. For each watershed where a screening is conducted, readily available information on the nature and extent of toxic discharges from industrial and municipal facilities is collected from DER files. This information is supplemented by the collection of additional toxics discharge information for selected discharges (mainly POTWs) where existing information is not available or is believed to be incomplete. These data, together with information on receiving stream design flow characteristics, is then used in a conservative, steady state mass balance model to determine where potential water quality violations may exist after the application of technology-based effluent limitations.(1) The results of the analysis are displayed in qualitative form, indicating the water quality criteria that are or may be violated, the location and the number of stream miles affected, and the discharge(s) that is contributing to the potential violation.

There is potential concern for toxics in any waters with industrial, municipal, nonmunicipal, or nonpoint source discharges. The only waters with less concern are those designated for Special Protection (except those that may be misclassified). We will not know which waters are a potential concern until we complete the screenings.

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(1)For many toxic paramters, no minimum technology-based effluent limitations have been established. In such cases, a base line of existing discharge concentration was used in the analysis.

FIGURE 1
STATE WATER PLAN SUBBASINS
WHICH DRAIN INTO THE CHESAPEAKE BAY

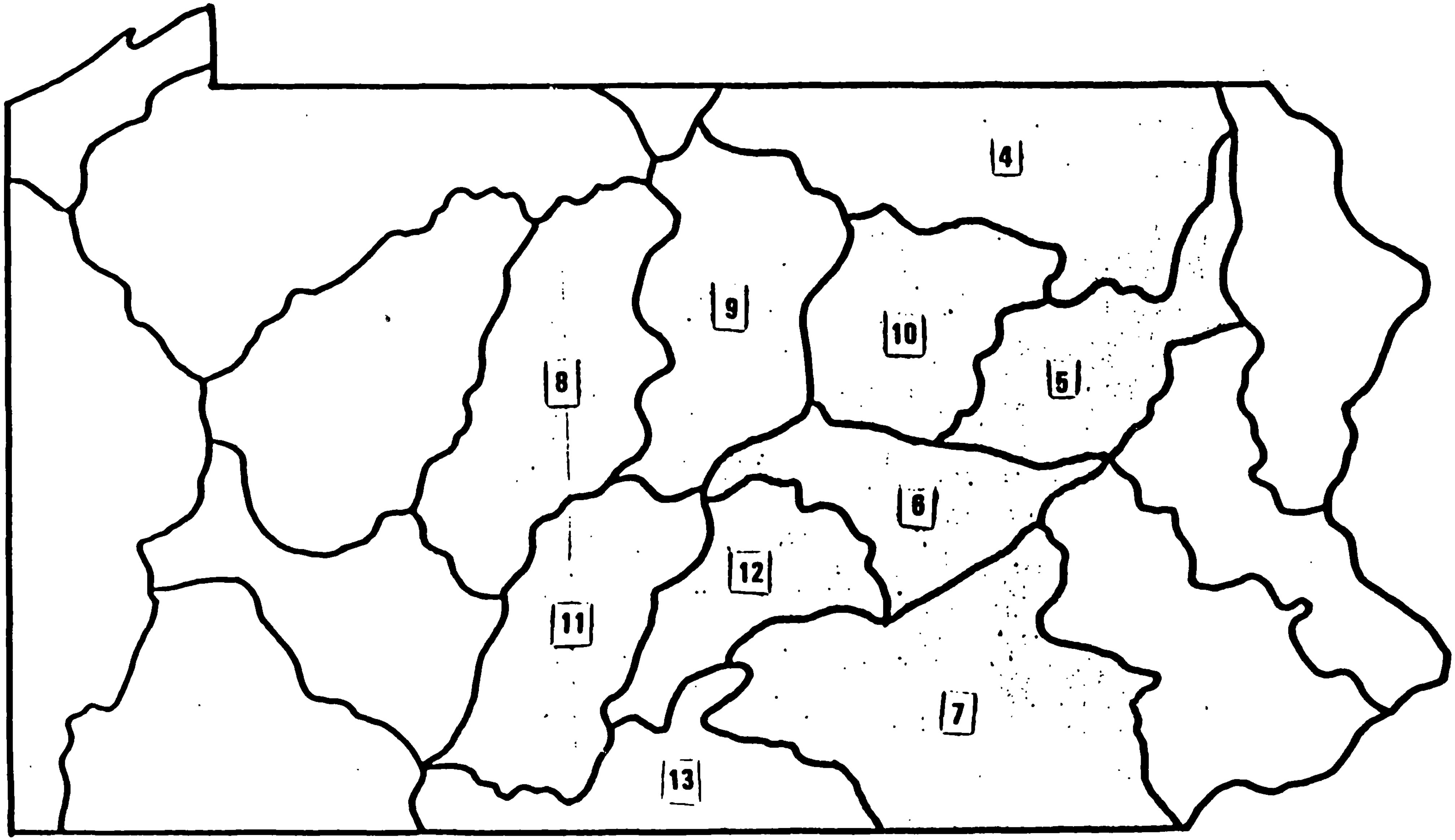

TABLE 1
STREAM SEGMENTS REPORTED AS IMPACTED BY TOXIC POLLUTANTS
DUE TO MINE DRAINAGE
(Metals or pH-Metals Listed as the Pollutant)
(All but one are Monitored Segments)

| SWP Sub-basin | Stream Code | Stream Name | River Mile Location | | Miles Degraded |
|---|---|---|---|---|---|
| | | | Upstr. | Dnstr. | |
| 4-A | 30990 | Tioga River | 56.0 | 13.0 | 36.2 |
| 4-A | 31443 | Johnson Creek | 3.4 | 0.0 | 3.4 |
| 4-C | 30337 | Schrader Creek | 23.5 | 0.0 | 6.5 |
| | | TOTAL | | | 46.1 |
| 5-B | 6685 | Susquehanna River | 197.0 | 181.9 | 6.6 |
| 5-B | 28343 | Newport Creek | 4.8 | 0.0 | 4.8 |
| 5-B | 28348 | Nanticoke Creek | 3.6 | 0.0 | 3.6 |
| 5-B | 28352 | Solomon Creek | 1.8 | 0.0 | 1.5 |
| 5-D | 28109 | Black Creek | 14.3 | 0.0 | 2.8 |
| 5-E | 6685 | Susquehanna River | 181.9 | 123.7 | 8.0 |
| 5-E | 27529 | Catawissa Creek | 18.0 | 0.0 | 18.0 |
| | | TOTAL | | | 45.3 |
| 6-B | 17556 | Mahanoy Creek | 53.5 | 26.1 | 9.6 |
| 6-B | 17556 | Mahanoy Creek | 26.1 | 0.0 | 26.1 |
| 6-B | 18489 | Shamokin Creek | 34.7 | 0.0 | 34.7 |
| 6-C | 16895 | Wiconisco Creek | 27.0 | 6.0 | 21.0 |
| 6-C | 17208 | Pine Creek | 12.7 | 0.0 | 12.7 |
| | | TOTAL | | | 104.1 |
| 7-D | 9361 | Swatara Creek | 73.1 | 51.6 | 21.5 |
| 7-D | 10079 | Good Spring Creek | 6.0 | 0.0 | 6.0 |
| | | TOTAL | | | 27.5 |
| 8-A | 24008 | Sinnemahoning Creek | 16.0 | 0.0 | 16.0 |
| 8-A | 24508 | Bennett Branch Sinnemahoning Creek | 44.0 | 0.0 | 35.0 |
| 8-A | 25222 | West Creek | 16.0 | 9.0 | 3.0 |
| 8-B | 26623 | Montgomery Creek (UNT) | 1.7 | 0.0 | 1.7 |
| 8-B | 26623 | Montgomery Creek | 3.8 | 1.4 | 1.9 |
| 8-B | 26657 | Anderson Creek | 13.0 | 0.0 | 10.0 |
| 8-B | 27032 | Bear Run | 8.0 | 0.0 | 3.0 |
| 8-B | 27100 | Cush Creek | 5.0 | 0.0 | 5.0 |
| 8-B | 25924 | Alder Run | 5.0 | 0.0 | 5.0 |
| 8-C | 25978 | Deer Creek | 10.0 | 0.0 | 10.0 |
| 8-C | 26030 | Surveyor Run | 4.0 | 0.0 | 4.0 |
| 8-C | 26041 | Trout Run | 13.8 | 0.0 | 5.0 |
| 8-C | 26082 | Lick Run | 6.0 | 0.0 | 6.0 |
| 8-C | 26107 | Clearfield Creek | 70.9 | 0.0 | 70.9 |

TABLE 1 (Continued)
STREAM SEGMENTS REPORTED AS IMPACTED BY TOXIC POLLUTANTS
DUE TO MINE DRAINAGE
(Metals or pH-Metals Listed as the Pollutant)
(All but one are Monitored Segments)

| SWP Sub-basin | Stream Code | Stream Name | River Mile Location | | Miles Degraded |
|---|---|---|---|---|---|
| | | | Upstr. | Dnstr. | |
| 8-D | 18668 | West Branch Susquehanna River | 207.0 | 176.4 | 19.6 |
| 8-D | 18668 | West Branch Susquehanna River | 242.2 | 208.3 | 18.9 |
| 8-D | 25570 | Loop Run | 3.3 | 0.0* | 1.3 |
| 8-D | 25626 | Mosquito Creek | 21.1 | 0.0 | 3.0 |
| 8-D | 25695 | Moshannon Creek | 55.6 | 0.0 | 52.0 |
| 8-D | 25703 | Black Moshannon Creek | 14.0 | 0.0 | 1.0 |
| 8-D | 25831 | Cold Stream | 13.0 | 0.0 | 1.0 |
| 8-D | 25853 | Laurel Run | 4.0 | 0.0 | 4.0 |
| | | TOTAL | | | 277.3 |
| 9-A | 21681 | Babb Creek | 21.5 | 0.0 | 14.0 |
| 9-B | 18668 | West Branch Susquehanna River | 116.8 | 55.0 | 61.8 |
| 9-B | 23332 | Tangascootack Creek | 9.0 | 0.0 | 9.0 |
| 9-B | 23620 | Drury Run | 3.0 | 0.0 | 3.0 |
| 9-B | 23621 | Stony Run | 1.0 | 0.0 | 1.0 |
| 9-B | 23625 | Woodley Draft Run | 1.0 | 0.0 | 1.0 |
| 9-B | 23661 | Kettle Creek | 46.5 | 0.0 | 3.0 |
| 9-B | 23988 | Cooks Run | 11.0 | 0.0 | 11.0 |
| 9-C | 22596 | Beech Creek | 35.1 | 0.0 | 35.1 |
| | | TOTAL | | | 138.9 |
| 10-B | 19804 | Loyalsock Creek | 25.0 | 0.0 | 25.0 |
| | | TOTAL | | | 25.0 |
| 11-A | 16317 | Beaver Branch | 8.5 | 0.0 | 4.5 |
| 11-A | 16416 | Burgoon Run | 3.4 | 0.0 | 3.4 |
| 11-A | 16423 | Kittanning Run | 4.2 | 0.0 | 4.2 |
| 11-A | 16428 | Glenwhite Run | 3.2 | 0.0 | 3.2 |
| | | TOTAL | | | 15.3 |

TABLE 2
STREAM SEGMENTS REPORTED AS IMPACTED BY TOXIC POLLUTANTS
(Toxics Problems Caused by Mining are Excluded from this Table)
(All Are Monitored Segments)

| SWP Sub-basin | Stream Code | Stream Name | River Mile Location | | Cause | Pollutant | Miles Degraded |
|---|---|---|---|---|---|---|---|
| | | | Upstr. | Dnstr. | | | |
| 5-E | 6685 | Susquehanna River | 181.9 | 123.7 | Other NPS | Pest HFT | 2.0 |
| | | | | | | TOTAL | 2.0 |
| 7-B | 10261 | Letort Spring Run | 6.8 | 0.0 | Industrial | Org HWC | 0.2 |
| 7-D | 9691 | Quittapahilla Creek | 16.5 | 3.4 | Industrial | Metals | 3.8 |
| 7-E | 63202 | Cold Spring Run | 2.0 | 0.0 | Other NPS | Metals | 1.0 |
| 7-E | 63203 | Spruce Run | 4.0 | 0.0 | Other NPS | Metals | 2.0 |
| 7-G | 7879 | Shawnee Run | 7.5 | 0.0 | Industrial | Metals | 0.7 |
| 7-H | 8032 | Codorus Creek | 33.8 | 0.0 | Industrial<br>Other NPS | Org HWC<br>Metals | 20.3<br>4.0 |
| 7-H | 8213 | Oil Creek | 6.8 | 0.0 | Industrial | Metals | 0.5 |
| | | | | | | TOTAL | 32.5 |
| 9-B | 23626 | Sandy Run | 1.0 | 0.0 | Undeterm | Metals | 0.5 |
| 9-C | 22966 | Spring Creek | 15.2 | 0.8 | Industrial | Pest HFT | 15.2 |
| | | | | | | TOTAL | 15.7 |
| 13-C | 59298 | Red Run | 1.2 | 0.0 | Agric | Pest/Herb | 1.1 |
| | | | | | | TOTAL | 1.1 |

State Water Plan Subbasin Descriptions:

Subbasin 4 - Upper Susquehanna River

Heavy metals from abandoned anthracite coal mining areas were the only toxics reported in the Upper Susquehanna River basin. These sources impacted 46.1 miles. The major reported problem area was the Tioga River (36.2 miles).

Subbasin 5 - Upper Central Susquehanna River

Abandoned anthracite coal mining drainage was responsible for heavy metals loading which degraded 45.3 stream miles in Subbasin 5. The largest reported problem was on the upper 18 miles of Catawissa Creek. A total of 14.6 miles of the Susquehanna River was also impacted by abandoned mine drainage.

Two miles of the Susquehanna River near Hunlock Creek were reported as impacted due to fish tissue contamination. PCB's in quillback carpsucker fillets equaled the FDA Action Level of 2.0 ppm in a 1984 sample. White sucker fillets collected in 1985 as a folow-up contained only 0.15 ppm.

Subbasin 6 - Lower Central Susquehanna River

Drainage from abandoned anthracite coal mining was reported as degrading 104.1 stream miles in Subbasin 6. Heavy metals, usually in combination with low pH, impacted Mahanoy Creek (35.7 miles), Shamokin Creek (34.7 miles), Wiconisco Creek (21 miles), and Pine Creek (12.7 miles). No other toxics problems were reported.

Subbasin 7 - Lower Susquehanna River

A total of 60 miles were reported as impacted by toxics in the Lower Susquehanna River basin. Of these, 27.5 miles in the upper Swatara Creek watershed were degraded by abandoned anthracite mine drainage.

The remaining 32.5 stream miles were affected by other sources. The major toxics problems were reported on Codorus Creek, York County. Chloroform and phenols exceeded drinking water standards for 20 miles downstream from the Borough of Spring Grove. In addition, metals introduced through urban and industrial runoff were a problem in the city of York (4 miles).

Two streams were reported as impacted by acid precipitation. Cold Spring Run and Spruce Run are impacted by metals due to acid precipitation.

Subbasin 8 - Upper West Branch Susquehanna River

The toxics impacts in the Upper West Branch Susquehanna River subbasin were due to heavy metals associated with abandoned anthracite mine drainage. Reports of degradation totaled 277.3 miles (1.3 miles were attributed to active mining). The major problems were: Clearfield Creek (70.9 miles); Moshannon Creek (52 miles); the West Branch Susquehanna River (38.5 miles); the Bennet Branch Sinnemahoning Creek (35 miles); Sinnemahoning Creek (16 miles); Anderson Creek (10 miles); and Deer Creek (10 miles).

Subbasin 9 - Central West Branch Susquehanna River

A total of 154.6 stream miles were reported as affected by toxics in the Central West Branch Susquehanna subbasin. Metals from abandoned anthracite mine drainage were cited as the responsible pollutants in 138.9 miles (89.8%). The major problem areas were: the West Branch Susquehanna (61.8 miles); Beech Creek (35.1 miles); Babb Creek (14 miles); and Cooks Run (11 miles).

The other reported toxics problems included metals of undetermined origin on Sandy Run (0.5 mile) and fish tissue contamination on Spring Creek (15.2 miles). A section of Spring Creek is closed to the killing of fish due to kepone and mirex contamination.

Subbasin 10 - Lower West Branch Susquehanna River

Abandoned anthracite mine drainage was responsible for degrading 25 miles of stream in Subbasin 10. This degradation was reported on the headwaters of Loyalsock Creek.

Subbasin 11 - Upper Juniata River

Metals from acid mine drainage was the only toxics problem reported in the Upper Juniata River subbasin. A total of 15.3 miles were reported as impacted. The streams impacted were the Beaverdam Branch Juniata Rvier (4.5 miles), Burgoon Run (3.4 miles), Kittanning Run (4.2 miles), and Glenwhite Run (3.2 miles).

Subbasin 12 - Potomac River

A 1.1 mile segment of Red Run has been affected by pesticide misapplication. A fish kill and a severe impact on the benthic community resulted. The stream is expected to recover with time.

**Point Source Toxics Problems:**

Section 304(1) of the Clean Water Act also requires a list of toxics problems due to point source discharges. Paragraph (B) requires a list of waters for which a state does not expect applicable water quality standards to be achieved after the requirements of applicable technology-based standards are met due entirely or substantially to the point source discharge of Section 307(a) toxic pollutants.

Table 3 presents a listing of streams or stream segments reported as affected by toxic pollutants introduced by point source discharges. As discussed previously, the list was developed using the Assessment Database (AD). The AD cause codes used to delineate point sources were Municipal, Industrial, and Other Point Sources. The list does not include toxics due to abandoned mine drainage. These discharges, even if from a tunnel or borehole, were considered to be nonpoint sources because of the lack of a responsible party and the inability to control them through the permitting process. The constraints discussed in the preceding sections also apply to the point source toxics list. The monitoring entries in the AD does not include technology-based standards. For this reason, Table 3 can only be construed as a list of problems reported as caused by point source discharges of toxic pollutants, and it does not fully comply with the Section 304(1) requirements. This list is essentially a subset of the one presented in Table 2.

TABLE 3
STREAM SEGMENTS REPORTED AS IMPACTED BY POINT SOURCES OF TOXIC POLLUTANTS
(All Are Monitored Segments)

| SWP Sub-basin | Stream Code | Stream Name | River Mile Location | | Cause | Pollutant | Miles Degraded |
|---|---|---|---|---|---|---|---|
| | | | Upstr. | Dnstr. | | | |
| 7-B | 10261 | Letort Spring Run | 6.8 | 0.0 | Industrial | Org HWC | 0.2 |
| 7-D | 9691 | Quittapahilla Creek | 16.5 | 3.4 | Industrial | Metals | 3.8 |
| 7-G | 7879 | Shawnee Run | 7.5 | 0.0 | Industrial | Metals | 0.7 |
| 7-H | 8032 | Codorus Creek | 33.8 | 0.0 | Industrial | Org HWC | 20.3 |
| 7-H | 8213 | Oil Creek | 6.8 | 0.0 | Industrial | Metals | 0.5 |
| | | | | | | TOTAL | 25.5 |
| 9-C | 22966 | Spring Creek | 15.2 | 0.8 | Industrial | Pest HFT | 15.2 |
| | | | | | | TOTAL | 15.2 |

**Subbasin Water Plan Subbasin Descriptions:**

Subbasin 7 - Lower Susquehanna River

A total of 25.5 stream miles were reported as being affected by point source discharges of toxic pollutants in the Lower Susquehanna River subbasin. The largest problem reported affected 20.3 miles on Codorus Creek, from Spring Grove to the mouth. Chloroform and phenols introduced by an industrial source adversely impact the entire reach. Levels of these pollutants exceed public drinking water criteria.

Most of the other reported problems affect less than one mile of stream. One, however, impacts a larger area. Residual oil and metals in the substrate of Quittapahilla Creek due to past industrial discharges continue to impact uses in a 3.8 mile segment.

Subbasin 9 - Central West Branch Susquehanna River

A 15.2 mile segment of Spring Creek was reported as impacted by an industrial source. The problem is kepone and mirex contamination of fish tissue. A portion of the stream is closed to the killing fish due to this contamination.

## B. Point Source Programs

Pennsylvania does not have a specific toxic strategy for the Chesapeake Bay basin. However, the Department of Environmental Resources, Bureau of Water Quality Management addresses toxics statewide through a variety of programs which are discussed below. These programs can be used in the development of Individual Control Strategies (ICS's).

The Bureau of Water Quality Management will be using a Water Quality Assessment Process to develop Individual Control Strategies (ICS's) in response to Section 304(1) of the Clean Water Act. The process starts with the selection and ranking of Priority Water Bodies for program actions. The 304(1) lists are developed from the list of Priority Water Bodies. A Total Maximum Daily Load/Waste Load Allocation (TMDL/WLA) screening of the 304(1) point source list is conducted to identify specific toxic parameters of concern and the scope of field data collection that is needed. Based on these screenings, water body surveys are conducted for the substances of concern. This information is used to perform a detailed analysis and water quality-based multiple discharge waste load allocations. The waste load allocations are then translated into effluent limitations for NPDES permits and the ICS's.

**Toxics Management Through the NPDES Program (Pennsylvania's Toxics Management Program)**

The control of toxic pollutants is mandated on the federal level by the Clean Water Act of 1977 which states in the declaration of goals and policy, Section 101(A)(3) that "...it is the national policy that the discharge of toxic pollutants in toxic amounts be prohibited..."

On the state level, the control of toxics is mandated by the Pennsylvania Clean Streams Law where in Section 1 pollution is defined as "...contamination of any waters of the Commonwealth such as will create or is likely to create a nuisance or render such waters harmful, detrimental, or injurious to public health, safety, or welfare to domestic, municipal commercial, industrial, agricultural, recreational, or other legitimate beneficial uses...".

The Department of Environmental Resources regulations toxics through Chapter 93 Water Quality Standards following sections:

25 PA Code Section 93.6 General Water Quality Criteria "(A) Water shall not contain substances attributable to point or nonpoint source waste discharges in concentrations or amounts sufficient to be inimical or harmful to the water uses to be protected or to human, animal, plant or aquatic life. (B) Specific substances to be controlled shall include, but shall not be limited to, floating debris, oil, grease, scum and other floating materials, toxic substances, pesticides, chlorinated hydrocarbons, carcinogenic, mutagenic and teratogenic materials, and substances which produce color, tastes, odors, turbidity, or settle to form deposits.

25 PA Code Section 93.7(C) lists specific toxic substances to be controlled and the criteria for each toxic substance (aluminum, arsenic, chromium, copper, cyanide, lead, iron, manganese, nickel, and zinc).

Section 93.7(f) then forms the basis for the Bureau of Water Quality Management's Toxics Management Strategy. The strategy is a water quality oriented approach in controlling the priority toxics which were identified by EPA in response to the 1976 consent decree between the National Resources Defense Council and the U.S. EPA, and to control other toxic pollutants. (Originally, there were 129 priority pollutants identified by EPA; 3 of them have since been deleted, 126 remain.) The Toxics Management Strategy involves a comprehensive step-by-step process for evaluating toxic pollutants and developing appropriate effluent limitations for such. It also contains the majority of the information which is needed to process permits and applications which are included as appendices to the document. Specific material contained in the appendices are:

- **Appendix A** - **Occurrence of Priority Pollutants Observed by EPA During BAT Screening and Verification Surveys**
- **Appendix B** - **Treatability Considerations for Toxics Substances**
- **Appendix D** - **Analytical Methods and Detection Limits**

- Appendix E - Guidelines for Conducting a Toxics Reduction Evaluation

- Appendix F - Transport and Fate of Priority Pollutants

- Appendix G - Procedures and Guidance for Obtaining Extensions of Time to Achieve Water Quality-Based Effluent Limitations

- Appendix H - Short Term Discharges of Toxics

The steps which are followed in the application of the strategy are as follows:

- Step 1 - Preliminary review considerations

- Step 2 - Determination of pollutants of further interest

- Step 3 - Development of water quality based limits and selection of toxics to be limited in the permit

- Step 4 - Establishment of NPDES permit terms and conditions for control of toxic pollutants

- Step 5 - Follow-up evaluation after initial permit issuance

- Step 6 - Establishment of final permit requirements

A brief discussion of actions required for each of these steps is included in the following paragraphs.

**Step 1 - <u>Preliminary Review Considerations</u>**

The purpose of this step is to become familiar with the various aspects of the facilities and associated wastewater discharges for which the NPDES permit application has been submitted. (NPDES permits are required for all wastewater discharges). This allows for cleaning up any discrepancies in the application data and for focusing on initial pollutants of interest. Pertinent historical data is reviewed including compliance status of the applicant.

Step 2 - Determine Pollutants of Further Interest

The purpose of this step is to compile a complete list of toxic pollutants of interest based on sufficient knowledge of actual or potential pollutant presence in the discharges in question. Pollutants of further interest would be identified by the following screening process:

1. Priority pollutants which have BAT requirement - If a pollutant is required to be regulated by an applicable BAT guidelined for the industry, the BAT limit on the corresponding water quality-based limit (whichever is more stringent), must be placed in a permit regardless of its presence or absence.

2. Non-BAT priority pollutants which the discharger must sample and analyze - These pollutants will also be designated as pollutants of further interest pending evaluation of water quality-based limits in Step 3.

3. Other toxics identified by the applicant as being present in the discharge - There are several places on the industrial NPDES application form where the applicant may indicate that various toxic pollutants are expected to be present in the discharge. Where the applicant identifies such pollutants as being routinely present in the discharge, they shall be identified as pollutants of further interest.

4. Other toxics known or suspected by the permit writer to be present - Based upon a working knowledge of the type of discharger in question, and the toxic pollutants normally associated with the discharge, the permit writer should designate any other toxics which would seem to be appropriate as pollutants of further interest.

Step 3 - Development of Water-Quality Based Limits and Selection of Toxics to be Addressed in the Permit

The purpose of this step is to determine which toxic pollutants should be addressed in the NPDES permit and in what manner they should be addressed. The information for developing the limits are contained in Appendix C of the "Toxics Management Strategy." This appendix contains information on both the adopted criteria from Chapter 93 of the Department's Rules and Regulations, EPA's instream criteria and threshold levels, and the Bureau of Water Quality Management's recommended criteria. These criteria are used to develop appropriate effluent limitation for the discharger's NPDES permit.

**Step 4 - Establishment of NPDES Permit Terms and Conditions for Control of Toxic Pollutants**

The purpose of this step is to establish appropriate effluent limitations, monitoring and reporting requirements, and other special conditions to be incorporated into the NPDES permit, based on the results of Steps 1 through 3 which were discussed previously. One of the special conditions which are considered during this step is a Toxics Reduction Evaluation (TRE). Toxics Reduction Evaluations are used where it appears that the water quality based requirements may not be able to be met with known technology. This provides the discharger an opportunity to (1) study the characteristics of his waste discharge; (2) to verify the actual extent of the toxic pollutants associated with the wastewater; (3) to determine sources of these toxic pollutants and (4) to recommend control and/or treatment technologies which may reduce or eliminate the toxic pollutants. The Department has developed extensive guidelines for conducting TRE which is included in Appendix E of the Toxics Management Strategy.

Another special condition is procedures for granting of extensions of time to achieve water quality-based effluent limitations. At the request of the permittee, the Department may grant an extension of time to achieve the water quality-based effluent limitations provided the permittee meets all eligibility requirements contained in Sections 95.4 of the Department's Rules and Regulations.

A third special condition is procedures for demonstration of alternative site-specific bioassay based instream water quality criteria. Where the water quality-based effluent limitations for the pollutants listed in the permit have been developed for protection of fish and aquatic life, the permittee may request an opportunity to demonstrate alternative site-specific bioassay-based instream safe concentration values for those pollutants. These procedures must be carried out in accordance with the Rules and Regulations of the Department contained in Sections 93.8(D-E).

A fourth condition is procedures for demonstrating alternative method detection limits. The permittee in these cases may request an opportunity to demonstrate alternative facility specific minimum detection limits to account for interfering factors associated with the wastewaters in questions.

Step 5 - Follow-Up Evaluation after Initial Permit Issuance

The purpose of this step is to evaluate information submitted by permittees in response to initial permit special conditions concerning water quality-based effluent limitations and other requirements for management of toxic pollutants.

This is where the Department evaluates the information discussed in Step 4 which may have been submitted by the permittees in response to permit requirements concerning the toxics reduction evaluations, requests for time extensions, requests for alternative site specific bioassay-based effluent limitations, and request for alternative method detection limit determinations.

Step 6 - Establishment of final permit requirements

The purpose of this step is to reflect the results of the follow-up evaluations carried out as discussed in Step 5 in the NPDES permit and related enforcement documents. Based on evaluation of the toxics reduction evaluation and any related demonstrations, the NPDES permit will be reopened and either modified or revoked and reissued to reflect appropriate changes resulting from the above evaluations.

As is apparent from the preceeding discussions, the current toxics management program in Pennsylvania is strictly a chemical-by-chemical approach. Applicable water quality criteria are based on protection of the most sensitive use (i.e., aquatic life or human health). However, proposed revisions to Pennsylvania's Water Quality Standards (Chapter 93, Section 93.8a) provides a comprehensive toxic management regulation which includes provisions for effluent toxicity testing. This will take into account effects due to synergisms or effects due to unreported or unidentified pollutants which may have slipped through the screening process. The Department has been working with USEPA in developing an effluent toxicity testing program. It must be remembered, however, that effluent toxicity testing will not replace or alleviate the need for chemical-by-chemical permitting and monitoring. Effluent toxicity testing is a supplement to a chemical-by-chemical regulatory approach and not an alternative. Effluent toxicity testing does not address human health concerns. Human health concerns are usually the most critical concern for most toxics.

Biomonitoring:

Pennsylvania's parameter specific approach to limiting toxics in wastewater discharges has proceeded without much emphasis on biomonitoring as a measure of toxicity. Although biomonitoring is viewed as an important aspect of toxics management, its exact role in our strategy is not defined. We have been working with EPA Region III to establish a meaningful role for biomonitoring in our program. Presently, we are proceeding with several test cases to evaluate biomonitoring's usefulness in establishing site specific whole effluent toxicity. Interpretation of the results of these tests and how the information may be used in future permit and enforcement actions are unclear at this time. A major concern is that biomonitoring will not be useful in evaluating the human health aspects of wastewater toxics.

Pretreatment Program:

The purpose of the Industrial Waste Pretreatment Program is to control the discharge of toxic and hazardous wastes to publicly-owned treatment works (POTWs) by regulating non-domestic users of sewer systems. These pollutants or unusually strong conventional wastes, when introduced to POTWs can interfere with treatment plant operation, can pass-through the plant into the environment, can contaminate treatment plant sludge thereby preventing its reuse or reclamation, or can be hazardous to treatment plant workers.

Pennsylvania carries out a delegated NPDES program; therefore, in accordance with federal requirements, we are also obliged to carry out the pretreatment program. DER has developed a draft proposal for program delegation and a package of regulations was published as final rulemaking in the Pennsylvania Bulletin on February 27, 1988. We anticipate receiving program delegation during 1989. Initial statewide program costs are estimated to be $300,000 in FY 88-89 and could increase to $1,000,000 per year in succeeding years.

Until delegation is accomplished, DER will continue to assist EPA in implementing the pretreatment program in Pennsylvania and will address the toxics discharge problem as part of its ongoing toxics management strategy, toxic reduction evaluation, process, and wasteload management program. Of the 91 municipalities in Pennsylvania that have been required to develop and implement local pretreatment programs, 38 are in the Chesapeake Bay drainage and of these, 37 have approved programs and one is in the process of developing a program.

After delegation is approved, DER will take over pretreatment compliance monitoring and enforcement duties from EPA for the 91 local programs and the estimated 500 categorical industrial users of POTWs not having approved local programs. Full implementation of the pretreatment program will result in a significant reduction in the discharge of toxics to the environment from POTWs.

## State Regulations and Policies for Toxics:

Toxics are currently controlled through Chapter 93.6, General Water Quality Criteria in the Department's Water Quality Standards regulations and the Bureau's Toxic Management Strategy which is a water quality-based approach to managing toxics. A new comprehensive toxics regulation is proposed as Chapter 93.8a. of the Department's regulations. Public hearings have been held and a final rulemaking recommendation has been prepared. The Environmental Quality Board adopted the regulation as final rulemaking at the November 1988 meeting. The regulation will become effective upon publication in the Pennsylvania Bulletin in February 1989.

Water Quality Standards are the in-stream quality objectives which are translated into NPDES water quality-based effluent limitations. Implementation methods under development and the new toxics regulation will improve the technical basis of future effluent limitations and strengthen the legal basis of Pennsylvania's program.

## Toxic Assessment and Monitoring:

Cause-effect surveys are conducted on an on-going basis by the Bureau's Regional Offices to determine the water quality impact of toxics as well as other wastewater discharges. The surveys are conducted based on Regional Office priorities for enforcement and permitting actions. The information along with other purpose surveys conducted by the Bureau as well as other agencies is used to prepare assessment summaries for input to the Bureau's Assessment Database. The database is used to prepare assessments of water quality on an area and statewide basis and to select and rank Priority Water Bodies. Priority water body surveys are conducted by central office as well as Regional office staff to determine the impact of toxics on fish and aquatic life. These surveys are also designed to serve as the basis for more detailed analysis of a watershed in order to develop wasteload allocations for multiple discharge situations.

The Bureau's fixed station ambient monitoring Water Quality Network (WQN) system contains 167 stations statewide (73 in the Chesapeake Bay Drainage basin) which is designed to monitor the trends in water quality. The analysis includes heavy metals and an annuual collection of fish tissue to determine whether contamination has occurred from toxic substances.

## C. Nonpoint Source Programs

Pennsylvania is concerned with nonpoint source pollution statewide, and particularly in the Chesapeake Bay drainage. The Nutrient Control Strategy, which has already been drafted for the overall Bay program addresses some control of toxics. Through the control of erosion and sediment pollution, pesticides which adhere to the fine sediment particles, are also controlled.

Pennsylvania does not have a special nonpoint source toxic control program specifically for the Bay, however, the following statewide programs which address toxics obviously apply to the bay drainage.

**Agricultural Pesticides:**

Agriculture comprises a major portion of Pennsylvania's economy. The fertile soils, climate, and a readily available water supply make conditions ideal for various types of agricultural activities. As with any anthropogenic activity, there is a potential for environmental degradation. The primary nonpoint source concerns associated with the agricultural category are soil loss through erosion which results in increased sediment loads in surface waters, nutrient management which when not implemented can result in increased nutrient loads and nitrate contamination of surface and ground waters, and use of pesticides which when not applied as directed or even if applied as directed may contaminate both surface and ground waters. The Pennsylvania Department of Agriculture deals with the usage control of pesticides.

Pennsylvania Department of Agriculture (PA)

The Department of Agriculture's involvement in controlling agricultural nonpoint source pollution is through the Pesticide Program which developed as a result of amendments to the Pennsylvania Pesticide Control Act adopted in 1987. The program requires the licensing of all pesticide applicators whether they be commercial, private and public. Commercial and public applicators must be licensed no matter what pesticide is used. Private applicators, such as farmers, must only be licensed if they apply "restrictive use" pesticides. Approximately 25,000 private applicators, of which most are farmers, are now licensed.

Licensing is accomplished through a state examination. All prospective candidates are given educational material supplied by Penn State University's Cooperative Extension Service. The examination insures that the candidate has the required knowledge for the proper use of pesticides in conformance with label requirements. Once licensed, the applicant must comply with pesticide label requirements, state law, and take updated training every 3 years as mandated by the Department. Failure to meet any of these requirements may result in the revocation of the license. Enforcement is carried out by PA field staff through "spot checks" and complaint investigations.

PA is promoting an Integrated Pest Management (IPM) program as part of its administration of the Pesticide Act. The Pennsylvania Pesticide Control Act mandated IPM education to pesticide applicators. The program is designed to encourage the development and implementation of Integrated Pest Management (IPM) and nutrient management on farms in Pennsylvania. IPM is a program which emphasizes pest prevention and offers possibilities for improving the efficiency of pest control while reducing potential adverse environmental impact. IPM techniques allow farmers to minimize the use of chemical pesticides by substituting alternative techniques and technologies without having to compromise on controlling pest levels and losses. Participating growers benefit by achieving acceptable pest control at reduced chemical pesticide costs.

IPM also will contain a nutrient component which will require the assessment of need for additional nutrients to produce a specific crop before application of that nutrient.

Plans for the development of the new IPM Program include providing financial incentives for farmers to adopt practices that minimize the use of pesticides and fertilizers, and to support the development of IPM technology required for today's agricultural production.

Implementation of the program will be accelerated by working through groups like Cooperative Extension, USDA, Penn State University, consulting firms, private non-profit groups such as Crop Management Associations, and in sme instances, directly with farmers.

PA is also working with several DER bureaus to develop an Agricultural Chemical Ground Water Protection Program. This program is in the very preliminary stages but is likely to involve vulnerability studies, usage surveys, and development of strategies and control programs. The program is tied to the U.S. EPA's draft strategy for controlling pesticide impacts on ground water. The strategy proposes a program based on existing authorities of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), Resource Conservation and Recovery Act (RCRA), Clean Water Act (CWA), Safe Drinking Water Act (SDWA), and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The program would function primarily through use of labeling restrictions, user registration, ground water monitoring, and enforcement actions. The strategy calls for strong state involvement in managing localized use and corrective action.

**Urban/Suburban Runoff:**

Pennsylvania's population continues to grow and with that growth comes new construction of homes, businesses, shopping areas, and roads. Because of this, the potential for surface water degradation from urban/suburban runoff is of significant concern. The quality and content of urban runoff can vary significantly depending on the type of land use. For example, runoff from residential housing developments, golf course, and parks may contain high nutrient levels due to fertilization of grassy areas, pesticides, and herbicides, and fecal bacteria due to surface malfunctions from on-lot sewage disposal systems. Runoff from paved areas and industrial sites may contain a host of metals, inorganic and organic compounds, as well as petroleum products. Results from the Nationwide Urban Runoff Program (NURP) indicate that metals and inorganics from urban runoff pose the greatest potential for long-term impacts on aquatic life.

Water quantity is also of concern. As the percentage of paved areas increases, a higher volume of runoff will occur. Extreme fluctuations in surface water flow from episodic storm events may occur causing localized flooding. In addition these fluctuations increase erosion of unstable stream banks and stream bed scour resulting in reduction of aquatic habitat.

The Bureau of Dams and Waterway Management administers Pennsylvania's storm water management program mandated by the Storm Water Management Act, 32 P.S. 680.1 et seq. The Act requires counties to prepare watershed storm water management plans for designated watersheds. The plans consider hydrologic and hydraulic effects of changes in land use and their impacts on receiving streams both quantitatively and qualitatively. Nonpoint source pollution identification is one of the components required in a plan. The specific issues addressed are: a.) identification of critical NPS sub-watersheds based on annual loadings; b.) estimation of annual pollutant loadings under existing and future land use conditions; c.) application of water quality modeling techniques to derive standards and criteria for use by municipalities; d.) identification of Best Management Practies (BMPs) applicable to the watershed, e.) evaluation of the effectiveness of BMPs.

The counties are required to prepare watershed plans to derive standards and criteria for the water quality controls associated with nonpoint source polluton. The applicable BMPs are recommended within those plans which are unique to the watersheds. These water quality issues and associated BMPs are generally addressed when the counties identify specific needs. The standards and criteria are implemented by local municipalities through adoption of codes and ordinances. If local governments desire, they may undertake construction projects to minimize water quality degradation of the receiving streams as recommended within the plan. BMPs commonly used by local municipalities are those described in the 1987 publication by the Washington, D.C. Council of Governments entitled "Controlling Urban Runoff."

The Bureau administers a grant program in accordance with the Storm Water Management Act, 32 P.S. 680.1 et seq., for county preparation of Storm Water Management Plans for designated watersheds. Pensylvania is divided into 353 watersheds, many of which overlap into the surrounding states of New York, Ohio, West Virginia, Maryland, and Delaware. The storm water management plans emphasize the management of surface waters such that developments or activities in municipalities within a watershed do not adversely affect the health, safety, and property in that municipality or affect the health, safety, and property in other municipalities or basins. The Bureau reviews and approves all watershed storm water management plans and subsequent revisions.

Storm water management plans prepared by counties for developing watersheds may involve water quality analysis based on concerns identified by the county or Department. Such concerns may involve but are not limited to the eutrophication of bodies of water, contamination of ground waters through recharge, and the protection of aquatic life and habitat in high quality streams. Products of the water quality analyses include the identification of nonpoint source water quality concerns and recommended BMPs to reduce levels of pollution for various nonpoint source pollution categories.

**Hazardous Waste and Superfund Programs:**

The identification of hazardous waste sites is one of Pennsylvania's top environmental priorities. The Bureau of Waste Management requires permits for the land disposal (landfilling) and land application of solid waste. The solid waste management permitting program, authorized by Act 97, The Solid Waste Management Act of 1980, is administered through the Bureau's six regional offices. The permitting program can be separated into three major categories; municipal, hazardous and residual waste management.

The municipal waste management regulations are identified in 25 Pa. Code, Section 271.1 through 285.222. The landfill permit application and design requirements are detailed in Chapters 271 and 273, and the land application criteria are identified in Chapters 271 and 275. The regulations specify that the operation of a site may not cause or allow point or nonpoint source discharges of pollution from a facility to the surface or ground waters of the Commonwealth. The landfill design and operational procedures are designed to facilitate this requirement. A double liner system is required, with the exception of a single liner requirement for construction/demolition waste landfills, and facility isolation distances from the groundwater table and surface waters are specified in the regulations. The sites are inspected prior to permit issuance, during facility construction, and during facility operation. In addition, surface and groundwater monitored at all sites.

The municipal waste land application regulations specify surface and ground water isolation distances, soil texture requirements, and conservative annual and lifetime application rates. Erosion and sedimentation control plans are required for these facilities as well as for all other solid waste management facilities.

The hazardous waste regulations are identified in 25 Pa. Code, Sections 75.259 - 75.450 and parallel the municipal waste requirements, i.e., double liner system, ground water monitoring, etc., to prevent nonpoint source discharges to waters of the Commonwealth.

The residual waste regulations are identified in 25 Pa. Code, Section 75.1 through 75.38. The residual waste requirements allow for a single liner system or a natural attenuation type system. Groundwater monitoring is required with either design. The residual waste land application criteria are not identified but present policy dictates the use of the municipal waste land application criteria until residual waste land application regulations are developed. Revisions to the residual waste regulations are presently being drafted and the revised requirements will likely parallel those for municipal and hazardous waste.

All permit applications received by the Department are forwarded to the local municipalities for review and comment. Any permit action taken by the Bureau is published in the Pennsylvania Bulletin. Solid waste permits are not issued until such time as adequate provisions for leachate management have been determined and all necessary NPDES permits have been issued.

## COMMONWEALTH OF VIRGINIA

## TOXICS REDUCTION STRATEGY

### A. IDENTIFICATION OF KNOWN TOXIC PROBLEM AREAS

Through the various monitoring programs that are described later in this Appendix the Commonwealth has identified a number of areas within the Chesapeake Bay watershed that have been impacted, or are potentially impacted, by toxic pollutants. These areas are described in extensive detail in reports prepared by Virginia's natural resource agencies.

The major reporting responsibilities regarding toxics are handled by the Water Control Board, the Department of Waste Management and the State Health Department's Bureau of Toxic Substances Information. The information on toxics available from these agencies is described below.

Virginia Water Control Board - Every two years the Board submits to EPA a Virginia Water Quality Assessment report, which is also known as the 305(b) report. The most recent of these reports, published in April 1988, also contains the draft 304(l) list of toxic hot spots. This listing is considered an "open file", subject to change as better information becomes available. A review of this list indicates that problems associated with toxics are generally localized in urban areas such as the Elizabeth River or in close proximity to the source of toxics, such as an industrial outfall. The Water Quality Assessment report describes other locations where concern over toxics has been identified, but which do not warrant inclusion on the 304(l) list at this time.

Department of Waste Management - The Department is responsible for administering the solid waste, hazardous waste, and Superfund programs in the Commonwealth. As in the case with point source discharges of toxics, the waters impacted by these waste disposal sites are usually limited to the immediate area.

State Department of Health: Bureau of Toxics Substances - The Virginia General Assembly in its 1976 session passed the Toxic Substances Information Act. It was an approach to augment efforts in controlling toxic substances in Virginia in that it created a single resource in State government to serve the needs of various state agencies, regulatory and local authorities, and the public in this area. The State Department of Health was designated as the State Toxic Substance Information agency.

The Act directed the State Board of Health to develop a list of substances which are toxic and directed Virginia manufacturers to periodically report in some detail the use or manufacture of each listed toxic substance and emissions to workroom and ambient air, to receiving lands and waters and to sewage treatment systems. It also required the Board to collect, evaluate, and disseminate information on toxic substances and made provisions for the protection of confidential information submitted by the manufacturers.

In 1977, the Act was amended to delete the reporting of emissions data and the listing of reportable toxic substances, substituting the reporting of all chemical substances used/manufactured by Virginia manufacturers. The amendment created Class 1 substances, those posing the greatest threat to human health and the environment, to be designated by the Board itself on the basis of toxicological and other scientific evidence. Reporting by user/manufacturer of designated Class 1 substances was similar to requirements of the original 1976 Act, and the scope of the chemical inventory was broadened by inclusion of all chemicals used/manufactured. However, inventory reporting was made easier for industry and it was foreseen that fewer substances, those designated as Class 1, would have to be reported upon in detail.

In 1979 and 1980, minor, non-germane amendments were passed by the General Assembly. Later, the concept of Class 1 chemicals was deleted from the Act.

The Federal Toxic Substances Control Act (TSCA) became effective later in 1976. It is a regulatory statute, quite different from Virginia's Toxic Substance Information Act. TSCA was designed to identify only manufacturers or importers of chemical substances and to define "old" chemicals. Virginia's law requires the reporting of all, current and proposed, chemical substances manufactured or used in manufacturing. Also, Virginia's law requires the exact geographic location of every establishment engaged in manufacturing where chemical substances are produced or used. Most of the information gathered under TSCA is not available to the States or citizens because it is classified as confidential business information.

The Bureau of Toxic Substances Information has two major objectives:

1. Collection, maintenance and utilization of the geographical inventory of chemical substances manufactured or used in manufacturing within the Commonwealth of Virginia.

2. Providing toxicological data, health hazard evaluations, and dissemination of information relating to chemical substances posing a threat to human health and the environment.

A geographic chemical inventory is maintained of Virginia manufacturing establishments using chemical substances as raw materials, catalysts, process solvents or final products. Generally, small, as well as large, businesses must report all chemicals that they manufacture or use in a manufacturing process. Examples of firms required to report include chemical manufacturers, asphalt and concrete batchers, cabinet and furniture makers, metal fabricators and machinists, printers, shipyards, cigarette manufacturers, packagers of animal feeds, pesticides, fertilizers, etc. Mixtures are reportable. Some out-of-state manufacturers have reported ingredients of their trade name products. The chemical inventory information is made available to State and local agencies, political subdivisions, commercial establishments, and the public. Computerized reports that contain all chemical inventory information are available upon written request. Typical questions addressed in the report are:

- What are the chemical substances reported by a particular commercial establishment?

- Within a city or county, which commercial establishments have reported and what are the chemical substances listed?

- Within a particular river basin, which commercial establishments have reported and what are the chemical substances listed?

- Which commercial establishments are reporting a particular chemical substance?

Toxicological data are retrieved and evaluated in response to specific requests of State agencies, local governments, media, and the public, thus affording a central resource for those requiring such service. The range of these requests is broad. They have included use of asbestos-concrete pipe for drinking water, habitability of residences after contamination, effects of spilled chemicals on humans, land animal and aquatic life, acute and chronic effects from work-related exposures, use of highly toxic substances in school science laboratories, art classes, and vocational shops as well as analytical techniques and methods of decontamination.

Similar evaluations are made for mass dissemination to affected parties on newly reported toxic effects, on subjects of current and/or popular concern, and when widespread misuse is apparent. Online searches are available via computer and over 300 databases such as Hazardous Substances Data Bank, Registry of Toxic Effects of Chemical Substances Data Bank, Registry of Toxic Effects of Chemical Substances, Chemical Abstracts, Medline, Enviroline, and Pollution Abstracts can be accessed. Questions often searched relate to human, mammalian, or aquatic toxicity. Scientific literature, medical information, references, and analytical methods can also be retrieved.

The future plans of the program include continuation of routine operations, complementing the chemical inventory aspects of the Superfund Amendment and Reauthorization Act (SARA), and providing toxicological evaluations of chemicals. Increasing involvement in areas of risk assessment and on-site investigations are also anticipated.

The remaining sections of the Virginia Toxics Reduction Strategy describes programs dealing with both point and nonpoint sources of toxics to the Chesapeake Bay. Existing activities and accomplishments are described as well as future plans. Where appropriate, milestones are included for specific actions that will be taken by certain dates in order to further the reduction and control of toxic pollutants within the Chesapeake Bay watershed.

## B. POINT SOURCE PROGRAMS

### 1. Water Quality Standards

Background - Water quality standards are the yardstick against which water quality conditions in the surface waters and groundwater of the Commonwealth are measured. Standards are an enforceable means of preventing the deterioration of water quality in State waters. These water quality standards are used in the administration of several Board programs, particularly the issuance of discharge permits and certification of 401 applications.

The State Water Control law mandates the protection of existing high quality State waters and provides for the restoration of all other State waters to such condition of quality that any such waters will permit all reasonable public uses and will support the propagation and growth of all aquatic life that might reasonably be expected to inhabit them (Section 62.1-44.2). The adoption of water quality standards under Section 62.1-44.15(3) of the Law is one of the Board's methods of accomplishing the Law's purpose.

Purpose - Activities of this program provide accurate and effective standards to maintain fishable and swimmable waters for the use of the citizens of the Commonwealth and to protect aquatic life, including economically valuable finfish and shellfish.

Water quality standards are intended to protect the beneficial uses of State waters. Virginia's standards do not assign specific uses to all streams, although they do specifically designate and protect trout streams and public water supplies. The standards are intended to protect all State waters for recreational use and for the propagation and growth of a balanced population of fish and wildlife. Through the protection of these two uses, which usually require the most stringent standards and the highest degree of protection, other usually less restrictive uses like industrial water supply, irrigation and navigation are usually also protected. Should additional standards be needed to protect other uses as dictated by changing circumstances or improved knowledge, they can be formulated and adopted.

Accomplishments - Specific actions taken to reduce toxics include the adoption of water quality standards for the biocide tributyltin for both saltwater and freshwater. This standard became effective September 14, 1988 and will be implemented in applicable NPDES permits subsequent to that date. Earlier in the decade the Board adopted a water quality standard for mercury in freshwater as well as chlorine standards for both saltwater and freshwater. During the 1987 triennial review of water quality standards the Board modified the chlorine standard to ban the discharge of chlorine and other halogen compounds to waters containing natural trout or endangered species.

In addition to the standards previously mentioned, the Board also has guidance criteria for 34 toxic compounds (including Kepone) which the Board intends to make mandatory enforceable standards at the same time that standards are adopted for other toxics parameters as mandated by the amendments to the Clean Water Act.

Future Plans - Before Virginia's next triennial review the Board plans to adopt standards for toxic parameters as mandated by the Clean Water Act amendments. This regulatory action was initiated this fall by holding public meetings to present the Environmental Protection Agency's guidance for state implementation of water quality standards for Section 307(a) toxic priority pollutants. Currently the Board has a freshwater standard for mercury but no saltwater standard, so plans are to consider adoption of a saltwater standard for mercury during this standards development process.

During the 1990 triennial review the Board will also consider the need to adopt the recommendations of the Chesapeake Bay Program report on living resources which includes references to toxic compounds.

As EPA develops additional criteria for toxic compounds the Board will evaluate the need to adopt water quality standards for these parameters.

Milestones

- Adopt in calendar year 1989 the necessary water quality standards for toxics in accordance with the CWA and EPA's regulations and guidance.

- During the 1990 triennial review consider the recommendations contained in the Chesapeake Bay Program report, Habitat Requirements for Chesapeake Bay Living Resources, for those toxic pollutants which have not previously been adopted as water quality standards.

- Discuss with the District of Columbia and the State of Maryland consistency in the definition of "freshwater" and "saltwater" for application of water quality standards.

2. NPDES Toxics Management Program

Background: At a planning session in October 1979, the Virginia Water Control Board (VWCB) determined the need for some type of toxics program and they instructed the staff to begin its development. In June 1980, the staff sent out requests to industries in Virginia for input on the type of toxics testing that would be appropriate. The industrial submittals were received by October 1981 and the staff incorporated these comments into the Board's program. The Board directed the staff to begin implementation of the Toxics Management Program in June 1982. Since December 1982 special conditions for toxics management have been drafted for inclusion into NPDES permits. The program was extended to include publicly owned treatment plants in May 1983.

Purpose: The aim of the toxics management program is to involve all industrial and municipal permit holders that may potentially discharge toxic pollutants in a systematic program of biological and chemical effluent monitoring. The monitoring requirements are designed to identify sources of acute or chronic toxicity to aquatic life and sources of toxic pollutants, whether listed as priority pollutants or not. If the results of this monitoring program indicate that there is a toxicity problem from the discharge, a toxicity reduction evaluation is required. Best Management Practices (BMP's) are also employed at certain sites for toxics control.

Status: There are currently about 200 NPDES permits in Virginia containing toxics management special conditions. They include most of the major industrial and municipal facilities and certain minor facilities which the staff believes have the potential to discharge toxic pollutants. The program will eventually expand to over 400 sites, which will be included as their permits are reissued. One hundred, twenty-nine of the sites currently in the program are located in the Chesapeake Bay drainage (See attached listing). Of the 88 major facilities discharging into the Bay drainage, all of the industrial and all but 18 of the municipal sites are involved in the toxics management program. The remaining major municipal facilities will be incorporated into the program as their permits are reissued or modified. There are 18 sites currently involved in some form of toxicity reduction work, 11 of which are in the Bay drainage (refer to 304(l) list for the names of these dischargers).

Prior to and following the Board's adoption of the water quality standard for chlorine, Virginia dischargers have installed dechlorination or alternative disinfection facilities to eliminate the toxic effects of chlorine on aquatic life. Of the 66 significant municipal wastewater treatment plants within the Bay watershed it is projected that only 5 will still discharge chlorinated effluent following application of the water quality standard and completion of the 22 projects that have received Virginia Chesapeake Bay Initiative funding through FY'89. This represents over a 97% reduction in the amount of chlorine discharged to the Bay and its tributaries. Of the five remaining facilities three are eligible in future years for grant funding under the Initiative. The other two are major federal facilities.

Future Plans: The emphasis of this program will eventually shift from screening effluents for toxicity to developing and implementing toxicity reduction studies at those sites where the monitoring indicates that a problem exists. Other aspects of toxics control such as the evaluation of human health effects or bioaccumulation potential will be included in the program as the testing technology improves.

Milestones

- o By July 1991 all major discharges will have chemical and biological toxics monitoring programs in their permits.
- o By June 1992 all discharges identified on the 1989 304(l) list will be in compliance with the Individual Control Strategies for toxics in their permits.
- o By July 1996 all appropriate discharges will have attained control of toxicity in their effluents

3. Virginia's Toxics Management Regulation

Background: Since toxics management program special conditions first began to appear in NPDES permits in 1983, the Board's regulatory authority to require such testing has been questioned. Two generic questions commonly asked were: 1. Where are the supporting regulations and/or policies that govern this program, which are required by the Administrative Process Act? and, 2. Where are the regulations and/or policies that allow the public to participate in this process as required by the Administrative Process Act? At its meeting in December 1985, the Board directed the staff to develop a regulation which would provide the public with details of the decision making process involved in the toxics management program and provide for public input to this process. In September 1987, the Board authorized the staff to take a draft toxics management regulation to public notice. Public hearings were held in January 1988, the draft document was revised in response to the comments and the Board adopted the Toxics Management Regulation in

March 1988. As a result of the review of this regulation by the Governor's office, further public comments were taken during June and July 1988 and the Board adopted the current version of the Toxics Management Regulation on August 8, 1988. It became effective on November 1, 1988.

Purpose: The stated purpose of this regulation is to control the levels of toxic pollutants in surface waters discharged from all sources holding NPDES permits issued pursuant to applicable State Water Control Board regulations. The regulation is designed to provide standards and procedures by which the permittee shall minimize, correct, or prevent any discharge of toxic pollutants in amounts which have a reasonable likelihood of adversely affecting human health or the environment. Thus, both the regulated community and the general public are aware of the process by which the State will address the discharge of toxic pollutants.

Content: The regulation contains the following sections:

Section 1: A general provisions section gives the reader a basic outline of the toxics management process.

Section 2: Describes the types of discharges which are covered by the regulation.

Section 3: Sets forth the requirements for biological and chemical monitoring.

Section 4: Contains the criteria by which the results of the toxics monitoring will be judged.

Section 5: Describes a low intensity type of compliance monitoring for those sites which pass the criteria in Section 4. Some sites that pass the criteria will be removed from the program.

Section 6: Those sites which fail to meet the decision criteria will be required to conduct a toxicity reduction evaluation as described in this Section.

Section 7: Discusses the use of water quality based effluent limitations in controlling toxics.

Section 8: Provides that any permit modifications which have to do with the toxics management program will be subject to public comment.

The Appendix to the regulation lists industrial categories to which it applies, arranged by Standard Industrial Classification codes.

The effluent toxicity decision criteria contained in Section 4 is the cornerstone of the regulation and will be used to judge the future success of toxic control programs. These criteria are as follows:

1. LC50 greater than or equal to 100 percent in six of the total of eight acute toxicity tests, or in at least 75% of the tests conducted if more than eight tests are conducted.

2. No observed effect concentration (NOEC) greater than or equal to Instream waste concentration (IWC) in six of the total of eight chronic toxicity tests, or in at least 75% of the tests conducted if more than eight tests are conducted.

3. No instream exceedence of water quality standards or criteria for protection of aquatic life or human health, where applicable pursuant to the Virginia Water Quality Standards (VR 680-21-00), based on any of the samples required under Section 3.B.3.

Implementation: As this regulation was designed to support an ongoing toxics management program, the implementation of the regulation will be to carry on the current program and meet the milestones listed under the NPDES Toxics Management Section. Toxics management programs written for permits after the effective date will follow the requirements of the regulation closely, as will the decisions made on the results of the testing. As the toxics management program expands into the areas of bioaccumulation and human health protection, the regulation may have to be revised to reflect this change.

## 4. Pretreatment Program

History/Background - In 1978, the EPA promulgated regulations setting forth the requirements for development of a pretreatment program by POTWs. This was done in fulfillment of the amendments to the Clean Water Act which directed the Environmental Protection Agency (EPA) to promulgate regulations for controlling indirect dischargers to Publicly Owned Treatment Works (POTWs).

In 1976, the Virginia General Assembly amended the Water Control Law to require each owner of a sewerage system to conduct an industrial waste survey to determine the physical, chemical and biological properties of each discharge into the sewerage system or treatment works. The amendment also authorized the Board to issue permits to industrial users of the treatment works. In 1985, the General Assembly appropriated $200,000 for the Virginia Water Control Board to develop a statewide pretreatment program, and to seek delegation for statewide program administration from the EPA.

Purpose - The purpose is to establish a statewide program that will protect both the POTWs and the receiving streams from toxic, hazardous and environmentally damaging substances. To accomplish this the State had to establish the legal requirements for State administration of the pretreatment program. It is the POTW which must implement the pretreatment program, thus controlling pollutants which pass through the treatment system, interfere with the treatment processes, or which may contaminate sewage sludge.

Accomplishments - In 1976 the Virginia Water Control Board adopted a regulation requiring POTWs with a design flow of 40,000 gallons per day (gpd) and greater to conduct an industrial waste survey. Based on the industrial waste survey submittals, 35 facilities were targeted for the development of a pretreatment program and NPDES permits were amended to require the development of an approvable pretreatment program. All of the programs were submitted to EPA and approved by 1985 and the NPDES Permits were amended or reissued to require the implementation of the approved programs. (See attached listing of pretreatment programs.)

Since 1985 the Virginia Water Control Board staff has developed regulations, shepherded legislation through the General Assembly and prepared the necessary program elements for program delegation by the EPA. The Virginia program is now at the EPA for approval.

The staff identified 186 significant industrial users that discharge to 26 POTWs located within the Chesapeake Bay drainage area. The industrial users discharging to these POTWs include the following National Categorical Standards industries; Aluminum Forming, Coil Coating, Copper Forming, Electrical and Electronic Components, Electroplating, Inorganic Chemical, Iron and Steel, Metal Finishing, Organic Chemicals and Plastics and Synthetic Fibers, Pharmaceuticals, Pulp and Paper, Textile, and Timber. Each has the potential of discharging toxics into the POTWs.

Although the EPA is responsible for administering the pretreatment program in Virginia, the VWCB staff has been accompanying the EPA during their audits of the POTWs and inspections of industrial users.

In addition, the Virginia Water Control Board staff has reviewed the approved programs for deficiencies which need to be corrected, conducted audits of the POTWs and accompanied the POTW staff on industrial inspections. The VWCB staff has also included requirements for industrial waste surveys in VPDES Permits issued to POTWs not previously included in the pretreatment program.

Future Plans - The staff of the Virginia Water Control Board, upon delegation of the pretreatment program, will administer the program according to the Board-adopted regulations.

Milestones

- The POTWs will be audited yearly and all categorical dischargers will be inspected yearly.
- Enforcement and follow-up action against non-complying POTWs and industrial users will be taken.
- New candidate POTWs for pretreatment program development will be investigated and included as necessary.
- Sampling will be conducted at POTWs at least annually, and at the significant dischargers when necessary.

5. Pilot Toxics Strategy

Background/History: During 1985-1987, effluent samples were collected at 70 point source discharges to the Chesapeake Bay drainage. These sources consisted of sewage treatment plants, industries and federal facilities. In addition to effluent sampling, sediment samples were collected at each site and tissue samples (shellfish) were collected at 25 of the sites. These samples were analyzed for volatile and extractable organics and metals. Also, a computerized toxics database was developed to handle the generated data. This database resides on the VIMS mainframe computer.

Purpose: The purpose of the Pilot Toxics Strategy was to provide a "chemical fingerprint" of effluents discharging to the Chesapeake Bay and to determine the impact of such discharges on sediment and tissue contamination. Also a computerized database was developed to catalog and track toxic compounds in the Bay environment and to provide easy access to scientists and managers.

Accomplishments:

1. It was determined that at 32 of the 70 sites the sediment was contaminated by chemicals present in the effluent. Of

the 25 tissue samples collected, 10 were contaminated by chemicals found in the point source discharge.

2. It was determined that oil/water separators are a major source of organic chemicals entering the Bay drainage, especially the Elizabeth River. Also, it was determined that oil and grease is an inappropriate permit parameter to protect water quality from such discharges.

3. Identified a large number of discharges which failed bioaccumulative screening tests.

4. Identified point source discharges where toxic chemicals where present. As a result, the VWCB mobile bioassay trailer is following up at identified sites.

5. Raised the issue that best management practices in shipyard permits need to be enforced and violations result in a significant loading of toxic compounds to the Elizabeth River.

6. Identified a new class of toxic compounds in Chesapeake Bay - polychlorinated terphenyls.

7. Findings resulted it two permittees being required to develop toxicity reduction plans.

8. A computerized toxics database was developed that will assist the VWCB in water quality standards development, toxics monitoring, special toxics studies, and toxicity reduction and permitting programs.

9. Identified a need for the VWCB to move towards regulating bioaccumulative compounds in effluents.

10. Determined that sediment monitoring is an invaluable tool in addressing toxic releases from point sources.

(See attached table which summarizes program findings.)

<u>Future Plans:</u> The "chemical fingerprinting" of effluent, sediment and tissue samples will not be continued in FY'89-90. The toxics database will be expanded by uploading historical toxics data, programming modifications will be made to include bioaccumulation and biological testing end points.

Milestones

- o Conduct "chemical fingerprinting" of effluent, sediment and tissue samples at point source discharges to the Bay on a 2 to 3 year frequency beginning in 1990.

- o Develop an inventory of toxics data for Chesapeake Bay and determine the format of available data.

- o Establish a centralized database or databases for toxics compounds in Chesapeake Bay. Make such a database available to all interested users by 1990.

6. Toxicity Testing with Mobile Bioassay Lab

Background/History: Recognizing the need to conduct more toxicity tests, the staff developed a 205(j) proposal in the summer of 1983 that called for the development of a mobile laboratory facility which could be set up at different industrial and municipal facilities for assessing the impact of these outfalls. The funding for this proposal was approved, and the mobile laboratory facility was completed in the fall of 1984.

Purpose: The mobile laboratory improves the staff's ability to gather information and data concerning effluents containing toxic or potentially toxic compounds by providing the manpower and equipment necessary to perform sampling for chemical analyses and on-site bioassay toxicity testing. The benefits of the work include the qualitative and quantitative identification of toxic compounds in effluents, and the identification of sources of potential water quality criteria violations. The chemical data are used to make correlations with biological responses, to calculate instream waste concentrations (IWCs) of toxic components of effluents, and to compare the calculated IWCs, real IWCs, and effluent concentrations with water quality criteria and permit limits. The data generated by on-site toxicity testing are used to evaluate a facility's effluent under the SWCB's Toxics Regulation.

Accomplishments: The Effluent Toxicity Testing Initiative was designed to assess the biological and chemical toxicity of effluents in the Bay drainage. In its first 18 months, the program has addressed these concerns and expanded to investigate other permit conditions, specifically the Best Management Practices at shipyards. The program's staff was hired in February of 1987, and by April of 1987, testing had begun on freshwater discharges in the James River. The staff was able to utilize existing cultures of freshwater organisms, which enabled the program to get off to a fast start.

Between April and July 1987, extensive work was done in the laboratory to culture and breed three marine organisms for toxicity testing. By August 1987, through much trial and error, the program was able to move to the marine environment of the Tidewater area. Chemical and biological investigations have been conducted on sixteen discharges, including:

3 - POTWs
4 - Processed Waste Discharges
5 - Oil/Water Separators
4 - Drydocks

Testing has shown that 9 of the 16 discharges were either acutely or chronically toxic to aquatic organisms, and that permit limits for chemicals were exceeded in some of the discharges. These studies, combined with previous data, have resulted in the issuance of a TRE for three discharges at one facility and the withdrawal of a permit to discharge from oil/water separators at another site. (See attached table which summarizes program findings.)

In conjunction with the effluent studies, the program also addresses ambient water quality. Chemical sampling in freshwater receiving streams has shown that instream levels of metals and organics are below criteria, however one facility did show chronic toxicity to organisms tested in water from the area of the discharge. In the Elizabeth River, the ambient study is designed to measure overall water quality, and is not related to a specific discharge. Due to the number of discharges and the tidal nature of the Elizabeth River, it is almost impossible to locate an exact source for instream toxicity. The program has to this date tested 11 miles of the Elizabeth River.

The most prevalent problem uncovered by this program is the inability and refusal of shipyards to adhere to the Best Management Practices in the permit. The number of uncontrolled discharges emanating from drydocks, wetslips, and marine railways have the potential for high toxicity. The program has investigated four ship yards, and has recorded daily observations of violations/discharges. These investigations have resulted in the issuance of 6 Notices of Violation(NOVs) by the State Water Control Board. These NOVs have prompted some shipyards to make an effort to change operational procedures; however constant inspections are still necessary. The documentation of BMP violations has prompted the VWCB to review the language and increase the enforcement of this section of NPDES permits.

Future Plans: The abundance of problems and potential problems that have been discovered by this program has raised concern over the quality of water throughout the state. The addition of a second mobile lab and staff will allow the Agency to address these concerns without abandoning the Chesapeake Bay area.

A second mobile lab will be used to evaluate discharges outside the Bay drainage. The existing mobile lab will continue to be used in the Tidewater area. Data from these studies will be added to the toxics data base, and recommendations will be made to the toxics management program or the regional offices.

Milestones

- o Study 10 sites/ mobile lab/ year, incorporating toxicity and chemical data on the effluents tested into the Toxics Database.

- o Investigate and evaluate within 5 years the feasibility of adding toxicity testing of the sediment within the vicinity of an outfall.

## 7. Elizabeth River Initiative

The Elizabeth River, a sub-estuary of the James River is the major deep water port of the Hampton Roads Harbor. The River Basin drains over 700 $km^2$ in Southeastern Virginia within the cities of Chesapeake, Norfolk, Portsmouth, and Virginia Beach.

The Elizabeth River has served as the focal point for military, industrial, and commercial growth in the Hampton Roads area. The proximity of the port to the Chesapeake Bay and the Atlantic Ocean and the vast resources of nearby inland regions have contributed to make it an important maritime port.

The environmental awareness that developed in the late 1960's and early 1970's resulted in federal legislation which focused national attention on restoring and preserving our natural resources. Studies were initiated to determine the effects of over 200 years of man's activities on the Elizabeth River. Unfortunately, the price of prosperity was great. The River, once home to the many diverse species of plants and animals which live and thrive in estuarine environs, had serious water and sediment quality problems.

To insure that the Elizabeth River can continue as an economic and industrial facet of the region, yet be restored to an environmentally sound condition, it was realized that a comprehensive plan was required. The SWCB, as the major entity involved in developing the plan, is initiating the first major effort to restore the River with its Elizabeth River Initiative. The Initiative will serve to focus available resources on several issues of concern in the Elizabeth River Basin.

The goal of the Elizabeth River Initiative, to improve the water quality of the Elizabeth, represents an enormous task that requires complex and often innovative approaches. To achieve this goal, a concerted and coordinated effort by federal, state, and local authorities, local governments, and from the citizens residing in the Basin is necessary. The following projects represent the initial efforts by the VWCB towards achieving this goal.

a. Elizabeth River - Permits and Inspections

The State Water Control Board is the delegated authority in the Commonwealth of Virginia to administer the NPDES program (State Water Control Law 62.1-44 et seq. as amended). Effective July 1, 1988, the Permit Regulation (VR680-14-01) delineates the authority and general procedures for issuance of Virginia Pollutant Discharge Elimination System (VPDES) and Virginia Pollution Abatement (VPA) permits by the State Water Control Board. The Regulation prohibits the discharge of any pollutant (except for those excluded in the Regulation) "including sewage, industrial wastes or other wastes, into, or adjacent to State waters or otherwise alter the physical, chemical, or biological properties of State waters, except as authorized pursuant to a VPDES or VPA permit." VPDES permits authorize the discharge of pollutants from point sources, and the management of pollutants that are not point source discharges to surfaces waters may be authorized by a VPA permit.

Regional permit writers and inspectors are an integral part of the VPDES/VPA permit program. Permit writers develop permits for each facility with effluent limits designed to protect water quality. Inspectors insure, through a variety of mechanisms, that facilities are in compliance with their permits. The VWCB currently permits 47 industrial, 10 municipal, and 4 federal facilities which discharge in the Elizabeth River watershed. Most of this facilities have multiple outfalls which discharge municipal and/or industrial wastes. Most dischargers are required to monitor for one or more conventional parameters and selected non-conventional or toxic pollutants which are believed present in their effluent.

The NPDES program initially focused on the control of conventional pollutants such as TSS, oil and grease, pH, and BOD. However, an increasing emphasis has been placed on the regulation of non-conventional (i.e. nutrients) and toxic pollutants. The VWCB began including Toxics Management Programs (TMPs) in selected permits in the early 1980's as a means to control these pollutants. TMPs require facilities to perform chemical and biological tests to determine the toxic nature of their effluents. Over twenty percent of the facilities which discharge to the Elizabeth River have TMP requirements and several more facilities are scheduled for TMPs.

In the past, as many as six regional staff members have spent part of their time with permit development and inspections for Elizabeth River facilities. These responsibilities have been shifted to two new positions, an Elizabeth River permit writer and an Elizabeth River inspector, in order to enhance development and issuance of VPDES/VPA permits, provide quick and efficient responses to permit violations, and insure future compliance with permit requirements. In addition to their standard activities, the Elizabeth River permit team will:

- Develop a priority list for modification of permits.
- Develop an inspection schedule with increased frequency for all majors and selected minors.
- Participate in a surveillance program to identify unpermitted discharges (The appropriate permits will be issued to identified discharges).
- Develop recommendations and implementation strategies to strengthen nonpoint source pollution control at permitted facilities.

The Elizabeth River permit team will provide the continuity and focus required to integrate the permit process with the diverse water quality projects occurring in the Basin.

b. Elizabeth River - Toxicity Assessments

In order to focus the VWCB's bioassay testing program on the Elizabeth River discharges, the existing mobile bioassay laboratory will be assigned to the Elizabeth River watershed for several years. The second mobile bioassay lab will cover dischargers in other areas of the Commonwealth. The Elizabeth River mobile lab will provide the opportunity for an in-depth investigation of the dischargers located in the basin.

The VWCB has already completed toxicity evaluations at several facilities which discharge into the Elizabeth River. Results from these studies assist staff in reviewing the impacts of specific point source discharges to the Elizabeth River, assists in permit reissuance, and is instrumental in developing toxicity control strategies.

c. Elizabeth River - Planning and Management

The Elizabeth River Initiative integrates a number of new and existing water quality related projects into a comprehensive program. Projects included in the initiative represent a range of activities, including the enhancement of regulatory activities, applied research, and planning and management functions.

Individual projects are implemented and managed through appropriate Headquarters or Regional offices, with directors or program managers of the primary offices involved in the Initiative serving as members of the Initiative Steering Committee. An essential component of the Initiative is the coordination of these various VWCB projects, integration of VWCB projects with other State, federal, and local water quality projects, and the compilation and dissemination of information so that the Steering committee can make timely and effective decisions regarding the direction of the Elizabeth River Initiative programs.

The improvement of water quality in the Elizabeth River will necessitate the use of complex and innovative approaches to pollution abatement and a degree of coordination between state and local government which has seldom been achieved. Because of this complexity and the need for an enhanced degree of coordination of Initiative activities, an individual skilled in project coordination will track and consolidate the work performed by the various participants. The coordinator will also work closely with the Steering Committee to insure that program goals and objectives are being meet and to recommend additional or alternate projects as needed.

d. Elizabeth River - Comprehensive Monitoring Program

The Elizabeth River receives a wide variety of point and nonpoint source discharges within its 300 square mile drainage area, in which approximately one-half million people reside. Poor flushing characteristics increases the amount of sediment and associated pollutants trapped within the river system. Metals and organics that are present in the water column and are bound to the sediment have created serious environmental problems. In 1983, the Chesapeake Bay Program identified the Elizabeth River system as one of the most highly polluted bodies of water in the entire Bay watershed.

In order to assist in achieving the goal of water quality improvement, a comprehensive long term monitoring program is being developed. The program will have the following major objectives:

1. Characterization of the river's quality

2. Developing a trend analysis over time

3. Aid the VWCB's Water Quality Standards program by identifying pollutants of concern, providing data for standards development, and measuring compliance with standards, and;

4. Conducting special studies of short term concern as needed and as funding allows.

Meeting the objectives described above requires long term monitoring of the a number of water quality parameters including conventional pollutants, metals, and toxic organics. Analysis of sediments for priority pollutants and toxicity tests are also being considered for inclusion in the long term monitoring program. Benthic surveys and shellfish and finfish studies are also on the list for consideration in the long term monitoring program. A Technical Advisory Group has been selected to assist in development of the program which is scheduled to begin in January, 1989.

e. Elizabeth River - Special Studies

Special studies of identified problems in the Elizabeth River represent an integral part of the comprehensive restoration program developed for the Elizabeth River. These studies are intensive short-term studies of sources with high contaminant concentrations or toxicities, or have unusual characteristics which warrant special studies. Special studies may also include periodic measurements of toxicity or contaminants of concern (e.g. TBT, dioxins) when the need has been identified by other programs or studies.

The initial focus of the Elizabeth River Initiative special studies will be on pollution sources at area shipyards which have demonstrated significant toxicity and discharge high levels of toxic substances to the Elizabeth River. The sources of concern are oil/water separators and floating drydocks. Special studies have been funded by a 205(j) grant and the comprehensive toxics initiative (Elizabeth River Restoration) to further evaluate these pollution sources. These studies will provide the much needed information to develop and implement effective pollution control strategies for these sources of concern.

Oil/water Separators - During the 1984-1986 biennium the staff collected samples at several discharges for pollutant analyses. Five discharges originated from oil and water separators. These separators were located at the Navy Craney Island Fuel Supply Center, Virginia Power's Firefighting Center, Norfolk and Western Railway Company, Seahorse Marine (now Marpol), and Norfolk Shipbuilding and Drydock Company. The results of the analyses at these facilities showed high concentrations of organic priority pollutants being discharged. In addition some facilities had significant numbers of non-priority pollutants present. Furthermore many of these facilities had separate violations of oil and grease. In the most recent biennium (86-88) the staff collected samples from six additional oil and water separators. The conclusions have been the same; oil and grease limits are exceeded, discharges are toxic, and numerous organic pollutants are being discharged at significant concentrations.

Based upon those findings a study will be conducted to evaluate the control of organic pollutants and oil and grease in oil/water separator discharges. The study will begin with an inventory of the types of separators, their location, and the types of wastes treated. The second phase will involve site inspections and collection of operational parameters. The third phase involves the analysis of samples for comparison and evaluation of different types of treatment systems. At the close of this study the agency will be able to identify effective treatment systems for controlling oil and grease and organics.

Best Management Practices - As part of the effluent toxicity testing program the staff collected several samples from floating and graving docks for testing. The results of some of these tests showed toxicity. During the time of sampling staff also observed that the operating practices were inconsistent with the best management practices included in the permits. Due to the magnitude of these discrepancies the staff established an inspection procedure and began noting deviations from the recommended best management program (BMP).

Typical violations of the BMP program included lowering the drydock before cleaning it, allowing paint spray to be washed into the river or drift into the river, and allowing spent abrasive to be washed into the river by leaking or ruptured water hoses. The staff also recognizes that the optimum methods for controlling discharges, paint spray, and spent abrasives from reaching the river may need to be developed or used more routinely. The staff is interested in identifying those BMP's that would result in significant improvement to water quality by control of wastes in the drydock operation.

f. Elizabeth River - Toxics Search and Identification

Background - The Board's Office of Water Resource Management's Toxics Search and Identification project is a 104(b)(3) federally funded effort to identify and prioritize toxic compounds in the Chesapeake Bay watershed. The project will initially focus on the Elizabeth River system and then be expanded throughout the watershed.

Objective - The major objective of the project is to identify toxic substances from the existing databases and literature, which show high potential of causing environmental degradation or human health affects. This effort will provide the Office of Environmental Research and Standards with a list of substances which are probable candidates for adoption of statewide or area specific standards. For those compounds which are suspected of causing degradation, but for which insufficient data exits, specific monitoring recommendations will be made.

Methodology - The study will begin its focus on VPDES facilities judged to have the highest potential for discharge of toxic substances. Chemical information from the VWCB Chesapeake Bay Toxics Initiative Database residing on the VIMS Prime computer along with data from DMR and TMP reports will be evaluated in terms of acute and chronic toxicity, carcinogenicity, mutagenicity, teratogencity, and capacity for biomagnification. The frequency of occurrence and concentration of each substance in the system will also be considered. Later phases of the study will examine other available databases and information sources to observe frequency of occurrence of substances noted in previously analyzed dischargers and identify additional substances.

Products

1. Problem substances will be identified quarterly; these lists of candidates for adoption of water quality standards will be updated as further information is added; a final list of compounds identified will be developed by the end of fiscal year 1990.

2. A catalog of potential databases and other information sources for use in the project will be developed and updated quarterly.

3. Specific recommendations will be made for monitoring of substances suspected of needing regulation and/or closing of information gaps in the data set.

g. Elizabeth River - Water Quality Standards

Purpose - The goal of the Elizabeth River Initiative is to improve the water quality of the Elizabeth River. To do this, toxics standards must be developed so that legal enforcement actions can be undertaken to reduce the discharge of toxics into the estuary. Some of the standards will be developed for statewide enforcement and others will be specific for the Elizabeth River. A successful program will be measured by reduction or elimination of the discharge of pollutants into the Elizabeth River, and hence, into the Chesapeake Bay.

Accomplishments - Standards staff is assisting the Office of Water Resources Management in a database search and identification of toxic compounds found in the Elizabeth River by drafting a screening criteria which determines which of the compounds should be regulated. The screen includes a selection matrix which rates the compounds according to their toxicity (for aquatic life and human health), frequency of occurrence and bioaccumulation potential. This matrix will also ensure standard development for the most toxic compounds will begin first.

Future Plans - Future plans include providing the Chesapeake Bay Office monitoring program with database inadequacies discovered during the screening process described above so that unknown compounds and compounds lacking in research can be identified and prioritized for standards development. In 3 years the standards development process for the toxic compounds selected from the screening matrix will be completed. The standards development process will include literature research to ensure adoption of a protective enough standard and the Commonwealth's Administrative Process Act which satisfies public participation requirements of proposed regulatory changes.

h. Elizabeth River - Oily Waste Management

Background/History - The Virginia Water Control Board has identified the handling of slop oils, bilge waste, tank bottom washings, etc. to have a serious impact on water quality in the Elizabeth River. Such wastes are generated during ship repair and are primarily treated by oil/water separators. Oil/water separators are not designed to adequately treat light weight petroleum products which predominate such wastes. Chemical and biological testing of effluents from the oil/water separators on the Elizabeth River have indicated extreme acute and chronic toxicity and concentrations of organic chemicals and metals which exceed water quality criteria. Other problems have been identified with the off loading of slop oils and bilge waste from Naval vessels and the refueling of such vessels.

Purpose - There is a need to develop an oily waste management plan for the Elizabeth River. The components of such a plan would include the following: 1) identify all potential sources of oily waste on the Elizabeth River both commercial and military; 2) investigate practices used to handle and treat such waste which includes not only the wastewater but solid wastes as well; 3) investigate treatment technologies that can adequately treat such waste; and, 4) develop a comprehensive management strategy for regulating all activities concerned with this issue. A number of state agencies would need to work together on this issue such as the VWCB, Department of Waste Management and Virginia Port Authority in addition to federal agencies such as the Coast Guard, EPA, etc.

Milestone

- By 1992 develop a management strategy for the Elizabeth River to regulate activities concerned with the handling and treatment of petroleum-contaminated wastewater in order to improve water quality on the Elizabeth River.

8. Bioaccumulation Project

Background/History: Living aquatic resources can be harmed by chemicals present in effluent discharges. Such harm may be acute or chronic toxicity and continual exposure to low levels of chemicals might result in high tissue concentrations. The latter was the case with Kepone and mercury contamination in Virginia. As a result the Commonwealth of Virginia suffered serious economic losses and environmental concern. Human consumption of fish, shellfish, and blue crabs contaminated by chemical residues is an exposure route of serious concern to both Virginia and EPA.

Purpose: During FY'89-90, the VWCB will be conducting a Bioaccumulation Initiative. The purpose of this project is to screen, identify, and control bioaccumulative contaminants in effluent discharges to State waters.

Accomplishments: At the end of the two year study, 200 point source discharges will be screened for bioaccumulative compounds. From the 200, 40 will be selected for follow-up work to identify the contaminants. Field studies will be conducted at 10 sites to determine the distribution of identified contaminants in fish, shellfish, blue crabs and sediments. As a final product, an assessment approach will be outlined for including the issue of bioaccumulation in the VWCB Toxics Management Regulation.

Milestone

- o Include in the toxics regulation the control of bioaccumulative compounds by 1993.

9. Human Health Project

Background: The water quality criteria adopted by the VWCB to date have been based on a number to protect aquatic life. The protection of human health has not been an issue in developing these criteria. However, compounds that are known to be carcinogenic, mutagenic, and teratogenic have been detected in effluents. In addition, the EPA is expected to require Virginia to address the topic of human health protection, and to investigate the establishment of water quality criteria based on the protection of human health.

Objectives:

- o Identify the carcinogenic, mutagenic, and/or teratogenic compounds in the state of Virginia that are not included in section 307(a).
- o Produce recommended approaches in prioritized fashion for the VWCB to use in establishing water quality criteria/standards for these compounds for the protection of human health.

Tasks:

- o Determine the potential presence in the state of carcinogenic compounds that are not included in section 307(a).

    a. Use databases (BTSI, CERA Title III, etc.) to determine the non-307(a) chemicals used, stored, or manufactured in the state.

    b. Use databases such as the Carcinogen Assessment Group (CAG) List, Chemical Information System (CIS), National Library of Medicine, QSAR, and the Michigan Critical Material Register to determine which of these chemicals are carcinogenic, mutagenic, and/or teratogenic.

    c. Investigate actual sampling data (ETT, TMP, etc.) for these compounds.

- o Develop list of carcinogenic, mutagenic, and/or teratogenic non-307(a) compounds in the state for which the VWCB needs to develop standards, either on a state wide basis, or for certain stream segments.

  a. Compounds that already have water quality criteria for the protection of human health that have not been adopted by various states and/or EPA.

  b. Compounds that do not already have water quality criteria for the protection of human health that the VWCB can adopt.

  c. Compounds above a certain frequency level in the state, or above a certain concentration level.

  d. Non-307(a) compounds that have been shown to be carcinogenic, mutagenic, and/or teratogenic.

- o Review the approaches used by other states in developing water quality criteria for carcinogenic, mutagenic, and/or teratogenic compounds. Identify the basis for these approaches (Federal Register, state legislation, etc.), and whether these approaches have encountered any enforcement problems. Produce a list of approaches, such as mass balance equations, lab tests, EPA numbers, etc., for the VWCB to use in establishing water quality criteria for the protection of human health for carcinogenic, mutagenic, and/or teratogenic non-307(a) compounds.

Products:

- o A list of carcinogenic, mutagenic, and/or teratogenic non-307(a) compounds for which Virginia needs to develop water quality criteria that will protect human health.

- o A report that presents and explains the approaches that can be used in establishing water quality criteria for these compounds for the protection of human health.

Input from "Technical Committee":

A committee may be formed at the completion of this initiative that will interface with the VWCB's Standards section to determine the best approach from the list produced to use in developing criteria for the protection of human health for non-307(a) compounds. Committee members may include employees from other states that have worked on developing criteria for the protection of human health in their state, and/or individuals who have been involved in performing or evaluating human health assays. Risk levels ($10^{-5}$, $10^{-6}$, $10^{-7}$, etc.) and associated concentrations for these compounds will be determined by the Standards section at that time.

Milestones

- o By the year 2000, incorporate standards that protect human health into the Toxics Regulation and permit limits.

- o Within 5 years, evaluate whole effluent toxicity tests for determining the effects of an effluent on human health (carcinogenicity, mutagenicity, and teratogenicity).

10. Biomonitoring and Core Monitoring Programs

Background

Environmental monitoring of toxic substances is an integral part of a toxics reduction program. Only through monitoring can the program be assessed as to its effectiveness.

Beginning in 1979, Virginia's 40 Core monitoring stations have been monitored for fish tissue contamination by toxics (see attached Figure), sampled on a biennial, and more recently, on a triennial basis. Of these stations, 13 are on tributaries of the Chesapeake Bay east of the fall line (circled in Figure), which have a more direct influence on ambient Bay water. Since initiation of the program electrofishing techriques have been refined, resulting in more efficient capture and better composite sample replication.

The biological monitoring program began in 1978 and includes approximately 150 stations sampled semiannually. The program utilizes qualitative benthic macroinvertebrate evaluations to determine overall water quality conditions. Of the 150 stations, roughly 40 are located east of the fall line.

Purpose

A number of Virginia's tributaries to the Chesapeake Bay are sampled through the EPA core monitoring program (see attached Table). This program is designed, in part, to monitor organic (pesticides and herbicides) and metallic toxic substances present in fish tissues. Two composite samples taken from each location are edible filets of predator species of fishes which indicate human health risks from fish consumption. In addition, one composite whole fish sample is also taken from each location, of a bottom feeding species of fish.

Tissue analysis of the bottom feeding species indicates the presence or degree of ecosystem contamination.

The purpose of the biological monitoring is to assess long term water quality trends at a large number of stations statewide. Stations are selected to monitor water quality changes upstream and downstream of major discharges, entire metropolitan areas, suspected nonpoint pollution sources, or to document conditions in relatively unaffected or pristine streams.

Accomplishments

Data from the core monitoring program (which also includes water and sediment toxicant concentration data- collected by the individual regional offices) is entered on the federal EPA STORET water quality data base. Trends in metal and pesticide toxicant concentrations at these stations can now be analyzed because of the long term data base. Special studies can and have been initiated as a result of fish tissue contamination findings. These special study follow-ups are undertaken to identify and correct the source of the contamination problem.

Since the inception of the biomonitoring program, station locations have been fine tuned to provide the most accurate information concerning water quality conditions statewide. In 1985 the qualitative analytical methods for the benthic macroinvertebrates was improved to include identification to the family level of taxonomy. This increased the accuracy of the program with very little increase in staff time resources. The results of these biomonitoring efforts have revealed numerous previously unknown water quality problems and continue to measure the effectiveness of ongoing pollution abatement programs.

Future Plans

Future plans for the EPA core program include increasing the number of stations sampled to 45-55 sites statewide with each station investigated on a triennial basis.

Although the biological monitoring program is designed around long-term trend data gathering, station locations are continually being evaluated for their effectiveness and are adjusted as new water quality problems are encountered or existing problems are rectified. Recently introduced computer software programs will enhance the quality of the biological monitoring reports as well as streamline data transmittal time between the regional offices and headquarters.

TABLE - EPA CORE FISH STATIONS IN OR EAST OF FALL ZONE

| RIVER | ROUTE (BRIDGE) | RIVER MILE |
|---|---|---|
| Little Hunting Creek | Geo. Washington Parkway | LIF000.19 |
| Rappahannock | At 301 | RPP080.19 |
| Rappahannock | at 3 | RPP008.42 |
| Pamunkey | at 614 | PMK082.34 |
| Mattaponi | at 33 | MPN001.34 |
| York | at 17 | PRK005.93 |
| Appomattox | at 10 | APP001.53 |
| James | at 156 | JMS074.44 |
| Pagan | near 677 | PGN008.42 |
| Pagan | at 10 | PGN005.46 |
| James | at 17/258 | JMS013.92 |
| E. Branch of Elizabeth | at 58/460 Alt. | EBE000.07 |
| S. Branch of Elizabeth | Across from Naval Base | SBE001.53 |

11. Comprehensive Review of Toxic Substance Sampling Data

Background/History - The Virginia Water Control Board has used the EPA STORET computerized data base as a repository for water quality data from the ambient monitoring and EPA CORE monitoring programs for approximately 20 years. A comprehensive review of toxic substances in this data base under a 205(j) grant was proposed in 1986. The project was begun in January, 1988 and is scheduled for completion by May, 1989. Although this is a statewide effort much of the data is in the Chesapeake Bay watershed.

Objectives - The major objective of this grant is to examine the Virginia STORET data base to identify areas with elevated or comparatively high concentrations of toxic substances. Attempts will be made to identify natural and anthropogenic sources of these hotspots. Where point sources are deemed responsible, these problems will be identified to permit writers for corrective action.

A secondary objective of the project is to evaluate the effectiveness of the parameters monitored and the media (water, sediment, tissue) analyzed. Specific recommendations concerning future parameter coverage and effective targeting of ambient monitoring resources will be made.

Methodology - From initial examination of the STORET data base, a list of toxic substances was prioritized on the basis of potential for environmental effects and size of data set. A complete literature review covering toxicity, sources, standards and criteria, and normal or "background" levels in other states will be written for each substance.

STORET-to-SAS programs have been written to produce concentration frequency tables and descriptive statistics for each parameter. Frequency distributions will be used along with standards or criteria and available supporting literature references to define what level will be considered elevated for each parameter. The data sets will then be analyzed to determine the location and dates when results above background levels were detected.

Computerized mapping of the values above the "elevated" level will help identify patterns or clusters in the geographic distribution. This will present a visual comparison of contamination between basins, geographic provinces and urban vs. rural areas. Mapping software being used for this project includes programs available through the EPA-NCC mainframe computer and the GIS Arc-Info System used by the U. S. Geological Survey.

Products - A final report will be generated by May, 1989 containing the following:

1) A determination of what a normally occurring "background" level is for each examined parameter in the state of Virginia.

2) A list and map of identified areas above the determined elevated level for each parameter.

3) Where possible, a determination will be made as to a probable source of each hotspot.

4) Recommendations for continuing or discontinuing monitoring of parameters analyzed and identification of additional parameters for the AQM program.

## C. NONPOINT SOURCE PROGRAMS

### 1. Urban Stormwater

As a result of the Nutrient Reduction Strategy, Virginia is committed to improving loading and load delivery estimates for "developed land uses" in the 1989 update. This is a specific commitment to better characterize urban runoff quantity and quality thus including toxics in general. In 1990, this information will be further refined and in 1991 control costs must be developed.

Uncontrolled urban stormwater can lead to increased downstream flooding and chemical pollution, diminished groundwater supplies, increased erosion and sedimentation, extensive alteration of stream channels and damage to aquatic wildlife. The quality of stormwater, while highly variable, is roughly equivalent to that of secondarily treated wastewater for many pollutants; stormwater may have higher concentrations of some metals. Controlling stormwater quality should be considered along with the control of stormwater quantity.

In developed areas, certain pollutants are more prevalent than in undeveloped areas. Typically, these contaminants include suspended solids, nutrients, bacteria, oil and grease, metals and other toxicants. Atmospheric deposition onto these areas contains particulates and associated contaminants from cars, factories and wood stoves. Runoff from these developed areas is subsequently a significant source of the contaminants and toxicants which move into Virginia's watercourses.

The toxicants in urban runoff include oil and grease, chlorides and heavy metals such as lead, zinc, bromium, arsenic, silver, cadmium, mercury, chromium, nickel, copper and iron. Many of these are washed into waterways from roads and streets and originate from vehicles (tire wear, exhaust, lubrication losses and corrosion of parts), pavement degradation, street marking paint and from commercial and industrial developments. While industrial and commercial developments yield substances such as phenols, cresols and various pesticides, their concentrations in stormwater runoff are usually well below relevant threshold levels. In addition, there are exotic toxic chemicals that are infrequently found in stormwater such as heavy metals, hydrocarbons and chlorides which can be toxic to aquatic and terrestrial organisms, including man. Recent studies indicate that the normal levels of these substances in runoff are not high enough to cause significant pollution due to their inert nature (i.e., readily attach to soil/sediment particles) and the diluting effect of the receiving waters. However, as urbanization of the state continues, the contribution of these toxicants to pollution of surface waters will become more significant unless it is properly managed. The success of any management program to deal with toxics will lie in its ability to improve water quality at a minimal cost.

Current methods for identifying and prioritizing these toxics is summarized in the technical information provided by the National Urban Runoff Program (NURP) studies and the EPA priority pollutant list. Methods for estimating pollutant (toxicant) export from urban development sites can also be obtained from the NURP studies and the EPA priority pollutant list.

Presently, the Virginia Division of Soil and Water Conservation has programs and guidelines in effect which work to decrease toxicant export from developing areas during and after the construction process. The establishment of "General Criteria #7" in Chapter III of the Virginia Erosion and Sediment Control Handbook (adopted by all state localities in 1982) regulates erosion, downstream flooding and the associated toxicant movement caused by increases in the volume, velocity and peak flow rate of stormwater. The criterion requires adequate outfall channels and/or attenuation of post-development flows to pre- developed levels. As of July 1, 1988, wording was added to the Erosion and Sediment Control (E&S) Law which will allow for future modifications of our stormwater criteria which involve water quality issues. Draft legislation is currently being developed for presentation to the 1989 General Assembly.

The division also carries out an erosion control inspection program which covers all state agency projects which involve land disturbance. Field Specialists located throughout the state make inspections periodically to ensure that both temporary and permanent measures are preventing erosion and subsequent sediment and pollutant (possible toxicant) losses into adjacent drainage ways and water courses. The program also extends into the private sector as erosion control complaint response and local technical assistance are performed routinely, primarily in response to requests. The Division also provides administrative oversight over 171 local E&S programs. This involves reviewing local ordinances for compliance with state law, updating the law and statewide regulations and generally ensuring the consistent application of the law statewide.

Educational services are made available around the state by virtue of the division's stormwater management and erosion control courses. Consultants, inspectors, municipal officials contractors and developers are able to learn strategies for reducing soil losses during construction as well as methods for preventing degradation of drainageways and watercourses by newly created post-construction runoff.

Another form of education, the implementation of Best Management Practice projects, also serves to promote water quality enhancement. Through projects which involve urban marsh creation, porous pavement, vegetated swales, bio-technical stabilization of drainage ways, level spreaders and infiltration trenches, the division is advertising the benefits of soil and stormwater conservation as well as accumulating technical data on construction and performance of these practices.

In addition to the aforementioned changes in the E&S Law relating to stormwater management, some other modifications were made which should serve to further control urban nonpoint source pollution. The deletion of exemptions for railroad (new) construction and electric and telephone utility installation and the addition of civil penalties for violations of the law were incorporated on July 1, 1988.

The division's urban program for the future will emphasize the establishment of guidelines which encouragae nonpoint source pollutants reduction as a result of comprehensive planning. The goals of this urban plan include the following:

1. Use of additional (recently authorized) division personnel for more thorough inspections of state and private construction projects, local erosion program evaluations, increased technical assistance and local feedback statewide, and additional training workshops and associated certification programs.

2. Development of comprehensive stormwater management legislation and regulations for the state that address water quality impacts from other urban nonpoint source pollution and stormwater discharges.

3. Development of a method to estimate urban NPS loads (including toxicant loadings), and to target high priority areas/watersheds. This may involve modification and application of the previously mentioned NURPs methods in a more comprehensive form. In addition, upcoming E.P.A. guidelines concerning the NRDES permitting for stormwater outfalls should help guide our program in certain areas of the state.

4. Further investigation of BMP technologies, especially those that provide control of nonpoint sources in previously developed areas.

5. Revision of the Urban BMP Handbook as well as the Virginia E&S Handbook to emphasize the following priority of stormwater management techniques.

   A. Infiltration or comprehensively planned retention

   B. On-site retention

   C. Detention

   D. Outfall into adequate channel

6. Obtaining financial assistance for urban BMP implementation in identified priority areas.

7. Promotion of the incorporation of BMP implementation strategies into the land development regulation processes of localities in identified urban priority areas.

Because most stormwater quality programs are just beginning, we cannot accurately estimate the ultimate level of success in keeping toxicants out of surface and groundwaters. The nature of the stormwater management program requires cooperation from diverse segments of the society - the development community, business and individuals. The division along with the federal and local governments will lead the way through guidelines, regulations, education and enforcement; however, success in solving the problem will be a function of society-wide efforts.

Milestones - Urban

1989

* Develop consistent methodologies for estimating loads and/or load delivery calculations, for developed land uses.

1990

* Use the developed methodology to quantify and characterize toxic loads into the Bay basin.

1991

* Identify control programs and associated costs

## 2. Agricultural Pesticides

The Virginia Department of Agriculture and Consumer Services (VDACS) is responsible for several programs involving the use of runoff will also assist in controlling the runoff of attached chemical fractions of pesticides into our waters. At the same time participation in the cost-share program allows DSWC and the Soil and Water Conservation Districts (SWCDs), who administer the program locally for DSWC, an educational opportunity to visit the farmer and provide proper pesticide use and management information.

Technical Assistance

DSWC provides technical assistance to SWCDs in the form of DSWC personnel who assist the SWCDs in implementing the cost-share and other programs locally, and in the form of funds which the SWCDs utilize to hire their own personnel. These personnel, particularly the district personnel, at this time provide technical assistance to the farms on proper pesticide use and management. All of the SWCD and DSWC field personnel are being required to obtain commercial pesticide applicator certification so they will be better trained to provide assistance.

Additional DSWC field personnel are being hired during the fall of 1988. These personnel will be provided extensive technical training which will include aspects of proper pesticide management and use. These personnel will then provide additional technical assistance and education to the farmers in the Chesapeake Bay basin.

Research Projects

Two major ongoing research projects in the Chesapeake Bay basin involve the monitoring of two small watersheds over a ten year study period to address the issue of the effects of BMP usage on downstream water quality and groundwater quality. These effects include those potential effects related to pesticide use and how they may be affected by the implementation of best management practices. One watershed, the Nomini Creek watershed in Westmoreland County, was selected since it was representative of a watershed dominated by cropland land use and the absence of point source discharges. A second watershed, the Owl Run watershed in Fauquier County was chosen because it contained a large percentage of livestock operations representative of a watershed where livestock management BMPs were needed. Water quality information from both ground and surface water is being gathered pre-BMP and post-BMP implementation.

Continuing information being developed at our two demonstration sites will better identify the fate of ag-related toxics (i.e. pesticides) in both surface and groundwater. As needed, new or expanded nonpoint monitoring will be proposed in 1990 and recommendations for additional control programs (either regulatory or voluntary) will be made in 1991.

Integrated Pest Management

Integrated pest management (IPM) is the use of a combination of cultural, biological and chemical controls of insects, weeds and diseases that effect agronomic crops. The Virginia Cooperative Extension Service (VCES) has been promoting the concepts of IPM for many years in Virginia. Crops with extension implemented IPM programs include alfalfa, soybeans, peanuts, small grain and fruit production. Insect scouting to ensure proper timing and applications of pesticide and other IPM techniques have been utilized in these programs.

The VCES is currently developing farm system IPM strategies as a part of strategies for low-input sustainable agriculture. In 1987 the Virginia Committee for Sustainable Agriculture was established to research, develop and promote sustainable agriculture in Virginia. In-service training for County extension agents is planned on sustainable agriculture concepts to promote viable concepts to growers. The development of an expert system data base is also planned to assist growers and extension agents in developing farm system strategies involving sustainable agriculture concepts which will stress soil management concepts and not strict commodity related concerns.

Agricultural Pesticide Milestones

**1989**

* **Summarize and analyze the baseline demonstration watershed data relative to pesticides.**

**1990**

* **Implement necessary new and/or expanded monitoring programs for pesticides within the basin.**

**1991**

* **Identify additional control programs as necessary.**

## 3. <u>Air Deposition of Toxics</u>

**<u>Background</u> - The Air Toxics Program in the Virginia Air Pollution Control Board is charged with the maintenance and improvement of Virginia's air quality, with special attention to toxic air pollutants which are not regulated at the federal level.**

Our authority comes from the Air Pollution Control Law of Virginia (Title 10.1-1308 of the Code of Virginia) through 120- 04-0300 and 120-05-0300 (Rules 4-3 and 5-3) of the State Air Pollution Control Board Regulations for the Control and Abatement of Air Pollution. These rules had an effective date of January 1, 1985 and enforcement was initiated with a pilot-scale program.

The pilot program gave the Department the opportunity to become more familiar with the evaluation and control of point sources of toxic pollution. We have also taken our first steps towards establishing a monitoring network for toxic air pollutants. Very little information exists on typical ambient concentrations of toxic pollution in our air. Our first monitoring goal is to survey as broad a spectrum as possible and gather background information on urban areas. Research on monitoring and analysis techniques is very active and our initial efforts may be just as valuable for their technical experimentation as for the direct information generated on air quality.

With the completion of the pilot-scale program we now move into full implementation. This involves evaluation of toxic pollution from approximately 250 new and modified facilities per year, resulting in permit limitations and testing requirements. Also, the program begins to work its way through some 4000 to 5000 existing sources of toxic air emissions. An evaluation of ambient air impact and a compliance determination must be made for each of these facilities and updated periodically. The monitoring program will establish several permanent stations and develop capabilities for special study/complaint response air monitoring of toxic substances.

The eventual product of this effort will be a toxic emission inventory database for Virginia's air. This will enable us to better evaluate and improve the air quality and protect the health and welfare of Virginia's residents. Additionally, much of this information will be essential in meeting one of the objectives of the Bay Agreement's Water Quality Section:

> Quantify the impacts and identify the sources of atmospheric inputs on the Bay system.

This is a very worthwhile objective, and to promote its accomplishment our plan of action should include the following steps:

1. An inter-disciplinary effort to qualitatively analyze toxic pollution of the sediment, microlayer and atmosphere associated with the Bay and its tributaries. This qualitative analysis should include a correlation of those substances found in both the atmosphere and Bay system to determine the potential for transfers from one medium to the other.

2. Once substances with a potential for transference have been identified, a quantitative evaluation of both air and water concentrations should be conducted to determine their level of impact.

3. The originating source of those substances, found to have a significant impact, should be identified to the extent possible. It is recognized that this kind of fingerprinting of sources will be rare, but it may be possible to identify an industry type or geographic area of origin.

4. Take the appropriate action to achieve the required reduction of toxic emissions.

These four steps are, by necessity, somewhat general and lacking in detail. To provide the required detail, the following milestones are proposed.

Air monitoring data which is available now or in the immediate future consists of:

NFAN Particulate Analysis (Norfolk)

| | |
|---|---|
| Arsenic | Iron |
| Lead | Beryllium |
| Barium | Manganese |
| Cadmium | Molybdenum |
| Chromium | Nickel |
| Cobalt | Vanadium |
| Copper | Zinc |

Toxics Canister Sampling of Volatile Organic Compounds (Norfolk and Hampton)

dichloro difluoromethane
methyl chloride
1,2 dichloro 1,1,2,2, tetrafluoroethane
vinyl chloride
methyl bromide
ethyl chloride
trichlorofluoromethane
1,1 dichloroethane
dichloromethane
3 chloropropene
1,1,2 trichloro 1,2,2 trifluoroethane

1,1 dichloroethane
cis 1,2 dichloroethane
trichloromethane
1,2 dichloroethane
1,1,1 trichloroethane
benzene
carbon tetrachloride
1,2 dichloropropane
trichloroethene
cis 1,3 dichloropropene
trans 1,3 dichloropropene
1,1,2 trichloroethane
toluene
1,2 dibromoethane
tetrachloroethene
chlorobenzene
ethylbenzene
xylene
styrene
1,1,2,2 tetrachloroethane
4 ethyl toluene
1,3,5 trimethyl benzene
1,2,4 trimethyl benzene
benzyl chloride
dichlorobenzene
1,2,4 trichlorobenzene
hexachlorobutadiene

Acid Precipitation Monitoring (Hampton)

| | | |
|---|---|---|
| pH | Bromine | Iron |
| Ammonia | Manganese | Aluminum |
| Lead | Calcium | Molybdenum |
| Magnesium | Nickel | Manganese |
| Zinc | Sodium | Vanadium |
| Potassium | Zinc | |

Short-Term Milestones

- Make available any pertinent monitoring data to all involved agencies; to better focus our monitoring efforts on those toxic substances that are known to be present in the Bay and the ambient air.

- o Promote better intra-state agency cooperation and better inter-state communication in order to provide a more efficient implementation of the bay clean-up plan.

- o Provide high level support from all parties to the Agreement for a national research effort on atmospheric deposition in the Chesapeake Bay.

Long-Term Milestones

- o Continue to build toxic emissions inventories. When sufficient emissions information exists, it will be possible to generate multi-media dispersion models which predict expected concentrations of pollutants and their impact on the environment of the Bay.

- o Take full advantage of innovative technologies which may become available in the long-term. Such technologies might include satellite measurement of pollutant concentrations or improvements to the minimum detectable levels of analysis equipment.

- o Perform long-term, basic research into the mechanisms for pollutant transference between air and water.

- o Create and maintain permanent monitoring stations to measure the long term trends in toxic pollutant concentrations. Analysis of these trends will help to measure the effectiveness of our efforts to reduce toxic pollution.

- o Promote basic research into the health effects of toxic pollution on the plant and animal populations of the Bay system.

4. Solid and Hazardous Waste

The Virginia Department of Waste Management is responsible for the regulation of solid, hazardous, and radioactive waste, emergency planning for hazardous materials (SARA Title III), and hazardous materials transportation activities to protect public health and the environment.

Most of the Department's activities are focused on the management of solid and hazardous wastes in Virginia. "Solid waste" consists of garbage, refuse, sludge, discarded appliances, and debris, throw-aways, or disposed material, from commercial, mining, agricultural, or community activities. "Solid waste" does not include waste water discharges, however. In Virginia, the Department regulates solid waste management facilities, including:

173 sanitary landfills (municipal waste)

72 inert material landfills (ash, block, brick, etc.) and debris landfills (construction and land clearing)

52 industrial waste landfills (on-site, no-hazardous waste)

15 incinerators and resource recovery units (solid waste converted to energy)

16 transfer stations (solid waste storage and transfer in a regional system).

The 15-20,000 tons-per-day of solid waste that are generated across Virginia demand that the Commonwealth plan how to manage the problems of increasing flow of material, rising costs, and the siting problem affecting groundwater contamination, public health, and community well-being.

Hazardous waste presents a planning challenge for Virginia, as well. "Hazardous waste" is a term which describes either one of the listed 400 chemicals to be thrown away or a material which has ignitable, reactive, corrosive, or toxic properties. In Virginia, we regulate:

81 Treatment, Storage, Disposal Facilities (including land-based facilities)

581 Generators

1,374 Small-quantity generators

319 Transporters (both in-state, and out-of-state).

Commercial and industrial facilities which generate, store, treat, dispose of, or transport hazardous waste in Virginia are subject to the federal Resource Conservation and Recovery Act (RCRA). Virginia has adopted the Virginia Hazardous Waste Management Regulations, which regulate hazardous waste, "cradle- to-grave". Although it is difficult to set a precise figure on how much hazardous waste is produced in Virginia --- because much of this waste is characterized in so many different ways --- most of the estimated 30 million tons of wastes is in the category of spent solvents and acids or bases, and most are treated on-site, by recycling and reuse, burning and recovering their fuel value, or by neutralizing them.

Both solid and hazardous waste management represent significant planning, regulatory and enforcement challenges to Virginia. Foremost among these challenges is the need to move towards a waste reduction approach.

There are four concentrated areas of activity which represent a potential toxic threat to public health and the environment, and which lie within the jurisdiction of waste management program activities. Threats exist as a result of (1) the use of chemicals in the production process, (2) the subsequent generation, treatment, storage and disposal of hazardous wastes from such operations, (3) the transportation of hazardous materials, both product and wastes, and (4) the management of solid (non-hazardous) wastes which include household hazardous and industrial wastes.

Within this group, the most significant area of concern is related to the storage and final disposal of wastes generated. Wastes disposed of in landfills represents a potential long term liability and requires the greatest degree of attention. The Department administers eight major program components which directly support a basinwide toxics reduction strategy:

Hazardous Waste Minimization Program

State Waste Capacity Assurance Program

State Solid Waste Management Regulations

RCRA Hazardous Waste Management Regulations

State Site Certification for Hazardous Waste Management Facilities

Federal "Superfund" and State Site Clean-up Program

Virginia Emergency Response Council (SARA Title III)

Litter Control and Recycling

## Department Programs

### Hazardous Waste Minimization

The Department has initiated a new waste minimization program which is designed to assist Virginia industry and local governments to implement strategies which will result in the reduction of the amount of hazardous wastes generated. Technical assistance program activities will include information exchange, non-toxic product substitution recommendations and production process evaluation.

Milestones:

1. Target two chemical processes for technical assistance and develop information exchange system by July 1989.

2. Establish operating program with statewide reduction target by July 1990.

3. Host a waste minimization conference which addresses cross-media impacts by December 1989.

4. Initiate a waste minimization workshop series by November 1989.

5. Develop a method for evaluating and quantifying the economic and environmental consequence of implementing waste reduction programs, including cross-media impacts by July, 1990.

6. Establish, by October 1989, an Award Program to recognize industry, governmental, and community leaders in solic and hazardous waste minimization.

7. Begin offering a program of in-plant waste audits by July 1989.

8. By July 1989, develop a technical assistance program and information clearinghouse for local governments interested in instituting household hazardous waste collection days.

Hazardous Waste Capacity Assurance

The Department is developing the Commonwealth of Virginia's Hazardous Waste Capacity Assurance Program to assure capacity for all hazardous wastes generated for the next twenty year period. This assurance will assist in the identification of additional strategies for Virginia to provide facilities for activities to manage waste generated.

Milestones:

1. The Department will meet the SARA 104(k) capacity assurance certification by October, 1989.

2. Comply with assurance requirements by July 1992.

Solid Waste Management

Permitting and regulation of solid waste disposal activities.

Solid waste consists of garbage, refuse, sludge and other discarded material resulting from industrial, commercial, mining, agricultural and community services.

During its 1988 session the Virginia General Assembly approved a resolution supporting a goal of achieving 25% recycling by 1995.

Milestones:

1. Promulgate new regulations by February, 1989 to improve site location, engineering, design, construction and operation of waste management facilities.

2. Implement upgraded enforcement program by July 1990.

Hazardous Waste Management

Permitting and regulation of hazardous waste treatment, storage and disposal facilities and hazardous waste transportation. Hazardous wastes are designated or listed wastes, or characteristic wastes that may cause substantial present or potential hazard to public health or to the environment when improperly managed.

Milestone:

1. Inspect 50 regulated facilities in Basin target area by October 1989.

Site Certification of Off-Site Hazardous Waste Management Facilities.

Regulation of the siting of new or expanded hazardous waste management facilities. Site certification is required in addition to permits for the design and operation of hazardous waste management facilities. Site certification evaluates off-site environmental impacts.

Milestone:

1. By December 1989, reassess siting criteria and proposed regulations for promulgation.

Federal Superfund and State Site Clean-up Programs

Provides state participation in clean-up efforts for existing or abandoned sites where serious threats to health or environment arise because of past disposal practices or continued releases from non-permitted facilities.

Milestone:

1. Establish a program schedule for State Clean-up efforts by July 1989.

SARA Title III - Emergency Planning and Community Right-to-Know

Implements a state program in accordance with the federal "Emergency Planning and Community Right-to-Know Act of 1986" to prepare the Commonwealth and its local governments for emergencies involving extremely hazardous substances. Assures the development of local hazardous chemical emergency response plans and information management systems to handle community right-to-know requests. Coordinates program implementation with the Department of Emergency Services.

Milestones:

1. Review all emergency plans submitted by local emergency planning committees under SARA Title III by December 1988.

2. Begin data entry of hazardous chemical information submitted by regulated facilities under SARA Title III by January 1989.

Litter Control and Recycling

Promotes litter control and recycling programs as major components of comprehensive waste management plans. Litter control programs prevent the improper disposal of litter which poses threats to public health and the environment. Recycling programs advance beneficial uses of wastes and prevent or delay disposal of such wastes.

Milestone:

1. Implement initial recycling program activities, including household hazardous waste management recommendations, by July 1989.

Waste Management Planning

Development of policies, programs and initiatives to address major waste management issues in the Commonwealth. Promotes citizen participation in development of plans and regulatory programs and inform public of developing trends and activities in waste management.

Milestone:

1. Staff will develop draft solid and hazardous waste management plans by September 1989 including citizen education.

2. By September 1989, review regional plans submitted by Planning District Commissions receiving planning grants in 1988, incorporate the regional plans into the draft state solid and hazardous waste management plans, and develop recommendations on improving regional cooperation on integrated waste management implementation.

## D. CONTAMINATED SEDIMENTS

Results from studies of the Elizabeth River, James River, and Chesapeake Bay show areas of highly contaminated sediments. A description including history, purposes, accomplishments, and future direction of these studies are described below.

### JAMES RIVER

#### History

During the years of 1966-75, the production of kepone or chlorodecone, a persistent organochlorine insecticide similar to mirex resulted in the release of approximately 90,720 kg of the toxic compound to the environment through atmospheric emissions, wastewater discharges, and bulk-disposal of off-specification batches. Estimates indicate there were 9,070 to 18,140 kg of kepone deposited in the top 30 cm of the James River bed sediments. In late 1975, the James River and its tidal tributaries were closed to commercial fishing except for the taking of shad, herring, catfish, and the harvesting of bluecrab. This closure was followed by a ban on taking sport fish by order of Governor Mills E. Godwin, Jr., which was lifted in 1980. In 1981, the commercial fishing ban was lifted for all shellfish species and all fish species except striped bass and undepurated eel. In 1982, the commercial fishing ban was further modified. Croaker were banned year round and spot, bluefish, and gray trout were banned the last six months of each year.

#### Purpose

In December 1975, the Virginia Kepone Task Force was established to develop a comprehensive kepone monitoring program with responsibilities divided among the State Water Control Board (SWCB), State Department of Health (SDH), and the Virginia Institute of Marine Science (VIMS). In 1976, the State Water Control Board initiated a monitoring program designed to assess the magnitude of kepone contamination by focusing on contamination of surface water, bed sediments, finfish, and groundwater.

Data generated from the sediment monitoring program have been a valuable input into several aspects of the kepone contamination problem. Collection of kepone sediment data allows for an evaluation by state and federal agencies of the feasibility of removing or stabilizing kepone contaminated sediments. In addition, these data aid in federal/state 401 permit evaluations of dredging and disposal activities in the James River. Finally, the sediment data provides annual comparisons of kepone bed sediment to detect unexpected movements. The attached graphs illustrate significant decline in the average kepone concentrations from the year 1977 to 1987 at all sediment depths.

Accomplishments and Future Direction

Due to the natural sedimentation processes in the river the concentrations of kepone in fish tissue have steadily declined to a level below the FDA action level of 0.3 ppm. Therefore, the commercial fishing ban was allowed to expire in June 1988. Several thousand pounds of kepone remain in James river sediments, acting as a reservoir for potential contamination of aquatic life in the future. Therefore, intensive monitoring efforts will continue in order to ensure that tissue concentrations are below the designated action level.

## ELIZABETH RIVER

### History

Scientists have been aware for years that sediments in the Elizabeth River are enriched with heavy metals. Recent studies conducted by VIMS and ODU have also revealed the presence of elevated levels of polynuclear aromatic hydrocarbons (PNAs or PAHs) in the Elizabeth River sediments. Petroleum spills, urban runoff, sewage effluents, industrial processes, and combustion of fossil fuels are the major sources of PNA's entering aquatic systems. The toxicities of the majority of PNA's are unknown. However, many of the PNA's are reported to be carcinogenic, mutagenic, and teratogenic to mammals. Over 300 different organic compounds have been identified in the Elizabeth River sediments.

In 1981, VIMS collected sediment samples at 27 stations in the Elizabeth River system which were analyzed for organics. Highest concentrations in surface sediments, up to 100 ppm dry weight, were found in the highly industrialized southern branch. PNA's were the dominant group of compounds identified in the aromatic fraction. Sediment toxicity tests conducted by ODU indicates significant lethal effects to aquatic organisms exposed to PNA contaminated bed sediment from sites in the southern branch.

A number of studies have documented water quality problems in the Elizabeth River associated with contaminated sediments due to creosote, heavy metals, and dispersal of PNA's, which led to development of a comprehensive water quality management plan for the Elizabeth River by the Hampton Roads Water Quality Agency and the State Water Control Board. Through the efforts of this planning program, the Norfolk Harbor Dredging Project was identified as a significant issue for concern.

The Norfolk Harbor 40 foot channel dredging project includes maintenance dredging over a ten year period. The channel begins in the Elizabeth River at Lamberts Point and extends up river to the Norfolk and Western Railway Bridge near Paradise Creek. The authorized dimensions are 40 feet in depth, 375 to 750 feet in width, over a length of six miles. Routine maintenance involves periodically removing up to 250,000 cubic yards of predominantly clay and silt from various shoals in the channel until December 31, 1995. Initial disposal will be by direct pumpout to Craney Island Disposal Area. Subsequent disposal will be the same or through use of the Craney Island Rehandling Basin. As part of the 401 Certification Requirements issued to the U.S. Army Corps of Engineers, special conditions controlling dredging activities are part of the compliance. These Special Conditions prohibit double-handling of dredged material in the State waters and require that barges which are to be used to transport dredged material to Craney Island Rehandling can be filled to a point that no overflow occurs.

The Craney Island Rehandling Basin serves as an interim discharge facility for materials scheduled for the Craney Island Disposal area. Located on the western marginal flank of the Norfolk Reach of the Elizabeth River, the Rehandling Basin comprises an area of about 35 acres and when empty, a depth of 40 feet. Access channels of 18 ft. depth are incised in the river margin platform of about 10 ft. depths.

The SWCB has approved the proposed reinforcement of the existing perimeter dikes around Craney Island Disposal area in Hampton Roads Harbor at Portsmouth, Virginia. The proposed plan of dike stabilization makes it possible to raise the perimeter dikes to an elevation of 30 to 32 feet in four to eight years. This project requires hydraulic placement of 3-5 million cubic yards of dredged fill material around the perimeter of Craney Island. The fill material will be placed about 10 feet deep adjacent to the dike and will extend outwards into the waterway for approximately 1,000 feet tapering on a grade of about 1:100 and encompassing an area of about 675 acres of the sub-aqueous bottom. Completion of this project is expected to extend the useful life of Craney Island as a disposal area for dredged materials in Hampton Roads for approximately 34 years.

## Purpose

In order to continue the useful life of the Craney Island Disposal area, projects designed to increase capacity of the facility are necessary. A study conducted by the Virginia Institute of Marine Science (VIMS) on the physical and chemical properties of the Craney Island Rehandling Basin indicate that the basin is acting as an effective sediment trap under most conditions. Background measurements of sediment sorbed PAH concentrations indicated levels less than 10 ppm, and for the dissolved phase ranging between 3.4 and 29 ppb. Suspended solids background concentrations on February 1984 averaged 13.2 ppm. Plume monitoring results indicate that within two hours after discharge, the suspended solids concentration had approached background levels. Further investigations are needed to evaluate worst case conditions.

In order to determine the potential ecological impacts of dredging contaminated sediments from the Elizabeth river, the SWCB performed two acute sediment toxicity tests in 1984. An infaunal amphipod, Rheopoxynuis Abronius was used as the test organism for the 10 day static bioassay. Complete mortality occurred in sediments located in heavily industrialized portions of the southern branch. Immediately adjacent to the discharge from an active creosote operation a definite mortality gradient was shown by percent mortality increases moving down the southern branch and decreases toward the upper reaches of the river. Results indicated higher toxicity at bank sites closer to the source of contamination.

## Accomplishments and Future Action

Results obtained through sediment analyses and sediment toxicity tests have enabled the agency to identify point sources of pollution and thus establish and investigate control measures. (Refer to the description of the Elizabeth River Initiative in part B of this Appendix) As part of the Elizabeth River Initiative, sediment "hot spots" will be identified and sediment criteria will be developed.

## Chesapeake Bay

## History

In the late 1970s, the first comprehensive monitoring program for toxic organic chemicals was undertaken in the mainstem of the Chesapeake Bay. Funding from Virginia and the Chesapeake Bay Program allowed scientists to develop and use chemical analytical methodologies to quantify and track hundreds of organic compounds in the Bay sediments. The first set of samples was taken in the spring of 1979. The second set was taken in the fall of the same year. More samples were obtained in 1984 and 1985 with assistance from the Chesapeake Bay Program.

Hundreds of compounds were detected and most were found in the aromatic fraction. The most abundant toxic compounds found were polynuclear aromatic hydrocarbons. The spatial distribution reflects both particle size distribution in the sediments and input from rivers. Coarse-grained sediments found near the mouth of the Bay contained low, polynuclear aromatic hydrocarbon levels. There are too few stations for an area the size of the lower Bay to draw conclusions from comparison of 1979 and 1984-85 sampling results, although the 1984-85 samples show increases in overall toxics concentrations when compared to 1979 samples.

More than 60% of the total input into the Bay of iron, manganese, nickel, lead, and zinc is held in the bed sediments. There is a direct correlation between the ability of sediment to bind and store chemicals to the size of sediment particles since fine grained sediments have a relatively higher surface area per unit mass than coarse grained ones. Fine grained sands have higher concentrations of metals.

Results from tributary monitoring in the Bay conducted by VIMS in 1986 showed a variety of polycyclic aromatic hydrocarbons. There were few polar compounds detected in the tributaries. The aromatic hydrocarbon content was found to decrease from up river to down river supporting the theory that Chesapeake Bay tributaries carry and transport small amounts of sediment to the mouths from up river.

## Accomplishments and Future Action

The existing mainstem monitoring program in the Chesapeake Bay will be expanded to include more stations as well as additional parameters in order to assess the impact of toxics in the Chesapeake Bay.

# COMMONWEALTH OF VIRGINIA

# POINT SOURCE DISCHARGES

# WITH TOXIC MONITORING PROGRAMS

| NPDES# | FACILITY | CLASS | RCVSTRM | RVRBSN |
|---|---|---|---|---|
| VA0077879 | GLOUCESTER LUMBER PRODUCTS | INDMIN | XTRIB FOXES CR | CHES/ATL |
| VA0004049 | HOLLY FARMS TEMPERANCEVILLE | INDMIN | SANDY BOTTOM BR | CHES/ATL |
| VA0025275 | HRSD CHES-ELIZ | MUNIMAJ | CHESAPEAKE BAY | CHES/ATL |
| VA0024741 | NASA LANGLEY RESEARCH CENTER | FEDMIN | TABBS CR | CHES/ATL |
| VA0057541 | UNION CARBIDE LINDE | INDMIN | WYTHE CR | CHES/ATL |
| VA0079359 | VEPCO CHISMAN CREEK | INDMIN | CHISMAN CR | CHES/ATL |
| VA0005312 | ALLIED CHEMICAL CHESTERFIELD | INDMAJ | JAMES R | JAMES |
| VA0005291 | ALLIED CHEMICAL HOPEWELL | INDMAJ | JAMES R | JAMES |
| VA0058254 | ALLIED COLLOIDS INC | INDMIN | NANSEMOND R | JAMES |
| VA0005282 | ALLIED CORP. BENDIX ELECTRONIC | INDMIN | LUKAS CR | JAMES |
| VA0005304 | ALLIED TECHNICAL CENTER | INDMIN | X-TRIB SWIFT CR | JAMES |
| VA0002780 | AMERICAN TOBACCO HANMER DIV | INDMAJ | JAMES R | JAMES |
| VA0003492 | AQUALON COMPANY | INDMIN | CATTAIL CR | JAMES |
| VA0004189 | ATLANTIC WOOD INDUSTRIES | INDMAJ | SO.BR.ELIZ.R | JAMES |
| VA0004774 | BABCOCK & WILCOX COMML NUC | INDMIN | JAMES R | JAMES |
| VA0003697 | BABCOCK & WILCOX NAVY NUC | INDMAJ | JAMES R | JAMES |
| VA0003654 | BASF CORP FIBERS DIV | INDMAJ | WOOD CR | JAMES |
| VA0058122 | BLUE BIRD EAST | INDMIN | MAURY R | JAMES |
| VA0020991 | BUENA VISTA POTW | MUNIMAJ | MAURY R | JAMES |
| VA0004677 | BURLINGTON GLASGOW | INDMAJ | MAURY R | JAMES |
| VA0025488 | CAMELOT POTW RIVANNA WSA | MUNIMIN | N FK RIVANNA R | JAMES |
| VA0002798 | CHASE BAG CO | INDMIN | JAMES R | JAMES |
| VA0003336 | CHEVRON CHESAPEAKE TERMINAL | INDMIN | SO.BR.ELIZ.R | JAMES |
| VA0074781 | COGENTRIX PORTSMOUTH | INDMIN | ELIZ. R | JAMES |
| VA0053813 | COLONNA'S SHIPYARD | INDMIN | E.BR.ELIZ.R | JAMES |
| VA0073555 | COMMONWEALTH WOOD PRESERVERS | INDMIN | SALTERS CR | JAMES |
| VA0027065 | COOPER INDUSTRIES | INDMAJ | XTRIB SF RIVANA | JAMES |
| VA0025542 | COVINGTON POTW | MUNIMAJ | JACKSON R. | JAMES |
| VA0057576 | DOMINION TERMINAL ASSOCIATES | INDMIN | JAMES R | JAMES |
| VA0004669 | DUPONT SPRUANCE | INDMAJ | JAMES R | JAMES |
| VA0024996 | FALLING CREEK POTW | MUNIMAJ | FALLING CR | JAMES |
| VA0021351 | FARMVILLE POTW | MUNIMAJ | APPOMATTOX R | JAMES |
| VA0054607 | GENERAL ELECTRIC CHARLOTTESVIL | INDMAJ | HERRING BR | JAMES |
| VA0004791 | GEORGIA BONDED FIBERS INC | INDMIN | MAURY R | JAMES |
| VA0002925 | GRIFFIN PIPE PRODUCTS | INDMIN | JAMES R | JAMES |
| VA0063690 | HENRICO REGIONAL POTW | MUNIMAJ | JAMES R | JAMES |
| VA0003450 | HERCULES COVINGTON | INDMAJ | JACKSON R | JAMES |
| VA0004031 | HOLLY FARMS GLEN ALLEN | INDMIN | XTRIB CHICK. R | JAMES |
| VA0079502 | HOPEWELL COGENERATION | INDMAJ | GRAVELLY RUN | JAMES |
| VA0066630 | HOPEWELL POTW | MUNIMAJ | GRAVELLY RUN | JAMES |

| NPDES# | FACILITY | CLASS | RCVSTRM | RVRBSN |
|---|---|---|---|---|
| VA0025208 | HRSD ARMY BASE | MUNIMAJ | ELIZ R | JAMES |
| VA0025283 | HRSD BOAT HARBOR | MUNIMAJ | JAMES R | JAMES |
| VA0025241 | HRSD JAMES RIVER | MUNIMAJ | JAMES R | JAMES |
| VA0025259 | HRSD LAMBERTS POINT | MUNIMAJ | ELIZ R | JAMES |
| VA0064459 | HRSD NANSEMOND | MUNIMAJ | JAMES R | JAMES |
| VA0025267 | HRSD WILLIAMSBURG | MUNIMAJ | JAMES R | JAMES |
| VA0003077 | ICI AMERICAS | INDMAJ | JAMES R | JAMES |
| VA0073300 | JAMES RIVER COGENERATION CO | INDMIN | GRAVELLY RUN | JAMES |
| VA0020567 | LEXINGTON POTW | MUNIMAJ | MAURY R | JAMES |
| VA0002984 | LYDALL | INDMIN | JACKSON R | JAMES |
| VA0006262 | LYNCHBURG FOUNDRY ARCHER CR | INDMIN | JAMES R | JAMES |
| VA0003310 | LYNCHBURG FOUNDRY LYNCHBURG | INDMIN | JAMES R | JAMES |
| VA0024970 | LYNCHBURG POTW | MUNIMAJ | JAMES R | JAMES |
| VA0051268 | MARPOL INC | INDMIN | ELIZ R | JAMES |
| VA0073091 | METRO MACHINE CORP | INDMIN | ELIZ R | JAMES |
| VA0002771 | MODINE MANUFACTURING CO | INDMAJ | INDIAN GAP RUN | JAMES |
| VA0025518 | MOORES CR. POTW RIVANNA WSA | MUNIMAJ | MOORES CR | JAMES |
| VA0050962 | NAROX INC | INDMIN | SHAND CR | JAMES |
| VA0004804 | NEWPORT NEWS SHIPBUILDING | INDMAJ | JAMES R | JAMES |
| VA0005215 | NORFOLK NAVAL SHIPYARD | FEDMAJ | ELIZ R | JAMES |
| VA0004383 | NORSHIPCO BERKELY | INDMIN | ELIZ R | JAMES |
| VA0004405 | NORSHIPCO BRAMBLETON | INDMIN | ELIZ R | JAMES |
| VA0003026 | OWENS ILLINOIS | INDMAJ | JAMES R | JAMES |
| VA0000000 | PANTASOTE | INDMIN | JACKSON R | JAMES |
| VA0025437 | PETERSBURG POTW | MUNIMAJ | APPOMATTOX R | JAMES |
| VA0026557 | PHILIP MORRIS PARK 500 | INDMAJ | JAMES R | JAMES |
| VA0057142 | PIER IX TERMINAL CO (MASSEY) | INDMIN | JAMES R | JAMES |
| VA0025003 | PORTSMOUTH PINNERS PT POTW | MUNIMAJ | ELIZ R | JAMES |
| VA0060194 | PROCTORS CR POTW | MUNIMAJ | JAMES R | JAMES |
| VA0003034 | REEVES BROTHERS | INDMIN | INDIAN GAP RUN | JAMES |
| VA0002861 | REYNOLDS METALS BELLWOOD | INDMIN | PROCTORS CR | JAMES |
| VA0005525 | REYNOLDS METALS CORP OFFICE | INDMIN | HORSEPEN BR | JAMES |
| VA0063177 | RICHMOND POTW | MUNIMAJ | JAMES R | JAMES |
| VA0059005 | SMITHFIELD FOODS INC | INDMAJ | PAGAN R | JAMES |
| VA0003468 | SOLITE CORP NEW CANTON | INDMIN | JAMES R | JAMES |
| VA0053902 | ST. JOE PAPER CO | INDMIN | XTRIB ELIZ R | JAMES |
| VA0025216 | U.S. ARMY FT. EUSTIS | FEDMAJ | SKIFFES CR | JAMES |
| VA0004421 | U.S. NAVY SEWELLS PT COMPLEX | FEDMAJ | JAMES R | JAMES |
| VA0005487 | U.S.NAVY CRANEY ISLAND FUEL DP | FEDMAJ | ELIZ R | JAMES |
| VA0004138 | VEPCO BREMO BLUFF | INDMAJ | JAMES R | JAMES |
| VA0004081 | VEPCO CHESAPEAKE ENERGY CENTER | INDMAJ | ELIZ R | JAMES |
| VA0004146 | VEPCO CHESTERFIELD | INDMAJ | JAMES R | JAMES |
| VA0004090 | VEPCO SURRY | INDMAJ | JAMES R | JAMES |
| VA0003387 | VIRGINIA CHEMICALS INC | INDMAJ | ELIZ R | JAMES |
| VA0006408 | VIRGINIA FIBRE CORP | INDMAJ | JAMES R | JAMES |
| VA0003646 | WESTVACO | INDMAJ | JACKSON R | JAMES |
| VA0076384 | ABEX CORP | INDMIN | ABRAMS CR | POTOMAC. |
| VA0025160 | ALEXANDRIA POTW | MUNIMAJ | HUNTING CR | POTOMAC |

| NPDES# | FACILITY | CLASS | RCVSTRM | RVRBSN |
|---|---|---|---|---|
| VA0025143 | ARLINGTON POTW | MUNIMAJ | FOUR MILE RUN | POTOMAC |
| VA0002208 | AVTEX FIBERS INC FRONT ROYAL | INDMAJ | SO.FK.SHEN.R | POTOMAC |
| VA0073245 | COORS, ADOLPH CO | INDMIN | SF SHENANDOAH R | POTOMAC |
| VA0002160 | DUPONT WAYNESBORO | INDMAJ | SOUTH R | POTOMAC |
| VA0002402 | GENICOM CORP | INDMAJ | SOUTH R | POTOMAC |
| VA0060640 | HARRSBURG-ROCKINGHAM REG POTW | MUNIMAJ | NORTH RIVER | POTOMAC |
| VA0054453 | HOLLY FARMS NEW MARKET | INDMIN | SMITH CR | POTOMAC |
| VA0058726 | HOWELL METAL CO | INDMIN | NF SHENANDOAH R | POTOMAC |
| VA0025372 | LITTLE HUNTING CREEK POTW | MUNIMAJ | L.HUNTING CR | POTOMAC |
| VA0025364 | LOWER POTOMAC POTW | MUNIMAJ | POHICK CR | POTOMAC |
| VA0002178 | MERCK & CO | INDMAJ | SF SHENANDOAH R | POTOMAC |
| VA0076104 | MG INDUSTRIES | INDMIN | JONES HOLLOW | POTOMAC |
| VA0074951 | MONOFILAMENTS INC | INDMIN | XTRIB SOUTH R | POTOMAC |
| VA0025101 | MOONEY POTW PR WM COUNTY | MUNIMAJ | NEABSCO CR | POTOMAC |
| VA0002534 | O'SULLIVAN CORP | INDMIN | ABRAMS CR | POTOMAC |
| VA0001767 | REYNOLDS METALS GROTTOES | INDMAJ | SOUTH R | POTOMAC |
| VA0001902 | ROCCO FARM FOODS | INDMIN | STONY CR | POTOMAC |
| VA0001791 | ROCCO FURTHER PROCESSING | INDMIN | NF SHENANDOAH R | POTOMAC |
| VA0001961 | ROCKINGHAM POULTRY ALMA | INDMIN | SF SHENANDOAH R | POTOMAC |
| VA0002011 | ROCKINGHAM POULTRY BROADWAY | INDMIN | NF SHENANDOAH R | POTOMAC |
| VA0002437 | SNYDER GENERAL CORP | INDMIN | XTRIB MIDDLE R | POTOMAC |
| VA0064793 | STAUNTON POTW | MUNIMAJ | MIDDLE R | POTOMAC |
| VA0024988 | UOSA POTW | MUNIMAJ | XTRIB BULL RUN | POTOMAC |
| VA0002071 | VEPCO POSSUM POINT | INDMAJ | QUANTICO CR | POTOMAC |
| VA0002313 | WAMPLER LONGACRE INC | INDMIN | WAR BRANCH | POTOMAC |
| VA0025151 | WAYNESBORO POTW | MUNIMAJ | SOUTH R | POTOMAC |
| VA0001856 | WAYNTEX | INDMAJ | SOUTH R | POTOMAC |
| VA0074480 | WINARICK A.R. INC | INDMIN | SCATES BR | POTOMAC |
| VA0001864 | AILEEN INC. | INDMAJ | HICKMAN RUN | RAPP |
| VA0076538 | CHESAPEAKE CORP WOOD TREATERS | INDMAJ | RUFFINS POND | RAPP |
| VA0005398 | CLARKE L.A. & SON | INDMAJ | MASSAPONAX CR | RAPP |
| VA0059145 | CULPEPER WOOD PRESERVERS | INDMIN | XTRIB JONAS RUN | RAPP |
| VA0068110 | FMC POTW SPOTSYLVANIA CO | MUNIMAJ | RAPPAHANNOCK R | RAPP |
| VA0076392 | LITTLE FALLS RUN POTW | MUNIMAJ | RAPPAHANNOCK R | RAPP |
| VA0025658 | MASSAPONAX REGIONAL POTW | MUNIMAJ | RAPPAHANNOCK R | RAPP |
| VA0003018 | AMOCO YORKTOWN | INDMAJ | YORK R | YORK |
| VA0003115 | CHESAPEAKE CORP | INDMAJ | PAMUNKEY R | YORK |
| VA0029521 | DOSWELL POTW | MUNIMAJ | NORTH ANNA R | YORK |
| VA0021105 | GORDONSVILLE POTW | MUNIMIN | SO ANNA R | YORK |
| VA0064238 | HRSD YORK RIVER | MUNIMAJ | YORK R | YORK |
| VA0057011 | RIDGID KOLLMAN | INDMAJ | POORHOUSE RUN | YORK |
| VA0052451 | VEPCO NORTH ANNA | INDMAJ | LAKE ANNA | YORK |
| VA0004103 | VEPCO YORKTOWN | INDMAJ | YORK R | YORK |

COMMONWEALTH OF VIRGINIA - PRETREATMENT PROGRAMS

| Name of Facility | Design MGD | Treatment Type | River Basin | PTP Approval | VWCB Audit of Program | VPDES Permit Condition | Total SIUs VWCB Inspe- |
|---|---|---|---|---|---|---|---|
| Alexandria | 54 | (RBC),(N),(AWT),(AND),(LF) | Potomac | 2/15/84 | | PTP Implemen. TMP | 5/0 |
| Arlington | 30 | (AS),(N),(AWT),(SI) | Potomac | 9/14/84 | 4/18/88 | PTP Implemen. TMP | 4/3 |
| Army Base (HRSD) | 14 | (AS),(AND),(SI) | James | 3/1/82 | 6/23/88 | PTP Implemen. TMP | 6/0 |
| Atlantic (HRSD) | 36 | (AS),(AND),(LA) | Mouth of Bay | 3/1/82 | 6/23/88 | PTP Implemen. TMP | 5/2 |
| Augusta County Service Auth. | 4.15 (Total) | 11 plants in system | Potomac | | | PTP Develop. | |
| Boat Harbor (HRSD) | 22 | (AS),(SI) | James | 3/1/82 | 6/23/88 | PTP Implemen. TMP | 7/3 |
| Camelot (Rivanna) | 0.1 | (AS),(AND),(SC) | James | 10/12/84 | 3/17/88 | PTP Implemen. | 1/0 |
| Ches.-Eliz. (HRSD) | 24 | (AS),(AND),(SI) | Bay | 3/1/82 | 6/23/88 | PTP Implemen. TMP | 6/4 |
| Culpeper | 3.0 | (AS),(AWT),(AND),(LA) | Rappahan. | 5/24/85 | 3/17/88 | PTP Develop. TMP | 3/2 |
| Falling Creek (Chesterfield) | 9.0 | (AS),(AND),(LA) | James | 3/12/84 | 1/13/88 | PTP Implemen. TMP | 0/0 |
| FMC (Spotsylvania) | 4.0 | (AS),(N),(AD),(LA) | Rappahan. | | | PTP Develop. TMP | |
| Gordonsville (Rapidan SA) | 0.67 | (AL),(AWT),(LF) | York | 10/31/85 | 3/15/88 | PTP Implemen. TMP | 1/1 |
| Harrisonburg-Rockingham | 8.0 | (AS),(AND),(LA) | Potomac | 10/31/85 | 3/15/88 | PTP Implemen. TMP | 8/6 |
| Henrico Regional | 30 | (AS),(LA) | James | | | PTP Develop. TMP | 6/1 |
| Hopewell | 50 | (AS),(SI) | James | 1/11/84 | 1/14/88 | PTP Implemen. TMP | 5/0 |
| James River (HRSD) | 20 | (AS),(AND),(SC) | James | 3/1/82 | 6/23/88 | PTP Implemen. TMP | 5/0 |
| Lamberts Point (HRSD) | 35 | (PR),(AND),(SI) | James | 3/1/82 | 6/23/88 | PTP Implemen. TMP | 15/4 |
| Little Hunting Creek (Fairfax) | 6.6 | (TF),(N),(SI) | Potomac | 4/11/85 | | PTP Implemen. TMP | 0/0 |
| Lower Potomac (Fairfax) | 54 | (AS),(N),(AWT),(SI) | Potomac | 4/11/85 | | PTP Implemen. TMP | 19/0 |
| Lynchburg | 22 | (AS),(LF) | James | 11/8/84 | 3/23/88 | PTP Implemen. TMP | 19/2 |
| Massaponax (Spotsylvania) | 1.47 | (AS),(LA) | Rappahan. | | | PTP Develop. TMP | |
| Moore's Creek (Rivanna) | 15 | (AS),(N),(AND),(SC) | James | 10/12/84 | 3/17/88 | PTP Implemen. TMP | 9/5 |
| Nansemond (HRSD) | 10 | (AS),(AND),(SI) or (LA) | James | 3/1/82 | 6/23/88 | PTP Implemen. TMP | 4/0 |
| Opequon (Fred.-Winchester) | 5.0 | (AS),(N),(LF) | Potomac | | | PTP Develop. TMP | |
| Petersburg | 15 | (AS),(LF) | James | 5/1/84 | 1/14/88 | PTP Implemen. TMP | 10/0 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pinners Point (HRSD) | 15 | (PR),(AND),(LF) | James | 8/8/84 | 6/23/88 | PTP Implemen. TMP | 5/0 |
| Proctor's Crk. (Chesterfield) | 14 | (AS),(AND),(LA) | James | 3/12/84 | 1/13/88 | PTP Implemen. TMP | 3/1 |
| Richmond | 70 | (AS),(AND),(LA) | James | 11/8/84 | 5/3/88 | PTP Implemen. TMP | 24/0 |
| Stephens Run (Fred.- Winch.) | 0.25 | (AL),(LF) | Potomac | | | PTP Develop. | |
| Upper Occoquan | 10.9 | (AS),(N),(AWT),(AND),(SC) | Potomac | 5/1/86 | 2/5/88 | PTP Implemen. TMP | 2/0 |
| Waynesboro | 4.0 | (TF),(AND),(LF) | Potomac | 11/9/83 | 3/16/88 | PTP Implemen. TMP | 6/4 |
| Williamsburg (HRSD) | 9.6 | (AS),(SI) | James | 3/1/82 | 6/23/88 | PTP Implemen. TMP | 4/0 |
| York River (HRSD) | 15 | (AS),(AND),(SC) | York | 3/1/82 | 6/23/88 | PTP Implemen. TMP | 4/0 |

Key:

AD: Aerobic Digestion

AL: Aerated Lagoon

AND: Anaerobic Digestion

AS: Activated Sludge

AWT: Advanced Wastewater Treatment

LA: Land Application of sludge

LF: Landfilling of sludge

N: Nitrification

PR: Primary only

PTP: Pretreatment Program

RBC: Rotating Biological Contactors

SC: Sludge Composting

SI: Sludge Incineration

SIU: Significant Industrial User

TF: Trickling Filter

TMP: Toxics Monitoring Program

## Results of Chemical Fingerprinting Program

Association between anthropogenic compounds detected in 42 point source discharges to the Chesapeake Bay and its tributaries with sediment and biota collected near the outfalls. A total of 70 point sources where sampled during 1985-1988.

| Geographical Area | Compounds Detected in Effluent (42)[a] | Effluent Associated Compounds Detected Sediment(32) | Biota(10) |
|---|---|---|---|
| Elizabeth River | 13 (31%)[b] | 10 (31%) | 4 (40%) |
| Upper James | 7 (17%) | 8 (25%) | 2 (20%) |
| Lower James | 7 (17%) | 3 (9%) | 1 (10%) |
| Potomac | 6 (14%) | 4 (13%) | 1 (10%) |
| York | 4 (10%) | 2 (6%) | 1 (10%) |
| Chesapeake Bay | 3 (7%) | 3 (9%) | 1 (10%) |
| Rappahannock | 2 (4%) | 2 (6%) | ------- |

[a] Total number of samples
[b] Percentage of the total number

## Results of On-Site Toxicity Studies

Summary of results of effluent testing conducted in conjunction with the mobile bioassay lab.

| Facilities Tested | Effluent Toxicity Acute | Effluent Toxicity Chronic | Instream Effects | WQ Criteria Exceedences |
|---|---|---|---|---|
| POTWs (3) | 2 | 3 | 1 | Cu |
| Process waste (4) | 2 | 4 | 2 | Cd, Cu, Pb, Zn |
| Oil/Water separators (5) | 5 | 2 | 4 | Cu, Ag, Phenols |
| Drydocks (4) | 2 | not tested | 4 | Cu, Pb, Zn |

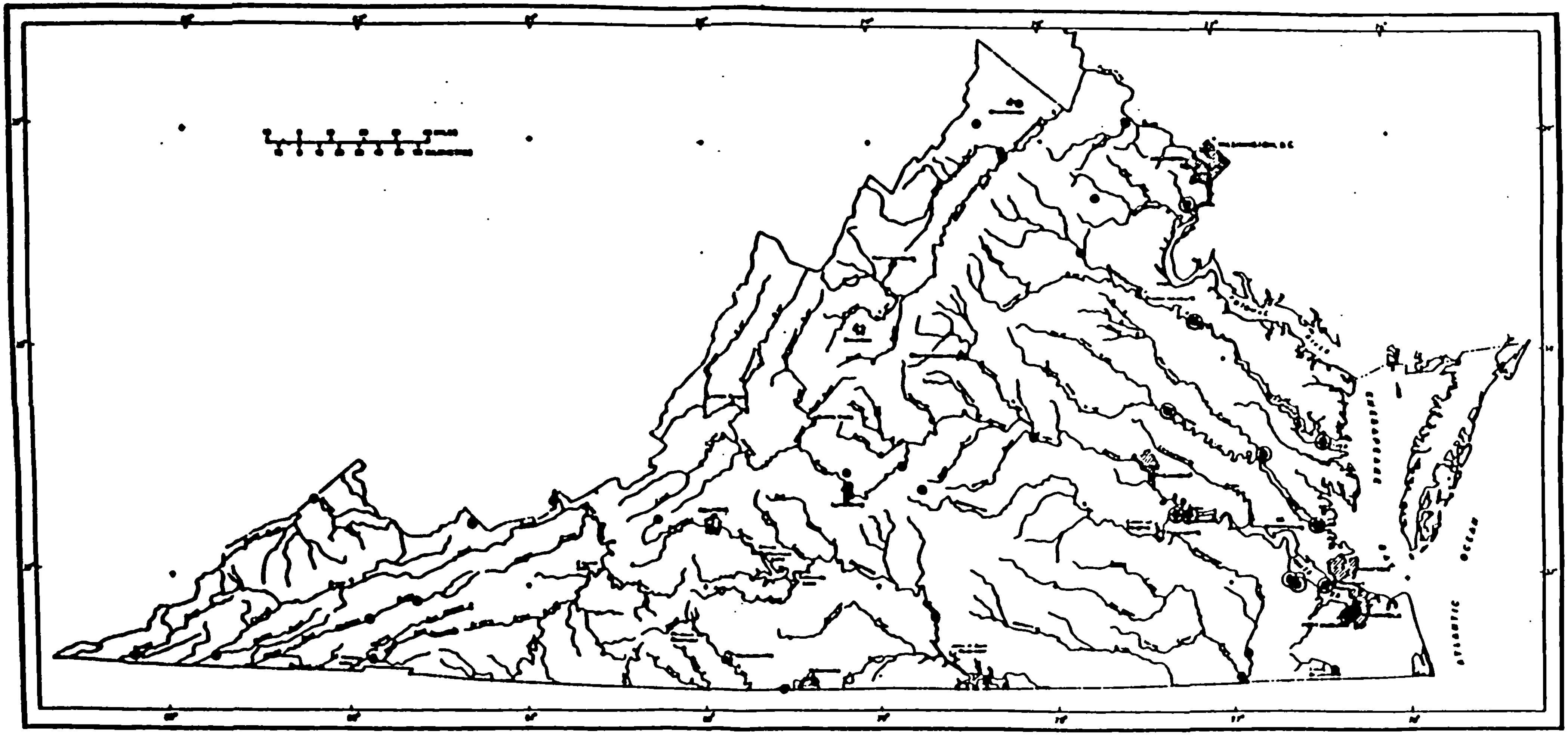

TABLE - EPA CORE FISH STATIONS IN OR EAST OF FALL ZONE

| RIVER | ROUTE (BRIDGE) | RIVER MILE |
|---|---|---|
| Little Hunting Creek | Geo. Washington Parkway | LIF000.19 |
| Rappahannock | At 301 | RPP080.19 |
| Rappahannock | at 3 | RPP008.42 |
| Pamunkey | at 614 | PMK082.34 |
| Mattaponi | at 33 | MPN001.34 |
| York | at 17 | PRK005.93 |
| Appomattox | at 10 | APP001.53 |
| James | at 156 | JMS074.44 |
| Pagan | near 677 | PGN008.42 |
| Pagan | at 10 | PGN005.46 |
| James | at 17/258 | JMS013.92 |
| E. Branch of Elizabeth | at 58/460 Alt. | EBE000.07 |
| S. Branch of Elizabeth | across from Naval Base | SBE001.53 |

# DISTRICT OF COLUMBIA

# TOXICS REDUCTION STRATEGY

**November 1988**

District of Columbia

Toxics Reduction Strategy

A. Identification of Known Toxic Problem Areas

The District of Columbia's toxics problem is unique in a number of ways. It is an entirely urban area with no agriculture. It is primarily a government and service economy with no heavy industry. And, it is located at or near the head of tide for the Potomac and Anacostia.

Consequently, toxics from agriculture do not originate in the District but may be carried down the river from upstream activities and settle with particles in the more sluggish tidal water. Yet, it may well be that nonpoint source generation of toxics on a per acre urban basis is much higher than for agricultural areas due to pesticides and heavy metals. Point source discharges of toxics in the District are predominantly from water and wastewater treatment systems. At present it is not possible to quantify the exact amount of toxics originating in the District; however, the following data give some indication of the magnitude of the problem.

Table 1

Toxics Loads

Pounds Per Year

| | |
|---|---|
| Nonpoint Source | |
| **Pesticides** | |
| Commercial application (FY 80) | 8,000,000 |
| Government application | ND |
| Individual application | ND |
| **Urban Runoff** | |
| Chromium | 665 |
| Iron | ND* |
| Zinc | 48,110 |
| Cadmium | 1,156 |
| Lead | 18,059 |
| Copper | 6,863 |
| **Combined Sewer Overflows** | |
| Chromium | ND |
| Iron | ND |
| Zinc | 3,353 |
| Cadmium | 189 |
| Lead | 6,591 |
| Copper | ND |

* ND = No Data

Point Sources

**Blue Plains Wastewater Treatment Plant**

| | |
|---|---|
| **Chlorine** (eliminated) | (474,500) |
| **Chromium** | 27,485 |
| **Iron** | 254,770 |
| **Zinc** | 57,816 |
| **Cadmium** | 190 |
| **Lead** | 15,914 |
| **Copper** | 11,388 |

**Water Treatment Plant**

| | |
|---|---|
| **Aluminum** | 2,800,000 |

Spills

| | |
|---|---|
| **Oil & Grease** | 18,750 |

The 8,000,000 pounds per year of pesticides applied by commercial companies is an estimate based upon an incomplete and inconsistent data base and is not necessarily the amount of active ingredient. How much of these materials reach a water body is also unknown. However, if the application rate was uniform it would represent 200 pounds per acre per year not even including the unknown amount applied by individual home owners and governmental agencies.

Urban runoff and combined sewer overflow (CSO) data is available only for heavy metals and the loading calculations are based upon an inadequate data set. Still, the annual load is estimated to be 85,000 pounds. This is about 2 pounds per acre per year.

Point sources contribute about 3.5 million pounds of toxics per year.

Two points that are immediately obvious are the lack of a good data base to substantiate the loading estimates and the "apples and oranges" nature of toxics such that total loading numbers are not useful.

Toxics problems in the waters of the District are generally most severe in the Anacostia River. These problems are evidenced by high concentrations of heavy metals in the sediment. The Anacostia River also suffers from anoxia and high levels of suspended solids which make it difficult to establish cause and effect relationships between the biota and toxics. The Potomac to a lesser extent also has elevated levels in the sediment which decrease downstream from the metropolitan area. Chlordane and PCB concentrations in fish are of concern and the subject of additional study. Hickey Run, a small tributary to the Anacostia has had chronic oil and grease discharges for decades. This has led to severe contamination of the bottom sediment to the extent that it continually releases oil into the water column.

## B. Point Source Programs

### 1. Water Quality Standards

In 1985, the District promulgated an extensive list of toxics standards for District Waters. These are contained in Table 2. Since that time additional information has been developed and the District will consider adopting additional toxics and more stringent standards in the next triennial review. The Habitat Requirements for Chesapeake Bay Living Resources will be used as a guide. The toxic of primary concern is aluminum for which the District has no specific standard.

**TABLE 2**

Toxics Water Quality Standards
For
Aquatic Life

**Chemicals (Maximum-mg/l)**

| | |
|---|---|
| Arsenic, total recoverable | 0.09 |
| Cadmium, total recoverable | * |
| Chlorine, total residual | 0.01 |
| Chromium hexavalent | 0.01 |
| Copper, total recoverable | * |
| Cynaide free | 0.003 |
| Iron, total | 1.0 |
| Lead, total recoverable | |
| Mercury, total recoverable | 0.00012 |
| $NH_3$, un-ionized (as N) | 0.02 |
| Phenol | 0.1 |
| Selenium, total recoverable | 0.04 |
| Zinc, total recoverable | 0.05 |

**Toxics (Maximum-ug/l)**

| | |
|---|---|
| Acenaphthene | 50.0 |
| Acrylonitrile | 700.0 |
| Antimony | 60.0 |
| Aldrin | 0.4 |
| Acrolein | 10.0 |
| Benzene | 1,000.0 |
| Benzidine | 250.0 |
| Beryllium | 150.0 |
| Carbon tetrachloride | 1 000 |
| Chlordane | 0.0043 |
| Chlorinated benzenes (except di) | 25.0 |
| Chlorinated ethanes | 50.0 |
| Chlorinated Naphthalene | 200.0 |
| Chloronated Phenols (except penta) | 3.0 |
| Chloroalkyl ethers | 1,000.0 |
| Chloroform | 3,000.0 |
| D D T & isomers | 0.001 |
| Dichlorobenzenes | 200.0 |
| Dichlorobenzidine | 10.0 |
| Dichloroethylenes | 1,000.0 |
| Dieldrin | 0.0019 |
| Dinitrotoluene | 33.0 |
| Diphenylhydrazine | 30.0 |
| Endosulfan | 0.01 |
| Endrin | 0.0023 |
| Ethylbenzene | 40.0 |

Toxics (Maximum-ug/1)
Continued

| | | | |
|---|---|---|---|
| Flouranthene | 400.0 | Polychlorinated biphenyls | 0.01 |
| Haloethers | 40.0 | Polynuclear aromatic hydrocarbons | 100.0 |
| Halomethanes | 1,000.0 | Silver (dissolved) | 1.0 |
| Heptachlor | 0.0038 | Tetrachloroethylene | 800.0 |
| Hexachlorobutadiene | 10.0 | Thallium | 100.0 |
| Hexachlorocylopentadiene | 0.5 | Toluene | 600.0 |
| Isophorone | 1,000.0 | Toxaphene | 0.01 |
| Naphthalene | 600.0 | Trichloroethylene | 1,000.0 |
| Nickel | 100.0 | 2-Chlorophenol | 100.0 |
| Nitrobenzene | 1,00.0 | 2,4-dichlorophenol | 200.0 |
| Nitrophenols | 20.0 | 2,4-dimethylphenol | 200.0 |
| Nitrosamines | 600.0 | Dichloropropane | 2000.0 |
| Pentachlorophenol | 7.0 | Dichloropropene | 400.0 |
| Pbthalate esters | 100.0 | Hexachororcyclohexane (Lindane & isomers) | 0.08 |
| Polychlorinated biphenyls | 0.01 | | |

NOTE: * denotes hardness based criteria

2. NPDES Permits

The Environmental Protection Agency issues the NPDES permits in the District; however, the District reviews each permit and, if appropriate, issues water quality certification that the standards will be achieved or maintained. Blue Plains Wastewater Treatment Plant and some other permitees now have biomonitoring requirements for toxics.

3. Pretreatment Program

The Blue Plains Wastewater Treatment Plant has implemented a pretreatment permit program regulating the discharge of toxics to the sanitary sewer system. The program has been in effect for about two years and effluent data suggests that it is reducing toxics loads to the Potomac.

4. Dechlorination

One of the Mayor's original Chesapeake Bay Initiatives was to implement dechlorination at Blue Plains WWTP. The dechlorination facility is now on line and effectively eliminates the discharge of half a million pounds per year of total residual chlorine.

C. Nonpoint Source Programs

1. Stormwater Management Program

The District has developed a regulatory program which requires BMP's be installed for all new development and redevelopment. There is also a requirement for the developer to maintain the BMP's. Because many of the toxics are associated with sediment in runoff, the program will begin to deal with part of the problem at the source. However, because the rate of development is relatively low in the District, significant improvements will not occur immediately.

2. Implementation/Demonstration Projects

Several demonstration projects are currently under development for nutrient management purposes which will result in a reduction of toxics loads from urban runoff. In 1989, three stormwater outfalls will be selected and controls will be constructed in 1990.

3. Combined Sewer Overflow

Phase I of the Combined Sewer Overflow Abatement Program when completed will result in about a 55% reduction in toxics (metals) from this source. Additionally, dechlorination will be employed at the swirl concentrator to control chlorine from the disinfection process.

D. Other Programs

Hazardous Waste Management Program

Hazardous waste is any discarded material that may be harmful to human health or the environment when improperly managed. In the District, dry cleaning establishments, print, plating, paint and body shops, and laboratories generate hazardous wastes. Household wastes, by statute, are not considered hazardous.

Hazardous waste management activities in the District are authorized by the D.C. Hazardous Waste Management Act of 1977 and its amendments, and the Federal Resource Conservation and Recovery Act. These acts regulate the generation, transportation, storage, treatment, and disposal of hazardous waste in the District. Disposal of hazardous waste is prohibited in the District; wastes are transported outside of the District for disposal.

Facilities which generate or store hazardous wastes prior to disposal are inspected for compliance with regulations. The facilities must maintain records including inspection and personnel training records, shipping manifests, and information about the composition, quantity, and location of wastes. Wastes are sampled by the District and analyzed to ensure the information recorded by the facilities about the composition of the waste is correct. In case of a spill, information collected from the samplings is used to facilitate clean-up operations. Clean-ups are coordinated through the Mayor's Command Center.

Facilities which generate or store hazardous wastes in the District must obtain an operating permit. The facilities are inspected for compliance with District regulations for employee training, accident response plans, and storage methods.

Underground storage tanks will contaminate ground water if their contents leak or spill. Because leaks and spills may occur, the District has established an underground storage tank (UST) program. The program requires that all non-residential USTs containing gasoline or hazardous materials be registered. This notifies the District government about the location, contents, and condition of storage tanks. The plan also requires any newly installed tanks to be non-corrosive. All of these preventive measures will increase the protection of groundwater resources in the District.

**Pesticides Control Program**

Pesticides are chemicals that control or kill weeds, insects, fungi, rodents, and other undesirable organisms. All pesticides are toxic to some degree and, if used or disposed of improperly, may possibly harm humans and pollute the environment. The District regulates the use, storage, sale, labeling, transportation, and disposal of pesticides.

Pesticide control activities in the District of Columbia are based on the D.C. Pesticide Operations Act of 1987 and the Federal Insecticide, Fungicide, and Rodenticide Act. The federal act authorizes the District to develop and administer a pesticide management plan. Under this plan, the District:

- Investigates consumer complaints of alleged misuse of pesticides by professional pesticide applicators and private citizens.

- Investigates indoor and outdoor pesticide spills, and pesticide poisonings. Pesticide poisonings are investigated in cooperation with local medical facilities. Georgetown University Hospital maintains a 24-hour emergency poison center which handles pesticide poisonings.

- Licenses any person or business that applies pesticides on the property of another person for hire or compensation in the District of Columbia. Companies are required to carry liability insurance and to operate from commercial zones.

Certified applicators are authorized to apply pesticides and to supervise the use of pesticides by other employees. To obtain certification, an applicator must pass written and practical tests for each category of pest control in which the applicator works. Certifications must be renewed every three years to ensure the applicator is familiar with the characteristics of new pesticides and new application methods. Certificates may be renewed by examination or by completing an approved refresher training course.

- Inspects pest control businesses in the District for compliance with licensing, record-keeping and pesticide storage and disposal requirements. Safety equipment, such as protective clothing, and pesticide application equipment is also inspected.

- Observes pesticides application activities throughout the District to ensure pesticides are used according to label directions.

- Registers pesticides. Pesticide manufacturers or distributors who sell their products in D.C. must register the products. During the registration process, the District reviews the product label to make certain it conforms with federal and District labeling requirements.

- Performs marketplace inspections. District representatives visit stores that sell pesticides. Products are examined to check for compliance with registration, packaging, and labeling requirements. The District can require a store to remove products from its shelves and to stop the sale of products that do not comply with regulations.

**Ground Water**

A ground water survey of the District will be initiated in 1989 to document groundwater quality and quantity. This will be the first urban groundwater assessment in the nation and should provide insight into the effects of urbanization on ground water.

**Air Pollution Control**

The reduction in use of leaded gasoline has caused a 90% decrease in airborne lead over the last decade. This has undoubtedly resulted in a reduction of lead in urban runoff however, data is not available to quantify the reduction. The District has been very aggressive in controlling volatile organic compounds for reducing ozone. This has secondary benefits in controlling toxic emissions from facilities such as gas stations and dry cleaners. In cooperation with EPA, the District will conduct a study to define the extent of the air toxics problem. A strategy will be developed for building a monitoring and control program and legislation will be drafted to regulate toxic emissions.

E. Specific Toxics Reduction Activities

The dechlorination of Blue Plains WWTP effluent has provided a major reduction in toxics to the Potomac.

The pretreatment program is believed to be making reductions in heavy metals in the effluent of Blue Plains WWTP; however, more time and data is needed to determine the exact magnitude of the reductions.

Phase I of the CSO Abatement Program will make about a 55% reduction in heavy metals discharged to Rock Creek, the Potomac and Anacostia Rivers. Preparation for evaluation of the effectiveness of Phase I and need for Phase II has begun. A model has been developed for the Anacostia and additional data is being collected on overflows, sediment fluxes and biota.

The aluminum discharge of 2,800,000 pounds per year from the

Dalecalia Water Treatment Plant is of concern due to the potential toxicity to striped bass larvae.

Two monitoring programs are underway to investigate the PCB and chlordane contamination of fish. The first is a more extensive collection of fish for analysis coordinated by Interstate Commission on the Potomac River Basin. The effort includes fish sampling by the State of Maryland and Potomac River Fisheries Commission both above and below the District. The second effort is a sediment sampling program to determine if and where there are contaminated areas in the rivers. The program will be expanded to investigate potential sources if necessary.

In 1989 a storm water monitoring program will be implemented to collect information on toxics and nutrients generated from different urban land uses. The data will improve both the toxics loading inventory and targeting of BMP's.

Biological gypsy moth control by the District government was implemented in 1987. The lack of citizen complaints about the program was notable when compared to jurisdictions using chemical controls. Some what similarly, the Hydrilla control program in the Potomac has avoided the use of herbicides.

Two potential sources of the oil spills to Hicky Run have been eliminated and a plan will be developed to remove the contaminated sediment and re establish a suitable aquatic habitat.

State of Maryland

# Toxics Reduction Strategy for the Chesapeake Bay and its Tributaries

January 1989

Maryland Department of the Environment

## EXECUTIVE SUMMARY: The Toxics Commitment

On December 14, 1987, Governor Schaefer of Maryland together with the Governors of Virginia and Pennsylvania, the Mayor of Washington, D.C. and the Administrator of EPA signed the 1987 Chesapeake Bay Agreement. This Agreement contains the following commitment specific to toxic substance control:

> By December 1988, to develop, adopt and begin implementation of a basinwide strategy to achieve a reduction of toxics consistent with the Water Quality Act of 1987 which will ensure protection of human health and living resources. The strategy will cover both point and non point sources, monitoring protocols, enforcement of pretreatment regulations and methods for dealing with in-place toxic sediments where necessary.

Representatives of the signatories to the Bay Agreement, working through a Water Quality Task Group to fulfill this commitment, prepared a Chesapeake Bay Basinwide Toxics Reduction Strategy. The Baywide strategy is enhanced by individual state strategies designed to address specific problems with toxic substances within each state. This Toxics Reduction Strategy was prepared by the Maryland Department of the Environment, working with the Departments of Agriculture and Natural Resources, to describe Maryland's activities to meet this commitment.

This strategy represents the consolidation and refocusing of existing efforts, together with some new initiatives targeted toward continuing and enhancing Maryland's toxics control programs. Maryland believes this strategy represents the beginning of a significant new effort to further reduce the impact of toxic substances on the State's waters. In recognition of the emerging nature of toxic substance control efforts nationwide, this strategy is organized to allow change and refocusing as goals are accomplished and as our knowledge of toxic substances expands.

The Maryland strategy is organized in five chapters. They are:

1. Introduction
2. Toxics and the Bay
3. Assessing the toxics problem
4. Water Quality Standards and Living Resource Requirements
5. Towards a Comprehensive Approach to Toxics Reduction

Each of these chapters presents some general discussion of issues followed by a listing of milestones and schedules for specific actions to which Maryland's agencies are committed.

Chapter 1: Introduction

In 1987, the Maryland General Assembly created the Department of the Environment (MDE) to serve as the central focus for environmental programs controlling land, air and water pollution. MDE was formed through the consolidation of units from the Maryland Departments of Health and Mental Hygiene and Natural Resources. Historically, these units carried out a number of programs to control the discharge of toxic substances. These programs are continued in MDE, and include NPDES permit limits, cleanup activities at superfund sites, toxic containment, monitoring of effluents, air toxic regulations, and water quality standards for toxic substances.

Within each element of this strategy, MDE will prioritize its commitments to assure that the worst problems are addressed first. The commitments within this strategy are dependent on the availability of manpower and resources. The acquisition of adequate resources will expedite completion of the commitments, but funding is not assured.

Within MDE, responsibilities for toxics management are distributed among the Water Management Administration; the Hazardous and Solid Waste Administration; the Stormwater and Sediment Administration; the Air Management Administration and the Assistant Secretariat for Toxics, Environmental Science and Health. The responsibilities of the respective agencies are described in the Appendix.

The Departments of Agriculture (MDA) and Natural Resources (DNR) are important partners with MDE in the effort to reduce and control toxic substances in Maryland. MDA is responsible for regulating the sale, use, storage and disposal of pesticides and for the establishment of integrated pest management programs. Together with the University of Maryland, MDA presents educational and informational programs for pesticide users. Cooperative programs among MDA, MDE and other State and federal agencies are implemented to promote proper application of pesticides to prevent groundwater contamination.

The Department of Natural Resources is responsible for the protection, management, and wise use of the natural resources of the State. In its role as protector of natural resources, the Department has established programs of monitoring and research designed to detect and understand the impacts of toxic contaminants on Chesapeake Bay living resources. The Department will play an important role in the protection of these living resources against the impacts of toxic substances by (1) identifying aquatic species and habitats that are impacted by toxics; (2) determining individual and cumulative effects of toxic substances on natural populations of living resources; (3) developing criteria adequate to protect selected commercially, recreationally and ecologically important species of living resources; (4) monitoring the integrity of habitats and the health and abundance of living resource populations; and (5) supporting research into the source, fates and biological effects of toxic substances on living resources.

## CHAPTER 2: TOXICS AND THE BAY

Historically, clean-up efforts in the Chesapeake Bay have focused primarily on the control of conventional pollutants and nutrients. Water pollution programs were designed to control oxygen demanding materials and suspended solids. This effort has been successful with municipal point sources, since the majority of dischargers achieved the final effluent limits by the July 1988 deadline of the National Municipal Policy.

In the early 1970's, nutrient enrichment and eutrophication were identified as major causes of deteriorating water quality in the Chesapeake Bay. To control discharges of phosphorus and nitrogen, the Bay jurisdictions developed a Baywide Nutrient Reduction Strategy. This strategy is expected to result in the attainment of a 40% reduction in nitrogen and phosphorus loads to the Bay by the year 2000. The estimated cost of this effort for the state of Maryland is $320 million.

The impacts of toxic substances on water quality are difficult to assess, understand, and control. Unlike nutrient enrichment, which is primarily caused by a relatively small number of substances, impacts from toxic substances may be caused by thousands of substances entering the Bay from point and non-point sources. New potentially toxic compounds are being developed every day. It is estimated that 65,000 are currently in use. Over 97% of the 65,000 chemicals have not been adequately tested for their human health and environmental effects. Current federal and state efforts are directed primarily toward the control of the 126 EPA "priority pollutants", leaving the vast majority of toxic substances unaddressed. Concentrations of concern for the priority pollutants have been established at extremely low levels by EPA. For many of the priority pollutants, levels of concern are at the parts per trillion or parts per billion level.

Reliable methodologies for detection of toxic substances at the low levels do not exist for the vast majority of the priority substances. The methodologies that do exist involve complex analytical procedures, requiring extensive quality assurance and quality control programs to assure the reliability and accuracy of the data. These chemical analyses are very expensive, with costs approaching $1,500 not uncommon. Costs can quickly escalate depending on the number of toxicants screened and the detection levels used.

The identification of biological impacts from toxic substances is further complicated by the inability to detect toxic effects in the environment. Detection of toxic effects demonstrated in a laboratory setting is often extremely difficult, if not impossible, to detect in the natural environment. To compensate, laboratory results are often extrapolated to the environment. The validity of this approach is difficult to demonstrate.

The collection and laboratory analyses of ambient water column samples is the most common form of water quality monitoring. Because of the problems with the detection limits and the extrapolation of laboratory results, the presence or absence of measurable toxic substances is not necessarily an indicator of an impact from toxic substances on the State's resources. In addition, many toxic pollutants do not remain in the water column and adsorb rapidly onto suspended particulates and bottom sediments. Sediment sampling is more labor intensive, and scientists have a poor understanding of the relationship between the presence of toxic substances in sediment, and their effect on the aquatic environment.

The limited readily available Bay data for toxic substances has been synthesized into Baywide means and ranges. Values reported at the same sites are not fully consistent within or among studies. Adequate water quality monitoring programs for toxic substances have not been fully implemented at this time; therefore, any effort to characterize the status of Maryland waters with respect to toxic pollutants must be qualified. Information does exist, however, to identify localized "hot spots" of toxic contamination.

MDE recognizes that its efforts to address the issue of toxic substances and their impacts on the Bay is severely hampered by the lack of an adequate data base. The commitment to the necessary monitoring and research must be made to provide a solid foundation for the rest of the strategy. In the meantime, MDE will use the information available to implement regulatory controls.

## CHAPTER 3: ASSESSING THE TOXICS PROBLEM.

Toxics monitoring currently conducted by MDE and other state and federal agencies provides an incomplete picture of the types and amounts of toxic inputs to the Bay the toxicants present in the Bay, and the impact toxic substances are having on the resources of the Bay. Information available to MDE is generated primarily through NPDES discharge permit applications, industrial and municipal effluent monitoring, published scientific reports, limited surveys by other agencies, pesticide usage data, and MDE water quality monitoring efforts.

A. Analytical Capabilities for Toxics

MDE recognizes that to appropriately assess the ambient levels of toxic substances, and to measure progress in reducing toxicity and toxic loadings, the appropriate analytical tools and capabilities must be available. Toward that end MDE is striving to upgrade available laboratory services.

**Milestones**

- By February 1989, sign a contract for additional laboratory services for priority pollutant analysis with a private laboratory.
- By August 1990, procure one new state-of-the-art gas chromatograph/mass spectrophotometer selective detector equipped with the NBS/EPA library, a data system and a printer plotter. Replace two antiquated gas chromatographs used in tissue analysis.

B. Chesapeake Bay Toxics Data, Management and Synthesis

Any effective toxics reduction strategy is dependent on an informational data base which is available to formulate and support management decisions and actions. Historically, allocation of resources for this effort has been given a low priority. With the increased concern over toxics in Maryland waters, as well as the requirements of the 1987 Amendments to the Federal Clean Water Act, quick access to toxics data has become a necessity.

Of all the toxics data that have been collected in the past from the State's point source programs, little is currently stored in computer-readable format. However, several computer systems are already in use for the conventional pollutants monitored under NPDES permit requirements and, with slight modification, will accommodate the toxics data. In the ambient monitoring programs, computer systems have been developed for tissue and sediment toxics data. The computer system for toxic substances in ambient waters is currently undergoing renovation by MDE. Existing computer systems will be adapted, as needed, to accommodate storage of new parameters measured in effluents, tissues and sediments. A computer system will be created for the storage of effluent toxicity testing and chemical data.

The objective in management of "toxics" data is data storage in an easily accessible, transferable and manipulatable form. Such storage will greatly enhance data use and the working relationships among State programs, as well as between State programs and outside interests.

Milestones

- o Beginning in July of 1990, all new NPDES applications and all quarterly NPDES reports will be stored in computer-readable format.
- o By July 1990, a new position will be created to complete the assembly and to oversee management of a computer system for the management of toxics data for ambient waters. An additional position will be provided to assist with data entry, simple programming and system interfacing.
- o By December 1989, the data base and data management system for the toxics loading inventory will be created and in place.

## C. Toxic Substance Monitoring

In order to develop the data necessary to establish a baseline for the Bay, to identify the areas impacted by toxics, to assure wise allocation of State resources, and to measure progress, a long-term commitment to toxics monitoring and research is necessary. Currently, detailed data concerning impacts from toxic substances are limited to widely recognized areas of historic abuse. Existing data from outside these areas are fragmented, outdated, sparse and in most cases, non-existent. Data concerning the associations between toxic levels in discharges, the water column, sediments and biota do not exist.

### 1. Chesapeake Bay Monitoring

A component of MDE's current Chesapeake Bay Water Quality Monitoring Program measures metal and organic toxicants in the Bay's bottom sediments. The primary emphasis of this component is to identify toxic "hot spots" for further evaluation. For several reasons, this component of the Bay-wide monitoring program is not as extensive as that devoted to the nutrient enrichment problem. The foremost reason is that, toxic substances have been shown to cause ecological damage only in localized areas of the Bay i.e. existing historical "hot spots". Secondly, because of the complex and often unique nature of toxic problems, a comprehensive and meaningful evaluation of potential "hot spots" is a very costly venture. The high cost prohibits conducting such evaluations on a Bay-wide basis. The objective of identifying areas for future investigation is satisfied by quantifying existing levels of metals and organic chemicals in Bay sediments and tributary sediments. Major entry routes and new "hot spots" as well as trends in the levels of toxic substances in sediments are detected. Sediment data serve as a first level screening tool at a reasonable cost. Finally, there are other programs conducted by the State which address human health issues through the monitoring of toxicant levels in edible fish and shellfish.

Identification of "hot spots" and the chemicals of concern are achieved through the monitoring of organic and metal contaminants in the recently-deposited surface layer of bottom sediments. Analysis of these compounds in the surface sediments is an indicator of the potential for regional or localized toxicant problems in the sediments, the water column and the resident organisms. The strategy to analyze sediments, rather than the water column or the organisms, has several advantages. One advantage is the fact that most toxic substances released into the Bay become associated with particulate matter and tend to settle to, and concentrate, in the bottom sediments. Therefore, even low levels of toxic substances become detectable over time. The detectability of low levels of toxic substances is important since some compounds are biologically active in very minute amounts. In addition, the source of toxic problems may not be in close proximity to the sampling station, resulting in dilution of the compounds. Therefore, sediment monitoring could uncover a local or regional problem, even when water column concentrations at a site are undetectable.

Twenty-two stations in the Bay's mainstream in Maryland were sampled for selected toxic substances in 1984 and 1985. Analysis of the data confirmed the distribution of toxic substances and the "hot spots" identified previously the Chesapeake Bay Program findings in 1983.

A total of 38 stations, distributed through the major Bay tributaries in Maryland, was sampled for sediment analysis in 1987 and 1988. The laboratory analysis and reporting of the organic compounds are not yet completed. The metals data for 1987 are analyzed and computerized, and an interpretative data analysis is underway.

From the interpretive sediment data collected in the tributaries, a determination will be made as to which tributaries, if any, need further investigation. The need to establish sediment sampling stations in freshwater reaches of major tributaries will be evaluated. Methodologies available to quantify the effects of contaminated sediments on aquatic organisms will be investigated. These investigations may lead to the identification of areas for consideration in a future sediment toxicity abatement program.

**Milestones**

- By September 1989, complete the laboratory and interpretative analysis of the sediment data collected from the 38 tributary stations.

- In 1990 - 1991, implement in-depth monitoring networks in those tributaries identified as having high levels of toxic substances in their sediments. Where possible, use the distribution of toxic substances in sediments and the available discharge data to pinpoint sources.

- By January 1991, evaluate the need to establish freshwater sediment sampling stations in the headwaters of the Potomac, Patuxent, Patapsco, Gunpowder, Choptank, Wicomico, Nanticoke and Chester Rivers and, if needed, implement the network in 1992 and 1993.

- In 1994, resample the 22 Bay mainstream stations to determine whether Bay conditions are changing.

- In 1995, resample the 38 tributary stations to determine if tributary conditions are changing.

### 2. Biological Monitoring and CORE Networks

Since 1979, Maryland's 33 CORE monitoring stations have been monitored for fish tissue contamination by toxic substances on an annual basis. All stations are on tributaries of the Chesapeake Bay.

The biological monitoring program began in 1979; it includes approximately 116 stations sampled biennially. The program also utilizes qualitative benthic macroinvertebrate evaluations to determine overall water quality conditions at many stations. Intensive, site-specific benthic investigations are made to evaluate the possible impacts of specific discharges on water quality and stream biota.

The oyster tissue monitoring network has been in place since 1974. Oyster tissues are monitored at 86 locations on an annual or biennial basis for heavy metals and selected organic chemicals. Intensive fish tissue monitoring studies are conducted on an intermittent basis in major tributaries of the Bay to provide baseline tissue-contamination levels for resident fish. Tissue analyses of fish and oysters indicate the presence and degree of ecosystem contamination and the potential health risks associated with fish consumption.

The biological monitoring program assesses long-term water quality trends at a large number of stations statewide. Stations are specifically selected to monitor water quality changes upstream and downstream of major discharges, metropolitan areas and suspected nonpoint pollution sources, or to document conditions in relatively unaffected or pristine streams.

Data from the CORE monitoring program, the biological monitoring program, the oyster-tissue monitoring and the intensive fish surveys are entered into BIOFILE, MDE's computerized data base. This information is stored in a way that can be integrated with EPA's Storet database.

Results of the fish tissue analysis from the CORE monitoring program have been published in reports on an annual basis since 1979. Data from several different intensive fish studies have been summarized in a series of interpretative reports available from MDE. Results of intensive biological monitoring at site-specific locations to document effluent impacts are summarized in in-house reports.

The station locations in the CORE network and the biological monitoring network will be evaluated and adjusted as identified problems are corrected or as new areas need to be investigated.

**Milestones**

- By December 1989, complete the analyses of the oyster tissue toxicant data from 1980 to 1987 and publish final report.
- By March 1989, evaluate the existing CORE fish tissue sample network.
- By December 1988, in cooperation with the Potomac River Fisheries Commission, collect sufficient fish-tissue samples to assess the levels of toxic contaminants in resident fish from the tidal Potomac River.
- By March 1991, complete the data analysis and prepare a report documenting contaminant levels in fish tissue from the Potomac River.

### 3. Air Monitoring

The Air Management Administration (AMA) currently measures toxic compounds in the ambient air under two projects. These data can be used to assess toxic deposition from the ambient air from general sources. In addition to indicating ambient air quality, the air monitoring programs conducted near the Bay provide a database to help evaluate deposition from the air as a possible entry route for toxic compounds.

AMA uses total suspended particulate monitoring filters to gather data at 10 sites throughout Maryland on the ambient air concentrations of lead, chromium, cadmium, arsenic, sulfates, nitrates and benzo-a-pyrene.

The non-methane organic hydrocarbon (NMOC) project measures both total non-methane hydrocarbons and 10 specific toxic compounds in the ambient summer air. Monitors are located at two sites near the Baltimore Harbor, at Arlington and Richmond, Virginia, and in Washington, D.C. The relationship between oxides of nitrogen and hydrocarbons is also being tracked. A comparison of these measurements with measurements in other industrialized areas such as Philadelphia have yielded results similar in concentration ratios. The data collected during the NMOC sampling increases our knowledge of pollutant ratios and atmospheric processes. The capability to more accurately model and forecast these processes will be enhanced. Inclusion of products of incomplete combustion in the monitoring network is being investigated.

AMA has a 10-year database of the ambient air concentrations for lead, chromium, cadmium, sulfates, nitrates and benzo-a-pyrene. Data for arsenic is available for the last two years. Eight stations in a tri-state area of Maryland, Virginia and Pennsylva-nia were sampled for total hydrocarbons and 10 specific compounds during the summers of 1987 and 1988. The 10 specific compounds sampled were chloromethane, chloroethane, 1,1 dichloroethene, methylene chloride, chloroform, 1, 2 dichloroethane, benzene, carbon tetrachloride, trichloroethene, and tetrachloroethene. A report of these data was made to EPA each year to enhance their research on toxic compounds and their modelling capabilities.

**Milestones**

- o During Summer 1989, run a time-specific study on the levels of total hydrocarbons and 10 toxic organic compounds to determine hours of peak concentration. The purpose is to determine whether the hours of peak concentration are related to traffic volumes.
- o In 1990-1991, increase the toxic monitoring network to include sites at different locations with different atmospheric factors, size, scales, etc.
- o Coordinate the use of existing air monitoring stations to provide data for calculating deposition rates of toxic pollutants on the Bay with other MDE agencies.

### D. Baltimore Harbor Initiative

The Baltimore Harbor is located at the mouth of the Patapsco River, a sub-estuary of the Chesapeake Bay. The Harbor is the major deep water port in Maryland and receives drainage from the extensively urbanized Baltimore area.

Within Maryland waters, the water quality problems associated with Baltimore Harbor appear to be particularly acute due to a long history of high loadings and a wide variety of toxic substances. The complexity of the transport and the fate of these materials, together with the uncertainty regarding the sublethal biological effects, serve to heighten public concern about this water body. The few studies and available historical information suggest that the Harbor has serious water and sediment quality problems.

In order to properly assess the toxic problem in the Harbor, a detailed environmental assessment and risk analysis are needed to identify both point and non-point sources of toxic substances, their relative contributions to toxic loading, and the probability of adverse effects associated with the various sources. This information provides a baseline for comparing and setting priorities among toxic substance-related issues which involve different pollutants, sources, and exposure pathways and which may affect human health, ecosystems and resources. The need for setting priorities is prompted by the realization that the hundreds of toxic substances potentially present in the Harbor pose some risk of causing adverse health effects. Comparison of the risks will help set priorities to allow MDE to focus the limited public resources in a manner that will achieve the greatest public benefit---to achieve the greatest reduction in risk for a given cost of control.

MDE recognizes that the information generated by the approach outlined above will take several years to develop. During that time, MDE will emphasize the traditional approaches of pollution control in the Baltimore Harbor and will strive to ensure that the toxic requirements of the 1987 Water Quality Act are implemented here first.

**Milestones**

- By February 1989, develop the Individual Control Strategies (ICS) for all Baltimore Harbor dischargers.
- By February 1992, complete the implementation of ICSs for all Baltimore Harbor dischargers.
- By July 1989, investigate the availability of obtaining funds through sources such as Superfund to provide money for an environmental assessment and risk analysis, and prepare the request for proposals and the necessary contracts to begin the environmental assessment and risk analyses for the Harbor.

## CHAPTER 4: WATER QUALITY STANDARDS AND LIVING RESOURCE REQUIREMENTS

Water quality standards and living resource habitat objectives are important management tools for measuring progress. Their use in management, however, differs in application. Water quality standards serve as a means to secure regulatory actions for a specific group of contaminants. Habitat objectives are goals for the protection and restoration of specific habitats.

Water quality standards are the yardstick against which water quality conditions in the surface waters and groundwaters of Maryland are measured. Enforcement of standards are one means of preventing the deterioration of water quality in State waters. The Maryland water quality standards (COMAR 26.08.02.01-07) mandate the protection of existing high-quality State waters. They also provide for the restoration of all other State waters to a condition of quality that will permit all reasonable public uses, and will support the propagation and growth of all aquatic life that might reasonably be expected to inhabit them.

The State water quality standards provide a regulatory mechanism to maintain "fishable and swimmable" waters for the use of all citizens and to protect aquatic life, including economically valuable finfish and shellfish. Water quality standards are intended to protect the beneficial uses of State waters. Maryland has assigned specific uses to all waters of the State (COMAR 28.08.02.07). The basic use, for which all waters are protected include recreational use and the propagation and growth of a balanced population of fish and wildlife. These uses require stringent standards and a high degree of protection. Other, less restrictive uses, like industrial water supply, irrigation and navigation, are also protected. The three more restrictive classifications (shellfish harvesting waters, put and take trout waters, and natural trout waters) impose additional restrictive criteria.

In 1980, Maryland adopted water quality standards for 7 toxic substances (PCB, toxaphene, aldrin, dieldrin, benzidine, endrin, and DDT). In April 1983, the Maryland General Assembly adopted legislation prohibiting the discharge of chlorine or chlorine compounds to natural trout waters. In 1986, this legislation was amended to require dechlorination of any effluent treated with chlorine. In 1989, MDE will adopt the regulations implementing the dechlorination legislation.

In 1987, the Maryland General Assembly adopted legislation regulating the release of tributyltin (TBT) contained in antifouling paints. This legislation severely limits the use of paints containing TBT and assigns the regulation of the use and sale of the paints to Maryland Department of Agriculture. The legislation requires the MDE to adopt water quality criteria for TBT in all fresh and marine waters by December 1, 1988. A proposed water quality standard is currently being promulgated. In 1987 and 1988, the Department of Natural Resources distributed public education materials concerning TBT to all registered Maryland boaters. In addition, DNR maintains a list of TBT paints registered with MDA and makes the list available to the public on request.

In August and September, 1988, the MDE held a series of public hearings to solicit public input concerning issues relating to the control of toxic substances which should be addressed in the 1988 EPA required triennial review of state water quality standards. This testimony is currently under review in preparation for the formulation of State regulations addressing the control of toxic substances.

The MDE will adopt standards for toxic substances as mandated in the 1987 Water Quality Act. This regulatory action will begin in January 1989 with the publication in the Maryland Register of the criteria proposed for selected identified toxic substances. As EPA develops additional criteria for toxic compounds or as additional information becomes available from the scientific community, MDE will evaluate the significance of these substances in Maryland and the need to adopt water quality criteria for additional toxic substances.

### Milestones

- By July, 1989, Maryland will reach consensus with Virginia and the District of Columbia regarding a consistent definition for the application of "freshwater" and "marine" criteria for toxic substances in the Chesapeake Bay watershed.

- By May 1989, complete the 1988 triennial review of Maryland's water quality standards and adopt the necessary standards for toxic substances.

- As part of the triennial review:

  (1) Redefine the basic water use designations to include a new use designation, "Potable Water Supply".

  (2) Establish a variance procedure for those waters where natural ambient water quality exceeds standards for toxic substances or where available technology is not sufficient to reduce toxics to achieve water quality standards.

  (3) Establish the criteria and procedures to evaluate results of the chemical and biological analyses of effluents and to define how this information will be used in discharge permit development.

  (4) Revise existing requirements for mixing zones for discharges of toxic substances.

- By December, 1989, have dechlorination facilities in use for all chlorinated sewage effluents.

- By September, 1989, procure a full-time position to research and develop water quality standards, and 0.5 man years of an aquatic toxicologist to provide technical expertise.

## CHAPTER 5: TOWARDS A COMPREHENSIVE APPROACH TO TOXICS REDUCTION

### A. NPDES Permits and Biomonitoring

Facilities which discharge wastewaters to the waters of the State must obtain discharge permits. EPA's National Pollution Discharge Elimination Systems (NPDES) is a federal program to regulate discharges nationally. Maryland received approval in 1974 to administer the NPDES Program through a State discharge permit program which closely mirrors the federal program.

The goal of the Maryland NPDES permit program is to assure that the State's water quality standards are not violated as the result of a single discharge or a group of discharges to a specific water body. This goal is accomplished through permit limitations which establish the quality of the effluent by limiting the levels of specific constituents in the effluents. These constituents include toxic substances. As early as 1973, Maryland was imposing permit limitations for some toxic substances.

The NPDES toxics management program uses a systematic procedure of biological and chemical effluent monitoring of all industrial and municipal NPDES permit-holders that may potentially discharge toxic pollutants. The monitoring requirements are designed to identify sources of acute or chronic toxicity to aquatic life. If the results of this monitoring program indicate that effluent toxicity occurs, additional testing and/or a toxicity reduction evaluation is required. Best Management Practices (BMPs) are also required through NPDES permits at certain sites for control of toxic substances that may be transported by runoff.

Currently, there are about 195 industrial NPDES permits in Maryland that contain special conditions for toxics management. They include 49 major industrial facilities and 146 minor facilities. The program will eventually expand to over 500 dischargers as permits are re-issued.

MDE has ambitious goals for its program to control point sources of toxic substance discharge. Within the next 4 years, MDE intends to eliminate acute toxicity from all industrial and municipal discharges. Chronic toxicity will be reduced to acceptable levels within seven years. These goals will be accomplished through an aggressive toxicity testing program using the State's Biomonitoring Laboratory at an approximate cost of $2 million dollars and a follow up effort culminating in the successful implementation of toxic reduction evaluation.

Prior to and following the State's passage of legislation addressing chlorine, dischargers have installed dechlorination or alternative disinfection facilities to eliminate the toxic effects of chlorine on aquatic life. One hundred seventy three municipal wastewater treatment plants within the Bay watershed have installed dechlorination equipment; all will have dechlorination facilities installed within the next 2 years. Fourteen industrial facilities have dechlorination facilities, with a total of 30 expected by December, 1989. In addition, ultraviolet disinfection has replaced chlorination facilities discharging to natural trout waters in Maryland.

Through the examination of available information, MDE has developed a list of Maryland waters impacted by toxic substances, in compliance with the new requirements of the 1987 Water Quality Act. This listing provides the nucleus for MDE's current development of Individual Control Strategies (ICS) and for its efforts to address toxic substances. As more information becomes available, this list will be refined or expanded.

Milestones

- By February 1989, submit to EPA, in accordance with Section 304(l) of the Water Quality Act, its listing of waters impacted by toxic substances.
- By February 1989, develop and submit to EPA its Individual Control Strategies for those stream segments appearing on the 304(l) list.
- By September 1989, hire 2 engineers to provide assistance to the publicly owned treatment works (POTWs) to assess potential effluent toxicity problems.
- By September 1989, obtain the services of 0.5 man years of an aquatic toxicologist to provide technical expertise in the interpretation of bioassay results and chemical testing.
- By July 1, 1991, require chemical and biological toxics monitoring programs for all appropriate NPDES dischargers.
- By December 1992, eliminate acute toxicity impacts from all industrial and municipal dischargers.
- By December 1995, reduce chronic toxicity impacts from all industrial and municipal discharges to acceptable levels.
- As part of NPDES permit issuance or renewal, all EPA-identified major industrial dischargers may be asked to submit with their 2-C application, the results of priority pollutant testing of their intake water. Each major industrial applicant will also be required to submit the

actual test scan of their effluent, in addition to tabulation of the numerical values.

- By February 1992, require that all discharges identified on the 1989 304(l) list comply with their Individual Control Strategies.

B. Pretreatment Program

In 1976, amendments to the Clean Water Act created a nationwide pretreatment program for the control of toxic pollutants discharged by industrial users to POTWs. EPA was authorized to develop regulations for the control of industrial discharges to POTWs and to develop general pretreatment program requirements. In January, 1981, EPA published 40CFR.403, General Pretreatment Regulations for Existing and New Sources. National pretreatment standards which require best available technology (BAT) were also promulgated for certain industrial categories.

In June 1984, Health Environmental Articles 9-222, 9-319 and 9-332 were enacted as part of the Annotated Code of Maryland. These articles authorized the creation of a State pretreatment program at least as stringent as the EPA program. Final State regulations were adopted August 26, 1985 to implement these laws. Full delegation of pretreatment authority from EPA Region III was received in September 1985.

Maryland is implementing the State's pretreatment program by requiring development and enforcement of local pretreatment programs for all POTWs with a capacity of 5 MGD or more and all POTWs receiving wastes from industries that interfere with plant operations, pass through or contaminate sludge. The State oversees the implementation of local programs and monitors compliance by reviewing POTW quarterly compliance reports, conducting field investigations at industries, performing audits and inspections of POTWs, and taking enforcement action where necessary.

Currently, 15 Maryland jurisdictions administer pretreatment programs involving 31 POTWs and approximately 500 significant industrial discharges and numerous small industries. One additional jurisdiction is applying for program delegation.

Eight small jurisdictions are implementing limited pretreatment programs. In addition, several federal facilities are subject to pretreatment requirements.

**Milestones**

- By February 1989, complete review of effluent testing for priority pollutants and prepare the final 304(l) list for dischargers.

- o By September 1989, require all POTWs with approved pretreatment programs to have 95% or more of their significant industrial users permitted and under regulation.

- o By September 1989, require all POTWs needing local pretreatment limits to adopt technology based standards.

### C. Biomonitoring of Effluents

Biomonitoring is the use of aquatic organism impairment as a measure of effluent toxicity. Maryland has implemented a two part program for the biomonitoring of wastewater effluents. Part one places in the permits of many major and some minor facilities special conditions requiring acute and chronic bioassay tests. The type and frequency of the testing is influenced by discharge flow, receiving water flow and the potential to cause a toxic impact.

For industrial facilities, biomonitoring test procedures are divided into two categories.

The first category includes all major industrial facilities and other industrial facilities with significant toxic potential. This category is further subdivided, based on whether the effluent flow is more or less than 10% of the receiving water low flow. If the effluent is less than 10%, the stream is considered to be stream-dominated, and MDE requires quarterly "acute" testing for one year and one-time "chronic" testing. The other subcategory, that in which effluent flow is greater than 10% of receiving-water low flow, is handled in the opposite manner. Under such effluent-dominated conditions, MDE requires quarterly chronic testing for one year and one-time acute testing.

The second general category for industrial dischargers contains those facilities with a somewhat lower potential for toxicity. In this category, MDE requires acute testing twice, three months apart. In all cases, if toxicity is observed, the Department has the authority to require additional toxicity testing and/or a toxicity-reduction evaluation.

All major municipal sewage facilities with approved pretreatment programs are required to perform quarterly acute testing, a one-time chronic testing and a "priority pollutant" scan as part of their NPDES permit reissuance.

The second part of the biomonitoring program is testing at the MDE Biomonitoring Laboratory of effluents from selected facilities.

In 1985, money was appropriated through a Maryland Chesapeake Bay Initiative to create a bioassay facility.

Legislation established a permit fee for industrial dischargers; the revenues were used to pay the laboratory costs. In 1986, MDE established, through a contract with the University of Maryland and the Johns Hopkins University Applied Physics Laboratory, a facility for evaluating the toxic effects of actual point source discharges using acute and chronic bioassays.

The MDE Biomonitoring Laboratory provides a mechanism to gather information and data concerning the effects on organisms from effluents containing toxic or potentially toxic substances. The benefits include the identification of toxic effluents and potential violations of water quality criteria, and the verification of biotoxicity testing results submitted by dischargers to meet NPDES permit requirements.

Between March 1987 and September 1988, 107 bioassays were conducted with effluents from 92 Maryland dischargers. Twenty seven percent of the effluent samples exhibited acute toxicity to fathead minnows or Daphnia magna, the standard test species for bioassay purposes.

The emphasis of the Maryland biotoxicity laboratory will eventually shift from acute to chronic toxicity testing, as the requirements of NPDES permit program change, and as the staff gains additional experience with chronic testing. MDE needs to work with the Department of Health and Mental Hygiene to enhance the capability of the DHMH laboratory, including equipment and staffing, to provide necessary chemical testing to complement the biotoxicity testing.

**Milestones**

- By December 1988, increase the level of effort at the biotoxicity laboratory for chronic testing.
- By March 1989, all major POTWs will be tested at least once for acute toxicity.
- By December 1990, all major POTWs will be tested at least once for chronic toxicity.
- In FY 90, increase laboratory testing to include 70 acute and 40 chronic tests. In FY 91 - 95, the level of testing will average 100 acute and 75 chronic tests annually.

## D. NONPOINT SOURCE PROGRAMS

Nonpoint sources of toxic pollutants are diffuse in nature and difficult to identify and to quantify, in terms of impact and environmental fate and control. Some evidence suggests that in many areas the nonpoint source contributions of toxic substances, particularly heavy metals and pesticides, may far outweigh the point source contributions. Major nonpoint source categories include urban, suburban, industrial and agricultural runoff, and atmospheric deposition.

A real need exists to better characterize the contribution of toxic substances associated with runoff, particularly urban runoff. In developed areas, certain pollutants are more prevalent than in undeveloped areas. The toxic substances in urban runoff include oil and grease, chlorides, bromides and heavy metals (such as lead, zinc, arsenic, silver, cadmium, mercury, chromium, nickel, copper and iron). Many of these are washed into waterways from roads and streets and originate from motor vehicles (tire wear, exhaust; lubrication losses and corrosion of parts), pavement deterioration, street-marking paint and from commercial and industrial developments. Specific industrial and commercial properties yield substances such as phenols, cresols and various pesticides. Atmospheric deposition onto the landscape contains particulates and associated contaminants emitted from cars, factories, wood stoves and other sources. Runoff of atmospheric deposition from developed areas is consequently a significant source of toxic contaminants.

Recent studies indicate that the average levels of toxic substances in urban runoff are not high enough to cause significant pollution in the water column, due to their ready attachment to soil/sediment particles and the diluting effect of the receiving waters. However, as urbanization of the State continues, the contribution of these toxic substances to pollution of surface waters will become more significant, unless properly managed. In addition, information is lacking concerning the relative contribution of toxicants from non-point sources to the bioaccumulation of such substances in aquatic organisms.

### 1. Stormwater Management and Sediment Control

Erosion and sedimentation from areas undergoing urban land development, and permanent changes in the hydrologic equilibrium of the land surface produce undesirable changes in fresh water, marine and estuarine environments. Pollutants and nutrients accumulate rapidly on impervious surfaces once a site is stabilized, and are transported into water bodies with storm runoff. Urban land development frequently occurs near streams, rivers, estuaries and oceans. These waterbodies provide habitat and nursery ground for many aquatic species and migratory waterfowl. Large sediment influxes carrying toxic substances may harm benthic species and the aquatic vegetation on which many aquatic species depend.

Agricultural practices disturb the earth's surface, making it vulnerable to erosion. Through the application of fertilizers and pesticides, agricultural areas also become sources of pollutants possibly releasing large quantities of sediments, nutrients and toxic chemicals to receiving waters during storm runoff events.

The primary goals of the State's sediment and erosion control and stormwater management programs are to maintain the pre-development runoff characteristics after development and to reduce stream channel erosion, local flooding, pollution, siltation and sedimentation. Although most of the sediment and stormwater control practices are not directly related to the control of toxic substances, many provide indirect benefits. Reduction in sediment transport and excessive surface water runoff provides some control of soil-attached chemicals and heavy metals. Infiltration practices (trench, basin, dry well, etc.) and pond construction contribute to the interception and confinement of heavy metals, priority pollutant organics, pesticides, and oil and grease.

**Milestone**

- By January 1, 1990, implement regulation changes which will provide design or performance standards for nutrients and toxic substances.

**2. Pesticides**

Pesticides, (including fungicides, herbicides, insecticides, nematicides, and plant growth regulators) are used by homeowners, gardeners, farmers, commercial application firms, public agencies, and others to control or manage a large variety of pests and diseases of plants, humans or animals. In Maryland, the largest quantity of pesticides is used for agricultural production, although significant amounts of pesticides are used for lawn and ornamental plant pest control.

The presence, or level of occurrence, of pesticides in surface water or ground water in Maryland is not well documented. In 1986, the U. S. Environmental Protection Agency estimated that 24 states had reported the presence in well water of at least one of 19 pesticides. At least six pesticides have been detected in groundwater in Maryland. Currently, the EPA is conducting a nationwide pesticide survey of private and public water supplies using groundwater; results should be available in 1990. Because so little is known about the extent and nature of pesticide occurrence in water resources, it is difficult to develop a program to reduce the level of pesticides.

Determining the pathway by which a pesticide enters a water source is often difficult. Pesticides can enter water sources during their manufacture, transportation, distribution, storage, use, handling, disposal of unwanted pesticides, or disposal of containers. Point source contamination (leaks, spills, disposal) is more easily recognized and dealt with than is nonpoint source contamination, resulting from the normal application or use of a pesticide (runoff, leaching). Several federal or state laws regulate possible point source contamination mechanisms, but regulation of non-point source contamination is more complex.

In order to reduce the concentration of pesticides in water sources, one or more of the following must occur: (1) reduce overall use of pesticides; (2) increase use of integrated pest management (IPM) techniques (use control methods that are less chemical dependent); (3) improve methods and targeting of pesticide application; (4) use a pesticide that has less leaching potential, shorter half life or environmental persistence, or has less risk to groundwater; (5) improve the timing of pesticide application to reduce potential for runoff or leaching; or (6) use farming practices that will reduce the contamination potential. Research and demonstration of improved techniques, followed by technical assistance and education for the user public, is essential to bring about such changes to a significant extent.

In Maryland, the Department of Agriculture (MDA) is the agency responsible for regulating the sale, use, storage and disposal of pesticides; the University of Maryland is the institution responsible for education and information programs for users of pesticides; and the Maryland Department of the Environment is the agency responsible for regulating the presence of contaminants, including pesticides, in water sources. Cooperative programs involving these agencies and other State and federal agencies are conducted to promote the proper application of pesticides in an effort to prevent contamination of water sources by pesticides.

Integrated pest management (IPM) is the term used for the systematic selection and use of one or more pest control programs that will ensure favorable economic, ecological and sociological consequences. The IPM process provides a system whereby, when an identified pest is causing sufficient damage to a plant or host, a specific decision-making process is used to select one or more pest control actions that will result in effective and economical pest control.

The MDA is committed to and promotes the use of IPM strategies for all pest control problems. The next logical step involves the expansion of IPM policy to an integrated crop management program (ICM). Benefits will be favorable economic, ecological and sociological consequences, but of a larger magnitude.

Effective March 1988, MDA implemented regulations to control the sale, distribution, possession, and use of marine antifouling paints containing tributyltin (TBT), a pesticide toxic to many marine organisms. Only a limited number of TBT products meet the

State's stringent requirements for release rate and are registered with MDA for 1988.

In June 1988, MDA implemented regulations to cancel the Maryland registration of any cyclodiene termiticide (chlordane, heptachlor, aldrin), precluding its distribution or use in Maryland. Water monitoring has detected quantities of chlordane in samples from specific locations.

The MDA has developed and implemented integrated pest management programs to deal with pests such as gypsy moth, mosquitoes, thistles, Colorado potato beetle, Mexican bean beetle, and yellow nutsedge.

An important issue that must be addressed is whether or not pesticides are a problem in surface and groundwater and, if so, to what extent. Data must be collected to establish baseline levels of pesticides present in water. Once completed, MDE, in cooperation with MDA, should continue to conduct monitoring programs of groundwater and surface waters throughout the State. A federal procedure or mechanism for determining "action levels" must be developed, and solutions must be sought to eliminate or control source problems.

**Milestones**

o By December 1989, MDA and MDE will identify the most extensively used pesticides in Maryland and will select the pesticides which are to be included in any monitoring program.

o By December 1989, MDE will investigate the available laboratory methodologies for testing for the presence of these compounds in waters and tissue, and will determine the manpower and resources needed to monitor for those substances.

o Using the available information, MDE and MDA will design an appropriate monitoring program to determine the extent of surface and groundwater contamination throughout the state.

o By September 1989, MDA and the Cooperative Extension Services will complete development of two video training "films" under grants awarded by EPA.

(1) One video will address pesticide regulations, pesticide use and safety for the purpose of training new employees of public agencies and commercial pest-control firms.

(2) The second video will be used to train private and commercial pesticide applicators on integrated pest

management techniques for corn and soybean production.

- o By July 1989, MDA will complete a survey of farmers, nurserymen, greenhouse operators, public agency applicators, and commercial applicators to identify and evaluate the extent of the current pesticide disposal problem. The survey will gather information on the types of excess (unwanted) pesticides that applicators have on hand because the products are beyond their usable shelf life, have been cancelled or banned, or are not being applied because better alternatives are now available. Each pesticide will be listed, and estimates of total amounts will be tabulated.

- o By December 1989, MDA will complete a survey of private and commercial pesticide applicators to provide information concerning 1988 use levels. This survey will build upon the 1982 and 1985 MDA survey data.

- o By October 1989, MDA will conduct a series of continuing educational programs for homeowners on the safe use, storage and disposal of pesticides and on the fundamental concepts of integrated pest management.

- o By October 1989, MDA will conduct a series of continuing educational programs for pesticide dealers. This effort will target establishments selling general-use pesticides to the untrained public.

- o By June 1990, MDA will develop an integrated pest management program to manage certain thistles in Maryland. This IPM program will involve one or more cultural, mechanical, biological or chemical methods.

### 3. Agricultural Cost Share Program

Because agriculture has been identified as a major source of pollutants (nutrients and sediments) to the Bay, implementation of agricultural best management practices (BMPs) is an important part of the Bay cleanup effort. To ensure the continued application of BMPs on farms to achieve a timely reduction of pollution from agricultural sources, the Maryland Agricultural Water Quality Cost-Share Program (MACS) was created. Established in 1982 and fully operational in 1983, MACS is a highly successful effort. To date, the Maryland General Assembly has appropriated a total of $32 million to support the MACS program, mainly through the innovative use of MDE-administered State water quality bond funds. The program provides grants to farmers for the application of BMPs on farms where water pollution problems have been identified, or where the potential for water quality problems exists. The total amount of State funds that have been appropriated for the program since 1982 is only 30% of the total amount ($90 million) estimated to be needed to treat "critical" agricultural water pollution conditions throughout Maryland's portion of the Bay drainage area. For each of the last three years, $1 million of the Maryland Chesapeake Bay Implementation Grant have been used for the Agricultural Cost-Share Programs. Federal funding from this source is also expected to be available for FY '88 and '89.

The agricultural water quality cost-share program is designed to improve water quality in the State's streams, rivers and the Chesapeake Bay by providing financial cost-share assistance to farmers for the installation of agricultural BMPs. While the cost-share practices are not directly related to pesticide management, many provide indirect benefits. Most of the agricultural BMPs are aimed at reducing sediment or nutrient loss and transport into waters from excessive surface runoff and the associated erosion. Control of sediment runoff will also help to reduce the delivery of soil-attached pesticides into Maryland waters. At the same time, participation in the cost-share program allows MDA and the cooperative agencies an educational opportunity to visit the farmer and provide proper pesticide use and management information.

## E. Other Programs Contributing to the Reduction of Toxic Discharges to the Bay

### 1. Solid Waste Management

Landfills represent potential sources of toxic pollutants to Maryland's ground and surface waters. In the past, solid waste was not properly managed and in many instances resulted in contamination of groundwater by leachate. Contaminated groundwater may eventually migrate into surface streams which find their way into the Chesapeake Bay. Maryland has issued refuse disposal permits to landfills for many years. Recently, MDE revised the State's solid waste regulations specifying state-of-the-art requirements for the design, location, and operation of landfills and other solid waste and toxics acceptance facilities.

The Solid Waste Management Program assures that all pollutants, including toxic substances derived from the use or disposal of solid wastes, do not impact Maryland waters. This objective is accomplished through issuance of Refuse Disposal Permits to new facilities listing the new regulation requirements and through the upgrading of existing facilities to meet the new regulations. MDE also plans to install or require adequate groundwater monitoring systems at all landfills. MDE will properly close landfills that reach permitted capacity or which are eliminated for some other reason.

### 2. Sewage Sludge Management

Sewage sludge can be an aesthetically distasteful waste product with expensive disposal options. On the other hand, it has nutritive value for plants and can serve as a soil supplement. Maryland has a strong program for managing sewage sludge and encourages land application. Sewage sludge permits are required for generation, transportation, and disposal of sewage sludge. The majority of all sewage sludge disposed in the State is land applied.

Sewage sludge may contain various types and levels of toxic substances depending on the inputs to the sewage treatment plant. Since most of the sewage sludge in Maryland is land applied, MDE is concerned with the release of toxic substances from the sludge into the soil, the plants, or into the groundwater. Soil contaminated with toxic materials from sludge disposal or the sewage sludge itself can be washed into streams in stormwater runoff. The ground water below the sludge disposal site can also migrate into nearby streams. In both cases, toxic substances can eventually find their way into the Chesapeake Bay.

The purpose of the sewage sludge management program is to properly regulate the disposal of sewage sludge. For land application, this objective is accomplished by establishing application rates based on the concentration of toxic metals in the sludge. Proper management practices such as plowing the sludge into the soil and liming to keep pH at acceptable levels are also required in the sewage sludge disposal permits. Heavily contaminated sludge may be prohibited from land disposal.

### 3. Superfund (CERCLA) Program

Environmental laws and regulations were not always as comprehensive as they are today. Past waste disposal practices have left numerous waste dumps scattered around the State. These sites frequently have caused ground water contamination. The contaminated ground water migrates into nearby streams and eventually enters the Chesapeake Bay. The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) established the Superfund Program for investigation and cleanup of hazardous waste dump sites. Maryland has also initiated its own State Superfund program to further address these concerns of environmental pollution resulting from illegal disposal practices.

The Superfund Program protects the public and the environment from environmental and health risks associated with toxic and hazardous waste sites. This objective is accomplished by investigating sites to determine their potential for environmental harm. Sites with the greatest potential for harm are systematically cleaned up, an expensive and time consuming task, but one which is important for protection of human health and the environment.

4. UST/LUST Program

Oil and other petroleum products are frequently stored in underground storage tanks. With time, nearly all tanks, valves, or pipes corrode or otherwise fail, and the oil leaks into the ground where it contaminates ground water. Improperly installed tanks will leak sooner. Oil may contain toxic materials which are carried by the migrating ground water into nearby streams and then to the Chesapeake Bay.

The Underground Storage Tank (UST) Program is designed to protect ground water resources from storage tank releases through a preventative program. This program emphasizes proper installation, and corrosion and leak protection in storage tanks, and ground water monitoring. Old or unsuitable underground storage tanks are replaced by properly installed and designed systems. The purpose of the Leaking Underground Storage Tank (LUST) Program is to remediate ground water where releases have occurred. MDE has established a LUST Trust Fund to provide funding for remediation efforts and has the authority to recover costs from the responsible parties to reimburse the Trust Fund.

5. Hazardous Household Materials Program

Hazardous household materials constitute an emerging source of toxic pollution within the Chesapeake Bay watershed. These toxic substances have the same characteristics as hazardous wastes: ignitability, corrosivity, reactivity and toxicity. Every household in the United States is believed to generate approximately 160 pounds of hazardous household materials annually. Although 160 pounds annually is a small amount when considered on an individual household basis, when taken as a combined source from all homes, this source may be the largest single class generating hazardous wastes.

Because of the small amounts of hazardous materials generated in each household, individual homeowners are exempt from federal regulations on the disposal of hazardous materials. Since most homeowners are not aware of the dangers associated with hazardous household materials, homeowners do not always store or dispose of these materials in a safe manner. Improper storage and use of these materials can result in contamination of ground water, surface waters and ultimately the Chesapeake Bay and its tributaries.

The Hazardous Household Materials Program seeks to educate the public to the dangers associated with certain hazardous household materials and the proper way to store, use and dispose of these materials. Alternative solutions to their use are proposed. Future plans for this Program include a telephone hotline for public information dissemination, and the provision of guidance and assistance to municipalities which want to establish collection programs for hazardous household materials.

### 6. Toxic Air Pollutant Control Program

Deposition of toxic air pollutants may be a significant source of toxics entering the Bay. Dry deposition occurs when air pollutants settle to earth as particulates, while wet deposition occurs when air pollutants attach to rain or snow. Toxic air pollutants can enter the Bay directly, or they may fall to land and be washed into the Bay by rainstorms.

In September 1988, the Air Management Administration (AMA) of the Maryland Department of the Environment promulgated extensive Air Toxics Regulations controlling over 600 toxic air pollutants from new and existing industrial point sources. About 150 new sources and 800 existing sources at 400 facilities are regulated. Area sources like automobiles and gas stations are not covered by the regulations. Toxic air pollutants regulated include heavy metals such as chromium, cadmium, nickel, arsenic and zinc, and polycyclic organic compounds such as benzo-a-pyrene.

The primary goal of the air toxics control program is to protect health by controlling emissions of toxic air pollutants discharged into the air by industrial point sources. Another important goal is to ensure that all new sources of air toxics use the best possible controls to reduce emissions. An air toxics emissions inventory is also being compiled.

There are three major requirements in the regulations controlling toxic air pollutants. First, all sources must quantify emissions of toxic air pollutants. Second, all new sources, and any existing that cannot meet de minimus risk screening levels must control emissions using Best Available Control Technology for Toxics (T-BACT). Finally, all sources must show that emissions, after control, do not cause unacceptable off-property concentrations. The regulations provide specific criteria on how to meet this last requirement.

An important issue that must be addressed in the future is the contribution to air toxics risk from sources like cars and woodstoves that are not covered by regulations. AMA has begun to develop a program designed to look at these and other sources that have the potential to contribute to high pollutant concentration in densely populated urban areas like Baltimore. This program called the Urban Air Toxics Initiative will involve updating a preliminary computerized toxic emission inventory of sources, expanding a software package that manipulates the emissions inventory data and refining a recently initiated air toxic monitoring network.

Milestones

- By January 1, 1989, all sources must report emissions of carcinogens and highly toxic non-carcinogens.
- By July 1, 1990, all sources of carcinogens and highly toxic non-carcinogens must be in compliance with the regulations.
- By January 1, 1991, all sources must report emissions of other non-carcinogens.
- By January 1, 1992, all sources must be in compliance with the regulations.

## APPENDIX

### Water Management Administration

The Water Management Administration (WMA) is responsible for protection of surface and ground waters in the State. The controlling objective is to restore, maintain and enhance the chemical, physical and biological integrity of Maryland waters. This objective is accomplished through a variety of State programs, including: develop and promulgate water quality standards to protect human health and aquatic life; regulate through the NPDES program the discharge of pollutants, including toxic substances, from municipal discharges; enforce implementation and development of best management practices to control sediment, stormwater, and agricultural nonpoint source pollution; monitor effluents; sample ambient water quality and fish tissues; and quantify loads from nutrients, sediments, and toxics to the Bay system. The industrial pretreatment program prevents industrial discharges from interfering with municipal sewage treatment processes by prohibiting the passing of toxic pollutants through the treatment plants.

As required by the 1987 amendments to the Clean Water Act, this Administration is currently involved in an effort to identify surface waters impaired by toxic pollutants and significantly upgrade the State's water quality standards covering toxic pollutants. The WMA also implements programs required under the Federal Safe Drinking Water Act to provide the public with a safe supply of water.

### Hazardous and Solid Waste Management Administration

The goal of the Hazardous and Solid Waste Management Administration (HSWMA) is to protect the public and the environment from toxic and hazardous waste. HSWMA manages the handling, storage, collection, and disposal of solid wastes which includes toxic substances. It also regulates industrial wastewater discharges to both ground and surface waters of the State, under the NPDES program and the State discharge permit program, and inspects these facilities. HSWMA controls hazardous waste disposal or reduction through implementation of the Resource Conservation and Recovery Act (RCRA) and the State Controlled Hazardous Substances (CHS) program.

HSWMA administers the federal Superfund Program to inspect, identify, and clean up hazardous waste releases into the environment. This program also places abandoned and uncontrolled hazardous waste sites on a National Priority List (NPL), where they are ranked by EPA for cleanup. To ensure that other sites do not become Superfund sites or impose a risk to public health and the environment, HSWMA permits and enforces proper treatment, storage, and disposal of toxic hazardous substances through its

Hazardous Waste Permitting and Enforcement programs. These programs add support to the Industrial NPDES Discharge Permits Program and Toxics in Solid Waste Management Program, which are both entrusted, by policy, to protect the waters of Maryland from the effects of toxic wastes. HSWMA also regulates sewage sludge utilization to ensure that the material is effectively recycled on land. Application rates and sludge quality are monitored to assure protection of public health and the environment, as well as future productive use of the land. Several other HSWMA programs address other toxics issues within their jurisdiction. Briefly, some of these involve inspections, management, permitting, and enforcement of toxic wastes in sewage sludge disposal, underground storage tanks, discharges to groundwater, waste minimization, and application of aquatic herbicides and biocides.

## Air Management Administration

The Air Management Administration (AMA) manages a variety of programs to protect air quality. The AMA develops and implements regulations to control emissions from large industrial sources and "area" sources, like cars and gas tanks. Most of AMA's programs directly or indirectly reduce emissions of toxic pollutants into the air. Recently, AMA has proposed comprehensive regulations that specifically control certain toxic air pollutants from most sources required to get air quality permits. These regulations cover any carcinogenic or non-carcinogenic toxic air pollutant discharged into the air.

Other AMA programs designed to significantly reduce emissions of toxic air pollutants into the air include the development of State Implementation Plans (SIP), to meet the Federal standards for ozone and small particulate matter. These programs, called the Ozone SIP and the PM10 SIP require emissions controls at many sources. The Ozone SIP calls for sources to reduce emissions of volatile organic compounds (VOCs). VOCs react with nitrogen oxides in the presence of sunlight to form ozone. Almost all VOCs are considered toxic. The PM10 SIP will require sources to control fine particulate matter, which can cause toxic effects if inhaled deeply into the lungs. Another important program under the AMA which controls toxic substances is the Asbestos Program. This program ensures that demolition projects involving asbestos are carried out in accordance with regulations designed to protect the public health.

## Stormwater and Sediment Control Administration

The Stormwater and Sediment Control Administration (SSCA) was placed under MDE in 1987. It is responsible for reducing the impact on State surface waters of toxic substances transported by runoff from urban areas. The Administration accomplishes its responsibilities by working with local governments and state agencies to minimize erosion, siltation, sedimentation, and pollution through management of non-point source runoff while maintaining pre-development runoff characteristics.

## Toxics, Environmental Science and Health

Toxics, Environmental Science, and Health (TESH), an assistant secretariat of MDE, provides a variety of support services and management functions for toxic substances control. The Toxics Operations Center within TESH administers programs designed to prevent toxic substance releases through education and enforcement efforts. It also provides technical support for ecological assessment work relating to toxic materials in the environment.

The Radiological Health Center is involved in the recently identified problem involving the presence of radon gas in dwellings. It is actively working to make Maryland citizens aware of the associated health risks of radon gas and is acting as a clearinghouse for information concerning corrective procedures used to alleviate radon levels within buildings.

The Environmental Health Center provides risk analysis, abatement, and education for hazards associated with asbestos and lead. The programs are comprehensive and inclusive, forming a complete management program.

All of the programs under TESH are supported by the Technical Information Center, which serves as a resource for technical publications. It is also responsible for providing information to citizens concerning chemicals stored, disposed, and manufactured within Maryland. This responsibility is directed by the Superfund Amendments and Reauthorization Act (SARA) Title III, Chemical Right-to-Know. Further work is being conducted to determine the correlation of disease and adverse health effects with environmental exposures.

U.S. Environmental Protection Agency
Region III
Chesapeake Bay Liaison Office

Appendix

## 1. INTRODUCTION

The Chesapeake Bay Basin-wide Toxics Reduction Strategy was adopted by the Chesapeake Executive Council in December 1988. The Strategy continues and extends many toxic control activities undertaken since the 1970s under several Federal laws, and programs pursued by the states with increasing intensity during the 1980s. These programs form a complex composite of actions that are intended to "eliminate the discharge of toxic substances from any source to the Chesapeake Bay."

Activities to achieve this goal fall into five general categories:

- o Reducing the discharge of toxics from point sources
- o Reducing nonpoint discharges of toxics
- o Defining the extent of toxic problems in the Bay from point and nonpoint sources
- o Reducing ambient toxicity
- o Determining the potential impacts of toxics on the living resources of the Bay and human health.

Specific activities within these categories include State and Federal programs under the Clean Water Act and related media-specific pollution control legislation and special initiatives under the Chesapeake Bay Program. Controls on toxic discharges to the Bay include regulation of industrial point sources under NPDES permits, pretreatment requirements applicable to industrial discharges to municipal treatment plants, and special State and Federal restrictions on the use of specific pesticides, most notably tributyltin antifoulant paints.

The long-term goal of the Toxics Reduction Strategy is the elimination of discharges of toxic substances to the Chesapeake Bay. The strategy also includes a number of interim objectives and milestones which may be used to assess progress toward the long-term goal or re-direct activities, if necessary.

Intermediate goals, although not clearly stated within the Strategy, include the phased elimination of acute and chronic toxic discharges from major municipal and industrial point sources by 1996. The point source toxics reduction goal will be achieved through the implementation of Individual Control Strategies at specific discharges identified in 304(l) list designated areas of concern and through application of consistent criteria for defining toxic discharges and setting requirements for initiation of Toxicity Reduction Evaluations.

Reducing nonpoint discharges of toxics will initially emphasize defining sources and loads of toxic substances. Regulation of stormwater discharges will be used to reduce urban runoff of toxics. Additional educational and outreach efforts will concentrate on Baywide implementation of Integrated Pest Management, a procedure that requires careful surveillance of pests and selective use of pesticides and control programs to reduce reliance upon chemicals. While this technique has been applied most commonly in agriculture, there is now widespread interest in the program in urban areas as well.

The first step toward setting toxic reduction objectives specifically addressing habitat needs of the Bay's living resources will be to list the toxics of concern in the Chesapeake Bay. With this list as a guide, studies will be undertaken to define water quality and sediment criteria that should be incorporated into State standards. This approach recognizes the fact that too few toxic chemicals are reflected in existing state standards.

The activities of the EPA Chesapeake Bay Liaison Office (CBLO) in support of the implementation of the Basinwide Toxics Reduction Strategy are described within this appendix. These technical and coordination activities will become an integral component of the overall Chesapeake Bay Program work plan required by the 1987 Bay Agreement.

## 2. ASSESSING THE TOXICS PROBLEM

### A. Research

Through continued support of the Scientific and Technical Advisory Committee and representation on the Research Planning Committee, CBLO will promote and support research studies to better understand the impact of toxics on the Bay system. These studies should provide information that can be used effectively in risk assessment and in decision making to ensure that toxic impacts are reduced and eventually eliminated.

The Comprehensive Research Plan established a structured approach to define priority research needs and to secure adequate funding sources. The Toxics Research Plan (Appendix C) defines toxics research priorities within a risk assessment framework. CBLO will work to channel internal resources and those of EPA and other Federal agencies through the established institutional structure to ensure a long-term commitment is made to achieving a better understanding of the Bay's toxics problems.

### B. Evaluation of Analytical Capabilities for Toxics

EPA and the States share a common concern about the capability of state, federal, private and university laboratories in the Bay region to adequately meet the analytical burden to be imposed through the implementation of the Toxics Reduction Strategy. EPA's long involvement in analytical methods development and establishment of a nationwide contract laboratory program can bring significant expertise to bear on this issue. EPA's role will not be limited to the design and conduct of the proposed survey, but will include support for the implementation of resulting recommendations and actions.

### C. Chesapeake Bay Toxics Data Collection, Management and Synthesis

A critical logistical and technical support role of CBLO is to ensure the fulfillment of commitments that are made for the collection, management and Baywide synthesis of data required for decision making. Significant progress already has been made through the Chesapeake Bay Program's Committee structure toward establishing the structure for meeting these commitments.

The Monitoring Subcommittee, with staff support from CBLO, has developed a Chesapeake Bay Basin Monitoring Program Atlas which includes descriptions of ongoing, long-term toxics monitoring programs within the Bay basin. The Subcommittee will use the monitoring atlas (and its periodic supplements and updates) to help determine whether data collection needs are being addressed effectively. The task of identifying these data needs, however, has not yet been accomplished.

Through the Data Management Subcommittee and CBLO's in-house Chesapeake Bay Program Computer Center contractor staff, data management support can be found for the development and maintenance of a basin-wide toxics data base. Plans for updating and revising guidelines for formatting and submitting all forms of toxics data are outlined in the Data Management Subcommittee's 1989 workplan. CBLO plans to devote Computer Center staff resources towards development of the toxics data base.

### D. Toxics Loading Inventory

A key commitment in the Toxics Reduction Strategy is the development of a Toxics Loading Inventory for the Chesapeake Bay basin. Sources of information will be as diverse as the sources of toxics themselves. CBLO will play a major role in coordinating data input from EPA and other Federal agencies and ensuring a linkage between the submission of source information and its incorporation into the computerized loading inventory.

o Toxic Chemical Release Reporting Under SARA Title III

Under SARA title III, section 313, EPA is required to establish an inventory of toxic chemical emissions from certain facilities. Facilities covered by this provision are required to report annually to EPA and designated state officials releases of specified chemicals that occurred during the preceding calendar year. The first annual report was due July 1, 1988; subsequent reports are to be submitted by the same date each year.

EPA may modify the list in the future on the basis of adverse environmental effects due to such factors as toxicity, persistence, or a tendency to bioaccumulate. Governors may petition the EPA Administrator to add or delete a chemical based on these or other reasons. The Chesapeake Bay drainage basin could comprise an appropriate geographical area for redefining the list of chemicals, thresholds quantities or Standard Industrial Classification Codes (SIC) categories subject to reporting.

EPA must establish and maintain a national toxic chemical inventory based on the data submitted by industry. The toxic chemical release reporting form contains the following information:

- the name, location and type of business;
- whether the chemical is manufactured, processed or otherwise used and the general categories of use of the chemical;
- an estimate (in ranges) of the maximum amounts for the toxic chemical present at the facility and at any time during the preceding year;
- waste treatment/disposal methods and efficiency of methods for each waste stream;
- quantity of the chemical entering each environmental medium annually; and
- a certification by the senior official that the report is complete and accurate.

Facilities using listed toxic chemicals in quantities exceeding 10,000 pounds in a calendar year are subject to the chemical release reporting requirement. Reports also are required from facilities manufacturing or processing any of these chemicals in amounts exceeding 75,000 pounds in 1987, 50,000 pounds in 1988, and 25,000 pounds in any year thereafter.

o Permit Compliance System

The Permit Compliance System (PCS), the national data base for the NPDES program, is the primary source of point source information for EPA, the States, Congress and the public. It provides basic administrative, enforcement, and discharge information on all point sources with NPDES permits, including permit limits and concentrations of pollutants in effluents. It has been used to develop input data for Chesapeake Bay water quality models and to determine compliance with NPDES permit limits. It will have direct application in developing the Toxics Loading Inventory.

o Pesticide Use Survey

EPA will work with the States and other Federal agencies to complete a pesticide use survey including recent information on agricultural and urban pesticide use in the Chesapeake Bay basin. The report will incorporate information now becoming available from 1) the EPA groundwater survey, 2) State Departments of Agriculture and the Cooperative Extensions (data on acreage under IPM), 3) the NOAA-EPA Pesticides Loadings to Estuaries Survey, and 4) other pertinent agencies.

**E. Chesapeake Bay Toxics of Concern**

CBLO will work with the States to develop the Chesapeake Bay Toxics of Concern List and supporting matrix. The experience of other programs (e.g., Puget Sound, Great Lakes) in developing lists of toxics of concern to specific estuarine/aquatic systems will be factored into the process here to ensure a sound approach to development and application within the designated timeframe. CBLO will maintain the Toxics of Concern List and Matrix on the Chesapeake Bay Program Computer Center data base to ensure accessibility and to facilitate future updates.

## 3. WATER QUALITY STANDARDS AND LIVING RESOURCE REQUIREMENTS

### A. Water Quality Standards

Water quality standards set forth the designated uses of a waterbody and the water quality criteria necessary to protect those uses. States establish the standards, following their own administrative and legal procedures. Water quality standards serve two purposes: first, they establish the water quality goals for a body of water and second, they serve as the regulatory basis for the establishing water quality-based treatment controls and strategies that go beyond technology-based levels of treatment. Section 303(c) of the Clean Water Act which requires States to develop water quality standards and to review and, if necessary, revise the standards at least once every three years.

EPA will continue to provide guidance and review state water quality standards up for adoption. In addition, there will be a renewed effort under the Clean Water Act and the Toxics Reduction Strategy to encourage adoption of additional water quality standards by the states. Given a common list of toxics of concern, these efforts can focus on greater regional consistency and innovation in the development of standards, including new approaches such as Baywide promulgation.

Publication by EPA of water quality criteria documents delineating safe levels of pollutants for aquatic life and human health is a major area of technical assistance to the states. Criteria recommendations, made for both fresh and marine waters, include acute and chronic values for the protection of aquatic life, and chronic values for the protection of human health. Recommendations in the criteria documents are offered as scientific guidance--they are not standards and they are not regulatory in nature. Criteria recommendations may form the basis for enforceable standards, however, if they are adopted by the States. Because of the high cost of developing criteria, states generally have chosen not to develop their own but to rely on EPA's recommendations in developing their water quality standards.

Adopting section 304(a) criteria recommendations published by EPA is the simplest, fastest, and least costly way for a State to incorporate numerical criteria in its water quality standards. EPA approval of such standards is assured and, if necessary, EPA can provide technical expertise in support of the recommendations at a State's public hearings. There is, however, a valid toxicological basis for the contention that national criteria may be under protective or over protective at specific sites. This may be the case when (1) the species that comprise communities at a particular site may be more or less sensitive than those included in the national criteria data set; (2) physical or chemical characteristics--or both--of water at a particular site may alter the biological availability or toxicity of the substance; or (3) differences in species sensitivity and water quality may combine to alter the toxicity or availability of the substance.

#### National and Site Specific Criteria Development

The possible need for site-specific criteria coupled with the fact that EPA criteria recommendations are for fresh or saltwater, rather than an estuarine environment, some have expressed the concern that EPA criteria may not be applicable to the Chesapeake Bay. In 1985, two EPA laboratories collaborated on a study of site-specific criteria development for six bays on the East and South coasts, including two sites on the Chesapeake. The study used the simplest site-specific modification technique: the recalculation procedure which permits acute toxicity data cited in the national criteria document on species of organisms at a specific site to be used to recalculate the criterion for that specific site. In other words, the species found at the site are those that are used to determine the criteria. A central conclusion of the study (U.S. EPA 1985) was "that the sensitivity of communities at these large sites are not unique relative to sensitivities of tested species." Further, the authors concluded "that national water quality criteria are probably applicable to most marine sites even though the species at the sites vary."

EPA believes the federal criteria recommendations are applicable to estuarine systems for several reasons: (1) the minimum data base requirements cover a broad range of species, including those that may be unique to estuarine areas, (2) toxic impacts upon estuarine species tested by EPA are little different from those upon fresh and marine species, and (3) the boundary between estuarine and fresh/marine water often fluctuates. EPA will continue to recommend that States either adopt the more stringent of fresh or marine water quality criteria in their standards or, if a State is unsure the criteria are applicable, derive its own site-specific criteria as the basis for standards. The latter alternative, however, may result in significant differences from the EPA national criteria that the species-substitution approach appeared to support.

Two approaches for developing site-specific criteria are (1) using an indicator species procedure which permits limited toxicity testing to determine if the acute and chronic toxicity of the substance to resident or nonresident species tested in site water differs significantly from toxicity in laboratory water, and (2) a resident species procedure in which all minimum data base requirements of the EPA national guidelines are met by testing resident species in site water. Unless a State has data to indicate that the water chemistry in a given water body differs significantly from the water used in EPA tests, or that the toxicity of a pollutant to a species in a water body differs significantly from that in species used by EPA, neither of the site-specific calculation options is likely to result in a criterion much different from EPA's national recommendation.

**Establishing Toxics Standards for the Chesapeake Bay**

In direct support of the commitment to adopt water quality standards for toxics, EPA will consider the needs of Chesapeake Bay basin states in determining which pollutants will be selected for water quality criteria and advisory development over the next several years. CBLO will work with EPA's Office of Water, Criteria and Standards Division to ensure full consideration of Chesapeake Bay Program's criteria development and standards application guidance needs.

Once the toxics which warrant adoption of water quality standards are identified (through the toxics of concern list), there are two ways Baywide standards can be established.

One, each State would follow its own administrative rules in adopting or revising standards, then submit them to EPA for review. As part of its review, EPA, as a party to the Chesapeake Bay Agreement, would consider whether the State-adopted standards are consistent with the Toxics Reduction Strategy adopted by the Chesapeake Executive Council. In using this approach, standards would be established in a staggered manner as States proceeded independently within the strategy framework. The schedule for a State's triennial standards review as well as the priority each State gives to Bay-related standards vis-a-vis those to be applied elsewhere also would impact upon implementation of the strategy.

A second, more innovative approach for establishing water quality standards for the Chesapeake Bay, would be for EPA to promulgate as Federal standards applicable to all Bay States those which are developed and approved by the Executive Council. Section 303(c)(4)(B) of the Clean Water Act authorizes the EPA Administrator to take such action whenever (1) standards adopted by a State are not consistent with the requirements of the Act, or (2) the Administrator determines that a new or revised standard is necessary to meet the requirements of the Act.

This approach would offer these advantages: (1) it would ensure adoption of a single set of standards applicable to the entire Bay (though there could be variations for seasonal changes or application to different segments of the Bay), (2) all State standards would be replaced by the Federal rule simultaneously, effectively preventing inconsistencies that could permit unfair competitive advantages, (3) only one round of public hearings and review and consideration of public comments would be necessary, with the cost borne by EPA (though EPA likely would invite representatives from each State to attend the attend hearings and explain the proposal and the Executive Council's rationale for its support), and (4) States could not unilaterally revise standards applicable to the Bay if promulgated at the Federal level. EPA could withdraw the Federal rule later if States adopt standards that meet the requirements of the Act; i.e., standards accepted by the Executive Council as consistent with Toxics Reduction Strategy.

Disadvantages include (1) this approach substitutes Federal authority for that of the States (although in this case the substitution would occur only with the approval of the Bay States), and (2) it contradicts EPA's own policy which favors State action over the exercise of Federal authority.

Promulgation of a final rule, if the Executive Council requests Federal action, would take about two years. Although unorthodox, this option warrants serious consideration as a possible vehicle for establishing water quality standards for the Chesapeake Bay. The information needed and the work required to formulate a set of standards is about the same whether the States act individually or EPA promulgates a rule to implement the Executive Council's recommendations.

**Current and Future Focus of the EPA Criteria and Standards Program**

EPA criteria development has focused recently on providing criteria recommendations for toxic pollutants. Once water quality criteria are published by EPA, revisions generally will not even be considered for at least five years. Developing criteria for pollutants for which no guidelines currently exist is given higher priority by EPA than revising documents published previously.

Because of the data base and time requirements related to development of criteria documents, EPA is initiating the publication of water quality advisories in order to provide information more quickly on a larger number of pollutants. Advisories will be developed for pollutants in cases when the minimum data base requirements of the EPA Guidelines for Deriving National Water Quality Criteria cannot be met. This is not to say that a large amount of data is not available, but only that the broad spectrum data base required by the guidelines may be lacking. Since the amount of data used to develop an advisory varies, EPA's confidence in the resulting recommendation also will vary. An explanation of the level of confidence will be included in each advisory. Once issued, advisories may be used in the same way as criteria. EPA expects to produce about 30 advisories a year along with about three criteria documents.

**EPA Triennial Review Priorities 1988-1993**

EPA's long-term plan for the national water quality standards program defines national program objectives and the specific activities necessary to support each objective. The objectives build on traditional state water quality standards programs and focus on expanding these programs to address sediment quality, protect wildlife and utilize resident biological communities.

Objectives for the FY 1988-1990 Triennium are to:

1) Adopt numeric criteria for toxic pollutants
2) Identify waters needing toxic criteria
3) Update state policies and develop implementation procedures for antidegradation
4) Adopt toxicity-based criteria (ambient/whole effluent bioassays) and develop implementation procedures
5) Complete state toxic program reviews and ensure development of state action plans

Objectives for the FY 1991-1993 Triennium are to:

1) Establish permanent link between 304(l) listing requirements and triennial reviews
2) Establish water quality standards for wetlands
3) Adopt sediment criteria for toxics
4) Adopt fine sediment criteria for salmonid fisheries
5) Adopt biological criteria (biocriteria)

Beyond 1993, the single objective identified thus far is the adoption of criteria to protect wildlife.

EPA will work closely with the states to ensure that adequate guidance for achieving the stated objectives is available in advance of each triennial review. Because many of the objectives are components of the Toxics Reduction Strategy, EPA and the States may work to implement some of the objectives in the Bay basin before they are applied nationally.

## B. Living Resource Habitat Requirements

CBLO will continue to provide staff support to the Living Resources Subcommittee in its efforts to update the Habitat Requirements for Chesapeake Bay Living Resources adopted in January 1988 and to develop guidelines for the use and application of habitat requirements within the Toxics Reduction Strategy.

# 4. TOWARDS A COMPREHENSIVE APPROACH TO TOXICS REDUCTION

## A. Point Sources

Point sources are regulated under the National Pollution Discharge Elimination system (NPDES). Industrial and municipal dischargers must receive an NPDES permit before discharging wastewater directly to surface waters. With the exception of the District of Columbia, Bay States have been delegated authority by EPA to administer the NPDES program. States use the NPDES permit to set technology-based and water quality-based pollutant limits to ensure that state water quality standards are not violated.

In 1983, EPA set forth a policy calling for increased use of biomonitoring to detect toxicity that might be present in effluents despite technology-based or other controls. The NPDES permit can be used to require such biomonitoring and to trigger a Toxicity Reduction Evaluation (TRE). The purpose of the TRE is to identify sources of toxicity and to evaluate alternative ways to reduce it to acceptable levels.

Industrial dischargers that send their wastewater to municipal treatment plants are subject to pretreatment requirements. These regulations are intended to eliminate toxic concentrations that would disrupt the operation of treatment systems, pass directly through those systems to adversely affect waters receiving discharges, or contaminate sludge and render it unfit for beneficial uses. Authority to administer pretreatment programs has been delegated to Maryland, with Virginia and Pennsylvania anticipating delegation in 1988.

Section 304(e) of the Clean Water Act amendments of 1987 adds a new dimension to toxics control. It requires States and Regions to develop an Individual Control Strategy (ICS) by February 4, 1989 for point sources contributing to violations or exceedances of EPA water quality criteria or state water quality standards for priority pollutants. Implementation of an ICS is to scheduled to achieve compliance with applicable water quality standards no later than 3 years after its approval by EPA. The ICS requirement is met by an NPDES permit.

EPA is currently developing NPDES permit application requirements for urban storm water. As mandated by section 402(p) of the Clean Water Act, these requirements initially apply to discharges from municipal separate storm sewer systems serving population of 250,000 or more and storm water discharges associated with industrial activity. Permit requirements are to be extended to municipal separate storm sewer systems serving populations of 100,000 to 250,000 by February 1991 and to those serving populations of less than 100,000 by October, 1992. A key component to be emphasized in the regulations is the identification and effective prohibition of non-storm water discharges such as illicit connections and illegal dumping to municipal separate storm sewers. The Nationwide Urban Runoff Program indicated that significant water quality improvements could be achieved by eliminating these discharges.

In addition to addressing storm water discharges from separate storm water system, EPA is developing a permit strategy and guidance document for controlling discharges from combined sewer overflows (CSOs). It is the Agency's position that CSOs are point sources subject to regulation under section 402 of the Clean Water Act. The objectives of the CSO strategy are to provide maximum treatment of wet weather CSOs and to bring wet weather CSOs into compliance with technology-based and water quality-based permit limits. The CSO implementation plan calls for identifying CSOs, determining compliance with permit requirements, and controlling non-permitted and insufficiently permitted discharges. The guidance document will cover various permitting technologies, control options, best management practices, and operation and maintenance concerns.

EPA will track the progress of the states in meeting point source toxics reduction goals. EPA remains committed to meeting earlier target dates and to providing more specific goals statements and objectives to guide efforts at the State and Federal levels. CBLO will be working with EPA Regional and Headquarters staffs to provide sufficient guidance to ensure that the point source strategy addresses the Bay as a continuous estuarine system. Efforts will be made to promote the siting of pilot studies (e.g., bioaccumulation protocol confirmation) within the Chesapeake Bay basin to facilitate technology transfer among EPA Research Laboratories, EPA Region III, and the States.

**B. Urban Nonpoint Sources**

EPA will work with Federal, State and private nonpoint source groups to form a work group to address nonpoint source toxic reduction issues and to devise a management plan to reduce toxics loading from sources including, but not limited to: 1) storm sewers and illegal hookups; 2) traffic-generated exhaust products, heavy metals and tar residues; 3) rights-of-way and ice control chemicals; 4) commercial and household waste products; 5) pesticides and other chemicals for commercial, pre-construction, agricultural and home and garden uses; 6) disposal of PCB transmitters, capacitors and fluids containing PCB's; and 7) chemical dumping areas, junkyards and landfills.

Certain non-agricultural storm water discharges, such as urban runoff, have traditionally been considered nonpoint sources of pollution, but are legally defined as point sources when discharged from conveyance such as municipal separate storm sewers. Urban storm water discharges subject to NPDES permit requirements as point sources were discussed previously.

**C. Pesticides**

Through the Nonpoint Source Subcommittee and the institutional structure designated to coordinate the long-term implementation of the Toxic Reduction Strategy, CBLO will be working to incorporate effective pesticide management through existing State and Federal programs and new initiatives.

## National Standards for Pesticides Management

USDA's Extension Service and Soil Conservation Service are currently developing National Standards and Specifications for both nutrient and pesticide Best Management Practices (BMP). When completed, these state-of-the-art BMP guidelines will become part of the USDA national program, available for any State to use. The technical guidance for pesticides management involves reduction of the pesticide load; substitution of less toxic, mobile, persistent or more selective pesticides; and selection of BMPs for reduction of surface and subsurface transport of pesticides. Many of these concepts are already in use within the Chesapeake Bay basin, but have not been combined and delivered as a complete BMP for pesticide management.

## Integrated Pest Management

Integrated Pest Management (IPM) is an integral part of pesticide management that has been an Extension Service effort primarily. However, some private firms also have experience with IPM and are able to provide a range of services. IPM attempts to make the most efficient use of the techniques available to control pests. The basis of IPM is to take action to prevent pest problems, suppress damage levels and use chemical pesticides only where needed. Rather than seeking to eradicate all pests, IPM strives to prevent their development or suppress population numbers below levels which would be economically damaging. The heart of IMP is scouting to provide basic monitoring of fields, sampling pests, and recording pest populations. These data allow an IPM specialist to make recommendations to the urban homeowner or farmer based on pre-determined pest thresholds. IPM has been proven to decrease the use of pesticides and significantly reduce pest control or production costs, while crop yields and profits actually have been shown to increase.

The implementation of IPM in agricultural programs involves a combination of activities. These include: increasing technical/instructional services and scouting, providing for outreach to farmers, expanding IPM and providing for farmer cost share incentives, and conducting research on weed and insect controls needed to support IPM threshold recommendations. Reductions in pesticide use because of IPM efforts in the Bay region range from 10 percent to as high as 80 percent, depending on the type of crop treated and the pesticide applied.

Integrated Pest Management is not limited to agricultural applications. With increasing development in the basin, IPM is becoming more popular and necessary in urban areas as well. In that portion of Maryland within the Bay basin, more than 90 percent of the population lives in or near urban centers. Urban acreage in this part of the State increased by 170 percent between 1970 and 1980. Maryland has more than 700,000 acres in urban land within the basin, compared to 2,500,000 acres in crops and pasture. Virginia has more than 1,500,000 acres of urban land in the Bay watershed, compared to 4,500,000 acres of farmland. Comparable figures for Pennsylvania are more than 2,000,000 acres of urban land and 4,000,000 acres in crops and pasture. Basin-wide, urban acreage is roughly one-third to one-half of the total in farmland. These acreages do not take into account other uses such as forestland and highway rights-of-way where pesticides also are applied. Studies by the Maryland Cooperative Extension Service indicate that 88 percent of homeowners in Maryland use herbicides, fungicides and insecticides in quantities as great or greater per acre than those used by farmers.

In practice, the implementation of IPM in urban areas begins with pilot programs, which then serve as models that can be replicated in other communities. This process starts with identifying study areas, assessing current pesticide practices, and reviewing information available on alternative pest control packages compared to the traditional practice of applying pesticides according to label directions without fully identifying the type and extent of a pest problem. Reductions in pesticide use exceeding 90 percent have been achieved in some urban/suburban settings through IPM, studies by the University of Maryland Cooperative Extension Service have indicated. These studies included a commercial arborists project involving homeowners, nursery crop IPM projects, and indoor pest control for large public facility projects. In other Bay States, IPM outreach has included demonstration programs targeted to ornamentals used for landscaping and programs geared toward nursery growers.

## Pesticide Management for Chesapeake Bay

A nonpoint source pesticide management program for the entire Chesapeake Bay will provide state-of-the-art control for those chemicals that are labeled for use within the basin. The programs should be similar to the nutrient management programs now being implemented by the States and should include IPM and other USDA elements available. The first objective should be to include a pesticide plan in each agreement with the farmer, to base that plan on the recommendations of the Extension Service, and to integrate it with other BMPs appropriate for the field. The next step should be to obtain scouting and forecasting services for the most critical areas of the basin. Already existing scouting services should be expanded to meet these needs where possible. As the Soil Conservation Service's program becomes available within the basin, the two programs should then be integrated.

Pesticide BMPs for the Chesapeake Bay basin could provide economic benefits to users while reducing nonpoint source pesticides movement in the basin. CBLO, therefore, proposes that State implementation grant applications contain workplans for implementation of pilot IPM programs that would be the basis for a pesticide management component in FY1990 Chesapeake Bay Implementation Grants. EPA also will work with the States and other Federal agencies to develop pesticide management alternatives. This process will include carrying out Integrated Pest Management (IPM) pilot projects, both agricultural and urban, in each of the Bay States. Results of the pilot projects and data from the pesticide survey will be used to target areas (e.g., counties in which IPM is relatively unknown or not being practiced) needing alternative pesticide management programs.

## Pesticides and Ground-Water Protection

The National Agricultural Chemicals in Ground Water Pesticide Strategy envisions national registration of pesticides with State- or county-wide restrictions based on ground-water concerns. This will take place along with an EPA effort to establish ground-water protection measures that will be uniformly applicable across the country. State management plans will be developed for the purpose of addressing area-specific management of pesticide use to protect ground-water resources. In some cases, the use of a pesticide in a State will depend on the existence of and adequacy of a State management plan. Under the management plan, the State will develop and implement tailored prevention measures based on local differences in ground-water use, value and vulnerability. Some of the items included on the State management menu as methods for controlling pesticide use are:

- o change in rates of application,
- o change in timing of application,
- o change in method of application,
- o integrated pest management,
- o best management practices,
- o additional monitoring, and
- o additional training and certification.

These pesticides management methods would also be appropriate for use in the Chesapeake Bay Program.

The Chesapeake Bay basin may be an opportune location for taking a holistic approach to protecting its water resources and to facilitate a management program that realizes the important relationship between ground water protection and surface water quality. State pesticide management efforts developed in response to State ground water initiatives should be fully coordinated with the Toxics Reduction Strategy components for protecting surface water quality. This point was raised in the Proposed National Ground Water Protection Agricultural Pesticides Strategy, December, 1987. Finally, State strategies for protecting surface waters should also be consistent throughout the basin.

**D. Air Deposition**

EPA will target national program initiatives to further understanding of the magnitude of atmospheric deposition of toxics and intra- and interregional sources. CBLO will work through the Monitoring Subcommittee and the institutional structure designated for long-term implementation of the Toxics Reduction Strategy to ensure the creation of a permanent Bay basin atmospheric deposition monitoring network linked with other toxics monitoring programs.

**E. Solid and Hazardous Waste**

Solid and Hazardous Waste are regulated under the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Compensation and Liability Act (CERCLA).

The RCRA program regulates the disposal of municipal and industrial solid waste. The program is roughly divided into three regulatory areas: 1) non-hazardous solid waste (subtitle D); 2) hazardous waste (subtitle C); and 3) underground storage tanks (subtitle I).

Subtitle D regulations define minimum technical design, construction, and maintenance requirements for environmentally acceptable solid waste management facilities. States may establish comparable or more stringent standards for solid waste facilities.

Disposal of non-hazardous solid waste, especially municipal solid waste, has been drawing increasing national attention recently because of the rapid depletion of landfill capacity in some areas, growing public concern over safe siting and design of new disposal facilities, and the difficult choices municipalities face in deciding what to do with the trash generated in their communities.

The RCRA subtitle C program regulates hazardous wastes from "cradle to grave." Facilities involved in the generation, transportation, treatment, storage, and/or disposal of hazardous wastes (TSDFs) are subject to regulation under subtitle C.

All TSDFs are required to obtain an RCRA permit. TSDFs that have obtained a permit are subject to technical standards set forth in 40 CFR Part 264. TSDFs that have not yet obtained a permit (i.e., "interim status facilities") are subject to the technical standards contained in 40 CFR Part 265. Regulations in 40 CFR Parts 264 and 265 are organized and define acceptable management of hazardous waste in a similar way.

Subtitle I authorizes a regulatory program covering underground storage tanks (USTs) for petroleum and other chemical products. Proposed UST regulations require the installation of spill and overfill prevention devices. Examples of appropriate devices include sensors to indicate when a tank is 95 percent full, or spill catchment basins large enough to contain the volume of the fill hose.

The Comprehensive Environmental Response, Compensation, and Liabilities Act (CERCLA) established the Superfund program to respond to releases of hazardous substances into the environment from uncontrolled hazardous waste sites.

Upon discovery, potential Superfund sites are evaluated to determine whether they pose a serious environmental hazard. Information for this evaluation is collected during a Preliminary Assessment (PI) and a Site Investigation (SI). Information from the PA/SI is used in a model known as the Hazard Ranking System (HRS). The HRS assigns a numerical score to a site describing its environmental hazard. The HRS assign three types of scores to a potential Superfund site:

- A score that reflects the potential for harm to humans or the environment from migration of a hazardous substance away from the facility through ground water, surface water, or the air. It is a composite of separate scores for each of the three migration routes.

- A score that reflects the potential for harm from substances that can explode or cause fires.

- A score that reflects the potential for harm from direct contact with hazardous substances at the facility (i.e., no migration need be involved).

Sites with high scores for direct contact and/or fire and explosion generally fall within the CERCLA removal (immediate response) program while sites with high migration route scores (surface water, ground water, and air pathways) are proposed for listing on the National Priorities List (NPL). Sites added to the NPL undergo a Remedial Investigation/Feasibility Study (RI/FS). The RI/FS identifies alternative remedies for the environmental problems documented during the HRS process. In the RI, data characterizing the site and its wastes are collected, and treatability tests are conducted as necessary to evaluate the performance and cost of possible treatment technologies. In the FS, remedial alternatives are developed, screened, and evaluated. CERCLA requires that Superfund remedial actions meet all Federal or State standards, requirements, criteria, or limitations that are legally applicable or relevant and appropriate (commonly referred to as ARARs).

The Record of Decision (ROD) documents the remedy selected for a site based on the RI/FS, the rationale for choosing that remedy, and a summary of ARARs identified for a site. Then the remedial design and remedial action progress according to the rationale set forth in the ROD.

EPA will continue to work with the states to prioritize, where possible, regulatory activities related to solid and hazardous waste which have more immediate impacts on Chesapeake Bay and its tributaries. These efforts will include transfer of technologies for waste minimization (household and industrial) and landfill sitting targeted towards protection of the Bay's resources.

**F. Contaminated Sediments**

The signatories have recognized that toxic contaminants in bottom sediments of the Chesapeake Bay create the potential for continued environmental degradation even where water column pollutant levels comply with established state water quality standards. An accurate assessment of the contaminated sediment problem is difficult in the absence of a defensible sediment quality criteria. Enough is known, however, to create concern that existing and projected sediment contaminant concentrations can have significant adverse effects on aquatic life and human health. The application of sediment criteria will make it possible to implement regulatory, enforcement, and clean-up actions where necessary and to establish priorities between programs and sites.

The principal goal of EPA's national sediment criteria development effort is to focus on criteria that can be used in variety of ways to better address contaminated sediment problems. The immediate short-term goal is to gain acceptance of the procedure from the Agency's independent Science Advisory Board. Acceptance by this Board will indicate that the science and logic used in developing sediment quality criteria are suitable for regulatory purposes. Regulatory options are currently being evaluated, and guidance for sampling and analytical techniques are being developed. Once approval is obtained from the Board, activities will focus on developing sediment criteria values (or methodologies for site specific criteria development) for contaminants of greatest concern, as indicated by monitoring information and the needs of various EPA programs, implementing a regulatory framework, and reducing uncertainty levels associated with developed criteria. EPA intends to give priority in the FY91-93 triennial review cycle to establishing adoption of sediment criteria by the States as part of their water quality standards.

The first criteria values developed will be useful in identifying problem and potential problem areas and, in some cases, the need for more specific studies to determine the likelihood of adverse impacts. As developmental studies progress and data supporting the criteria improve, their utility will increase. Sediment criteria will be useful in implementing a number of laws, primarily those involving siting, permitting, or monitoring of waste disposal; identification or cleanup of contaminated areas, and preparation of environmental impact statements.

EPA will work with the States in the following areas to help achieve commitments within the Toxics Reduction Strategy related to contaminated sediments:

- o Dissemination of information on the status of EPA's efforts to develop national sediment quality criteria;

- o Development and State adoption of Chesapeake Bay sediment quality evaluation protocols and criteria; and

- o Transfer of technology on sediment bioassay protocols enhanced through siting evaluations of estuarine sediment bioassay tests within the Chesapeake Bay.

## 5. IMPLEMENTING THE STRATEGY AND MEASURING PROGRESS

### A. Implementing the Strategy

CBLO will provide staff support to the ad hoc Toxics Reduction Strategy Action Plan Development Panel to ensure integration of toxics reduction initiatives in the overall Chesapeake Bay Program workplan and coordination with Federal facilities in the basin and Federal agencies participating in the Chesapeake Bay Program. CBLO will work with the panel to establish a system for tracking achievement of strategy commitments.

### B. Public Education and Involvement

As the lead agency for implementation of the Baywide Communications Plan and in concert with the signatory jurisdictions, EPA will provide support necessary for the active involvement of the public in the implementation of the Toxics Reduction Strategy. There are several avenues for ensuring a role for the public through the existing program structure.

- o The Alliance for Chesapeake Bay will continue its lead role for public participation in the Chesapeake Bay Program

- o The Chesapeake Regional Information Service can help ensure wide distribution of information and public review notices

- o The Chesapeake Bay Information Network links information officers from a wide variety of agencies and public interest groups

- o The Local Governments Advisory Committee, the Scientific and Technical Advisory Committee and the Citizens Advisory Committee can promote the distribution of information to and the participation of the peers they represent.

CBLO will continue to coordinate the activities of Federal agencies and will take the lead in addressing any legal requirements for public involvement.

**C. Progress Reports and Reevaluation**

CBLO is committed to providing staff support for the development of future progress reports on the implementation of the Toxics Reduction Strategy and to coordinating the contributions of the Federal agencies participating in the Chesapeake Bay Program.

# APPENDIX C

## STAC Toxics Research Plan

# Toxics Research Strategy

(Prepared by the Toxics Subcommittee
of the Scientific and Technical Advisory Committee)

## INTRODUCTION

A goal of the 1987 Chesapeake Bay Agreement is to reduce and control point and nonpoint sources of pollution to attain the water quality necessary to support the living resources of the Bay. The Agreement states, "The improvement and maintenance of water quality are the single most critical elements in the overall restoration and protection of the Chesapeake Bay."

The issue of toxics in the Bay has not been clearly defined. However, declines in populations of important species have been associated with reductions in water quality. Except in a few cases, evidence is indirect. The example of other large aquatic systems, such as the Great Lakes, emphasizes the vulnerability of ecosystems bounded by densely populated regions and the important relationship between land use in the watershed area and the health of the aquatic system.

A useful definition of "toxics" is given in the Great Lakes Water Quality Agreement:[1] "'Toxic substance' means a substance which can cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological or reproductive malfunctions or physical deformities in any organism or its offspring, or which can become poisonous after concentration in the food chain or in combination with other substances."

The Basinwide Toxics Reduction Strategy provides a framework for controlling and monitoring substances that fall within the existing regulatory and management structures. It also calls for much information that must be developed through a program of directed research. A Research Strategy must address management needs; however, it must also look forward and extend our current knowledge base. The Research Strategy should permit us to improve current capabilities for detecting, assessing, and managing toxics and pollutants. It should also provide an understanding of the current significance of toxics in the Bay and the potential risks associated with their presence. And it should provide an understanding of the physical and chemical processes by which toxics may enter the system, move, and become available to biota. Because adverse effects of present and future toxic burdens must be minimized, predictive systems are needed. These can be developed only if findings from biological, analytical, and environmental studies can be successfully integrated.

[1] Revised November 1987.

The emphasis of this Research Strategy is on reducing risks to the Chesapeake Bay associated with toxic substances. In order to do this, one must determine the magnitude of existing or projected risks from the myriad of chemicals involved. Therefore the Strategy focuses on risk assessments and the major components required for effective risk determinations.

## I. RISK-ASSESSMENT RESEARCH

Risk assessments have been described as estimations of the probability of undesirable events such as injury, death, or decrease in biomass (standing crop) or productivity of living resources.[2] Environmental risk assessments can further be defined as estimations of the likelihood that adverse effects, such as mortality, acute and chronic toxicity, reproductive changes, or changes in community/ecosystem level function and structure, will occur, are occurring, or have occurred.[3]

Risk is a function of hazard and exposure; therefore, environmental risk is a function of toxicological hazard and environmental exposure. Toxicological hazard is the intrinsic capability of a contaminant to cause an adverse effect under a particular set of circumstances. Data used to estimate toxicological hazard are usually derived from laboratory bioassays.

Environmental exposure is a function of two components. The first is the estimated amount of the contaminant that will be in the environment and its availability to living resources of concern, and the second consists of estimates of the types, distribution, abundance, and natural history of the resources being exposed. Both of these estimates have associated errors and uncertainties.

The function and utility of risk assessment have been accurately described:

> "Risk assessment consists of formal scientific techniques that (1) integrate knowledge about a contemplated action and its possible effects (2) account for uncertainties associated with that knowledge and (3) express results probabilistically in order to account for both knowledge and uncertainty. Risk assessment provides a sound technical basis for making rational management decisions. Risk management is the process of making decisions about the acceptability of risks and the need for risk reduction."[4]

The Research Strategy has been structured to provide for the development and validation of source measurement protocols and designs, modeling of transport and fate processes, and increased understandings of the mechanism and magnitude of effects. Recommended research will provide toxicological hazard and exposure data contributing to a definition of the impact of toxics on the Chesapeake Bay system. The resultant risk assessment framework will eventually lead to structured risk reduction decision-making through the Basinwide Toxics Reduction Strategy.

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2 Suter, G.W., D.S. Vaughan and R.H. Gardner. 1983. Risk Assessment by Analysis of Extrapolation Error: A Demonstration for Effects of Pollutants on Fish. Environmental Toxicology and Chemistry. 2:369-378.

Roderick, J.V. and R.C. Tardiff. 1982. Conceptual Basis for Risk Assessment. Presented at the Annual American Chemical Society Meeting. Kansas City, MO. Sept. 14-16, 1982.

3 U.S. EPA. 1986. Ecological Risk Assessment. EPA 540/9-85-001, June 1985. U.S. Environmental Protection Agency, Office of Pesticide Programs, Washington, DC.

4 Fava, J.A., W.J. Adams, R.L. Larson, G.L. Dixon, K.L. Dixon, and W.E. Bishop, Editors. 1988. Research Priorities in Environmental Risk Assessment, Workshop Report, Society of Environmental Toxicology and Chemistry. Breckenridge, Colorado, Aug 1987.

## Findings and Recommendations:

I.1a Finding:
Environmental risk assessments offer a rational and consistent framework by which to evaluate the effects, existing or potential, of toxic substances entering the Bay or those already in the system.

I.1b Recommendation:
Research should be supported to examine and evaluate selected environmental risk assessment protocols to develop an appropriate protocol to be used throughout the Chesapeake Bay within the Basinwide Toxics Reduction Strategy framework.

I.2a Finding:
Environmental risk assessments rely on the accuracy and precision of toxicity and exposure estimates. In addition, a correct understanding of life histories and trophic interactions of the organisms involved is necessary to guarantee effectiveness of the predictions.

I.2b Recommendation:
Research should be focused on improving the effectiveness of the environmental risk assessments developed through Recommendation I.1b.

## II. SOURCES RESEARCH

A Research Strategy that is directed toward determining sources of toxic chemicals must be formulated with several facts in mind. One is that although detection of toxics is relatively simple for well-known compounds emanating from point sources, this is not the case for unidentified or unregulated compounds, or those entering the Bay via atmospheric deposition, groundwater, or urban runoff. For these compounds, chemical analyses must be capable of detecting as many compounds as possible. The problem of sampling is particularly difficult. For these reasons, most of the inventories of toxic loadings to the Bay are less than ideal either because they ignored some routes of entry such as groundwater or atmospheric deposition, or because the chemical analyses of the source materials were minimal and incomplete.

The Chesapeake Bay is the largest estuary in the United States. Yet, in the last effort to determine the extent of toxic chemicals in the mainstem of the Bay (i.e. not including the tributaries), fewer than 20 samples were collected. The probability of detecting "hot spots", sources, or trends with so few samples is low. Although it is likely that toxic impacts from point sources will be exhibited near the outfalls and hence not as much in the mainstem of the Bay, this may not be the case for many nonpoint sources of toxics, such as atmospheric deposition.

Most toxics regulatory programs now in existence are designed to control and limit the sources and inputs of a selected set of substances. The compounds or elements on the list(s) have been selected because it is believed that they have caused, or have the potential to cause, damage to the environment. Once a substance has been selected it becomes the focus of attention to determine analytical procedures to quantify its presence or biological effects. It is generally accepted that substances on such lists are or have the potential to be toxic. It is *not*, however, correct to assume that compounds not listed are harmless. For example, neither Kepone nor tributyltin (TBT) is on the EPA Priority Pollutant List.

Discharge permit limits and pretreatment standards are issued for a very limited number of known or regulated toxics in point-source effluents. As a result, the concentration of the material in effluents, sediments, waters, or tissues may be measured. In the process of determining the sought substance(s), hundreds of other substances are often detected and quantified. Most, if not all, of this free toxics information is ignored and discarded.

No program can be effective in evaluating the risks of toxic chemicals to the Chesapeake Bay if it relies solely on *preselected* lists of chemicals to formulate risk assessments. Such an approach, while widespread locally and nationally, is no longer necessary. Technology now exists to collect, store, and manipulate the many bits of information generated by the analytical instruments. Instrument outputs can be normalized to compensate for minute changes in analytical conditions. Data systems (i.e., computers) can be directly linked between laboratories to allow direct access to the analytical signals. One such system, the Virginia Institute of Marine Science (VIMS) Fingerprint Method, has already been demonstrated to be feasible on a local scale. With a minor amount of research, this method or a similar one could be implemented basinwide. If implemented as part of the Chesapeake Bay Program, such a system would likely become the model for national monitoring programs.[5]

The above mentioned difficulties in determining sources of toxics, plus the lack of effort to correct the deficiencies, have resulted in a very inadequate toxics database for management decisions relative to environmental risk assessments and risk management of toxics in the Bay.

## Questions:

- What are the appropriate sampling devices, sampling distributions, and sampling frequencies for toxics in nonpoint sources?
- What are the relative magnitudes of the various sources of toxic substances to the Bay?
- What can be done to reduce input to the Bay of toxic chemicals from agricultural and urban lands, the atmosphere, and groundwater?
- How can analytical protocols be modified to maximize the utilization and storage of quantitative and qualitative chemical data?

## Findings and Recommendations:

II.1a Finding:
Nonpoint sources of toxic chemicals to the Chesapeake Bay are poorly quantified because appropriate sampling protocols and/or networks have not been established to measure the amounts that enter by various pathways, e.g., from atmospheric particulates or urban runoff.

II.1b Recommendation:
Research is necessary to determine the proper sampling techniques, sampling distributions, and sampling frequencies, etc. for toxics in nonpoint sources. Groundwater, atmospheric gases, atmospheric particulates, and urban and agricultural runoff should be included. The objective of this research should be to obtain sufficient information to design sampling protocols and networks to accurately estimate the relative magnitude of toxics in the various nonpoint sources entering the Bay.

II.2a Finding:
The spatial distribution, collection frequency, and type of samples from the mainstem of the Chesapeake Bay and its tributaries have been inadequate to determine the extent and origin of toxic chemicals now in the Bay. Therefore the

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5 Science Advisory Board, U.S. EPA. 1987. Review of a framework for improving surface water monitoring support for decision-making. Report of the Surface Water Monitoring, Environmental Effects, Transport, and Fate Committee. SAB-EETFC-88-006.

Science Advisory Board, U.S.EPA. 1988. Future Risk: Research strategies for the 1990s. Appendix A - Strategies for Sources, Transport and Fate Research. SAB-EC-88-040A.

relative importance of the various sources to the Bay, both point and nonpoint, cannot be determined at this time. Since the risk management options available to regulatory agencies are usually much more limited, complex, time-consuming, and expensive for nonpoint sources, knowledge of the relative magnitude and biological significance of various types of sources is essential.

II.2b Recommendation:
Research is necessary to estimate the relative magnitude of inputs of toxic chemicals to the mainstem of the Chesapeake Bay and its tributaries. The research efforts should focus upon the relative contribution and fluxes from nonpoint sources. This should be a multidisciplinary program, taking into account atmospheric transport, and using hydrologic models and all source information available (e.g., automobile density and agricultural activity).

II.3a Finding:
A vast amount of valuable toxic chemical information is being generated by existing regulatory and research programs but most is being ignored and discarded.

II.3b Recommendation:
Determine the appropriate analytical conditions, standards, columns, software, etc., to allow coupling of analytical chemical data systems and exchange of data among laboratories. Generate software, quality assurance, and quality control plans to optimize the utility of the system. Develop statistical evaluation protocols to allow for identification of spatial and temporal patterns and the evaluation of the "information content" of individual compounds.

II.4a. Finding:
Techniques such as the use of biological disease-suppressing agents, integrated pest management, best management practices, and the use of genotypes that are tolerant or persistent to pests and diseases can reduce the need for chemicals that can reach soil in agricultural and urban situations.

II.4b. Recommendation:
Support research to develop techniques that minimize the need for chemicals used on agricultural and urban land, so that nonpoint source pollution can be diminished.

Finding IV.4a and Recommendation IV.4b, which relate to the use of biomarkers, are also appropriate to this section.

## III. FATE AND TRANSPORT RESEARCH

To understand the effects of a toxic substance on an organism, it is necessary to have some measure of the exposure of the organism to the particular substance. As a first approximation, the exposure can be assumed to be a function of the concentration of the substance in the medium or compartment which the organism inhabits. This concentration will be controlled by physical, chemical, and biological factors which influence the partitioning of material among various compartments: soil, air, surface water, groundwater, open water, surface layers, suspended and bottom sediment, biota, etc.

The concentration in a compartment is not only dependent on the physical and chemical properties of the material but also on the rate of removal or degradation. The rate of degradation will almost always be different in the different compartments. The disappearance of the material from the system will therefore be a complex process that depends on the rate at which it enters the ecosystem as well the rate of its re-distribution as it is lost from one or more compartments. The disappearance of the parent material may result in the appearance of daughter products of greater or less toxicity, which may themselves become redistributed in a different pattern through the ecosystem.

It is thus evident that a complete understanding of the exposure of an organism to a toxic chemical cannot be obtained on the basis of the total amount of the material in the immediate habitat of the organism. A knowledge of the physical, chemical, and biochemical factors controlling the overall distribution is therefore vital to the estimation and interpretation of exposure.

A principal research need is to build a database and obtain an understanding of the factors controlling the distribution of the toxic materials in the various compartments of the Bay, together with measurements of the rate of disappearance by re-distribution or degradation within the compartments and the flux of the chemicals among the compartments. This will result in formulation of the necessary mathematical models to predict concentrations and hence exposures.

Although the underlying theoretical principles that must be incorporated in such models are well understood, no satisfactory model for this purpose currently exists, and the development and evaluation of such models is a major research need. Not only is this approach essential for an adequate understanding of the transport, distribution, and exposure of organisms to toxic materials, but it will also permit major economies in our research efforts, allowing us to identify those places where we may seek the highest concentrations (and toxic levels) in the overall ecosystem. Where both data and observations exist for a compound whose properties are similar to those of a new material whose effects are initially unknown, the approach will also provide immediate insight into the probable behavior of the new material. This technique can be extended to the identification of chemical markers that should receive major attention in the monitoring and sampling programs.

### Questions:

- What are the physical, chemical, and biological processes that affect the distribution of toxic chemicals in the Chesapeake Bay?

- What are the processes and rates that affect the longevity of toxics in various compartments of the Chesapeake Bay system?

- What physical, chemical, and biological processes govern the deposition/consolidation/resuspension of fine grained sediments in the Chesapeake Bay?

**Findings and Recommendations:**

III.1a Finding:
Sediments play an important role in concentrating and transporting toxic substances and removing them from the water column. Mathematical models formulated to predict sediment movement, and hence movement of toxics, are usually ineffective because a basic scientific understanding of consolidation and/or resuspension of cohesive sediments is not available.

III.1b Recommendation:
Initiate research to determine all the processes, including the influence of benthic infauna and epifauna, controlling consolidation and resuspension of cohesive sediments on the exchange of sediments between the bottom and the overlying water.

III.2a Finding:
Benthic organisms mix and rework sediments as they burrow through the bottom. Predators foraging in the sediments also may contribute to the bioturbation process. In the process, toxic chemicals sorbed to the particles are mixed to varying depths depending on the sediment type, season of the year, community structure, etc. Predictions of the fate and transport of sorbed toxic substances must consider these biological and physical processes. Our present understanding of the role of biota in transporting toxic chemicals from the surficial bottom sediments to greater depth and vice versa is limited.

III.2b Recommendation:
Support research efforts to determine the extent and rates of sediment mixing and reworking by benthic organisms in the Chesapeake Bay. Particular attention should be given to effects due to community composition, sediment type, and season.

III.3a Finding:
Non-benthic aquatic organisms may also be very important in the uptake, concentration, conversion, and transport of toxic chemicals. The bioavailability of these chemicals may remain unchanged, be enhanced, or be inactivated as they move through the food chain to other trophic levels of biota (including plants, terrestrial wildlife, birds, and even human beings).

III.3b Recommendation:
Support research to determine the importance of non-benthic aquatic organisms in the fate and transport of toxic chemicals in the Chesapeake Bay.

III.4a Finding:
Complex processes are involved in the transfer of toxics from the atmosphere to the aquatic system and their subsequent fate and transport to other compartments. To develop adequate models of these phenomena, it is necessary to know the physical properties of the toxic chemicals, their partitioning or distribution coefficients among the compartments involved, and their kinetic transfer coefficients.

III.4b Recommendation:
Support research to determine physical constants and kinetic transfer coefficients of toxics among various compartments of the Chesapeake Bay system. Emphasis should be placed on determining coefficient ranges for various chemical classes and for toxics in various environmental phases. In addition, the influence of the surface microlayer on the exchange of toxics between atmosphere and water should be determined. This information should be used to develop appropriate demonstration models for the transfer of toxics between the atmosphere and the aquatic system.

III.5a Finding:
A number of chemical classes are detected frequently in environmental samples. Some components may or may not be toxic. However, because they can be readily detected and measured, and since transport and fate estimates may be inferred from the behavior of materials of similar physical and chemical properties, they may provide useful information on other components.

III.5b Recommendation:
Determine, if appropriate, chemical markers to be included in Bay monitoring and sampling programs to provide information concerning transport and distribution.

III.6a. Finding:
Microorganisms can play a critical role in the transformation and mineralization of toxic substances in soil, sediments, and groundwater. If accurate predictions are to be made concerning the fate of toxics reaching the Chesapeake Bay and already present in it, then biodegradation kinetic parameters must be obtained.

III.6b. Recommendation:
Support research to determine aerobic and anaerobic biodegradation kinetic parameters for toxic chemicals in soil sediments and groundwater.

## IV. EFFECTS RESEARCH

A wide variety of man-made and naturally occurring chemicals have entered and are entering the Bay by many routes. Although many have not been identified, they can be detected and followed. The ultimate goal of the toxics research program should be to determine the existing or potential biological effects of these anthropogenic substances so that their effects or risk can be managed in an appropriate manner.

Biological effects resulting from exposure to toxics can be measured at various levels of organization, from the molecular or gene level through cellular, tissue, organ, organism, and population levels both in the laboratory and the field. Assays have been developed to detect toxic effects at each of these levels. Others now in the developmental stage may soon prove useful. It is likely that a multiplicity of tests will be necessary to demonstrate toxic impacts.

The major problem we face is determining whether contaminants found in the field or within the tissues of the biota cause unacceptable biological effects. The research strategy must bridge the gap between measurable quantities and biological impacts.

Laboratory tests are but one way to determine the magnitude and importance of toxic chemicals. Another approach is to examine indigenous or feral organisms whose physiological and biochemical systems indicate that they are being stressed by chemicals. In many cases this is a much more sensitive and realistic approach because the animals integrate the many environmental variables and respond to the total mixture or combination of toxic chemicals to which they are exposed. For example, if a fish's DNA has been damaged, it is clear that the causative material was biologically available at sufficient concentrations to react with the animal, that an essential part of the organism has been damaged, and, if damage is severe enough, that the organism may be irreparably harmed.

Historically, environmental scientists and regulators have used organisms in other ways to determine the impacts of toxics on the environment. In laboratory bioassays certain species were exposed to substances of interest and lethal concentrations were determined. For certain "easy-to-work-with" species, the effect of the toxicant on such parameters as growth or reproduction would be ascertained. More recently, bioassays have moved from the laboratory to the environment through the use of mobile trailers and the exposure of organisms to actual effluents, etc. This is a significant advancement but it is still a test conducted under controlled conditions and is not necessarily indicative of the real environment. Utilizing animals already in the environment overcomes many of these difficulties.

### Questions:

- What are the availabilities and biological effects of anthropogenic compounds in the Bay system?
- What are the most effective indicators for detecting, predicting, or assessing toxic effects at various biological organizational levels (i.e., cell, organ, individual population, etc.); what are the normal ranges of values of such indicators for a

number of resident Bay species and how do they vary with environmental conditions?

Can we recognize increased susceptibility to infectious and other diseases or other potential effects in which toxics may act as synergists and vice versa?

Can we identify effects of toxics at the population, community, or ecosystem level? How do we link conventional laboratory assessments of toxicity and indicators of sublethal stress measured in the field with actual impacts on communities and ecosystems?

### Findings and Recommendations:

IV.1a Finding:
To date no critical compendium of scientific information relating to distribution and effects of toxics in the Chesapeake Bay has been formulated. Without such information, developing hypotheses concerning effects of toxic substances on biota in the Chesapeake Bay is difficult if not impossible.

IV.1b Recommendation:
Prepare a critical summary of the knowledge concerning the presence and implications of toxics in the Chesapeake Bay. This should include a summary of literature and incorporate available data from monitoring programs within the Bay area.

IV.2a Finding:
Toxicity tests conducted in the laboratory, whether single species, microcosm, or mesocosm, may be faulty predictors of effects in the natural environment. It is critical that the uncertainty boundaries of results derived from such tests be clearly defined.

IV.2b Recommendation:
Research should be initiated to determine the effectiveness of various toxicity testing alternatives (e.g. single species, microcosm, mesocosm, etc.) for determining whether specific toxic chemicals could contribute to population, community, and ecosystem effects. Substances with various physical, chemical, and toxicological properties should be used, and results should be field-validated whenever possible, using areas in the Bay with known toxic chemical problems. The program should determine optimum and realistic conditions for such testing.

IV.3a Finding:
The evaluation of a compound's toxicity by a tiered system of testing may offer substantial advantages over conventional toxicity testing protocols. Among these advantages are significant reductions in manpower, cost, time, etc. However, tiered testing systems cannot provide certainty, and the possibility exists for the toxicity of some substances to be improperly assessed.

IV.3b Recommendation:
A research effort should be initiated to construct a tiered system which would be appropriate to the needs of the Basinwide Toxics Reduction Strategy decision-making framework. Tests and species selected should be relevant to the Chesapeake Bay.

IV.4a Finding:
Physiological and biochemical indications of toxic chemical stress (biomarkers) offer an opportunity to determine, in the environment, the areas and species being affected by toxic chemicals. Utilizing biomarkers, sources of toxic chemicals can be discovered and, through continued testing, the effectiveness of remedial actions can be determined.

IV.4b Recommendation:
Research should be initiated to evaluate the effectiveness of the various Biomarker Assays in determining chemical stress. Assays to be considered include DNA adducts, enzyme induction, immune suppression, and metabolic products. Determination of the most sensitive assays for particular chemicals or classes of chemicals as well as the optimum organisms and assay frequencies should be among the goals of the program. The research should focus upon establishing cause and effect relationships considering confounding factors. The technologies should then be transferred to appropriate agencies for implementation in Chesapeake Bay programs.

IV.5a Finding:
Organisms in the Bay are being exposed to a variety of toxicants but environmental risk assessments of toxic chemicals usually consider only single substances.

IV.5b Recommendation:
Support research to determine realistic toxicity exposure regimes and appropriate species to be used. The focus should be to determine ways to estimate toxic effects of a substance in the presence of other chemical stresses in the Chesapeake Bay system.

## IMPLEMENTATION

Identification of research needs is only the first step in reaching our goal of providing adequate information for a basinwide toxics reduction program. We must now ensure the research is conducted and the results are translated for use in management programs. Recommendations specific to this implementation process follow:

1. The type and extent of chemical analyses performed on environmental samples to determine the presence and amount of toxic substances is often determined by regulatory statutes or laws rather than by environmental significance. As a result, much of the scientific instrumentation and personnel involved in toxics work in the Bay have been assembled for these "set" or "routine" analyses. The necessary equipment and expertise to perform state-of-the-art chemical analyses in the Bay region are at present only minimally available and are not distributed equally throughout the region.

   A panel of experts from around the nation should be established to review the Basinwide Toxic Reduction Strategy's survey of existing toxics analytical capabilities and provide recommendations on research needs. This guidance will be incorporated into the survey report and will serve to encourage maximum utilization of existing and new instrumentation and expertise.

2. As described in the Basinwide Toxics Reduction Strategy, the Toxics Research Strategy should be implemented in accordance with the 1988 Comprehensive Research Plan. This will entail the following activities completed on an annual basis:

   Step 1: The Water Quality Task Group and the STAC Toxics Subcommittee will review the Toxics Research Strategy and produce an addendum containing recommendations based on the previous years' research findings and results of reduction programs.

   Step 2: The STAC Toxics Subcommittee will convene a group of environmental scientists, not affiliated with the Chesapeake Bay Program, to review the Toxics Research Strategy and the Basinwide Toxics Reduction Strategy Biennial Progress Report and identify the priority toxics research needs. Consideration will be given to both short-term management oriented research, and longer-term fundamental process oriented research.

   Step 3: The Water Quality Task Group and the STAC Toxics Subcommittee will outline research projects to satisfy the priority needs and estimate required funding.

   Step 4: The Water Quality Task Group will present the priority research needs, the recommended research projects outlines, and the estimates for funding needs to the Chesapeake Bay Program Research Planning Committee (RPC).

   Step 5: The RPC will incorporate this material into the Bay Program research planning process and produce a comprehensive list of research priorities, outlines for recommended research projects, estimates of funding needs, and alternative financing recommendations. This material will be submitted to the Implementation Committee for consideration in the annual budget cycle. It will also be distributed to the principal Chesapeake Bay research institutions and research funding agencies.

3. Management of all toxics research projects resulting from these efforts should incorporate scientific peer-review at each step (i.e. development and distribution of detailed "Requests for Proposals;" review of proposals and award of grant; oversight of research progress; review of interim and final reports).

4. The Chesapeake Bay Comprehensive Research Plan includes several activities, such as a research directory and periodic synthesis of research findings, designed to enhance communication between the management community and the research community. These types of activities are encouraged for the toxics area.

5. Longterm, perhaps multi-source, funding of toxics research as described in this strategy is encouraged.

6. The acquisition of data during research programs should be conducted in accordance with acceptable quality assurance/quality control procedures where appropriate.