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THE CHESAPEAKE BAY TOXICS STRATEGY

Prologue: Evaluating Our Toxics Strategy

"No matter where we look in the Bay, we find evidence of some chemical contamination...Many of the contaminants found in highly impacted areas are also now found in remote areas but at much lower concentrations. There are probably no pristine, truly uncontaminated sites left in Chesapeake Bay."

These conclusions were made by two scientists in a 1987 report on contaminant issues in the Chesapeake Bay. The words are both an echo from the past, and a warning for the future. Today, contaminant problems are better understood than in the past. Still, a number of fundamental questions confront managers, scientists and the public regarding the issues of "toxics in the Bay."

In 1988 the first Chesapeake Bay Basinwide Toxics Reduction Strategy was developed (adopted in 1989 by the Executive Council of the Chesapeake Bay Program), using the 1987 Amendments to the Clean Water Act as a cornerstone. The signatories of the Strategy believed that in order to fully protect the Bay, efforts in addition to the legal requirements of the Clean Water Act would be needed "to deal effectively with the full spectrum of toxic compounds, as well as cross- media problems caused by toxics." But first, "better information on sources and loads of toxic chemicals' effects on biota and human health, and the efficacy of control actions" was prescribed, and a cooperative effort initiated to better define toxics problems in the Chesapeake Bay.

Implementation of the strategy has resulted in a range of accomplishments. For example, a research strategy was developed and implemented; the first basinwide inventory of toxics loadings was published; a list of 14 substances were identified as Bay Toxics of Concern; the first baywide pesticide use survey was completed; and programs expanding the implementation of integrated pest management techniques were promoted.

During the past two years, the Toxics Subcommittee of the Chesapeake Bay Program engaged in a reevaluation of the original Basinwide Toxics Reduction Strategy. The Strategy Reevaluation was designed to: 1) evaluate toxic conditions of the Bay, 2) assess the effects of current programs, and 3) identify additional actions needed to further reduce toxics impacts in the Bay. A series of workshops and "critical issue" forums brought together experts on various topics including contamination in groundwater, sediments, the water column, wildlife, finfish and shellfish, as well as issues concerning pesticides and atmospheric deposition. These forums featured presentations on research and monitoring findings, addressed management issues, and strived to clarify our understanding of the extent and severity of toxics problems in the Chesapeake.

Each of the Critical Issue forums resulted in a report which is available. In addition, interested persons may obtain copies of the Reevaluation Report and other documents related to the work of the Toxics Subcommittee by calling the Chesapeake Bay Program, 1-800- YOUR-BAY.

Introduction

From acenaphthene to zirconium, more than 1,000 toxic substances have been detected in, released into, or applied to the water, soil, and air of the Chesapeake Bay basin.

These substances have been measured in water or sediments, sampled in finfish or shellfish tissue, found in atmospheric deposition, documented as having been released through industrial or municipal discharges, monitored in urban runoff, spilled from ships, or applied as pesticides.

They have been classified into two broad categories: metals, which occur naturally, and organic compounds, some of which are manmade chemicals. In great enough quantities - and under the right conditions - they can kill. In lesser amounts, they may cause sublethal effects such as reproduction problems or tumors - or they may have no impact at all.

To understand the complex issue of chemicals in the Chesapeake, the reevaluation process was designed to address and answer these questions:

- *When does a chemical, found in a large ecosystem such as the Bay, become "toxic?"*
- *Does evidence suggest that all or part of the Bay system has a "toxics" problem?*
- *Are we accurately measuring the amounts, or loads, of potentially toxic chemicals which are getting into the Bay and the tributaries?*
- *Are our regulatory, preventative, and education programs sufficient to eliminate problems?*
- *Can our efforts, our dollars and our programmatic resources be more effectively targeted?*

When compared to some other water bodies, the severity of chemical contamination in the Chesapeake Bay is relatively less than waters which have been historically inundated with industrial pollutants. Contaminant levels in fish and shellfish, as well as toxic concentrations in sediments, are almost uniformly lower than those found in Puget Sound and the Great Lakes.

In the Great Lakes, high levels of a number of contaminants were discovered in the '60's and 70's. At a recent conference, researchers reported dramatic declines. For example, PCB's in trout now measure 3 parts per million in Lake Michigan, down from 23 ppm in 1974. Beyond agreeing that programs to reduce and eliminate toxicity have resulted in markedly lower concentrations of some chemicals, the researchers, policy makers and citizens in the Great Lakes area continue to debate this complex issue. The significance of low level concentrations, data suggesting that declines have leveled off, and debate about risk engage experts on the Great Lakes as well as here on the Chesapeake Bay.

In comparison to nutrients, nitrogen and phosphorus, widely believed to be the most severe threat to the overall health of the Chesapeake system, the reevaluation report concludes the Bay does not appear to have the same kind of severe system wide problem with toxics. Problems linked to excess nutrients can be found throughout the Bay: reduced oxygen levels in the water and large-scale declines in Bay grasses. By contrast, the most severe problems with toxics - those with the clearest impacts - seem to be limited to localized areas near major urban or industrial centers.

But nutrients and toxic chemicals are fundamentally different, and direct comparisons of either loadings or effects are somewhat meaningless. There are at least 65,000 organic compounds in commercial use today and less than 2% have been tested for their effects on the environment. The low levels of potentially toxic chemicals which have been found throughout the Bay, even in areas once considered "pristine", should serve as a wake-up call. The challenge to managers, scientists, regulators, industry and the concerned public is how to craft a course of action that protects aquatic life and public health but does not impose unwarranted burdens. The reevaluation process has helped define the issues that need to be part of the debate, although many of those issues are not resolved.

Policy Guidance from the EC

Using the findings of the reevaluation as a starting point, the Executive Council provided guidance to the toxics committee last September, when it held its annual meeting. At that time, the Executive Council said, "the reevaluation has shown that significant steps toward controlling the input of toxics to the Bay system have been taken over the past decade. However, much remains to be done to address the known and potential problems identified by the reevaluation. We should therefore pursue the following directions in the development of a strategy to protect the Bay and its resources from toxic pollution: increase emphasis on pollution prevention; supplement regulatory programs; use a regional focus to address problem areas; and focus assessments in direct support of management actions."

When a new toxics reduction strategy is completed, these four points will serve as the cornerstones. Public and professional debate is centered on what kinds of specific commitments can and ought to be made in each of the four areas; what timetable should be associated with each; and whether additional resources can be found to implement new actions.

Defining Toxicity

A toxic chemical is any substance that 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, in the environment, or in combination with other substances. Toxicity is determined by the concentration of the chemical in the system and its availability to a living organism. Many chemicals are potentially toxic. Determining toxicity in an ecosystem is a complex task; scientists are making major advances in understanding toxicity, what causes it and how to measure it, but much remains to be learned.

The difficulty associated with evaluating toxic effects on biota is due in part to the problem of determining acceptable levels of toxic effects on cells, individuals, or communities. Additionally, connecting cause and effect is exceedingly difficult in most cases. Whether or not toxic chemicals are available to organisms depends on the properties of the chemicals themselves, as well as the prevailing natural and man-made conditions. These properties and conditions include factors such as salinity, pH, and temperature, as well as the presence or absence of multiple chemicals, disease organisms, or such direct anthropogenic impacts as fishing mortality and habitat loss. Ecological processes such as predation and competition also influence the magnitude of effects.

Many chemicals, such as polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and some metals, are known to be especially persistent, or long-lasting, sometimes remaining in the environment for decades. Often, these compounds adhere to particles which become incorporated into the sediments on the bottom of the Bay. These contaminated sediments can have direct impacts on the benthic (bottom-dwelling) community which inhabits them, and can act as a source of pollutants to the water column when the compounds get resuspended.

Many man-made organic compounds (PCBs, dioxin, and chlordane) and some metals (mercury and lead, for example), are taken up by fish and stored in their fatty tissue and organs such as the liver. This tissue, when ingested by other animals and humans, then becomes a source of contamination. As these organic compounds and metals move up the food chain, their concentrations can increase dramatically, and what appears to be a safe level in the water column may pose a threat to organisms or humans who ingest the contaminated tissue.

Chesapeake Bay Toxics of Concern: Atrazine, Benzo[a]antracene, Benzo[a]pyrene, Cadmium, Chlordane, Chrysene, Chromium, Copper, Fluoranthene, Lead, Mercury, Napthalene, PCBs, Tributyltin.

Determining Concentrations and Effects

One of the most commonly asked questions guiding the toxics program in Chesapeake Bay is "Does the Bay have a toxics problem?" Although numerous types of toxicological data exist, it is difficult to evaluate the extent of toxic effects on the biota in the Bay. We are acutely aware of major episodic fish kills when they occur; however, it is much more difficult to detect low level adverse effects, whose long- term impacts may be equally, if not more, detrimental.

Using a number of different approaches, scientists have shown that Chesapeake Bay waters in some locations actually cause low-level toxic effects on organisms. Much of this work has been concentrated in urban areas where human and industrial activity lead to high toxics loadings and accumulation and subsequent ambient toxicity. The bulk of toxicological research in the Bay has been conducted in these areas; however, separate studies have documented toxicity outside of these areas as well.

Biomonitoring and ambient toxicity testing allow scientists and managers to compare the impacts on test organisms in a given sample with experimentally determined threshold effects, defined, for instance, as the mortality of a certain percentage of individuals. If test organisms exhibit impacts equal to or above these threshold effects, toxicity is demonstrated.

The benefits of biomonitoring are that it can detect synergistic effects of mixtures of chemicals, and it may pick up effects of compounds otherwise thought to be harmless. Conversely, it does not give a complete picture of toxic effects on organisms higher up the food chain, or on human health. A combination of chemical specific limits and biomonitoring (with followup actions to identify and address sources of toxicity, such as toxics reduction evaluations) is increasingly being adopted by State agencies and dischargers, taking advantage of the strengths of both approaches.

The Elizabeth, Patapsco, and Anacostia Rivers are the recognized regions of concern for toxicity in the Bay. Numerous studies have shown that the water as well as the sediment in these areas is toxic to a variety of test organisms. Effects include compromised immune systems, induced enzyme systems related to chemical exposure, histological abnormalities such as liver tumors, gill pathology, cataracts, and lesions on the kidney and the skin, reduced respiratory and osmoregulatory ability, and finally, mortality. Ambient toxicity to invertebrates including copepods, grass shrimp and daphnids has been documented in the Elizabeth, Patapsco, and Potomac Rivers.

Copper Concentrations In Sediment

Still other studies have shown similar effects in areas not necessarily thought of as regions of concern, and even in some areas previously thought to be pristine. For example, one study has shown that water from the Rappahannock River had genotoxic effects on the American oyster. Menhaden with severe skin ulcers have been sampled in the Rappahannock, York and the James Rivers, and the mainstem of the Bay. Other areas where liver pathology has demonstrated adverse effects in fish include the Choptank River, C&D Canal, Potomac River, Susquehanna River, Back River, Severn River, and Cedar Point. Similarly, adverse effects on fish gills have been documented in striped bass yearlings from the Nansemond, C&D Canal, Choptank, Potomac, Susquehanna, Elk, and Sassafras Rivers. Yearling striped bass exposed to Potomac River water developed kidney lesions.

In ambient toxicity tests, striped bass larvae and juveniles exposed to Potomac River water and even larvae exposed to Choptank and Nanticoke River water suffered high mortality. In some rivers such as the Nanticoke and Choptank, this mortality has been attributed to a combination of low pH and high metal concentrations. Rivers that are predominantly fed in the Bay's Coastal Plain tend to be especially susceptible to acid conditions. Interestingly, although the Potomac River has some history of being polluted, neither the Potomac, the Choptank, nor the Nanticoke Rivers are generally thought of as toxic regions of concern.

Sediment toxicity has been well documented in various locations in the Elizabeth River, Baltimore Harbor and Anacostia River. Besides these locations, sediment toxicity also has been documented in the Potomac, and even in the Wye River. The potential toxicity of sediments in the Wye River, which was otherwise considered unimpacted by toxics, raises concerns about other parts of the Bay generally not thought of as problem areas.

Scientists have begun to frame the extent of the toxics problem in the Bay; however, some areas have not been well investigated, and may prove difficult to understand. Population and community level effects resulting from toxicity, such as population declines, and shifts in species dominance, are likely to be affected by toxic chemicals. Unfortunately, because this is a fundamentally difficult area of study, our understanding of these processes is still undeveloped.

Assessing Probable Risk

Risk Assessment is a procedure used to estimate the probability of an adverse effect based on a given set of circumstances. Risk Management uses the results of individual risk assessments to compare and contrast various alternative control strategies to identify the approaches that are most beneficial to society as a whole. The most beneficial strategies are identified as the ones that provide the most risk reduction for a given level of expenditure. Risk management does not seek to define a level of "acceptable risk." Rather it recognizes that resources are finite and that society is best served by directing resources toward solving the problems that are of greatest concern first.

This is the concept behind "targeting source reduction/prevention through mass balancing" discussed in the section of the reevaluation report that addresses refinements to the basinwide strategy. The report states that "a more precise accounting of both human-generated and natural toxic loads to the Bay is critical in understanding toxic substance cycling within the ecosystem and the ultimate effect of these substances on the living resources."

The advantage of a risk management approach is that it is not necessary to know the exact levels of risks involved - indeed in many cases that can never be known. Rather what is suggested is to use the best information available to estimate the magnitude of risk caused by all the important sources so that the most effective source reduction/prevention strategies can be identified. As the report says "The magnitude of inputs and outputs of toxic substances must be determined to have successful and cost-effective control strategies."

The difficulty in determining loadings of toxics to the Bay is addressed in the next section. It has been discussed that the ability to fully account for loadings to the entire Bay may not be practical at this time. Nonetheless, working to identify significant loadings and their sources has been supported as an important part of the process that will be used to develop control strategies for particular Chesapeake Bay Regions of Concern.

Determining Chemical Loadings to the Bay

Improving our knowledge about where potentially toxic chemicals come from and in what quantities has been a major component of the Bay Program's work. While we have more and better data than previously, most people still agree that our understanding of loadings and sources of these chemicals in the Chesapeake system is at best incomplete. Actual measurements are not as extensive as we would like, and many numbers are calculated by a process of estimation which may be incorrect by one or more orders of magnitude.

Although the loads entering the Bay seem large, actual concentrations measured in Bay waters are usually small - often below common laboratory chemical analysis detection limits. "We cannot yet equate loadings with exposure levels in Bay habitats," the reevaluation report noted. However, because we are talking about a suite of chemicals that can kill under certain circumstances, more information about the significance of even very low concentrations is needed.

One source of loadings information is the national Toxics Release Inventory (TRI). The TRI was created by the Superfund law as amended in 1987, to enable communities to get information about chemical releases from nearby facilities. The limitations of the Emergency Planning and Community Right-To-Know-Act, Title III of the Superfund Amendments and Reauthorization Act - SARA - are that only facilities using 10,000 pounds or more of any of 300 chemicals are required to report. This requirement captures about 10% of the facilities - obviously the largest ones - in the Bay. These data do show significant reductions in the discharges to surface waters since 1988, and provide useful, if limited insight into point source loadings.

The Bay Program recently published its own inventory, which incorporates the TRI data as well as other information. Publication of the inventory fulfilled a commitment made in the 1989 strategy, but it proved to be an especially difficult task. There is much disagreement on the accuracy of the loadings numbers and what conclusions, if any, can be drawn from them. Improving this inventory tool seems to be an objective sought by all those involved with the Chesapeake program.

The "Chesapeake Bay Basin Toxics Loading and Release Inventory," published in early 1994, provides some information and perspective on loadings and sources. It states:

- *Industry-reported chemical releases to the air, water and land have declined 52% between 1987 to 1991.*
- *Stormwater runoff from urban and suburban areas is a larger source of metals and organics than previously thought. All 14 chemicals on the Bay Program's Toxics of Concern List are found in stormwater.*
- *Air deposition is a larger source of metals and pesticides than previously thought. Air deposition includes not only direct deposition to the Bay and the tidal areas of its tributaries, but also deposition to the land. This can then be flushed to the Bay in urban and suburban stormwater, and runoff from agricultural and forest lands.*

- *Point source loadings to surface waters from industry, sewage treatment plants, and federal facilities are smaller, compared to other loadings in the Bay basin, than previously thought. They are concentrated in urbanized and industrial areas such as Baltimore Harbor in Maryland, and portions of Virginia's James and Elizabeth rivers, and the Anacostia River in Washington, D.C.*
- *Only a small fraction of the pesticides farmers apply to their crops reach the Bay via runoff. However, the timing of the runoff could be significant because the pesticides are flushed to the Bay in the early spring. This is the same time fish are making spawning runs and underwater Bay grasses are beginning to grow.*

Chesapeake Bay studies have looked at contaminant concentrations in three areas: the water column, sediments, and the microlayer. The microlayer is the thin layer where the water surface meets the air -a millimeter or less in thickness - which serves as a concentration point for toxic substances. Recent studies have found concentrations of metals, pesticides and organic compounds in the microlayer that often exceed levels in the water below. This may present an important source of exposure to surface-dwelling organisms and to eggs of some fish species that float on the surface, but evidence suggesting presence of toxic impacts is very limited.

Elsewhere in the Bay's water, concentrations of metals rarely exceed the EPA's water quality criteria or state standards. Concentrations of metals are elevated in some portions of the tidal and non-tidal tributaries compared to levels measured in the mainstem Bay. Still, only a limited number of samples have been found to exceed water quality criteria, the report said.

Measurable concentrations of organic compounds in surface waters are rare. Throughout the Bay, concentrations are generally below conventional detection limits. Most organics appear to attach to particles and become embedded in the bottom sediments or are taken up by algae or other biota. The report noted, though, that data for organic compounds in much of the Bay is very limited because of the expense of analyzing for these chemicals.

Levels of contaminants in sediments are closely related to the proximity to pollution sources. The highest sediment concentrations are found near major urban areas and industrial areas in the Bay and its tidal tributaries where stormwater runoff or point sources are concentrated - or combined - to create larger contaminant loads. Those areas include the industrialized zones of the Bay on the Patapsco and Elizabeth rivers, and the heavily urbanized or rapidly growing areas along the northern, western and eastern shores.

The large amount of chemical contaminants that originate in stormwater runoff are spread over a wider area when they are washed down the rivers into the Bay. The loads from the Susquehanna River, for example, are thought to have resulted in higher than normal metal concentrations on the western side of the upper Bay from the Gunpowder River to the Patuxent River. But because the metals are distributed over a wider area, their concentrations do not generally reach levels associated with major impacts on resources, such as mortality. While the reevaluation report said those levels, found in a "relatively high" number of sites primarily in the upper Bay and near the mouths of major tributaries, are not high enough to cause obvious impacts as is the case in some of the industrial areas, they may be great enough to "cause effects of a more subtle nature."

There is no doubt effects on finfish have been documented in some areas of the Bay. Significant declines in finfish and shellfish tissue contaminant concentrations throughout the Bay and its tidal tributaries since the 1970's are documented for several metals - cadmium, mercury, and zinc - and chlordane. What remains unknown is whether current contaminant concentrations are low enough to pose no unacceptable risk.

The sensitivity of certain segments of the population - children, pregnant women, the poor who depend on fish for subsistence - and whether they are adequately protected by federal standards is part of an ongoing national debate that is also relevant in the Chesapeake watershed.

Regulating Chemicals

An extensive network of programs mandated by Congress exists to control inputs of chemicals from various sources. The Clean Water Act and the National Pollution Discharge Elimination System (NPDES), which the Clean Water Act created, focuses on point source dischargers. Superfund requires the cleanup of certain hazardous waste sites. The Resource Conservation and Recovery Act (RCRA) manages hazardous substances. The sale, use, storage and disposal of pesticides is regulated under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), and the manufacture and use of chemicals falls under Toxics Substances Control Act (TSCA). The Clean Air Act, amended in 1990, contains many requirements for reducing emissions of toxic pollutants into the air.

These programs and the pollution prevention initiatives undertaken by many industries have resulted in significant reductions in chemical discharges. The reevaluation process within the Bay Program has documented these reductions. A wide spectrum of new programs, innovative approaches, regulations and voluntary initiatives have emerged since chemical contamination was first acknowledged as a Bay issue.

For example:

- *New programs for the control of pesticides include pesticide container recycling and integrated pest management (IPM). In addition, programs for collection and disposal of banned or excess pesticides are being implemented, thereby removing the threat that they will cause harm to people or accidentally enter the ecosystem. Applicator training programs have been expanded to include prevention of Bay contamination.*
- *In 1990, the EPA, as required by the 1987 amendment to the Clean Water Act, published the final NPDES Permit Application Regulations for Storm Water Discharges, requiring permits for stormwater from municipal separate storm sewer systems serving populations of 100,000 or more, and for stormwater*

discharges associated with industrial activities. The states are beginning to issue permits for stormwater discharges for both industrial and construction activities.

- *Best Available Technology (BAT) is being utilized to control air pollutants, including potentially toxic chemicals, from new sources. Air toxics analysis is also required for some municipal and hospital waste incinerators.*
- *Point dischargers with the potential for causing toxicity are being required to incorporate biomonitoring into their permits. Some facilities with toxic discharges are required to test for toxicity and undergo "toxicity reduction evaluations" to identify and remove the sources of toxicity.*
- *Permitting which requires pretreatment of industrial wastes is underway. Programs in all of the Bay states and the District of Columbia now require some industrial dischargers to treat their waste before it enters a municipal wastewater treatment plant.*
- *Broader lists of chemicals are being regulated. Water quality standards to protect living resources as well as human health have been adopted by the Bay jurisdictions.*
- *Many companies, both large and small, have voluntarily enrolled in EPA's pollution prevention program. Reductions of discharges achieved through prevention significantly augment those achieved via regulation.*

Regulatory issues which appear worthy of continuing dialogue, and around which legitimate differences exist, include these:

- *Is EPA doing all that it can to develop water quality criteria for chemical contaminants, especially those on the Bay Program's Toxics of Concern List? To date, only a fraction of the chemicals on the "priority pollutant" list of 126 chemicals have had criteria developed for them. States have the option, in lieu of numeric standards, to write narrative standards.*
- *Is permit compliance and enforcement adequate? The Bay region has a better record on compliance than the nation as a whole, but is it good enough?*
- *Are current regulatory programs sufficiently protective to prevent problems from low level, long term exposure, or from the synergistic effects of multiple chemicals?*
- *Will an increased focus on nonpoint sources of chemicals which loadings data suggest is needed, come at the expense of point source programs? Are additional resources available to expand the effort, rather than shift it from one source to another?*
- *Are differences in the states' programs and approaches to permits and monitoring requirements significant? The reevaluation report describes some of these differences. As in other areas of the Bay Program (wetlands regulation, nutrient reduction, fisheries management and so forth) there is great variety in how states permit and monitor chemical discharges.*
- *Should additional sources and chemicals be regulated?*

The fundamental question, as the Bay Program looks to the next decade, is whether the existing level of effort in the regulatory arena is enough. No clear answer emerges. The reevaluation did help focus on issues related to regulation. Because control of toxic chemicals is difficult and expensive, and because remediation programs to correct problems after they occur are even more so, understanding how well existing regulatory programs are working and what gaps exist in our knowledge base become critically important to a sound and implementable toxics reduction strategy.

Framing the Debate

Two broadly divergent perspectives characterize the outer bounds of the discussion of chemicals and potential toxicity that are fundamental to understanding the complexity of the "Toxics in the Bay" issue. One perspective says "find an impact; then we'll know we have a problem and we will address it." This perspective is illustrated in the three areas of the Bay - Anacostia, Patapsco and Elizabeth Rivers - known to be impacted by toxics. There, well documented damaging impacts on fish, shellfish and other living resources have made these three areas the principal "Regions of Concern" for the Chesapeake Bay toxics reduction program. The new toxics strategy will specifically address these three areas by laying out a process and timetable for remedial action plans. It will also establish a protocol for screening other areas - both those that need protection as well as those that may need remediation.

The second perspective says, "toxicity is unacceptable in the Bay system; don't wait to find an impact, but rather do everything possible to reduce and eliminate sources of toxic chemicals before they get into the system." This perspective is illustrated by the strong emphasis the Bay Program is placing on pollution prevention. All kinds of preventative measures are being encouraged, in the industrial arena, on farms and elsewhere. The new toxics strategy will have a pollution prevention component intended to elevate the importance of these kinds of programs.

The Bay Program's Executive Council has reaffirmed the goal of the original Toxics Reduction Strategy. The Executive Council has said that it is the policy of the Chesapeake Bay Program "to work towards a toxics free Bay by eliminating the discharge of toxic substances from all controllable sources. By the year 2000 the input of toxic substances from all controllable sources will be reduced to levels that result in no toxic or bioaccumulative impact on the living resources that inhabit the Bay or on human health." Achieving this goal will, no doubt, challenge our understanding of the concept of toxicity in the ecosystem, stretch our financial resources, and demand a steady hand at the political helm. The participation of governments, the research community and the public to develop and implement a sound toxics strategy offers promise for a cleaner Bay in the future.

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For more information about the development of the toxics strategy for the Chesapeake Bay Program, call 1-800-YOURBAY.

Information about the Alliance for the Chesapeake Bay can be obtained by calling 1-410-377-6270.
