Chapter 2

Development of the Point Source Inventory

The methodology employed in developing the Point Source Inventory had three basic steps. First, a master list of chemicals of interest was compiled. The chemicals selected were those with available sediment chemistry screening values that were used to evaluate Site Inventory data. These chemicals are frequently detected in sediment and have been studied for their potential adverse effects on aquatic life or human health. Second, annual loading amounts were determined for the chemicals of interest. Two EPA computer databases were used as the primary sources of release information: the Toxic Release Inventory (TRI) and the Permit Compliance System (PCS). Releases were then assigned to watersheds, chemical classes, and industrial categories.

Identification of Point Source Releases of Sediment Contaminants

For the Site Inventory, EPA compiled sediment chemistry and fish tissue residue data for more than 230 chemicals whose detected levels in these media could be evaluated for potential adverse effects to aquatic life or human health. The Site Inventory evaluation of potential adverse effects to aquatic life was based on comparing sediment chemistry measurements to levels associated with adverse effects. The evaluation of adverse human health effects was based on comparing direct fish tissue measures, or predicted levels based on sediment concentrations, to EPA risk levels or Food and Drug Administration (FDA) guidance. Evaluating the potential threat to sediment quality posed by a point source chemical release requires knowledge of the level in sediment associated with an adverse effect. EPA could not evaluate sediment chemistry measurements for approximately 100 of the more than 230 chemicals because the Agency lacked either information regarding adverse effects to aquatic life or the means to predict fish tissue concentrations resulting from exposures to sediment contaminant concentrations (i.e., a biota-sediment accumulation factor (BSAF), available for nonionic organic compounds only). Other chemicals lacked the necessary information to evaluate the chemical fate or intermedia partitioning upon discharge to surface water. These factors limited the inventory to 111 individual sediment contaminants.

The data requirements of the Point Source Inventory limited the number of useful databases containing information about the release of those 111 chemicals from point sources. The requirements include (1) classification of the type of discharger (industrial category or Standard Industrial Classification [SIC] code); (2) pollutant-specific release data (e.g., measured or estimated load to the environment in mass per time) for individual facilities; and (3) location information for pollutant releases. TRI and PCS are the only national databases that meet these data requirements.

Toxic Release Inventory (TRI). TRI is a consistent, comprehensive national database of toxic chemical releases to all environmental media. Congress mandated its creation to fulfill the community right-to-know provision (section 313) of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This section requires the owner/operator of an industrial facility to report environmental releases of more than 300 specified toxic chemicals to EPA if the facility meets certain criteria. EPA's Office of Pollution Prevention and Toxics (OPPT) manages the information on releases submitted by industry.

Reports submitted by industry are the sole source of data in TRI. TRI contains release information from approximately 27,000 facilities. An owner/operator must file a report for a facility when it meets the following criteria:

- It employs the equivalent of 10 or more full-time employees.
- It engages in manufacturing (SIC Codes 20 through 39).
- It manufactures, imports, or processes more than 25,000 pounds of any listed chemical, or otherwise uses more than 10,000 pounds of any listed chemical.

For each listed chemical (currently over 300 specific chemicals and 20 chemical groups), the facility must submit a "Toxic Chemical Release Reporting Form," which contains the following:

- Facility identification information such as facility name, parent company, location (street address and latitude/longitude), type of business (based on SIC codes), key identifiers (such as Dun and Bradstreet ID, and NPDES numbers), and name of receiving water body.
- Offsite transfer locations for toxic chemicals, such as publicly owned treatment works (name and address of POTW) or waste disposal and treatment facilities (name, address, and EPA identification number).
- Chemical-specific information such as chemical identification (name and Chemical Abstract Service [CAS] number); use of the chemical at the facility; quantities released to air (fugitive and stack), water (including storm water), underground injection, and land; quantities transferred to offsite locations; and waste treatment methods and efficiencies. The quantities are reported either as a range for levels below 1,000 lb/year (i.e., 0-10, 11-499, and 500-999) or as a total annual release. The facility also reports the methods used in determining the release quantities (e.g., actual monitoring data, mass balance calculations, or emission factors).

Permit Compliance System (PCS). PCS is the national information management system for tracking compliance, enforcement, and permit status for the National Pollutant Discharge Elimination System (NPDES) program under the Clean Water Act. The NPDES program requires permits for all point source pollutant discharges to navigable U.S. waterways (other than dredged or fill material regulated under section 404 of the Clean Water Act). Specific discharge limits or monitoring requirements have been set for over 200 individual chemicals.

EPA's Office of Wastewater Management oversees the NPDES program on a national level. EPA has authorized 38 states and the Virgin Islands to administer the NPDES program. EPA regional offices administer the program in nonauthorized states. More than 65,000 active NPDES permits have been issued to facilities throughout the Nation. PCS has extensive records on approximately 7,000 permits that are classified as "major." Facilities are classified as "major" based on consideration of many factors, including effluent design flow, physical and chemical characteristics of the waste stream, and location of discharge. Each permit record in PCS may contain information that:

- Identifies and describes the facility (including a primary SIC code) to which the permit has been issued.
- Specifies the pollutant discharge limits for that facility.
- Records the actual amounts of pollutants and flows measured in the facility's wastewater discharges.
- Tracks the facility's history of compliance with construction requirements, pollutant limits, and reporting requirements.

Major facilities must report compliance with NPDES permit limits, usually on a monthly basis, via Discharge Monitoring Reports (DMRs). DMRs provide detailed information on measured concentrations, including those which are in violation of established limits for the permit. DMR data entered into PCS include the type of violation (if any), concentration and quantity values, and monitoring period. The PCS database is updated twice weekly.

Determination of Chemical Loads

The Point Source Inventory consists of two distinct sets of chemical loading data: one based on TRI records and one based on PCS records. For this evaluation, data from TRI and PCS were extracted for the calendar years 1993 and 1994, respectively. Together, TRI and PCS form the most comprehensive national chemical loading database. Facilities covered by both TRI and PCS cannot be readily identified, however, because no common, quality-controlled facility identification data elements are available in these databases. TRI contains a field for NPDES number, but its quality control is poor. Both TRI and PCS contain a field for EPA identification number, but these numbers, too, are unreliable. Therefore, there is a potential for double records of releases for chemicals reported in both TRI and PCS. As a result, the data in TRI and PCS are evaluated independently.

Toxic Release Inventory Data

For each TRI facility, total amounts of the chemicals of interest reported to be discharged to surface water and POTWs in calendar year 1993 were retrieved. For each chemical, the total release to surface water and an adjusted release to POTWs were summed to yield a total facility discharge. Some characteristics of the TRI database might introduce uncertainty into the release estimates. For example, manufacturers required to report to TRI might estimate chemical releases using ranges (e.g., 10 to 499 lb/yr). In the TRI database, the ranges are converted to a single value represented by the midpoint of the range (e.g., 250

lb/yr). Use of these midpoint values may overestimate or underestimate the actual releases of TRI chemicals.

The reported amounts of releases to POTWs were adjusted by assuming that typical secondary treatments, such as activated sludge and aeration lagoons, remove a portion of the chemical load. Review of chemical-specific data from the Office of Research and Development's Treatability Database (USEPA, 1991) indicated that removal rates can be highly variable and dependent on conditions at the POTW. Based on peer review comments received on a version of this methodology (Adams, 1994), all pollutants were assigned a removal rate of 75 percent. This removal rate does not tend to significantly overestimate or underestimate actual loading values. In a secondary treatment system, such as an activated sludge system, chemicals that are readily biodegraded are usually, but not always, removed at rates equal to or in excess of 90 percent, and adsorption often removes 80 to 85 percent of the mass of chemicals that do not biodegrade (Adams, 1994).

Permit Compliance System Data

It is important to recognize that, unlike TRI, PCS is a permit tracking system, not a repository of pollutant release amounts. However, an option in PCS called Effluent Data Statistics (EDS) can process PCS data to calculate loading values (USEPA, 1992a). EDS uses the following hierarchy to assign a loading for each pollutant: (1) reported chemical mass loading and (2) chemical loadings estimated based on discharge flow and concentration measurement. Depending on the monitoring requirements imposed by the permit, concentrations may be reported in many different ways. EDS selects concentration measurements from PCS in the following order of preference for inclusion in the inventory:

- Average concentration
- Maximum concentration
- Minimum concentration.

Loadings were estimated only for records with valid concentrations (as defined by EDS) and corresponding flow data assuming 30 operating days per month for each facility. Loadings were estimated using the following general equation:

$$Load = Flow * Conc * Conversion\ Factors \qquad \text{Equation 1}$$

where:

load	=	specific pollutant load from a facility per unit time;
flow	=	facility effluent flow per unit time;
conc	=	concentration of a pollutant; and
conversion factors	=	appropriate factors to convert reported units to standard units.

Total release amounts of the chemicals of interest were calculated for each PCS facility. Data were retrieved at the discharge pipe level from PCS for every NPDES discharger where the requisite data were available. Concentration data for each chemical were con-

verted into annual loadings using Equation 1 above. The calculated loads for a given chemical from each discharge pipe at a facility were summed to yield the total facility load. In addition, multiple parameters sometimes exist for the same pollutant. For example, zinc concentrations might be reported as total zinc and dissolved zinc. In these cases, the largest calculated load (usually the "total" load) was selected for inclusion in the Point Source Inventory.

Concentration measurements for the chemicals of interest are often recorded in PCS as below the detection limit. In some cases, these measurements might reflect a low chemical concentration that available analytical instrumentation cannot recognize. In other cases, the chemical might not be present in the effluent. Measurements reported below a detection limit most commonly occur for highly toxic pollutants. Monitoring requirements for these chemicals might exist as a "safeguard" to alert managers to the presence of a particular chemical in effluent, or might be part of a large set of chemical measurements required by an effluent guideline rule covering a particular industrial category. In any case, a measurement reported below detection in PCS monitoring data does not establish the presence of the chemical in effluent. Therefore, values below the detection limit are set to zero in this inventory.

Assignment of Geographic Location and Industrial Category

Stream reach numbers (from EPA River Reach File 1) were assigned to each facility in the Point Source Inventory to place chemical discharges into watersheds. Because the reach number was frequently missing from both PCS and TRI, reach numbers were added electronically by linking PCS and TRI facility identification codes to the EPA Industrial Facilities Discharge File (IFD). If the reach number was not available in IFD, a computerized routine that starts with the facility latitude/longitude and searches the EPA Reach File for the nearest reach, up to a maximum distance of 10 miles, was employed. If the facility latitude and longitude coordinates were missing, the centroid of the county was used as the discharge location.

Industrial categories are groupings based on SIC codes. An industrial category can be based on a single 4-digit SIC code (e.g., Petroleum Refining) or a large and variable range of SIC codes (e.g., Metal Products and Finishing). Each facility in the Point Source Inventory was assigned a single SIC code based on the designated primary SIC code in PCS and TRI. However, because many large industrial facilities are involved in multiple activities that could correspond to different SIC codes, industrial category groupings are only approximate. There were 31 industrial categories overall. PCS data were grouped into 27 industrial categories, and TRI data were grouped into 21 industrial categories.

Inventory Limitations

The Point Source Inventory contains various limitations that should be considered when using this information in environmental decision-making. These limitations do not, however, preclude its use as a targeting tool to prioritize watersheds, chemicals, and industries for further evaluation. In some instances, the limitations might affect small-scale analyses

(i.e., individual stream or lake water body segments) while large-scale analyses, such as the ones presented in this report, are affected to a lesser degree. Conclusions presented in this report are made with consideration of the following factors.

This analysis is primarily limited by the quality and quantity of existing data in national EPA databases. The broad scope of the inventory has prohibited collection of large amounts of data from numerous site-specific information sources at this time. Therefore, the inventory relies on data available in national electronic databases such as TRI and PCS. Although a considerable volume of information is contained in these databases, many important parameters are not available. In particular, no national electronic database accurately, consistently, or completely stores information concerning the characteristics of water bodies, such as underlying sediment type. Furthermore, data quality assurance/quality control is an important issue when using data from large national databases that receive input from a variety of sources. The amount of data contained in these national databases is too large to conduct comprehensive verification procedures. In addition, it should be noted that the number of facilities discharging chemicals of interest may vary from year to year based on such factors as regulatory changes (e.g., increased chemical reporting or SIC coverage in TRI, or increases in the number of recorded storm water permits in PCS) or economic conditions. Given these qualifications, the three major limitations of the inventory as it is now structured are:

- The inability to predict whether a point source release could contribute to a sediment contamination problem.

- The inability to predict where point source releases might contribute to sediment contamination (i.e., the geographic analyses are limited to identifying areas or watersheds where point source releases occur).

- The inability to assess contributions from nonpoint source inputs (including deliberate introduction of toxic substances, such as pesticides and household chemicals, to the environment) and from point source inputs not represented in the PCS or TRI databases (e.g., facilities that do not meet a TRI reporting criterion and for which NPDES permits do not require monthly monitoring).

Conclusions based on the Point Source Inventory should take into consideration the inherent limitations of the databases and the assumptions used in developing the inventory. Factors associated with database limitations that should be considered include the possibility of erroneous data in TRI and PCS, the limited coverage of TRI and PCS, and inherent database biases. Neither PCS nor TRI accurately reflects the full extent of toxic chemical releases from point sources, and the data contained in both may be inherently biased. Although several hundred individual chemicals are represented in each database, as many as 5 to 10 times more chemicals might be discharged (Adams, 1994). In addition, the number of chemicals addressed in PCS permits is highly variable. Because the types and number of chemicals included are partly a function of the policies and practices of the state or regional permitting authority, and of the industrial activities conducted at the facility, the data might be biased toward some geographic regions and industrial categories. Furthermore, only approximately 10 percent of permitted dischargers are classified as “major” and have extensive records from which chemical loads can be derived. Facilities subject to TRI reporting represent a relatively narrow range of commercial activities (manufacturing only). Although the TRI database is based on a standard set of chemicals, many highly toxic chemicals that

tend to accumulate in sediment are not included. Therefore, TRI captures only a portion of chemical releases to the environment. Future enhancements to TRI might overcome some of these limitations and the biases they create.

Other potential sources of error are associated with the assumptions used in the assignment of geographic location and industrial category. In many cases, geographic location assignment was made using latitude and longitude coordinates of the facility and the nearest stream reach. However, the nearest stream might not be the receiving stream for some facilities. Also, for TRI data, POTW receiving streams could not be identified. Consequently, chemical loadings derived from POTW transfers for TRI data were assigned to the stream reach associated with the reporting facility. Industrial category assignment was made on the basis of primary SIC code; however, many facilities are engaged in a wide range of commercial activities. As a result, chemical wastes generated from non-primary SIC code activities are included with those from the primary SIC code in the Point Source Inventory.