3.0 DATA SOURCES

EPA uses readily available Agency and other databases, models, and reports to evaluate water quality effects. For the Meat and Poultry Processing (MPP) Environmental Assessment, EPA used two basic sets of data. The first data set was used to develop baseline conditions (current use levels) for stream reaches affected by MPP discharges. The second set of data were used to develop estimates of individual facility pollutant loadings. These data sets were then entered into the National Water Pollution Control Assessment Model (NWPCAM) to quantify impacts of the MPP dischargers under current and regulatory treatment levels. The following sections describe the specific types of data used to run the NWPCAM model and the primary sources for those data.

3.1 POINT SOURCE LOADS USED IN NWPCAM TO ESTIMATE BASELINE WATER QUALITY CONDITIONS

Point sources represented in NWPCAM 1.1 include municipal and industrial wastewater treatment plants and combined sewer overflows. Pollutant discharges from municipal and industrial outfall pipes are represented in the model by estimates of annual mean loading rates input at a discrete location along the length of a stream or river. Pollutant discharges from urban runoff and combined sewer overflows, accounted for by an urban network of multiple discrete outfall pipes discharging to one or more waterways, are aggregated and distributed uniformly to RF1 reaches within the urban land use portions of a watershed. Pollutant loads for point sources are estimated for each of the following state variables selected for NWPCAM 1.1:

- 5-day biochemical oxygen demand (BOD5)
- Total Kjeldahl nitrogen (TKN)
- Dissolved oxygen (DO)
- Total suspended solids (TSS)

- Fecal coliform bacteria (FCB).

3.1.1 Municipal and Industrial Dischargers

3.1.1.1 Primary Data Sources.

The primary data sources used to estimate the magnitude and location of municipal and industrial point source loads are the following EPA national databases:

- Permit Compliance System (PCS)
- Clean Water Needs Survey (CWNS)
- Industrial Facilities Database (IFD).

The PCS database, used by EPA to track compliance by a discharger with NPDES permit limits, provides monthly or quarterly summaries of monitored effluent flow and concentration data submitted to EPA as Discharge Monitoring Reports (DMRs) by "major" municipal and industrial facilities. Standard Industrial Classification (SIC) codes are used to identify the type of discharger (e.g., municipal, pulp and paper, allied chemicals). Data are generally not available in PCS for numerous small facilities classified by EPA as "minor" based on criteria that include effluent flow (<1 MGD), population served (<10,000), or a qualitative judgment of minimal "water quality impact."

The CWNS provides an inventory of the existing and projected status of both major and minor municipal wastewater treatment plants. The database contains records of population served, effluent flow rates, influent and effluent concentrations, and loads of conventional pollutants. The CWNS also includes a coded description to identify the category of each treatment plant by the level of existing and projected wastewater treatment. The levels of treatment performed by plants represented in the CWNS include the following treatment technologies that are summarized briefly below:

- Raw (no treatment): Wastewater is collected and discharged to surface waters without any removal of pollutants.

- Primary: Screens and physical settling of wastewater results in separation and removal of heavy solids. Pollutants associated with large particles are removed.
- Advanced Primary: Enhanced settling and physical removal of pollutants are achieved with low to high doses of chemical coagulants such as metal salts or organic polyelectrolytes.
- Secondary: Removal of heavy solids by physical settling is followed by biological processes designed to enhance bacterial growth to decompose organic materials.
- Biological treatment processes used are designed to enhance the growth of suspended or attached bacteria in (a) activated sludge and waste stabilization ponds and (b) trickling filters.
- Advanced Secondary: Physical settling and conventional biological treatment are enhanced with either chemical coagulation or additional biological processes to increase the removal efficiency of solids, BOD, and nutrients.
- Tertiary or Advanced Treatment: Physical settling and conventional biological treatment are enhanced for very high removal efficiency with high dosage chemical coagulation, biological processes for nitrification and denitrification, filtration, and adsorption with granular activated carbon or reverse osmosis.
- No Discharge (to surface waters).

Technical details about these levels of municipal treatment can be obtained from standard environmental engineering texts (e.g., Metcalf and Eddy, 1991).

The IFD provides comprehensive records on effluent discharges from the nation's major and minor industrial facilities. A significant shortcoming of the IFD, however, is that EPA no longer maintains this database. Therefore, these data are no longer completely up to date. The RF1 database was used to link the locations of point source inputs with specific river-mile points on an RF1 reach for input to the model.

3.1.1.2 Typical Pollutant Concentrations.

For many major municipal facilities, reliable estimates of effluent flow, BOD5, and TSS concentrations were available from PCS and CWNS. Considerably fewer data were available to characterize municipal effluent concentration levels of TKN and FCB. For estimates of DO loads, effluent data were typically not reported by wastewater treatment facilities. Literature data were used to assign effluent DO levels assuming 50 percent saturation (at 25 degrees C).

Thousands of industrial facilities are included in EPA inventories of the nation's industrial wastewater dischargers. In both PCS and IFD, municipal and industrial facilities are identified by their NPDES identification number and a Standard Industry Category (SIC) code. For example, municipal sewage treatment facilities are assigned the SIC code of 4952. In general, the availability of data to characterize effluent flow and pollutant loading rates for industrial dischargers was more limited than for municipal facilities. Most of the largest industrial "major" sources are, however, included.

For municipal and industrial point sources (major and minor) in which actual discharge data were available from either PCS, IFD, or CWNS, those data were used to assign a loading rate for input to the model. For municipal point sources for which effluent data were not available, default effluent flow, loads, and concentrations, compiled from PCS, CWNS, and other sources (e.g., Metcalf and Eddy, 1991; EPA, 1995; NRC, 1993), were used to estimate typical pollutant loading rates for input to the model. For industrial point sources for which effluent flow and pollutant loading data were not available, typical pollutant loads (TPLs) and typical pollutant concentrations (TPCs), compiled as look-up tables for groups of four-digit level SIC codes were obtained from the National Oceanic and Atmospheric Administration (NOAA, 1994) to develop NWPCAM 1.1.

3.1.1.3 Inventory of Point Source Facilities.

There were 8,878 reach-indexed municipal facilities and 23,118 reach-indexed industrial facilities (direct discharge) included in NWPCAM version 1.1.

3.1.2 Urban Runoff and Combined Sewer Overflows

3.1.2.1 Primary Data Sources.

The public works infrastructure in every town and city includes an urban stormwater drainage system designed to collect and convey runoff from rainstorms and snow melt. Stormwater runoff can contribute significant intermittent loading of pollutants with adverse impacts on water quality and aquatic resources. EPA's National Urban Runoff Project (NURP) concluded that wet weather events contribute significant loadings of pathogens, heavy metals, toxic chemicals, and sediments (EPA, 1983). Over the past several years, EPA has worked closely with state and local governments to design and implement effective programs to reduce pollutant loading from urban runoff. Under the 1987 Amendments to the CWA, EPA published regulations for general permits for stormwater discharges from urban areas (Phase 1, >100,000 population; Phase 2, <100,000 population) and industrial sites. Reduction of pollutant loads to surface waters is typically accomplished using best management practices (BMPs) designed to remove debris accumulation on paved surfaces and to attenuate the rate of urban stormwater flow (Novotny and Olem, 1994).

As a vestige of public works practices in vogue from the nineteenth century (ca. 1850-1900), many older cities, primarily in the Northeast, Midwest, and Upper Midwest, have urban drainage systems that were designed, for cost-saving reasons, to convey both stormwater runoff and raw sewage. These combined sewer overflow (CSO) systems were intentionally designed to overflow and discharge the mixture of raw sewage and stormwater into the nearest urban waterway, when runoff from heavy rainstorms exceeded the hydraulic capacity of the combined sewer pipe network. Although pollutant loading from CSOs occurring only during heavy rainstorms is intermittent, high loading rates of pathogens often result in closure of recreational beaches and shellfish beds to protect public health (Brosnan and Heckler, 1996). Discharges from CSOs also can result in high loading rates of organic materials and accumulations of noxious sludge beds near CSO outfalls with locally depressed levels of dissolved oxygen. EPA 1997) estimates that about 880 older cities, including Washington, DC, for example, still have combined sewer systems that periodically discharge a mixture of raw sewage and stormwater runoff into urban waterways. Several cities have also initiated costly construction projects to eliminate combined sewer systems by separating urban stormwater drainage from raw sewage collection systems. In Minneapolis-St. Paul, MN, for example, an aggressive $320 million (1996 dollars) construction program implemented over a 10-year period from 1985-1995 eliminated the old combined sewer system and greatly improved compliance with water quality standards for FCB levels in the Upper Mississippi River (MCES, 1996).

3.1.2.2 Typical Pollutant Concentrations

Based on data archived in EPA's NURP database (EPA, 1983) and data compiled by Novotny and Olem (1994), a range of characteristic effluent concentrations is presented in Table 3-1 for urban runoff and for CSOs. The data in Table 3-1 illustrate the relative magnitude of the range of characteristic effluent levels for urban runoff and CSOs. The urban runoff loading rates used in NWPCAM 1.1 are based on data obtained from Lovejoy (1989) and Lovejoy and Dunkelberg (1990).

Table 3-1. Effluent Characteristics of Urban Runoff and CSOs

Parameter	Urban Runoff	CSO (Event Mean)
BOD5 (mg/L)	10-13	60-200 (115)
CBODU:CBOD5	3.0	1.4
TSS (mg/L)	141-224	100-1100 (370)
TKN (mg/L)	1.68-2.12	ND (6.5)
NH_3-N (mg-N/L)	ND	ND (1.9)
NO_2-N + NO_3-N (mg-N/L)	0.76-0.96	ND (1.0)
Total N (mg-N/L)	3-10	3-24 (7.5)
Total P (mg-P/L)	0.37-0.47	1-11
Total lead (mg/L)	161-204	ND (370)
Total coliforms (MPN/100 mL)	103-108	105-107 (ND)

Note: ND = no data.

MPN = most probable number.

3.1.2.3 Primary Data Sources for Urban Runoff Estimates

Annual urban runoff pollutant loading data have been compiled on a county-level basis by Lovejoy (1989) and Lovejoy and Dunkelberg (1990). Urban runoff loads were first transformed from county-level loads to catalog unit loads using the areal proportion of a county in a given catalog unit. Urban and rural runoff loads were then allocated to RF1 stream reaches based on the length of the reach and whether or not a populated place (1990 Census) was allocated with the reach. Estimates of effluent loads derived from CSO inputs are based on an analysis performed to support EPA's 1992 Clean Water Needs Survey (Tetra Tech, 1993) with the inventory of CSO facilities reduced from 1300 to 880 by EPA (1997). Effluent loads from CSOs are based on a pulse load driven by storm runoff volume and the pollutant load associated with a 5-year, 6-hour duration design storm event. Using the design storm parameter values, runoff volume was estimated from the CSO system drainage system, population served, and degree of imperviousness. Table 3-2 presents a nationally aggregated summary of the loading estimates used in NWPCAM 1.1 to represent pollutant loads contributed by urban runoff and CSOs.

Table 3-2. National Summary of Annual Load Estimates for Urban and Rural Runoff and CSOs (as metric tons/day)

Parameter	Urban Runoff	Rural Runoff	CSOs
BOD_5	1,701	19,974	2,823
TSS	3,081	778,638	10,361

3.2 NONPOINT SOURCE LOADS

Nonpoint source loads, characterized as intermittent diffuse inputs distributed over an entire drainage basin, are related to hydrologic conditions, topography, physiography, and land uses of a watershed. In NWPCAM 1.1, the county land-use data used by Lovejoy (1989) and Lovejoy and Dunkelberg (1990) to estimate pollutant loads over a drainage basin were classified very simply as either urban or rural. In NWPCAM 1.1, urban and rural runoff are the only nonpoint sources of pollutant loads included in the model framework. The very broad category of rural land uses accounts for essentially all other land uses not classified as urban (e.g., forest, agricultural pasture, and crops). The data obtained from Lovejoy's work (1989) do not allow a breakdown of rural nonpoint source loads into more detailed classifications of either forest or the several subclassifications of agricultural land uses (e.g., grassland, pasture, feedlots, cropland).

To assign the catalog unit-based rural nonpoint source loads as an input load for each RF1 reach, the loads were attenuated using drainage area-dependent sediment delivery ratios (SDR) assigned to each catalog unit (Vanoni, 1975). Since the data used to quantify rural nonpoint source loads are so highly aggregated, evaluations of policy scenarios for BMP controls of nonpoint sources are not possible in NWPCAM 1.1. Nonpoint source loads from rural land uses are included in the model framework to account for the contribution and impact of nonpoint source loads on water quality. The NPS data provided by Lovejoy and Dunkelberg is based on work done by Giannessi at Resources For the Future. The urban loadings are estimated using a simplified procedure that takes estimates of the number of urban residents per county and multiplies that number by coefficients to get total loadings of urban pollutants to the water. The "Lovejoy" rural loadings is a much more involved process that includes three modules. The first module estimates sheet and rill erosion, first estimating the total tons of erosion, then applying soil texture and stream density factors, which provides a net amount deposited to surface waters by county. Then, the elemental composition of the surface soil and non-sheet and rill sources are added in to get a total pounds of pollutants (BOD5, TSS, TKN, TP, Cu, Pb, Fe, Zn) reaching the surface waters. The second module accounts for livestock runoff by estimating the total manure generated by county, then applying USDA estimates of manure "losses" by state from volatilization, runoff, and seepage. The total quantity "lost" to surface waters is then partitioned into physical/chemical characteristics by assuming 12 percent of the total manure is total solids (TS), BOD5 is 23 percent of TS, COD is 95 percent of TS, TKN is 4.9 percent of TS, and TP is

1.6 percent of TS. This calculation produces total annual estimates of these pollutants reaching surface waters by county. The third module is a nutrient runoff module using the Cornell Nutrient Simulation Model; outputs from this module are not used in NWPCAM 1.1.

3.3 FACILITY-SPECIFIC LOADING DATA

EPA used various sources for collecting data on MPP facilities. The Agency obtained data through EPA site visits and sampling, and facility responses to 2001 Meat Products Industry Survey (herein referred to as the "Detailed Survey"). Information from the Detailed Survey provided many of the facility-specific parameters required for this analysis, such as annual discharge volume, current pollutant loadings, and discharge location information (i.e., name of receiving water body). EPA's data collection procedure is described in detail in Chapter 3 of the technical development document.

For the MPP facilities which responded to the Detailed Survey, EPA identified discharge location based primarily on NPDES information provided in the Survey. For indirect dischargers, EPA also used NPDES information provided by the respondent. Where such information was not available, EPA contacted the facility or performed additional analysis using either the EPA's Permit Compliance System (PCS) or the Industrial Facilities Discharge (IFD) database to identify the appropriate POTW.

EPA also extracted facility-specific pollutant loading information from the Detailed Surveys. Facilities respondents provided final discharge information for a suite of pollutants. As noted above and described in Chapter 2 of this document, the NWPCAM model assessed four conventional pollutants: DO, BOD, TSS, and FCB. In addition, loadings for TKN were also included to support the modeling of DO and BOD.