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DATA COLLECTION FOR THE HAZARDOUS WASTE IDENTIFICATION RULE

SECTION 1.0 INTRODUCTION AND OVERVIEW
SECTION 2.0 SPATIAL FRAMEWORK

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Acronyms

3MRA	multimedia, multiple-exposure pathway, multiple-receptor risk assessment
AML	arc macro language
AOI	site-specific area of interest for HWIR 3MRA
ASCII	American Standard Code for Information Interchange
AT	aerated tank
DEM	Digital Elevation Model
EPA	U.S. Environmental Protection Agency
GIS	geographic information system
GIRAS	Geographic Information Retrieval and Analysis System
HGDB	Hydrogeologic Database
HWIR	Hazardous Waste Identification Rule
ISCST3	Industrial Source Complex Short Term, Version 3, air model
LAU	land application unit
LF	landfill
NWI	National Wetlands Inventory
QA/QC	quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
RF	Reach File
SAMSON	Solar and Meteorological Surface Observation Network
SI	surface impoundment
SQL	structured query language
STATSGO	State Soils Geographic Database
STORET	Storage and Retrieval System
USGS	U.S. Geological Survey
WMU	waste management unit
WP	wastepile

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1.0 Introduction and Overview

This report documents the data collection effort supporting the U.S. Environmental Protection Agency's (EPA's) 1999 Hazardous Waste Identification Rule (HWIR) multimedia, multiple-exposure pathway, and multiple-receptor risk assessment (3MRA). The goal of this HWIR risk assessment is to help identify wastes currently listed as hazardous that could be eligible for exemption from hazardous waste management requirements.

This documentation addresses data collected for the HWIR 3MRA, except for chemical property data that were addressed under separate efforts (U.S. EPA, 1999a, 1999b, 1999c). This document describes

- What data were collected for use in the 3MRA
- Where data were obtained (data sources)
- How data were compiled and processed (methodology)
- Issues and uncertainties associated with data availability (data gaps) and accuracy.

EPA designed the 3MRA model to estimate potential risks from the long-term management of exempted waste. To provide data for the model, the HWIR data collection effort centered around the collection of site-based data for industrial nonhazardous waste management sites representative of those that could manage HWIR-exempted wastes. National and regional data were also collected as necessary to complement the site-based data set. EPA limited this data collection effort to information that could be obtained from readily available data sources. EPA determined that more extensive data collection activities, such as door-to-door or telephone surveys and contacts with facilities, vendors, or state or local governments, were beyond the scope of this data collection effort due to resource limitations.

1.1 Background

The HWIR 3MRA estimates potential human and ecological risks from the long-term management of industrial waste in waste management units (WMUs) not subject to Resource Conservation and Recovery Act (RCRA) hazardous waste regulations. It employs an integrated, multimedia, multiple-exposure pathway, and multiple-receptor risk assessment model (the 3MRA model) to evaluate risks that may occur from the long-term multimedia release of a chemical from such WMUs.

The 3MRA model contains 18 media-specific pollutant release, fate, transport, exposure, and risk modules. The modules have varying data requirements covering a wide range of general data categories: WMU characteristics; waste properties, meteorological data; surface water and watershed layout and characteristics; soil (vadose zone) properties; aquifer (saturated zone)

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properties; food chain or food web characteristics; human and ecological exposure factors; and the types and locations of human receptors and ecological receptors and habitats surrounding a WMU. In addition, for each chemical to be assessed under HWIR, the modules require the following chemical-specific data: chemical properties, biouptake and bioaccumulation factors, and human and ecological health benchmarks.

1.2 Approach

The HWIR 3MRA is a national-scale risk assessment that evaluates human and ecological risks that may occur from the release of a chemical from WMUs typically expected to handle exempted wastes. Although EPA implemented the assessment on a national scale, it based the analysis on a regional, site-based approach, in which risks were evaluated at a number of representative individual nonhazardous industrial waste management sites across the country. To collect data for model implementation, EPA employed three data collection approaches; in order of preference, they are:

- *Site-based* - Input data were collected and passed to the model for each site.
- *Regional* - The nation was divided into regions of similar characteristics, data were collected to characterize the variability within each region, and each site was assigned to a region.
- *National* - Distributions or fixed values were collected for inputs that characterize the nation as a whole.

For each variable, EPA selected one of these data collection approaches by considering the preference for site-based data, data availability, and the level of effort for data collection. In other words, EPA collected regional data (e.g., meteorological and aquifer data) and national data (e.g., exposure factors, waste properties, chemical-specific data) to satisfy the data requirements of the 18 3MRA modules only when site-based data were not readily available. Table 1-1 shows the data collection approach by data type, along with the section of the document that describes the data collection approach for each data type in detail.

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Table 1-1. HWIR Data Collection Approach, by Data Type

Data Type (Report Section)	Data Collection Approach		
	Site-Based	**Regional**	**National**
Waste management unit (Section 3)	!		!
Waste properties (Section 16)			!
Meteorological (Section 4)		!	
Watershed and waterbody layout (Section 5)	!		
Surface water (Section 6)		!	!
Soil/vadose zone (Section 7)	!		!
Aquifer (Section 16)		!	!
Farm food chain/terrestrial food web (Section 10)			!
Aquatic food web (Section 11)		!	!
Human exposure factors (Section 8)			!
Cological exposure factors (Section 12)		!	!
Chemical properties[a,b]			!
Biouptake/bioaccumulation factors[b] (Sections 10, 11, 16)			!
Human health benchmarks[b] (Section 15)			!
Human receptor type and location (Section 9)	!		!
Ecological benchmarks[b] (Section 14)			!
Ecological receptor and habitat type and location (Section 13)	!	!	

[a] Addressed under separate HWIR data collection and documentation efforts (U.S. EPA, 1999a; U.S. EPA, 1999b; U.S. EPA, 1999c.)
[b] Chemical-specific variables.

Although site-based data were the basis for this analysis and the site-based data were determined by site location, the HWIR 3MRA is not a site-specific analysis. The site-based data are intended to provide a representative data set for a national assessment. Thus, although a large effort went into identifying, as best we could, the locations of each site and collecting accurate data to characterize each site, the data are not meant to be used for a site-specific risk assessment. Instead, the site-based data and analysis are intended to develop **nationwide** chemical-specific distributions of risks.

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1.3 Sites, Settings, and Area of Interest

To represent nonhazardous industrial waste management across the United States, EPA used data on onsite, nonhazardous industrial waste management from its 1985 *Screening Survey of Industrial Subtitle D Establishments* (Westat, 1987). This survey was designed to represent a total population of nearly 150,000 establishments generating nonhazardous industrial wastes. Although over 10 years old, the survey represents the largest consistent set of data available on Industrial D facility location and WMU dimensions. EPA selected a total of 201 sites from the 2,850 facilities (out of a total of 15,844 surveyed facilities) that had one or more of four types of waste management units onsite (landfill, wastepile, land application unit [LAU], and surface impoundment).

EPA selected the sample of 201 facilities to represent the types, sizes, and geographic locations of WMUs at which exempt waste could be currently disposed. The locations of these facilities determine the sites where the 3MRA is implemented and the screening survey data determine the type and size of WMUs that are present at a particular site. The area of interest (AOI) is the spatial area within which data are collected and risks are estimated. At each site, the AOI for the HWIR 3MRA is the WMU area plus the area encompassed by a 2-km radius extending from the corner of the square WMU (Figure 1-1).

Because of difficulties in modeling multiple units at a single site, where there are multiple WMU types at an Industrial D site, the data collection effort assigned multiple AOIs and multiple settings. HWIR defines a setting as a unique WMU type/site combination. Thus, a site with a landfill and a wastepile would constitute two settings. Settings are the basic spatial modeling unit for the 3MRA analysis, with each model realization being run at a single WMU/site setting. There are 419 unique WMU/site settings across the 201 sites selected for the HWIR risk analysis; Table 1-2 shows the breakout of WMU types across theses 419 settings and compares these

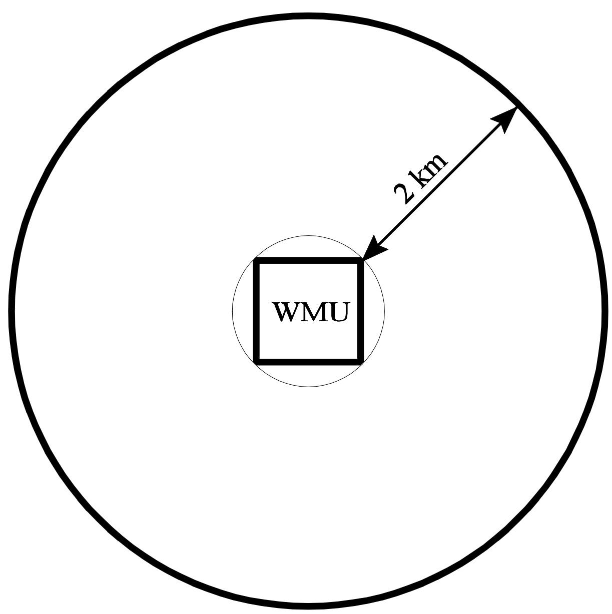

Figure 1-1. Area of interest (AOI) for HWIR 3MRA

Table 1-2. Settings/WMU Type Distribution for the HWIR 201-Facility Sample.

WMU Type	Settings - 201 Sample Facilities[a]	Settings - 2,850 Industrial D Facilities[b]
	Number	Number
Landfill (LF)	56	827
Land application unit (LAU)	28	354
Surface impoundment (SI)	137	1,930
Wastepile (WP)	61	853
Aerated tank (AT)	137[3]	–[c]
TOTAL	419	3,964

[a] Random sample, proportional by industry sector, from the 2,850 Industrial D facilities reporting onsite waste management. A setting is a unique WMU type/site combination.
[b] Facilities in 1985 *Screening Survey of Industrial Subtitle D Establishments* (Westat, 1987) reporting onsite hazardous waste management (out of 15,844 establishments surveyed).
[c] HWIR places an aerated tank at every surface impoundment facility (there are no tank data in the Industrial D Screening Survey data).

statistics with the overall survey data (for the 2,850 facilities in the screening survey with onsite WMUs). The 419 settings include all the 282 unique Industrial D WMU/site combinations plus 137 aerated tank settings.[1]

To estimate human and ecological risk for each of the 419 settings, the HWIR 3MRA used the Industrial D data on WMU dimensions along with site-based data on waterbodies, watersheds, soils, and human and ecological receptor types and locations collected within the 2-km AOI. To supplement these site-based data, EPA collected regional data (e.g., meteorological, water quality, and aquifer data) and national data (e.g., exposure factors, waste properties, chemical-specific data) to satisfy the data requirements of all 18 3MRA modules (i.e., five sources, five fate-and-transport, three food-chain/foodweb, two exposure, two risk, and the exit-level processor).

1.4 Methodology

The HWIR data collection effort was limited to information that could be obtained from readily available electronic and published data sources. The strategy for collecting data to support the HWIR 3MRA included both automated and manual collection methodologies, as follows:

[1]The Industrial D screening survey data do not include aerated tanks. EPA placed a tank at each surface impoundment site from the 201 sites because the presence of the impoundment indicates that the facility manages liquid wastes and therefore could have a treatment tank (see Section 3).

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- # *Automated methods* involved electronic processing of data using a combination of geographic information system (GIS) technology and conventional electronic databases.

- # *Manual techniques* involved desktop analysis, such as literature reviews and analyses, and manual data entry.

EPA considered data availability, accuracy, sample coverage, and available resources in developing and choosing collection methodologies for particular data types. There was a general preference for automated methods, although, in many cases, hybrid methods were required that involved some manual interaction with data collection or processing programs.

Figure 1-2 provides an overview of the HWIR 3MRA data collection process, showing data sources, primary data processing operations, and the final files supplied to the 3MRA model.

- # *Data sources* included both conventional electronic data sources and GIS coverages (spatial data), as well as published literature and professional judgment.

- # *Data processing* operations used both GIS software and more conventional database programs to process the data to 3MRA system requirements.

- # *Final data files* were exported to the 3MRA system in American Standard Code for Information Interchange (ASCII) format (meteorological data) and Microsoft Access databases.

Two separate lines of data processing are depicted in Figure 1-2. The Industrial Source Complex short-term (ISCST3) air model requires ASCII files processed through the PCRAMMET hourly data processing program. Other programs develop the PCRAMMET input files from meteorological and land use data (from the GIS), as well as derive, from the hourly data files, the longer term average (climatic) meteorological ASCII data files required by other 3MRA modules (daily, monthly, annual, and long-term annual average).

The other processing system compiled the 3MRA model input database and grid data used by the 3MRA site layout processor to place air points in the input database. This system employed GIS programs (ARC/INFO and ArcView) along with conventional database processing using structured query language (SQL) and Visual Basic to automatically generate the input databases. Data collected from the literature or estimated using professional judgment were entered into the system manually. Other data were processed from electronic sources using a combination of GIS programs (for spatial data analysis) and database programs.

In general, GIS programs put data within the spatial context required by the modeling assumptions (i.e., a 2-km AOI; 500-m, 1,000-m, and 2,000-m receptor rings; a single average WMU for each setting) and interrelated different spatial data coverages using overlays to create the site layout variables required by the model. Database programs processed these and all other data to meet system requirements in terms of database format (table structure) and the variable specifications in the 3MRA input dictionary (ssf.dic) files.

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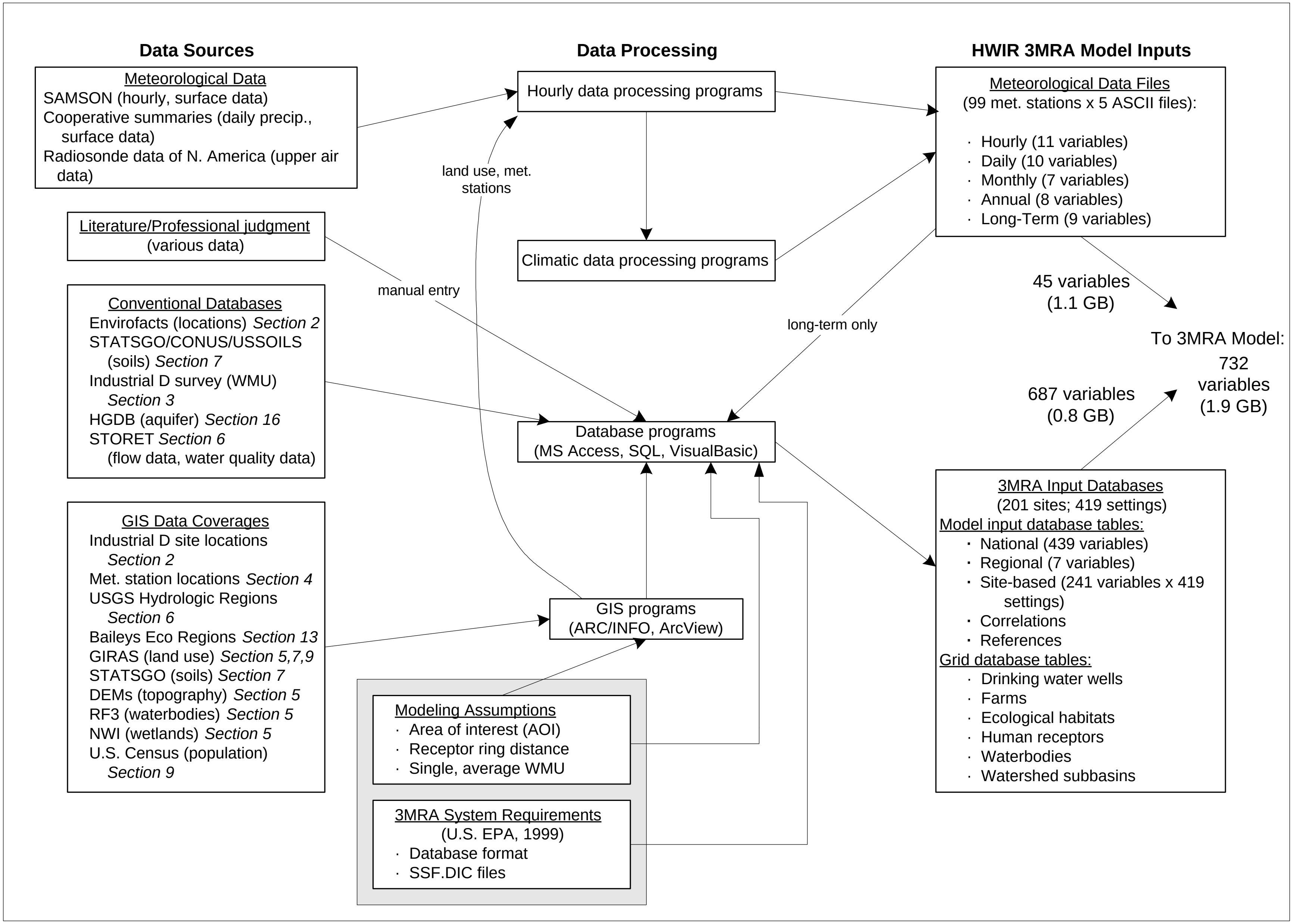

Figure 1-2. Overview of HWIR 3MRA data collection and processing.

1.4.1 GIS Data Collection and Processing

EPA selected a GIS as the platform for collecting much of the site-specific data for the HWIR risk analysis because it can be automated and can perform spatial overlay of georegistered data. Most of the GIS processing used ARC/INFO for UNIX workstations; some processing occurred in the PC environment with ARC/INFO and ArcView. This document uses the term GIS "program" to refer to arc macro language (AML) scripts, a batch-process scripting language used with the ARC/INFO GIS software. The term "coverage" refers to a GIS map layer (e.g., geographically referenced digital points, lines, or polygons with attached data).

The GIS programs provided the following three primary data coverages for this risk analysis:

- Waterbody and watershed layout (Section 5.0)
- Human receptor locations, including farms and residences (Section 9.0)
- Ecological habitats and home ranges (Section 13.0).

We also conducted GIS processing to assign sites to meteorological and hydrologic regions (Sections 3.0 and 6.0), to identify soil types by watershed and WMU (Section 7.0), and to accurately locate facilities (Section 2.0). In general, these GIS methodologies combined automated and manual techniques. Details on the various GIS methodologies used to derive these data may be found in the previously referenced sections. Section 2.0 describes the overall spatial framework used to conduct site-based GIS data collection, data processing, and 3MRA modeling.

1.4.2 Conventional Database Processing and Export to 3MRA Model

A conventional Microsoft Access database, using VisualBasic and SQL programs for data processing, was developed to import the GIS and other input data shown in Figure 1-2 and to process them to create the Microsoft Access input databases required by the 3MRA modeling system. As shown in Figure 1-2, the Access input data were exported in two primary file formats:

- The *model input database (687 variables)* includes national, regional, and site-based data tables containing the input variables needed by the 3MRA model. Appendix 1A shows the structure of these data tables and Appendix 1B contains a full listing of these variables, by data table (national, regional, or site-based) and data group. Sections 3.0, 5.0 through 13.0, and 16.0 of this report describe collection and processing of these data by data type.

- The *grid database* includes six data tables containing x,y coordinates for watersheds, waterbodies, farms, human receptor points, drinking water wells, and ecological habitats. These are used by the 3MRA Site Layout Processor (SLP) to place air receptor points for the air module into the model input database and to determine the coordinates for drinking water wells and surface water discharge points for the ground water module. Section 2.0 describes the preparation and formatting of the grid database files.

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As mentioned previously, meteorological data files (45 variables) were processed and delivered separately from the Access database as a series of five sets of ASCII data files containing hourly, daily, monthly, and annual time series data as well as long-term annual average climatic data for each meteorological station. Section 4.0 describes preparation of these files in detail. Together, these data files and databases account for over 700 variables requested by the HWIR 3MRA model and are almost 2 gigabytes in size uncompressed.

1.4.3 Quality Assurance/Quality Control and Recordkeeping

Each of the subsequent sections of this report describes the quality assurance and quality control (QA/QC) procedures that are unique to the data type discussed in each section. In addition to these, there are certain approaches that are common to all activities in this effort. These common approaches may or may not fit a particular data type, depending on the specific data collection methodology.

Prior to data collection, we developed a basic QA/QC protocol for each data type and briefed all involved staff to ensure that they were aware of these requirements. Each section of this report describes these simple protocols. Any necessary deviations from these protocols during data collection were discussed with and approved by the team leader and the QA officer.

QC staff checked all data manually entered into the input database from hard-copy sources 100 percent after a senior staff member reviewed the data source and highlighted the data to be entered. Other general QA/QC and recordkeeping procedures included the following:

- Recording the name of the staff member performing QC and the date as part of QC records.

- Maintaining files documenting QC activities. These files were used to track data sources, data entry, and changes to data, for instance, and included copies of the hard-copy data sources.

- Keeping metadata electronically for all electronic data sources.

- For automated import of data from electronic sources, validating the data extraction system before use by hand-checks and calculations. After initial system validation, we manually checked a sufficient fraction of the data (usually 5 to 10 percent) to ensure that the data processing system was functioning properly. Automated checks also were built into the system to detect data inconsistencies. Data types checked in this fashion included automated portions of meteorological data, WMU data, soil data, watershed and waterbody data, soil data, and human and ecological receptor data collection.

- Similar to automatic data collection, we validated the HWIR input data processor system by manually checking a portion (usually 5 percent or more) of the processed data for each variable to ensure that the system was functioning properly. The system also included automated checks to spot inconsistencies. Finally, the 3MRA Site Definition Processor (SDP) checked each database update

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for missing data and for consistency with the 3MRA input data specifications (i.e., the ssf.dic dictionary files).

In several cases, QC checks found that source data were of unacceptable quality (e.g., see Section 4.0, Meteorological Data). Approaches for spotting such errors and inconsistencies are described under each data type, as well as how the issues were resolved.

1.5 Document Organization and Scope

This report first describes the spatial framework of the data collection effort (Section 2.0), including site location, site layout, and an overview of the collection and processing of site-based data. The report is then organized according to major groups of model input data, defined both by the model requirements and the data collection methodologies for the 201 sites and the 419 site/WMU settings to be modeled. Sections address each of the following data types:

Section 3.0	Waste Management Unit Data
Section 4.0	Meteorological Data
Section 5.0	Watershed and Waterbody Layout
Section 6.0	Surface Water Data
Section 7.0	Soil Data
Section 8.0	Human Exposure Factors
Section 9.0	Human Receptor Data
Section 10.0	Farm Food Chain / Terrestrial Food Web Data (including terrestrial biouptake and bioaccumulation factors)
Section 11.0	Aquatic Food Web Data (including aquatic biouptake and bioaccumulation factors)
Section 12.0	Ecological Exposure Factors
Section 13.0	Ecological Receptors and Habitats
Section 14.0	Ecological Benchmarks
Section 15.0	Human Health Benchmarks
Section 16.0	Miscellaneous Data.

Most of these data types (except human and ecological exposure factors) were required by multiple HWIR modules. Table 1-3 illustrates the crosswalk between these data types and the 3MRA component modules by showing which data types each model requires and, for each data type, whether data were collected for that model on a site-based, regional, or national basis. Although shown in Table 1-3 for completeness, chemical property data were collected and documented under separate efforts (U.S. EPA, 1999a, U.S. EPA, 1999b, U.S. EPA, 1999c).

Each report section is generally organized to provide the following information for the 201-site data collection effort:

- Parameters addressed (by module)

- Data sources

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Table 1-3. Data Types Used by the HWIR 3MRA Model

Module	Data Type and Document Section												
	Waste management unit (WMU) Sect. 3	Waste property Sect. 16	Meteor-ologic Sect. 4	Watershed & waterbody layout Sect. 5	Surface water Sect. 6	Soil / vadose zone Sect.7	Aquifer (saturated zone) Sect. 16	Food web/ food chain Sect. 10, 11	Chemical property[a,b]	Biouptake and bioaccumu-lation factors[b] Sect. 10, 11	Exposure factor Sect. 8, 12	Receptor/ habitat type & location Sect. 9, 13	Health bench-mark[b] Sect. 14. 15
Source modules													
Aerated tank	N	N	R						N				
Landfill	S, N	N	R			S			N				
LAU	S, N	N	R	S		S			N				
Surf. Imp.	S, N	N	R			S			N				
Wastepile	S, N	N	R	S		S			N				
Fate and transport modules													
Air	S		R									S	
Watershed			R	S		S			N				
Surface water			R	S	R,N				N				
Vadose zone						S			N				
Aquifer				S			R,N		N			S	
Aquatic food web				S	R			N	N	N		S,R	
Farm food chain						S		N	N	N		S,R	
Terres. food web						S		N	N	N		S,R	
Exposure and risk modules													
Eco. exposure				S	R	S			N	N	R,N	S,R	
Human exposure				S		S			N	N	N	S,R,N	
Eco risk									N			S,R	N
Human risk												S,R,N	N

[a] not addressed in this document.
[b] Chemical-specific.
S = site-based data; R = regional data; N = national data; blanks = not applicable to module.

Data collection methodology, including
  - data selection and retrieval
  - data conversions and derivations
  - QA/QC.

Data collected (by parameter)

Significant issues and uncertainties associated with data collection

References for data sources and collection methodologies.

Although each section generally follows this scheme and includes this information at a minimum, some section-to-section variability in structure and content exists due to differences in the data collection scope and methodologies.

1.6 References

U.S. EPA (Environmental Protection Agency). 1999a. *Changes in the MINTEQA2 Modeling Procedure for Estimating Metal Partitioning Coefficients in Groundwater for HWIR99.*Office of Research and Development. Athens, GA July.

U.S. EPA (Environmental Protection Agency). 1999b. *Chemical Database for HWIR99*. Office of Solid Waste. Washington, DC.

U.S. EPA (Environmental Protection Agency). 1999c.*Partitioning Coefficients for Metals in Surface Water, Soil, and Waste for HWIR99*. Office of Research and Development. Athens, GA July.

U.S. EPA (Environmental Protection Agency). 1999d. *FRAMES-HWIR Technology Software System for 1999: System Overview*. Office of Research and Development. Athens, GA July.

Westat. 1987. *Screening Survey of Industrial Subtitle D Establishments. Draft Final Report.* U.S. EPA. Westat, Inc., Rockville, MD. December 29.

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Appendix 1A. Structure of HWIR 3MRA Model Input Database

Table 1A-1 shows the data structure for the HWIR 3MRA model input database. The data are stored in a Microsoft Access® database composed of seven separate data tables (i.e., the database is not relational). The table also lists the field (or column) names for each of these tables.

Three primary data tables with identical structures hold most of the model 3MRA inputs:

National_Variable_Distribution_Data, which contains data collected on a national scale that characterize values across the nation. In this table the "Setting_ID" field is always "national" (i.e., for each variable, a single value or distribution characterizes the variable's value for the HWIR 3MRA(

Regional_Variable_Distribution_Data, which contains data collected for individual regions to characterize the nationwide distribution of values. In this table the "Setting_ID" field contains the region (e.g., meteorological station, USGS Hydrologic Region, hydrogeologic environment) to which the data correspond. For a particular HWIR site, the 3MRA reads the site's regional assignments from the site-based data table and uses these data to select the correct regional data from the regional data table.

Site_Variable_Distribution_Data, which contains site-based data collected by HWIR site. In this table, the "Setting_ID" field contains the setting ID, one of 419 unique site and WMU combinations.

Other 3MRA database data tables include *Cross_Correlation_Data*, which provides correlation coefficients between correlated variables; *User_Defined_Distribution_Data*, which provides empirical distributions for specific variables with a nonnull entry in the "User_Defined_Distribution_Index" field in the primary data tables above; *facility*, which provides, for all 201 HWIR sites, the number of each type of waste management unit (landfill, surface impoundment, land application unit, wastepile, and aerated tank); and *Reference_Data*, which contains reference information (data sources) for each HWIR 3MRA variable.

Additional detail on the design and structure of the HWIR 3MRA database and its functioning within the 3MRA model may be found in *FRAMES-HWIR Technology Software System for 1999: System Overview* (U.S. EPA, 1999d) and its supporting documents.

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Table Structure for HWIR Input Database

National_Variable_Distribution_Data

RowID LONG (AK)
Setting_ID TEXT(20) (IE)
Data_Group_Name TEXT(20) (IE)
Variable_Name TEXT(20) (IE)
Units TEXT(20) (IE)
Index_1 INT (IE)
Index_2 INT (IE)
Index_3 INT (IE)
Index_4 INT
Index_5 INT
Index_6 INT
Data_Type TEXT(10)
Reference_Index TEXT(20)
Distribution_Type TEXT(12)
Central_Tendency DOUBLE
Variance DOUBLE (IE)
Maximum DOUBLE
Minimum DOUBLE
User_Defined_Dist_Index TEXT(20)
String_Value TEXT(80)
Logical_Value BOOL
Weight SINGLE
AutoFilled BOOL

Regional_Variable_Distribution_Data

RowID LONG (AK)
Setting_ID TEXT(20) (IE)
Data_Group_Name TEXT(20) (IE)
Variable_Name TEXT(20) (IE)
Units TEXT(20) (IE)
Index_1 INT (IE)
Index_2 INT (IE)
Index_3 INT (IE)
Index_4 INT (IE)
Index_5 INT (IE)
Index_6 INT (IE)
Data_Type TEXT(10)
Reference_Index TEXT(20)
Distribution_Type TEXT(12) (IE)
Central_Tendency DOUBLE
Variance DOUBLE (IE)
Maximum DOUBLE
Minimum DOUBLE
User_Defined_Dist_Index TEXT(20)
String_Value TEXT(80)
Logical_Value BOOL
Weight SINGLE
AutoFilled BOOL

Site_Variable_Distribution_Data

RowID LONG
Setting_ID TEXT(20) (IE)
Data_Group_Name TEXT(20) (IE)
Variable_Name TEXT(20) (IE)
Units TEXT(20)
Index_1 INT (IE)
Index_2 INT (IE)
Index_3 INT (IE)
Index_4 INT (IE)
Index_5 INT (IE)
Index_6 INT (IE)
Data_Type TEXT(10)
Reference_Index TEXT(20)
Distribution_Type TEXT(12) (IE)
Central_Tendency DOUBLE
Variance DOUBLE
Maximum DOUBLE
Minimum DOUBLE
User_Defined_Dist_Index TEXT(20)
String_Value TEXT(80)
Logical_Value BOOL
Weight SINGLE
AutoFilled BOOL

Cross_Correlation_Data

V1_Setting_ID TEXT(20) (IE)
V1_DataGroup TEXT(20)
V1_Variable TEXT(50)
V1_Units TEXT(20)
V1_Index_1 INT
V1_Index_2 INT
V1_Index_3 INT
V1_Index_4 INT
V1_Index_5 INT
V1_Index_6 INT
V2_Setting_ID TEXT(20) (IE)
V2_DataGroup TEXT(20)
V2_Variable TEXT(20)
V2_Units TEXT(20)
V2_Index_1 INT
V2_Index_2 INT
V2_Index_3 INT
V2_Index_4 INT
V2_Index_5 INT
V2_Index_6 INT
Cross_Correlation DOUBLE

User_Defined_Distribution_Data

User_Defined_Dist_Index TEXT(20)
Value DOUBLE
CDF DOUBLE

Reference_Data

Reference_Index TEXT(20)
Reference_Description MEMO

facility

Setting_ID TEXT(255)
LF LONG
SI LONG
LAU LONG
WP LONG
AT LONG

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Appendix 1B. Model Inputs by Database Table

Note: Data groups in tables (column 1) correspond to specific 3MRA component modules requiring inputs. Variables in site layout data group are generally shared by multiple modules.

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1B-1. Model Inputs in National Variable Distribution Table

Data Group	Variable Name	Description	Units
Air	AirSplineAngle	angles used in polar mesh	degrees
Air	AirSplineDistance	radial distances of polar mesh	m
Air	ArrayLen	number of particle size categories	unitless
Air	DryDpStr	dry depletion by WMU	
Air	IceScav	scavenging coefficient for frozen precipitation	h/s-mm
Air	LiqScav	scavenging coefficient for liquid precipitation	h/s-mm
Air	MASSFRAX	fraction of each particle size category by WMU	fraction
Air	MASSFRAXOption	flag for internal calculation of PMF (true) or (false) read from ar.ssf	
Air	NumAirSplineAngle	number of angles used to construct the polar mesh used to construct the spline	unitless
Air	NumAirSplineDist	number of distances used to construct the polar mesh used to construct the spline	unitless
Air	PARTDIAM	diameter of particles in the distribution	µm
Air	PARTSICE	particle scavenging coefficient for frozen precipitation	h/s-mm
Air	PARTSLIQ	particle scavenging coefficient for liquid precipitation	h/s-mm
Air	SCIMBYHR	number of hours to skip in processing	unitless
Air	ScimStr	first hour to start processing	
Air	SHight	source height	m
Air	SplineOption	0=no spline; 1 = spline	unitless
Air	WetDpStr	wet depletion, does not vary with WMU	
Aquatic foodweb	a_fish	model slope of BCF regression equation across all tissues in fish	unitless
Aquatic foodweb	a_mus	model slope of BCF regression equation for muscle tissue in fish	unitless
Aquatic foodweb	b_fish	model intercept of BCF regression equation across all tissues in fish	unitless
Aquatic foodweb	b_mus	model intercept of BCF regression equation for muscle tissue in fish	unitless
Aquatic foodweb	BiotaType	biota categories	
Aquatic foodweb	BiotaTypeIndex	index of biota	unitless
Aquatic foodweb	BWFish	fish body weight	kg
Aquatic foodweb	c_fish	error term in BCF regression equation across all tissues in fish	unitless
Aquatic foodweb	c_mus	error term in BCF regression equation for muscle tissue in fish	unitless
Aquatic foodweb	FiletFrac	fraction of fish that is filet	unitless
Aquatic foodweb	FishWaterFrac	water fraction across all tissues of fish	unitless
Aquatic foodweb	LipFrac	lipid fraction	unitless
Aquatic foodweb	LipFracMus	lipid fraction in fish muscle (filet)	unitless
Aquatic foodweb	MaxPreyPref	maximum dietary preference for items in the AqFW	unitless
Aquatic foodweb	MinPreyPref	minimum dietary preference for items in the AqFW	unitless
Aquatic foodweb	MusWaterFrac	water fraction in muscle (filet) of fish	unitless
Aquatic foodweb	NumBiotaTypes	number of biota types in a given AqFW	unitless
Aquatic foodweb	rho_lip	density (organic carbon)	kg/L
Aquatic foodweb	rho_OC	density (lipids)	kg/L
Aquatic foodweb	T3EdibleFish	edible T3 fish for human consumption	unitless
Aquatic foodweb	T3NumEdibleFish	number of edible T3 fish in AqFW	unitless
Aquatic foodweb	T3NumFish	number of T3 fish in AqFW	fish

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Table 1B-1. (continued)

Data Group	Variable Name	Description	Units
AT	bio_yield	biomass yield	g/g
AT	CBOD	BOD (influent)	g/cm^3
AT	d_imp	impeller diameter	cm
AT	d_setpt	fraction of tank occupied by sediments (max.)	fraction
AT	d_wmu	depth (liquid)	m
AT	dmeanTSS	particle diameter (mean, waste suspended solids)	cm
AT	EconLife	economic life of a tank/SI	year
AT	F_aer	fraction surface area-turbulent	fraction
AT	focW	fraction organic carbon (waste solids)	mass fraction
AT	J	oxygen transfer factor	lb O_2/h-hp
AT	k_dec	digestion (sediments)	1/s
AT	kba1	biologically active solids/total solids (ratio)	unitless
AT	MWt_H2O	molecular weight (liquid [water])	g/mol
AT	n_imp	impellers/aerators (number)	unitless
AT	NumEcon	number of economic lifetimes	
AT	O2eff	oxygen transfer correction factor	unitless
AT	Powr	impellers/aerators (total power)	hp
AT	Q_wmu	volumetric flow rate (tank)	m^3/s
AT	rho_l	density (liquid [water])	g/cm^3
AT	rho_part	solids density	g/cm^3
AT	TSS_in	total suspended solids (influent)	g/cm^3
AT	w_imp	impeller speed	rad/s
Ecoexposure	BodyWt_rec	body weight for each receptor	kg
Ecoexposure	CR_food	consumption rate of food items (e.g., plants, animals) for each receptor	kg/d
Ecoexposure	CR_water	consumption rate of water for each receptor	L/d
Ecoexposure	CRfrac_sed	consumption rate of sediment for each receptor	mass fraction
Ecoexposure	CRfrac_soil	consumption rate of surficial soil for each receptor	mass fraction
Ecoexposure	HabitatIndex	index of habitat types	unitless
Ecoexposure	HabitatType	description of habitat type (e.g., grassland, pond, forested wetland)	
Ecoexposure	MaxPreyPref_HabRange	maximum dietary preference for items found in habitat range	unitless
Ecoexposure	MinPreyPref_HabRange	minimum dietary preference for items found in habitat range	unitless
Ecoexposure	NumHabitat	number of habitat types represented	unitless
Ecoexposure	NumPrey	number of potential prey items	unitless
Ecoexposure	PreyIndex	numerical index of potential prey items	unitless
Ecoexposure	PreyType	text description of each potential prey item	
Ecorisk	DoExposed	option on whether to include all receptors (false) or exposed receptors only (true) in CDF calculations	unitless
Ecorisk	EcoRegPercentile	policy criterion for selecting critical year for maximum HQ	unitless
Ecorisk	HabitatIndex	index of habitat types	unitless
Ecorisk	NumHabitat	number of habitat types represented	unitless
Farm foodchain	Fforage_beef	fraction of forage grown in contaminated soil (beef cattle)	fraction
Farm foodchain	Fforage_dairy	fraction of forage grown in contaminated soil (dairy cattle)	fraction
Farm foodchain	Fgrain_beef	fraction of grain grown in contaminated soil (beef cattle)	fraction
Farm foodchain	Fgrain_dairy	fraction of grain grown in contaminated soil (dairy cattle)	fraction
Farm foodchain	Fsilage_beef	fraction of silage grown in contaminated soil (beef cattle)	fraction

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Table 1B-1. (continued)

Data Group	Variable Name	Description	Units
Farm foodchain	Fsilage_dairy	fraction of silage grown in contaminated soil (dairy cattle)	fraction
Farm foodchain	Fw_exfruit	fraction of wet deposition that adheres to plant	unitless
Farm foodchain	Fw_exveg	fraction of wet deposition that adheres to plant	unitless
Farm foodchain	Fw_forage	fraction of wet deposition that adheres to plant	unitless
Farm foodchain	Fw_silage	fraction of wet deposition that adheres to plant	unitless
Farm foodchain	MAFexfruit	moisture adjustment factor to convert DW into WW for exposed above-ground fruits	percent
Farm foodchain	MAFexveg	moisture adjustment factor to convert DW into WW for above-ground vegetables	percent
Farm foodchain	MAFleaf	moisture adjustment factor for wet leaf	unitless
Farm foodchain	MAFprofruit	moisture adjustment factor to convert DW into WW for protected above-ground fruits	percent
Farm foodchain	MAFproveg	moisture adjustment factor to convert DW into WW for protected above-ground vegetables	percent
Farm foodchain	MAFroot	moisture adjustment factor to convert DW into WW for root vegetables	percent
Farm foodchain	Qp_forage_beef	consumption rate: forage (beef cattle)	kg DW/d
Farm foodchain	Qp_forage_dairy	consumption rate: forage (dairy cattle)	kg DW/d
Farm foodchain	Qp_grain_beef	consumption rate: grain (beef cattle)	kg DW/d
Farm foodchain	Qp_grain_dairy	consumption rate: grain (dairy cattle)	kg DW/d
Farm foodchain	Qp_silage_beef	consumption rate: silage (beef cattle)	kg DW/d
Farm foodchain	Qp_silage_dairy	consumption rate: silage (dairy cattle)	kg DW/d
Farm foodchain	Qs_beef	consumption rate: soil (beef cattle)	kg/d
Farm foodchain	Qs_dairy	consumption rate: soil (dairy cattle)	kg/d
Farm foodchain	Qw_beef	consumption rate: water (beef cattle)	L/d
Farm foodchain	Qw_dairy	consumption rate: water (dairy cattle)	L/d
Farm foodchain	rho_leaf	leaf density	g/L FW
Farm foodchain	Rp_exfruit	interception fraction	unitless
Farm foodchain	Rp_exveg	interception fraction	unitless
Farm foodchain	Rp_forage	interception fraction	unitless
Farm foodchain	Rp_silage	interception fraction	unitless
Farm foodchain	tp_exfruit	length of plant exposure to deposition	yr
Farm foodchain	tp_exveg	length of plant exposure to deposition	yr
Farm foodchain	tp_forage	length of plant exposure to deposition	yr
Farm foodchain	tp_silage	length of plant exposure to deposition	yr
Farm foodchain	VapDdv	vapor phase dry deposition velocity	cm/s
Farm foodchain	VGag_exfruit	empirical correction factor	unitless
Farm foodchain	VGag_exveg	empirical correction factor	unitless
Farm foodchain	VGag_forage	empirical correction factor	unitless
Farm foodchain	VGag_silage	empirical correction factor	unitless
Farm foodchain	VGbg_root	empirical correction factor	unitless
Farm foodchain	Yp_exfruit	crop yield	kg DW/m^2
Farm foodchain	Yp_exveg	crop yield	kg DW/m^2
Farm foodchain	Yp_forage	crop yield	kg DW/m^2
Farm foodchain	Yp_silage	crop yield	kg DW/m^2
Human exposure	BF	event frequency (shower)	event/d
Human exposure	Bri_cr1	inhalation (breathing) rate (child 1 resident)	m^3/d
Human exposure	Bri_cr2	inhalation (breathing) rate (child 2 resident)	m^3/d
Human exposure	Bri_cr3	inhalation (breathing) rate (child 3 resident)	m^3/d

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Table 1B-1. (continued)

Data Group	Variable Name	Description	Units
Human exposure	Bri_cr4	inhalation (breathing) rate (child 4 resident)	m^3/d
Human exposure	Bri_r	inhalation (breathing) rate (adult resident)	m^3/d
Human exposure	BWa	body weight (adult)	kg
Human exposure	BWc1	body weight (child 1)	kg
Human exposure	BWc2	body weight (child 2)	kg
Human exposure	BWc3	body weight (child 3)	kg
Human exposure	BWc4	body weight (child 4)	kg
Human exposure	CRb_af	consumption rate: beef (adult farmer)	g WW/kg/d
Human exposure	CRb_cf_2	consumption rate: beef (child 2 farmer)	g WW/kg/d
Human exposure	CRb_cf_3	consumption rate: beef (child 3 farmer)	g WW/kg/d
Human exposure	CRb_cf_4	consumption rate: beef (child 4 farmer)	g WW/kg/d
Human exposure	CRbm_cr_1	consumption rate: breast milk (child 1 resident)	mL/d
Human exposure	CRfr_cf_2	consumption rate: exposed fruit (child 2 farmer)	g WW/kg/d
Human exposure	CRfr_cf_3	consumption rate: exposed fruit (child 3 farmer)	g WW/kg/d
Human exposure	CRfr_cf_4	consumption rate: exposed fruit (child 4 farmer)	g WW/kg/d
Human exposure	CRfr_cg_2	consumption rate: exposed fruit (child 2 gardener)	g WW/kg/d
Human exposure	CRfr_cg_3	consumption rate: exposed fruit (child 3 gardener)	g WW/kg/d
Human exposure	CRfr_cg_4	consumption rate: exposed fruit (child 4 gardener)	g WW/kg/d
Human exposure	CRfr_f	consumption rate: exposed fruit (farmer)	g WW/kg/d
Human exposure	CRfr_g	consumption rate: exposed fruit (gardener)	g WW/kg/d
Human exposure	CRfs_a	consumption rate: fish (adult)	g/d
Human exposure	CRfs_c_2	consumption rate: fish (child 2)	g/d
Human exposure	CRfs_c_3	consumption rate: fish (child 3)	g/d
Human exposure	CRfs_c_4	consumption rate: fish (child 4)	g/d
Human exposure	CRl_cf_2	consumption rate: exposed vegetables (child 2 farmer)	g WW/kg/d
Human exposure	CRl_cf_3	consumption rate: exposed vegetables (child 3 farmer)	g WW/kg/d
Human exposure	CRl_cf_4	consumption rate: exposed vegetables (child 4 farmer)	g WW/kg/d
Human exposure	CRl_cg2	consumption rate: exposed vegetables (child 2 gardener)	g WW/kg/d
Human exposure	CRl_cg3	consumption rate: exposed vegetables (child 3 gardener)	g WW/kg/d
Human exposure	CRl_cg4	consumption rate: exposed vegetables (child 4 gardener)	g WW/kg/d
Human exposure	CRl_f	consumption rate: exposed vegetables (adult farmer)	g WW/kg/d
Human exposure	CRl_g	consumption rate: exposed vegetables (gardener)	g WW/kg/d
Human exposure	CRm_af	consumption rate: milk (adult farmer)	g WW/kg/d
Human exposure	CRm_cf_2	consumption rate: milk (child 2 farmer)	g WW/kg/d
Human exposure	CRm_cf_3	consumption rate: milk (child 3 farmer)	g WW/kg/d
Human exposure	CRm_cf_4	consumption rate: milk (child 4 farmer)	g WW/kg/d
Human exposure	CRpfr_cf_2	consumption rate: protected fruit (child 2 farmer)	g WW/kg/d
Human exposure	CRpfr_cf_3	consumption rate: protected fruit (child 3 farmer)	g WW/kg/d
Human exposure	CRpfr_cf_4	consumption rate: protected fruit (child 4 farmer)	g WW/kg/d
Human exposure	CRpfr_cg_2	consumption rate: protected fruit (child 2 gardener)	g WW/kg/d
Human exposure	CRpfr_cg_3	consumption rate: protected fruit (child 3 gardener)	g WW/kg/d
Human exposure	CRpfr_cg_4	consumption rate: protected fruit (child 4 gardener)	g WW/kg/d
Human exposure	CRpfr_f	consumption rate: protected fruit (adult farmer)	g WW/kg/d
Human exposure	CRpfr_g	consumption rate: protected fruit (adult gardener)	g WW/kg/d
Human exposure	CRpl_cf_2	consumption rate: protected vegetables (child 2 farmer)	g WW/kg/d
Human exposure	CRpl_cf_3	consumption rate: protected vegetables (child 3 farmer)	g WW/kg/d
Human exposure	CRpl_cf_4	consumption rate: protected vegetables (child 4 farmer)	g WW/kg/d
Human exposure	CRpl_cg_2	consumption rate: protected vegetables (child 2 gardener)	g WW/kg/d

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Table 1B-1. (continued)

Data Group	Variable Name	Description	Units
Human exposure	CRpl_cg_3	consumption rate: protected vegetables (child 3 gardener)	g WW/kg/d
Human exposure	CRpl_cg_4	consumption rate: protected vegetables (child 4 gardener)	g WW/kg/d
Human exposure	CRpl_f	consumption rate: protected vegetables (adult farmer)	g WW/kg/d
Human exposure	CRpl_g	consumption rate: protected vegetables (adult gardener)	g WW/kg/d
Human exposure	CRr_cf_2	consumption rate: root vegetables (child 2 farmer)	g WW/kg/d
Human exposure	CRr_cf_3	consumption rate: root vegetables (child 3 farmer)	g WW/kg/d
Human exposure	CRr_cf_4	consumption rate: root vegetables (child 4 farmer)	g WW/kg/d
Human exposure	CRr_cg_2	consumption rate: root vegetables (child 2 gardener)	g WW/kg/d
Human exposure	CRr_cg_3	consumption rate: root vegetables (child 3 gardener)	g WW/kg/d
Human exposure	CRr_cg_4	consumption rate: root vegetables (child 4 gardener)	g WW/kg/d
Human exposure	CRr_f	consumption rate: root vegetables (farmer)	g WW/kg/d
Human exposure	CRr_g	consumption rate: root vegetables (gardener)	g WW/kg/d
Human exposure	CRs_cr2	ingestion rate:soil (child 2 resident)	kg/d
Human exposure	CRs_cr3	ingestion rate:soil (child 3 resident)	kg/d
Human exposure	CRs_cr4	ingestion rate:soil (child 4 resident)	kg/d
Human exposure	CRs_r	ingestion rate:soil (adult resident)	kg/d
Human exposure	CRw_cr1	ingestion rate: drinking water (child 1 resident)	mL/d
Human exposure	CRw_cr2	ingestion rate: drinking water (child 2 resident)	mL/d
Human exposure	CRw_cr3	ingestion rate: drinking water (child 3 resident)	mL/d
Human exposure	CRw_cr4	ingestion rate: drinking water (child 4 resident)	mL/d
Human exposure	CRw_r	ingestion rate: drinking water (adult resident)	mL/d
Human exposure	DD	water droplet diameter	cm
Human exposure	EFr	exposure frequency (adult resident)	d/y
Human exposure	Fb_f	fraction contaminated: beef (farmer)	fraction
Human exposure	fbp	fraction of whole blood that is plasma	fraction
Human exposure	Ff_s	fraction contaminated fish	fraction
Human exposure	ffm	fraction of mother's weight that is fat	fraction
Human exposure	Ffr_f	fraction homegrown: exposed fruit (farmer)	fraction
Human exposure	Ffr_g	fraction homegrown: exposed fruit (gardener)	fraction
Human exposure	Fl_f	fraction homegrown: exposed vegetables (farmer)	fraction
Human exposure	Fl_g	fraction contaminated: homegrown exposed vegetables (gardener)	fraction
Human exposure	Fm_f	fraction contaminated: milk (farmer)	fraction
Human exposure	fmbm	fraction of fat in maternal breast milk	fraction
Human exposure	Fpfr_f	fraction homegrown: protected fruit (farmer)	fraction
Human exposure	Fpfr_g	fraction homegrown: protected fruit (gardener)	fraction
Human exposure	Fpl_f	fraction homegrown: protected vegetables (farmer)	fraction
Human exposure	Fpl_g	fraction homegrown: protected vegetables (gardener)	fraction
Human exposure	fpm	fraction of mother's weight that is plasma	fraction
Human exposure	Fr_f	fraction homegrown: root vegetables (farmer)	fraction
Human exposure	Fr_g	fraction homegrown: root vegetables (gardener)	fraction
Human exposure	Fs	fraction contaminated: soil	fraction
Human exposure	FT3fish	fraction of fish consumed that is T3 fish	fraction
Human exposure	FT4fish	fraction of fish consumed that is T4 fish	fraction
Human exposure	Fw	fraction contaminated: drinking water	fraction
Human exposure	Hn	nozzle height	cm
Human exposure	Rshower	shower rate	L/min
Human exposure	t_sb	time in shower and bathroom	min

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Table 1B-1. (continued)

Data Group	Variable Name	Description	Units
Human exposure	t_shower	shower time	min
human exposure	Vbath	bathroom volume	m^3
Human exposure	Vn	terminal velocity of droplet	cm/s
Human exposure	VRbh	bathroom to house ventilation rate	L/min
Human exposure	VRsb	shower to bathroom ventilation rate	L/min
Human exposure	Vshower	shower volume	m^3
Human risk	DoExposed	option on whether to include all receptors (false) or exposed receptors only (true) in CDF calculations	unitless
Human risk	ExDur_Car_Block	exposure duration (carcinogens, residents)	unitless
Human risk	ExDur_Car_Farm	exposure duration (carcinogens, farmers)	unitless
Human risk	ExDur_NCar_Block	exposure duration (noncarcinogens, residents)	unitless
Human risk	ExDur_NCar_Farm	exposure duration (noncarcinogens, farmers)	unitless
Human risk	LifeTime	average receptor lifetime	unitless
Human risk	RegPercentile	policy criterion defining regulatory percentile (not used in HWIR)	unitless
LAU	asdm	mode of the aggregate size distribution (till zone surface)	mm
LAU	bcm	boundary condition multiplier (lower boundary)	unitless
LAU	BDw	dry bulk density (waste solids)	g/cm^3
LAU	ConVs	settling velocity (suspended solids)	m/d
LAU	CutOffYr	operating life	year
LAU	Cwmu	USLE cover factor (WMU)	unitless
LAU	deltDiv	time step divider (for debugging)	unitless
LAU	effdust	dust suppression control efficiency	unitless
LAU	focW	fraction organic carbon (waste solids)	mass fraction
LAU	fwmu	fraction hazardous waste in WMU	mass fraction
LAU	Infild	input infiltration rate (for debugging)	m/d
LAU	Lc	roughness ratio (till zone surface)	unitless
LAU	Pwmu	USLE erosion control factor (WMU)	unitless
LAU	RunID	run identification label (optional)	
LAU	solid	percent solids (waste)	mass percent
LAU	Sw	silt content (waste solids)	mass percent
LAU	thetawZ1d	input volumetric water content in till zone (for debugging)	volume fraction
LAU	thetawZ2d	input volumetric water content in LAU subsoil zone (for debugging)	volume fraction
LAU	veg	fraction vegetative cover (inactive LAU)	fraction
LAU	vs	vehicle speed (mean)	km/h
LAU	zava	averaging depth upper (depth averaged soil concentration)	m
LAU	zavb	averaging depth lower (depth averaged soil concentration)	m
LAU	zruf	roughness height (inactive LAU)	cm
LAU	zZ1sa	depth (modeled soil column, subareas other than WMU)	m
LAU	zZ2WMU	subsoil layer thickness	m
LF	asdm	mode of the aggregate size distribution (LF waste zone surface)	mm
LF	bcm	boundary condition multiplier (lower boundary)	unitless
LF	BDw	dry bulk density (waste)	g/cm^3
LF	deltDiv	time step divider (for debugging)	unitless
LF	DRZ_W	depth (root zone in LF waste zone)	cm
LF	effdust	dust suppression control efficiency	unitless

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Table 1B-1. (continued)

Data Group	Variable Name	Description	Units
LF	focW	fraction organic carbon (waste)	mass fraction
LF	fwmu	fraction hazardous waste in WMU	mass fraction
LF	Infild	input infiltration rate (for debugging)	m/d
LF	KsatW	saturated hydraulic conductivity (waste)	cm/h
LF	Lc	roughness ratio (LF waste zone surface)	unitless
LF	mcW	volumetric water content (waste on trucks)	volume percent
LF	porW	porosity (total, waste)	volume fraction
LF	RunID	run identification label (optional)	
LF	SMbW	soil moisture coefficient b (waste)	unitless
LF	SMFC_W	soil moisture field capacity (LF waste zone)	volume %
LF	SMWP_W	soil moisture wilting point (LF waste zone)	volume %
LF	Sw	silt content (waste)	mass %
LF	thetawCd	input volumetric water content in LF cover soil (for debugging)	volume fraction
LF	thetawSd	input volumetric water content in LF subsoil zone (for debugging)	volume fraction
LF	thetawWd	input volumetric water content in LF waste zone (for debugging)	volume fraction
LF	veg	fraction vegetative cover (inactive LF cell)	fraction
LF	vs	vehicle speed (mean)	km/h
LF	zava	averaging depth upper (depth averaged soil concentration)	m
LF	zavb	averaging depth lower (depth averaged soil concentration)	m
LF	zC	optional soil cover thickness	m
LF	zruf	roughness height (inactive LF cell)	cm
LF	zS	thickness of liner (or subsoil zone)	m
Saturated zone	AL	longitudinal dispersivity	m
Saturated zone	ALATratio	longitudinal to transverse dispersivity ratio	m
Saturated zone	ALAVratio	longitudinal to vertical dispersivity ratio	m
Saturated zone	ANIST	anisotropy ratio	unitless
Saturated zone	DIAM	particle diameter (d)	mm
Saturated zone	FOC	fraction organic carbon (aquifer)	fraction
SI	bio_yield	biomass yield	g/g
SI	CBOD	BOD (influent)	g/cm^3
SI	d_imp	impeller diameter	cm
SI	dmeanTSS	particle diameter (mean, waste suspended solids)	cm
SI	EconLife	economic life of a tank/SI	year
SI	focW	fraction organic carbon (waste solids)	mass fraction
SI	hydc_sed	saturated hydraulic conductivity (sediment layer)	m/s
SI	J	oxygen transfer factor	lb O_2/h-hp
SI	k_dec	digestion (sediments)	1/s
SI	kba1	biologically active solids/total solids (ratio)	unitless
SI	MWt_H2O	molecular weight (liquid [water])	g/mol
SI	NumEcon	number of economic lifetimes	
SI	O2eff	oxygen transfer correction factor	unitless
SI	rho_l	density (liquid [water])	g/cm^3
SI	rho_part	solids density	g/cm^3
SI	TSS_in	total suspended solids (influent)	g/cm^3
SI	w_imp	impeller speed	rad/s

(continued)

Table 1B-1. (continued)

Data Group	Variable Name	Description	Units
Site Layout	AquFEOX	fraction iron-hydroxide adsorbent	fraction
Site Layout	AquLOM	leachate organic matter	mg/L
Site Layout	AquPh	average aquifer pH	pH units
Site Layout	ATIndex	uniform distribution needed to select AT index for national tank data	
Site Layout	BinRange_Min_C	minimum values of bins for human risk -- cancer	unitless
Site Layout	BinRange_Min_NC	minimum values of bins for human risk -- HQ	unitless
Site Layout	EcoBinRange_Min	minimum values of bins for eco risk HQ	unitless
Site Layout	FarmRcpType	type of human receptor (beef farmer, dairy farmer, beef farmer fisher, dairy farmer fisher)	
Site Layout	HabGroup	group in which habitat type is attributed: 1 = terrestrial, 2 = aquatic, 3 = wetland	not applicable
Site Layout	HabRangeRecType	type of receptor (e.g., erbivert, omnivert, small mammal, small bird)	not applicable
Site Layout	HumRcpTemp	typical shower temperature	degrees Celsius
Site Layout	HumRcpType	type of human receptor (resident, home gardener, resident fisher, home gardener fisher)	
Site Layout	NumBinC	number of bins for human -- carcinogen	unitless
Site Layout	NumBinNC	number of bins for human -- noncarcinogen	unitless
Site Layout	NumEcoBin	number of HQ range bins to assign receptor-specific HQs	unitless
Site Layout	NumEcoRing	number of eco rings (3rd ring is for entire site)	unitless
Site Layout	NumFarmRcpType	number of farmer receptor types	
Site Layout	NumHabGroup	number of general groups into which habitat types are placed	unitless
Site Layout	NumHumRcpType	number of human receptor types	
Site Layout	NumReceptor	complete receptor list across all habitat types	unitless
Site Layout	NumRecGroup	total receptor groups considered (terrestrial plants; aquatic plants; mammals; birds; amphibians; reptiles; soil biota; sediment biota; aquatic biota)	unitless
Site Layout	NumRing	number of rings at site	
Site Layout	NumTrophicLevel	number of possible trophic levels	unitless
Site Layout	NyrMax	maximum model simulation time	years
Site Layout	ReceptorIndex	indices assigned to each receptor	unitless
Site Layout	ReceptorName	receptor name	not applicable
Site Layout	ReceptorType	description of receptor (e.g., red-tailed hawk; aquatic biota; frog; plants)	not applicable
Site Layout	RecGroup	general receptor groups (e.g., mammals, birds, amphibians, reptiles, soil biota, terrestrial plants, aquatic biota, sediment biota, aquatic plants)	not applicable
Site Layout	RecTrophicLevel	trophic level into which each receptor falls	not applicable
Site Layout	RingDistance	distance of ring from source edge	m
Site Layout	SrcArea	area of source	m^2
Site Layout	SrcPh	average waste/source pH	pH units
Site Layout	TermFrac	peak output fraction for simulation termination	fraction
Site Layout	WBNfocAbS	fraction organic carbon (abiotic solids)	fraction
Site Layout	WBNfocBioS	biotic solids organic content	fraction
Site Layout	WBNfocSed	fraction organic carbon in sediments of stream, lake, and wetland reaches	fraction
Surface water	ahyd_d	stream depth hydraulic coefficient a	m
Surface water	ahyd_W	stream width hydraulic coefficient a	m

(continued)

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Table 1B-1. (continued)

Data Group	Variable Name	Description	Units
Surface water	bhyd_d	stream depth hydraulic coefficient b	
Surface water	bhyd_W	stream width hydraulic coefficient b	
Surface water	DepthBenthos	surficial sediment layer depth	cm
Surface water	DepthSedRes	underlying sediment layer depth	cm
Surface water	E_sw	sediment-water column diffusion coefficient	cm^2/sec
Surface water	E_thermocline	thermocline diffusion coeff.	cm^2/sec
Surface water	k_PlankCMin	plankton carbon mineralization rate constant	yr^{-1}
Surface water	k_SedG2	sediment mineralization rate constant, G2 fraction	yr^{-1}
Surface water	k_SedG3	sediment mineralization rate constant, G3 fraction	yr^{-1}
Surface water	porBenthos	surficial sediment layer porosity	Lw/L
Surface water	porSedRes	underlying sediment layer porosity	Lw/L
Surface water	rhoDBenthos	surficial sediment layer dry bulk density	g/mL
Surface water	rhoDSedRes	underlying sediment layer dry bulk density	g/mL
Surface water	S_upstream	upstream suspended solids concentration	mg/L
Surface water	TrophicIndex	trophic index	
Surface water	v_bury	underlying sediment layer burial rate	mm/yr
Terrestrial foodweb	Bv_ecf_plant	empirical correction factor for Bv	unitless
Terrestrial foodweb	Fw_exfruit	fraction of wet deposition that adheres to plant	unitless
Terrestrial foodweb	Fw_exveg	fraction of wet deposition that adheres to plant	unitless
Terrestrial foodweb	Fw_forage	fraction of wet deposition that adheres to plant	unitless
Terrestrial foodweb	Fw_silage	fraction of wet deposition that adheres to plant	unitless
Terrestrial foodweb	MAFexfruit	moisture adjustment factor to convert DW into WW for exposed above-ground fruits	percent
Terrestrial foodweb	MAFexveg	moisture adjustment factor to convert DW into WW for above-ground vegetables	percent
Terrestrial foodweb	MAFforage	moisture adjustment factor to convert DW into WW for forage	percent
Terrestrial foodweb	MAFgrain	moisture adjustment factor to convert DW into WW for grain (analogy to profruit)	percent
Terrestrial foodweb	MAFleaf	moisture adjustment factor for wet leaf	unitless
Terrestrial foodweb	MAFroot	moisture adjustment factor to convert DW into WW for root vegetables	percent
Terrestrial foodweb	MAFsilage	moisture adjustment factor to convert DW into WW for silage	percent
Terrestrial foodweb	rho_leaf	leaf density	g/L FW
Terrestrial foodweb	Rp_exfruit	interception fraction	unitless
Terrestrial foodweb	Rp_exveg	interception fraction	unitless
Terrestrial foodweb	Rp_forage	interception fraction	unitless
Terrestrial foodweb	Rp_silage	interception fraction	unitless
Terrestrial foodweb	tp_exfruit	length of plant exposure to deposition	yr
Terrestrial foodweb	tp_exveg	length of plant exposure to deposition	yr
Terrestrial foodweb	tp_forage	length of plant exposure to deposition	yr
Terrestrial foodweb	tp_silage	length of plant exposure to deposition	yr
Terrestrial foodweb	VapDdv	vapor phase dry deposition velocity	cm/s
Terrestrial foodweb	VGag_exfruit	empirical correction factor	unitless
Terrestrial foodweb	VGag_exveg	empirical correction factor	unitless
Terrestrial foodweb	VGag_forage	empirical correction factor	unitless
Terrestrial foodweb	VGag_silage	empirical correction factor	unitless
Terrestrial foodweb	VGbg_root	empirical correction factor	unitless

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Table 1B-1. (continued)

Data Group	Variable Name	Description	Units
Terrestrial foodweb	Yp_exfruit	crop yield	kg DW/m^2
Terrestrial foodweb	Yp_exveg	crop yield	kg DW/m^2
Terrestrial foodweb	Yp_forage	crop yield	kg DW/m^2
Terrestrial foodweb	Yp_silage	crop yield	kg DW/m^2
Watershed	bcm	boundary condition multiplier (lower boundary)	unitless
Watershed	ConVs	settling velocity (suspended solids)	m/d
Watershed	deltDiv	time step divider (for debugging)	unitless
Watershed	Infild	input infiltration rate (for debugging)	m/d
Watershed	RunID	run identification label (optional)	
Watershed	thetawZ1d	input volumetric water content in till zone (for debugging)	volume fraction
Watershed	zava	averaging depth upper (depth averaged soil concentration)	m
Watershed	zavb	averaging depth lower (depth averaged soil concentration)	m
Watershed	zZ1sa	depth (modeled soil column)	m
WP	bcm	boundary condition multiplier (lower boundary)	unitless
WP	BDw	dry bulk density (waste)	g/cm^3
WP	ConVs	settling velocity (suspended solids)	m/d
WP	CutOffYr	operating life	year
WP	Cwmu	USLE cover factor (WMU)	unitless
WP	deltDiv	time step divider (for debugging)	unitless
WP	DRZ_W	depth (WP root zone)	cm
WP	effdust	dust suppression control efficiency	unitless
WP	focW	fraction organic carbon (waste)	mass fraction
WP	fwmu	fraction hazardous waste in WMU	mass fraction
WP	Infild	input infiltration rate (for debugging)	m/d
WP	KsatW	saturated hydraulic conductivity (waste)	cm/h
WP	mcW	volumetric water content (waste on trucks)	volume %
WP	porW	porosity (total, waste)	volume fraction
WP	Pwmu	USLE erosion control factor (WMU)	unitless
WP	RunID	run identification label (optional)	
WP	SMbW	soil moisture coefficient b (waste)	unitless
WP	SMFC_W	soil moisture field capacity (WP)	volume %
WP	SMWP_W	soil moisture wilting point (WP)	volume %
WP	Sw	silt content (waste)	mass %
WP	thetawZ1d	input volumetric water content in WP (for debugging)	volume fraction
WP	thetawZ2d	input volumetric water content in WP subsoil zone (for debugging)	volume fraction
WP	vs	vehicle speed (mean)	km/h
WP	zava	averaging depth upper (depth averaged soil concentration)	m
WP	zavb	averaging depth lower (depth averaged soil concentration)	m
WP	zZ1sa	depth (modeled soil column, subareas other than WMU)	m
WP	zZ2WMU	subsoil layer thickness	m

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Table 1B-2. Model Inputs in Regional Variable Distribution Table

Data Group	Variable Name	Description	Units
Site layout	AquGrad	regional groundwater gradient	
Site layout	AquSatk	hydraulic conductivity in direction of gradient	m/yr
Site layout	AquThick	saturated zone thickness	m
Site layout	GWClassIndex	count of rows being passed for aquifer GWClass data	unitless
Site layout	VadThick	vadose zone thickness	m
Watershed	a_BF	regression coefficient "a" for baseflow model	m/d
Watershed	b_BF	regression coefficient "b" for baseflow model	unitless

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Table 1B-3. Model Inputs in Site Variable Distribution Table

Data Group	Variable Name	Description	Units
Air	AirData	station number for upper air data	
Air	AnemHght	anemometer height	m
Air	RuralStr	rural or urban	
Air	SHight	source height	m
Air	StartYr	first year of meteorological data in the met. file	
Air	SurfData	station number of surface meteorological data	
LAU	C	USLE cover factor	unitless
LAU	CN	SCS curve number	unitless
LAU	CNwmu	SCS curve number (WMU)	unitless
LAU	DRZ	depth (root zone)	cm
LAU	fcult	number of cultivations per application	unitless
LAU	fd	frequency of surface disturbance per month (active LAU)	1/mo
LAU	focS	fraction organic carbon (surface soil)	mass fraction
LAU	HydroGroup	hydrologic soil group	
LAU	K	USLE erodibility factor	kg/m^2
LAU	Ksat	saturated hydraulic conductivity (surface soil)	cm/h
LAU	Kwmu	USLE erodibility factor (WMU)	kg/m^2
LAU	mt	distance vehicle travels on LAU surface	m
LAU	Nappl	waste applications per year	1/year
LAU	nv	vehicles/day (mean annual)	1/d
LAU	nw	wheels per vehicle (mean)	unitless
LAU	P	USLE erosion control factor	unitless
LAU	Rappl	wet waste application rate	Mg/m^2-year
LAU	SMb	soil moisture coefficient b (surface soil)	unitless
LAU	SMFC	field capacity	volume %
LAU	SMWP	wilting point	volume %
LAU	Ss	silt content (soil at lau)	mass %
LAU	Theta	slope (local watershed)	degrees
LAU	vw	vehicle weight (mean)	Mg
LAU	WCS	saturated water content (surface soil)	volume fraction
LAU	X	flow length (local watershed, all subareas)	m
LAU	zZ1WMU	depth (tilling, LAU)	m
LF	fd	frequency of surface disturbance per month (active LF cell)	1/mo
LF	focC	fraction organic carbon (cover soil)	mass fraction
LF	focS_lf	fraction organic carbon (subsoil)	mass fraction
LF	KsatC	saturated hydraulic conductivity (cover soil)	cm/h
LF	load	waste loading rate (dry)	Mg/y
LF	mt	distance vehicle travels on active LF cell surface	m
LF	Nly	number of waste layers in a cell	unitless
LF	Nop	spreading/compacting operations per day	1/d
LF	nv	vehicles/day (mean annual)	1/d
LF	nw	wheels per vehicle (mean)	unitless

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Table 1B-3. (continued)

Data Group	Variable Name	Description	Units
LF	SMbC	soil moisture coefficient b (cover soil)	unitless
LF	SMbS	soil moisture coefficient b (subsoil)	unitless
LF	vw	vehicle weight (mean)	Mg
LF	WCS_C	saturated water content (cover soil)	volume fraction
LF	zW	waste zone thickness	m
Saturated zone	AquFractureID	indicator for degree of fracturing of saturated porous media	
Saturated zone	AquRandHeteroNorm	normally distributed random numbers with 0 mean and std of 1 - used when AquDoHetero ==TRUE	
SI	d_setpt	fraction of SI occupied by sediments (max.)	fraction
SI	d_wmu	depth of wmu	m
SI	F_aer	fraction surface area-turbulent	fraction
SI	n_imp	impellers/aerators (number)	unitless
SI	Powr	impellers/aerators (total power)	hp
SI	Q_wmu	volumetric influent flow rate	m^3/s
Site Layout	AirTemp	temperature (air, annual average, long-term)	° Celsius
Site Layout	AquDir	groundwater flow direction in degrees from North	degrees
Site Layout	AquId	environmental setting ID for aquifer	
Site Layout	AquLWSIndex	local watershed index for aquifer	
Site Layout	AquLWSSubAreaIndex	LWS subarea index for aquifer	
Site Layout	AquTemp	average aquifer temperature	° Celsius
Site Layout	AquVadIndex	vadose zone index per aquifer	
Site Layout	AquWellFracZ	fraction of aquifer covered by well screen	fraction
Site Layout	AquWSSubIndex	index of watershed for each aquifer	
Site Layout	EcoRingHabIndex	index of habitat contained within ecoring (1 = 0 - 1km; 2 = 1 - 2 km)	unitless
Site Layout	EcoRingNumHab	number of habitats contained within each eco ring	unitless
Site Layout	FarmAquIndex	well index associated with each farm	
Site Layout	FarmAquWellFrac	fraction farm uses aquifer well as animal DW source	fraction
Site Layout	FarmAquWellIndex	well index associated with each farm	
Site Layout	FarmArea	area of farm	m^2
Site Layout	FarmBlockGroup	census block group associated with farm	unitless
Site Layout	FarmLWSIndex	index of local watersheds associated with each farm	not applicable
Site Layout	FarmLWSSubAreaFrac	fraction of local watershed subarea on farm	fraction
Site Layout	FarmLWSSubAreaIndex	indices of each local watershed on farm	not applicable
Site Layout	FarmNumAquWell	number of wells in each aquifer on farm (= 1 in HWIR)	
Site Layout	FarmNumLWS	number of local watersheds on farm	
Site Layout	FarmNumLWSSubArea	number of local watershed subareas on farm	not applicable
Site Layout	FarmNumWBNRch	number of WBN reach that impact farm or crop area	
Site Layout	FarmNumWSSub	number of watersheds per farm	unitless
Site Layout	FarmPh	pH (subsoil)	pH units
Site Layout	FarmPopulation	population of a farm	unitless
Site Layout	FarmTemp	average farm food chain temperature	° Celsius

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Table 1B-3. (continued)

Data Group	Variable Name	Description	Units
Site Layout	FarmWBNIndex	selected WBN associated with each farm	
Site Layout	FarmWBNRchFrac	fraction of farm or crop area impacted by WBN reach	fraction
Site Layout	FarmWBNRchIndex	selected WBNRch associated with each farm	
Site Layout	FarmWSSubFrac	fraction of each watershed on farm	unitless
Site Layout	FarmWSSubIndex	watershed indices associated with each farm	not applicable
Site Layout	focS	fraction organic carbon (surface soil)	mass fraction
Site Layout	GWClass	hydrogeologic environment (GWClass1 - GWClass13)	
Site Layout	HabArea	area of habitat	m^2
Site Layout	HabIndex	index of habitat type	unitless
Site Layout	HabNumRange	number of ranges per habitat	unitless
Site Layout	HabNumWBNRch	number of WBN reaches that impact habitat range	unitless
Site Layout	HabRangeAreaFrac	fraction of range that falls within habitat	fraction
Site Layout	HabRangeFishWBNIndex	index of WBN containing fishable reaches that impact habitat range	unitless
Site Layout	HabRangeLWSIndex	indices of local watersheds in a habitat range	unitless
Site Layout	HabRangeLWSSubAFrac	fraction of LWS subarea within a habitat range	fraction
Site Layout	HabRangeLWSSubAIndex	index of LWS subarea in a habitat range	unitless
Site Layout	HabRangeNumLWSSubA	number of local watershed subareas in a habitat range	unitless
Site Layout	HabRangeNumSISrc	number of surface impoundments intersecting habitat range	unitless
Site Layout	HabRangeNumWBNRch	number of WBN reaches found within habitat range	unitless
Site Layout	HabRangeNumWSSub	number of watersheds that impact habitat range	unitless
Site Layout	HabRangeRecIndex	receptor index associated with each habitat range (a single receptor)	unitless
Site Layout	HabRangeWBNIndex	index of WBN that impacts habitat range	unitless
Site Layout	HabRangeWBNRchIndex	Index of WBN reaches that impact habitat range	unitless
Site Layout	HabRangeWSSubFrac	fraction of habitat range impacted by watershed	fraction
Site Layout	HabRangeWSSubIndex	index of watershed that impacts habitat range	unitless
Site Layout	HabType	type of representative habitat (e.g., grassland, pond, wetland)	Not applicable
Site Layout	HabWBNIndex	index of WBN that impacts habitat range	unitless
Site Layout	HabWBNRchFrac	fraction of habitat range impacted by aquatic	fraction
Site Layout	HabWBNRchIndex	index of WBN reaches that impact habitat	unitless
Site Layout	HRangeFishWBNRchInde	index of WBN fishable reaches that impact habitat range	unitless
Site Layout	HRangeNumFishWBNRch	number of fishable reaches that cross habitat range	unitless
Site Layout	HumRcpAquIndex	well index associated with each farm	unitless
Site Layout	HumRcpAquWellFrac	fraction of population drinking from wells	
Site Layout	HumRcpAquWellIndex	well index associated with a human receptor point	unitless
Site Layout	HumRcpLWSIndex	local watershed indices for each human receptor point	not applicable
Site Layout	HumRcpLWSSubAreaInde	LWS subarea indices for each human receptor point	not applicable
Site Layout	HumRcpPopulation	population represented by a human receptor point	unitless
Site Layout	HumRcpWSSubIndex	watershed indices for each human receptor point	not applicable
Site Layout	HydroGroup	hydrologic soil group	
Site Layout	HydrologicRegion	hydrologic regions	

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Table 1B-3. (continued)

Data Group	Variable Name	Description	Units
Site Layout	MaxSrcArea	maximum tank area (= SI SrcArea for AT, null for other sources)	m^2
Site Layout	MetSta	National Weather Service station number (surface)	
Site Layout	NumAqu	number of aquifers	
Site Layout	NumAquWell	number of wells in an aquifer	
Site Layout	NumFarm	number of farms at site	
Site Layout	NumHab	number of ecological habitats	unitless
Site Layout	NumHabType	number of habitat types represented at the site	unitless
Site Layout	NumHumRcp	number of human receptor points	unitless
Site Layout	NumVad	number of vadose zones	
Site Layout	NumWBN	number of waterbody networks	
Site Layout	NumWSSub	number of watershed subbasins	
Site Layout	RingFarmFrac	fraction of a farm in a ring	fraction
Site Layout	RingFarmIndex	index of a farm in a ring	unitless
Site Layout	RingHumRcpIndex	index of a human receptor point in a ring	unitless
Site Layout	RingNumFarm	number of farms in a ring	unitless
Site Layout	RingNumHumRcp	number of human receptor points in a ring	unitless
Site Layout	SettingID	setting ID (SrcType+SiteID)	
Site Layout	SiteGeoRefX	Easting in UTM coordinates (facility centroid)	m
Site Layout	SiteGeoRefY	Northing in UTM coordinates (facility centroid)	m
Site Layout	SiteLatitude	latitude (source)	degrees
Site Layout	SiteLongitude	longitude (source)	degrees
Site Layout	SiteUTMZone	UTM zone of SiteGeoRefX and SiteGeoRefY	
Site Layout	SoilType	soil texture (subsoil)	
Site Layout	SrcArea	area of source	m^2
Site Layout	SrcDepth	depth of source (0 for AT, WP)	m
Site Layout	SrcId	environmental setting ID for source	
Site Layout	SrcLocX	WMU Easting in site coordinate system (0)	m
Site Layout	SrcLocY	WMU Northing in site coordinate system (0)	m
Site Layout	SrcLWSNumSubArea	number of local watershed subareas	
Site Layout	SrcLWSSubAreaArea	area of LWS subarea	m^2
Site Layout	SrcLWSSubAreaIndex	local watershed subarea containing WMU	unitless
Site Layout	SrcNumLWS	number of local watersheds	
Site Layout	SrcTemp	average waste/source temperature	° Celsius
Site Layout	SrcType	WMU type (AT, SI, LAU, WP, or LF)	
Site Layout	VadALPHA	soil moisture parameter alpha (subsoil)	1/cm
Site Layout	VadBETA	soil moisture parameter beta (subsoil)	unitless
Site Layout	VadId	environmental setting ID for aquifer	
Site Layout	VadLWSIndex	LWS index for vadose zone	
Site Layout	VadPh	pH (subsoil)	pH units
Site Layout	VadSATK	saturated hydraulic conductivity (subsoil)	cm/h
Site Layout	VadSoilType	soil type/texture (subsoil)	
Site Layout	VadTemp	soil column temperature (annual average)	° Celsius

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Table 1B-3. (continued)

Data Group	Variable Name	Description	Units
Site Layout	VadWCR	residual water content (subsoil)	L/L
Site Layout	VadWCS	saturated water content (subsoil)	L/L
Site Layout	WBNDOC	dissolved organic carbon (stream, lake, wetland)	mg/L
Site Layout	WBNFishableRchIndex	index of reaches that are fishable	unitless
Site Layout	WBNId	environmental setting id of waterbody network	
Site Layout	WBNNumFishableRch	number of fishable reaches	unitless
Site Layout	WBNNumRch	number of reaches in waterbody network	
Site Layout	WBNpH	pH of stream, lake, and wetland reaches in waterbody network	pH units
Site Layout	WBNRchAquFrac	fraction of waterbody network reach impacted by the aquifer	fraction
Site Layout	WBNRchAquIndex	index of aquifer that impacts waterbody network reach	
Site Layout	WBNRchArea	reach surface area (nonstream reaches)	m^2
Site Layout	WBNRchBodyType	type of waterbody for each reach (lake, stream or wetland)	
Site Layout	WBNRchHypoAreaFrac	fraction of total surface area for hypolimnion	fraction
Site Layout	WBNRchLength	waterbody reach length	m
Site Layout	WBNRchNumAqu	number of aquifers that impact waterbody reach	
Site Layout	WBNRchNumRch	number of waterbody reaches that impact waterbody reach	
Site Layout	WBNRchNumWSSub	number of watershed subasins that impact waterbody network reach	
Site Layout	WBNRchOrder	stream order	unitless
Site Layout	WBNRchRchFrac	fraction of waterbody network reach impacted by another waterbody network reach	fraction
Site Layout	WBNRchRchIndex	index of waterbody network reach that impacts waterbody network reach	
Site Layout	WBNRchSrcLWSFrac	fraction of waterbody network reach area impacted by the source local watershed	fraction
Site Layout	WBNRchSrcLWSIndex	index of local watershed from source	
Site Layout	WBNRchType	type of waterbody network reach; selected from (headwater, exiting or other)	
Site Layout	WBNRchWSSubFrac	fraction of watershed subbasin impacting waterbody network reach	fraction
Site Layout	WBNRchWSSubIndex	index of watershed subbasin that impacts waterbody network reach	
Site Layout	WBNTemp	median temperature of stream, lake, and wetland reaches in waterbody network	° Celsius
Site Layout	WBNTempMax	maximum temperature of stream, lake, and wetland reaches in waterbody network	° Celsius
Site Layout	WBNTOC	TOC of stream, lake, and wetland reaches in waterbody network	mg/L
Site Layout	WBNTSS	TSS of stream, lake, and wetland reaches in waterbody network	mg/L
Site Layout	WBNWaterHardness	water hardness	mg $CaCO_3$ eq/L
Site Layout	WSPh	pH (subsoil)	pH units
Site Layout	WSSubArea	area (watershed subarea j)	m^2
Site Layout	WSSubNumSubArea	number of watershed subbasin subareas (= 1)	

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Table 1B-3. (continued)

Data Group	Variable Name	Description	Units
Site Layout	WSTemp	average watershed temperature	° Celsius
Surface water	d_epil	epilimnion depth	m
Surface water	d_hypol	hypolimnion depth	m
Surface water	d_pond	depth of pond	m
Surface water	d_wtlnd	depth of wetland	m
Surface water	Q_upstream	upstream flow rate	m^3/day
Vadose zone	POM	percentage organic matter	g/g
Vadose zone	RHOB	dry bulk density (subsoil)	g/cm^3
Watershed	C	USLE cover factor	unitless
Watershed	CN	SCS curve number	unitless
Watershed	DRZ	depth (root zone)	cm
Watershed	HydroGroup	hydrologic soil group	
Watershed	K	USLE erodibility factor	kg/m^2
Watershed	Ksat	saturated hydraulic conductivity (surface soil)	cm/h
Watershed	P	USLE erosion control factor	unitless
Watershed	SMb	soil moisture coefficient b (surface soil)	unitless
Watershed	SMFC	field capacity	volume %
Watershed	SMWP	wilting point	volume %
Watershed	Theta	slope (watershed)	degrees
Watershed	WCS	saturated water content (surface soil)	volume fraction
Watershed	X	flow length (watershed)	m
WP	C	USLE cover factor	unitless
WP	CN	SCS curve number	unitless
WP	CNwmu	SCS curve number (WMU)	unitless
WP	DRZ	depth (root zone)	cm
WP	focS	fraction organic carbon (surface soil)	mass fraction
WP	HydroGroup	hydrologic soil group	
WP	K	USLE erodibility factor	kg/m^2
WP	Ksat	saturated hydraulic conductivity (surface soil)	cm/h
WP	Kwmu	USLE erodibility factor (WMU)	kg/m^2
WP	load	waste loading rate (dry)	Mg/yr
WP	mt	distance vehicle travels on WP surface	m
WP	Nop	spreading/compacting operations per day	1/d
WP	nv	vehicles/day (mean annual)	1/d
WP	nw	wheels per vehicle (mean)	unitless
WP	P	USLE erosion control factor	unitless
WP	SMb	soil moisture coefficient b (surface soil)	unitless
WP	SMFC	field capacity	volume %
WP	SMWP	wilting point	volume %
WP	Theta	slope (local watershed)	degrees
WP	vw	vehicle weight (mean)	Mg

(continued)

Table 1B-3. (continued)

Data Group	Variable Name	Description	Units
WP	WCS	saturated water content (surface soil)	volume fraction
WP	X	flow length (local watershed, all subareas)	m
WP	zZ1WMU	height (WP)	m

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2.0 Spatial Framework

The Hazardous Waste Identification Rule (HWIR) data collection effort centers around the collection of site-based data for a representative sample of 201 nonhazardous industrial waste management facilities, along with the national and regional data necessary to complement this site-based data set. These data were collected for the 3MRA model, an integrated, multimedia, multiple-exposure pathway and multiple-receptor risk assessment model developed by the U.S. Environmental Protection Agency (EPA). EPA developed the model to evaluate risks that may occur from the long-term multimedia release of chemicals from industrial waste management units (WMUs) likely to receive wastes exempted from regulation as hazardous wastes under the Resource Conservation and Recovery Act (RCRA).

The HWIR 3MRA emphasizes the use of site-based modeling to provide spatial distributions of contaminants in a prespecified radius of interest around industrial D facilities with land-based WMUs. To support this strategy, the goals of this data collection effort include mapping the modeled facilities nationally (using geographic information systems or GIS), providing a spatial frame-of-reference around each facility within the area of interest (AOI) for the analysis, and collecting site-based and regional data within this framework.

2.1 Modeled Sites

The 201 sites modeled by the HWIR 3MRA are a random sample from EPA's 1985 *Screening Survey of Industrial Subtitle D Establishments* (Westat, 1987), also referred to as the Industrial D Screening Survey or Industrial D. This survey was designed to characterize nonhazardous (RCRA Subtitle D) waste management practices for 17 industry groups and 4 land-based WMU types: landfills, wastepiles, land application units (LAUs), and surface impoundments. Data from this survey have been used to represent Industrial D facility locations and WMU characteristics in a variety of RCRA regulatory initiatives, including the 1995 HWIR proposal. Although the Industrial D data are more than 10 years old, they represent the largest consistent set of data available on Industrial D WMU locations, dimensions, and waste volumes. Information on the survey design, response rates, and overall data quality and completeness may be found in Westat (1987), Clickner (1988), and Clickner and Craig (1988).

The Industrial D screening survey contacted 15,844 industrial facilities. Of those, 2,850 reported that they managed waste in a landfill, LAU, surface impoundment, or wastepile. To adequately represent the 17 industry groups, EPA randomly selected 201 sites from these 2,850 facilities (see Section 3.0 for more details on site selection). Appendix 2A lists these 201 facilities by their Industrial D industry group and shows the number of WMU types at each. The basic assumption for this analysis is that these Industrial D data are representative of the types, characteristics, and locations of WMUs for similar facilities currently operating.

2.2 Site Locations

The Industrial D Screening Survey contained only address and zip code locations for the sampled facilities. Although zip code centroids were adequate for previous uses of the Industrial D data, the HWIR site-specific data collection required more accurate locations. Results of a pilot study showed that locational accuracy could have a great impact on the data collected around a site, especially for population and land use data. Because zip code centroid locations can be off by 2 km or more, facilities can be displaced from urban to rural settings or vice versa.

Accuracy of the site location information was improved through a variety of techniques, including the following:

- Matching facilities to EPA's Location Reference Tables (LRT) from the Envirofacts database to obtain the Agency's most reliable location

- Zipcode centroids using GIS software (for sites that could not be matched to the LRT)

- Visual placement using interactive ARC/VIEW software based on land use, WMU features (e.g., large surface impoundments), and topographic maps (when available).

Appendix 2A provides the best locations obtained for each of the 201 Industrial D facilities. Appendix 2B describes the facility relocation effort in detail, including the source for each location and the rationale for every manual site location adjustment. In essence, the effort helped to ensure that all Industrial D locations used in the 3MRA are a reasonable representation of current and future industrial nonhazardous waste management facilities.

2.3 Settings and Area of Interest (AOI)

Based on air model sensitivity analysis results, EPA has defined the AOI for the HWIR risk assessment as the WMU plus the area encompassed by a circle defined by a 2-km radius extending from the corner of the square WMU. Many Industrial D sites have multiple WMU types; when this occurs multiple AOIs and "settings" are defined. A setting is the basic modeling unit for the HWIR 3MRA model and is defined as each unique WMU type/site combination. Thus, a site with a landfill and a wastepile would constitute two settings.

There are 419 unique site/WMU settings across the 201 sites selected for the HWIR risk analysis. In the HWIR 3MRA model, each of these settings is modeled independently and all site-based data are passed to the 3MRA system with a unique setting identification number, Setting_ID. The Setting_ID is simply the WMU type present in the Industrial D data[2] (LF, WP,

[2]Because aerated tanks were not included in the Industrial D screening survey data, a tank is placed at every Industrial D site with a surface impoundment (see Section 3); thus every surface impoundment site has at least two settings.

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LA, SI, and/or AT)[3] plus the seven-digit Industrial D Site ID. Thus if Industrial D site 1234567 has a landfill and a waste pile present, it would have two settings: LF1234567 and WP1234567. Appendix 2A includes the WMU types present at each of the Industrial D facility sites; a full list of the 419 settings modeled in the HWIR 3MRA is provided in the Appendixes to Section 3.

2.4 Regional Assignments

Regional assignments, including meteorological station, U.S. Geological Survey (USGS) hydrologic region, and ground water class, are necessary so that the HWIR 3MRA system can assign the correct regional data to each Industrial D site/setting. Meteological station and USGS hydrologic region (Seaber et al., 1987) were assigned using GIS overlays as described in Section 4.0 and Section 6.0, respectively. Assignment of ground water class (i.e., hydrogeologic setting) is described in U.S. EPA (1996). Appendix 2A provides these regional assignments for all 201 Industrial D facilities.

2.5 Site Layout, Spatial Data Layers, and Grid Database

Collection of site-based data for the HWIR 3MRA centered around the use of GIS technology (ARC/INFO and ARC/VIEW software) to create several key spatial data layers for each site/WMU setting, as shown in Figure 2-1. These key areas are

- *Human receptor points*, defined by U.S. Census block centroids (residents) and randomly placed farms based on block group (beef and dairy farmers), agricultural census, and land use data (see Section 9.0). These serve as points to calculate exposure concentrations in various media and to estimate risks to human receptors

- *Ecological habitats*, areas with assigned ecological receptors, defined by land use and other ecologically relevant data (see Section 13.0). These areas perform a similar function as the human receptor points for ecological receptors.

- *Watersheds*, delineated using digital elevation models (DEMs) of topography or manually, based on Reach File stream networks (see Section 5.0). Watershed subbasins provide the input data and output spatial framework necessary to model contaminant deposition, erosion, and overland transport, as well as resultant soil concentrations, in the LAU, wastepile, and watershed models.

- *Waterbodies* (lakes, streams, and wetlands), defined by DEMs, Reach Files data, land use data, and/or the National Wetlands Inventory (NWI; see Section 5.0). These provide the input data and output spatial framework necessary to model contaminant deposition, fate, and transport and the resulting water column and sediment concentrations in streams and lakes.

[3]LF = landfill; WP = wastepile; LA = land application unit; SI = surface impoundment; AT = aerated tank.

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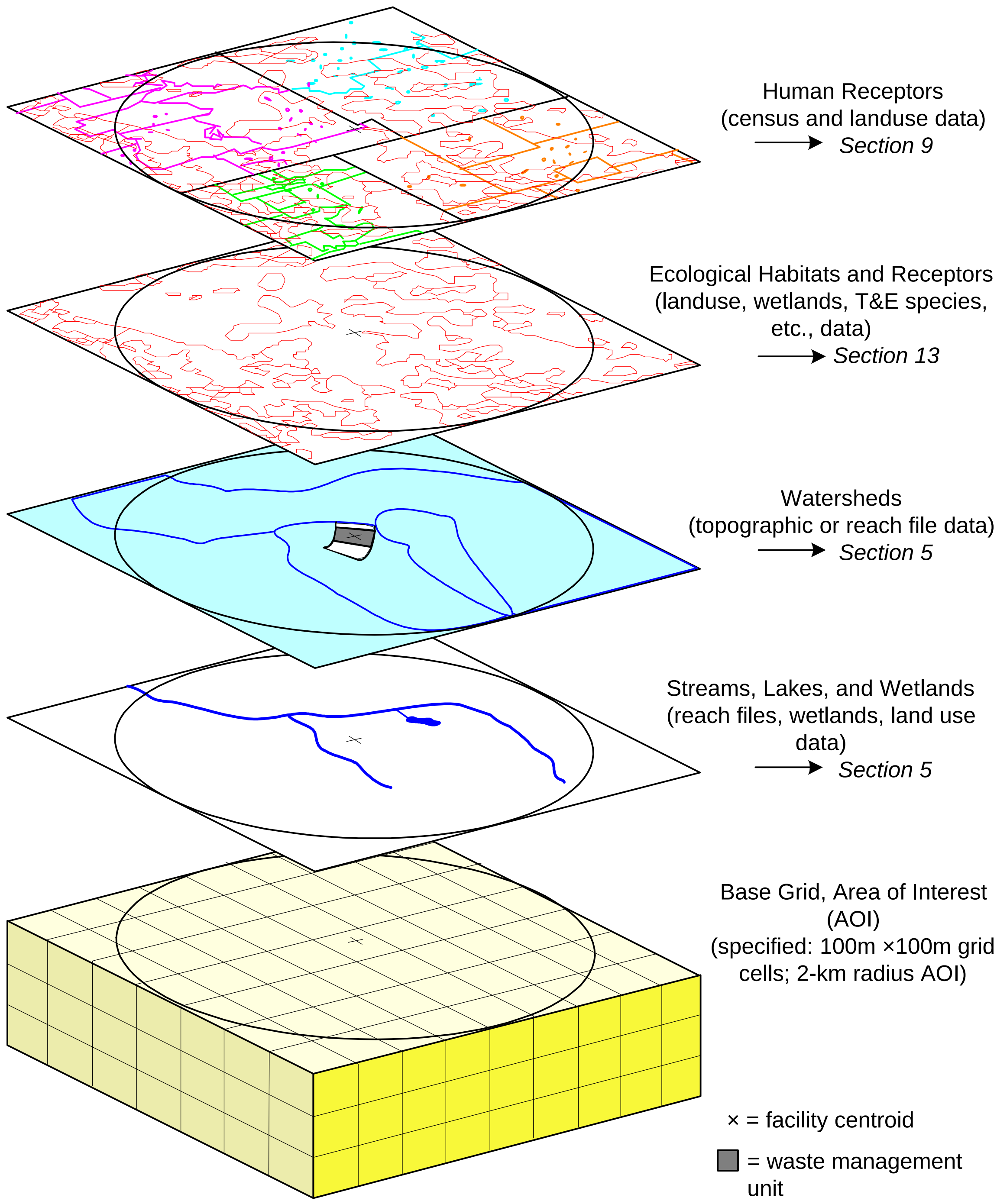

Figure 2-1. Site-based spatial overlays for HWIR 3MRA spatial framework (GIS analysis).

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In the GIS, each of these spatial data layers is composed of two-dimensional polygons, with the exception of streams, which are defined by one-dimensional vectors (stream reaches). Because these polygon coverages could not be exported directly to the 3MRA model, each spatial data layer was defined in terms of a base grid composed of 100-m by 100-m cells, which roughly correspond to the minimum resolution of several site-specific data types (i.e., land use, topographic, and soil).

This base grid (or x,y coordinate system) serves as the basis for defining receptor points at which the 3MRA air and aquifer models produce contaminant concentrations (and deposition rates for the air model) in terms of distance and direction from the WMU contaminant source. To provide the 3MRA model's site layout processor with the data necessary to specify air points, spatial data are passed to the model using this site coordinate system for the following data layers:

- Watersheds
- Waterbodies
- Farms
- Human receptor points
- Wells (human receptor points with drinking water wells)
- Ecological habitats.

These data are passed as six separate data tables within the "grid" database, along with the Setting_ID and the necessary indices (e.g., the number of watersheds). Figure 2-2 shows the structure of these data tables.

The site coordinate system is described using metric x,y coordinates (in meters) relative to a 0,0 georeference point, which is defined as the ground surface at the facility centroid. The 3MRA system specifications further required the georeference point to be specified using a latitude and longitude in the Universal Transverse Mercator (UTM) coordinate system, to allow for the transfer of latitude and longitude to Northing/Easting. This required conversion of the GIS coordinates (which are conventionally in Albers meters) to UTM.

The concept of using one grid template was originally conceived as a method of passing consistent grid cell information about spatial point, line, and polygon data to the 3MRA system. By representing grid cells as an integer identification (ID) number rather than as x,y coordinates, grid table sizes could be reduced. (Although in the final deliverable grid cells are passed as x,y coordinates centering the site location at 0,0, the grid ID number did ease data processing requirements for the grid database.)

Using GIS, a coverage of spatial data (e.g., watersheds) would be overlayed with the standard grid. If the centroid of a grid cell intersected a polygon, it would receive the identifier for that polygon (see Figure 2-3). The resulting table from this overlay would then be passed on to the database processors as the table of grid cell IDs that represent that spatial feature. The database processors would then use the standard grid table of x,y points to convert the real-world UTM coordinates to a set of x,y points centered about 0,0.

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Table Structure for HWIR Grid Database

AquWell	Farm	Habitat
ID LONG Setting_ID TEXT(9) (IE) LocX DOUBLE (IE) LocY DOUBLE (IE) LocZ DOUBLE Index1 INT (IE) Index2 INT (IE) Fraction DOUBLE	ID LONG Setting_ID TEXT(9) (IE) LocX DOUBLE (IE) LocY DOUBLE (IE) LocZ DOUBLE Index1 INT (IE) Index2 INT (IE) Fraction DOUBLE	ID LONG Setting_ID TEXT(9) (IE) LocX DOUBLE (IE) LocY DOUBLE (IE) LocZ DOUBLE Index1 INT (IE) Index2 INT (IE) Fraction DOUBLE

HumRcp	WBNRch	WSSub
ID LONG Setting_ID TEXT(9) (IE) LocX DOUBLE (IE) LocY DOUBLE (IE) LocZ DOUBLE Index1 INT (IE) Index2 INT (IE) Fraction DOUBLE	ID LONG Setting_ID TEXT(9) (IE) LocX DOUBLE (IE) LocY DOUBLE (IE) LocZ DOUBLE Index1 INT (IE) Index2 INT (IE) Fraction DOUBLE	ID LONG Setting_ID TEXT(9) (IE) LocX DOUBLE (IE) LocY DOUBLE (IE) LocZ DOUBLE Index1 INT (IE) Index2 INT (IE) Fraction DOUBLE

Figure 2-2. Table format and content for HWIR 3MRA model grid database.

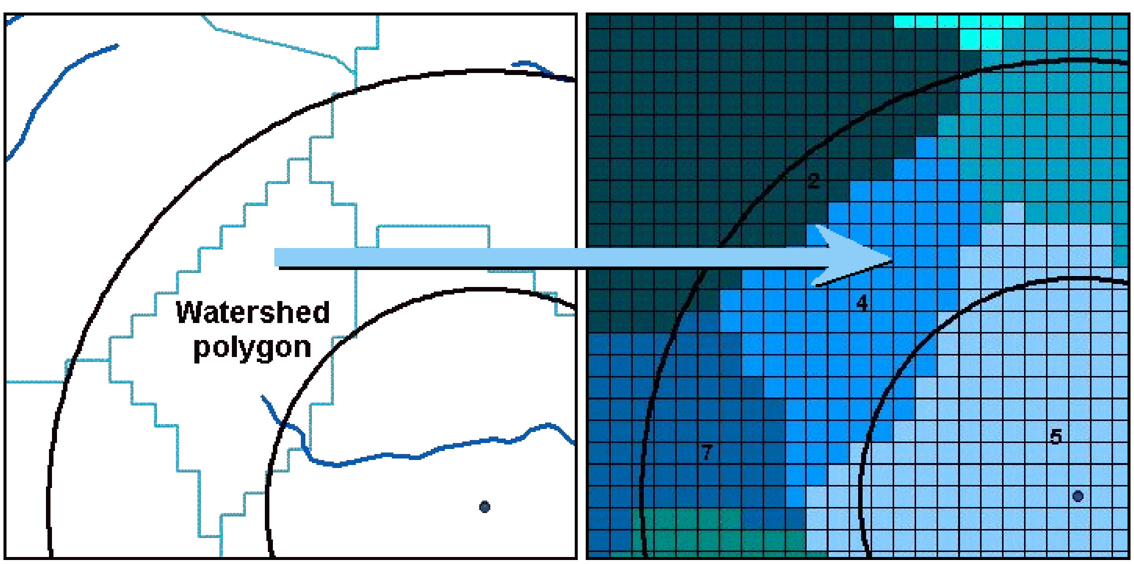

Figure 2-3. Transfer of watershed polygons to 100- by 100-m template grid.

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A template grid was created to cover the largest AOI of the 419 site/WMU settings. This way, only one grid needed to be created for use with all the sites. The largest WMU from the 201 selected sites was 1,618,800 m^2 at site 0431912. This served to define the template grid for HWIR.

Because the template grid was created the same way for each site (centered on the site location) the cell centroid x/y coordinates were always the same delta x and delta y from the site centroid (0,0). As a result, only one grid definition file needed to be created. The grid definition file consisted of the cell address, the x distance, and the y distance. A cell's UTM coordinates can be determined by simply adding the x and y distance from the grid definition file to the facility centroid UTM coordinates. Cell ordering starts at 1 in the upper left corner and works its way across horizontally.

2.6 Quality Assurance/Quality Control

General quality assurance/quality control (QA/QC) of the spatial aspects of the HWIR 3MRA data collection and processing effort included checks to ensure accuracy of facility location, proper registration (alignment) of GIS coverages, proper placement of grid templates, and accurate transfer of grid information to the 3MRA grid database. These QC activities included:

- Visual review of each facility/WMU location and manual relocation as necessary to ensure reasonable location prior to GIS processing of spatial data (see Appendix 2B)

- Automatic regeneration of the grid template for a site prior to GIS postprocessing of spatial data to ensure proper correspondence with facility centroid

- Generation and visual review of thumbnail images of all spatial data for every site to ensure accurate registration and collocation of all data layers

- Visual checks of a subset of sites in 3MRA grid database against original GIS coverages to ensure accurate data processing and transfer.

QA/QC of specific data layers is discussed in the section describing data collection for each data type.

2.7 Issues and Uncertainties

Overall, one of the most significant general uncertainties with the HWIR 3MRA spatial data is the accuracy of facility location and its impacts on the site-based data collected around each site. Appendix 2B discusses such locational uncertainties in some detail. However, although there are uncertainties in terms of accurate locations, they are likely to be significant only in terms of a site-specific analysis at certain sites, and the HWIR 3MRA is site-based **not** site-specific. EPA believes that the location review and relocation efforts described in Appendix 2B resulted in site locations representative of current and future locations of Industrial D waste

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management units, and, as such, these locations are adequate and appropriate for a **nationwide** site-based analysis. EPA emphasizes that the site-based data collected for the HWIR 3MRA are not intended to be used for site-specific risk assessments.

Issues and uncertainties associated with specific site-based data layers are found in the sections of this report discussing each data type.

2.8 References

Clickner, Robert. 1988. "Sampling weights for the industrial Subtitle D screening survey." Memorandum to Zubair Saleem (U.S. Environmental Protection Agency) from Robert Clickner (Westat, Inc.), Rockville, MD. July 28.

Clickner, Robert P., and Jim Craig. n.d. Using Business Establishment Size in an Environmental Survey (Unpublished).

Seaber, P. R., F. P. Kapinos, and G. L. Knapp. 1987. *Hydrologic Unit Maps*. U.S. Geological Survey Water-Supply Paper 2294. U.S. Government Printing Office, Washington, DC. pp. 1-13.

U.S. EPA (Environmental Protection Agency). 1996. *EPA's Composite Model for Leachate Migration with Transformation Products; EPACMTP: Background Document for Metals. Volume 1: Methodology*. U.S. Environmental Protection Agency, Office of Solid Waste, Washington, DC.

Westat, Inc. 1987. *Screening Survey of Industrial Subtitle D Establishments*. *Draft Final Report.* U.S. Environmental Protection Agency. Westat, Inc., Rockville, MD. December 29.

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Appendix 2A. 201 Industrial D Sites Used in HWIR Risk Analysis

SiteID	State	Urban/ Rural [a]	Latitude	Longitude	Meteorologic Station [b]	Water Resources Region [c]	Ground Water Class [d]	WMU Type
1 - Organic Chemicals								
0130207	IA	Rural	41.399742	-91.06297	Moline, IL	Upper Mississippi	Bedded Sedimentary Rock	WP
0136703	NM	Rural	35.19942	-103.71577	Amarillo, TX	Arkansas-White-Red	Alluvial Basins Valleys and Fans	AT, LAU, SI
0131207	NY	Urban	43.079444	-79.008889	Buffalo, NY	Great Lakes	Bedded Sedimentary Rock	AT, SI
0114001	PA	Urban	40.49308	-80.07914	Pittsburgh, PA	Ohio	Bedded Sedimentary Rock	WP
0131508	TN	Urban	36.52501	-82.53999	Bristol, TN	Tennessee	Bedded Sedimentary Rock	AT, LF, SI, WP
0131104	WI	Rural	42.66416	-89.05569	Rockford, IL	Upper Mississippi	Bedded Sedimentary Rock	AT, SI
2 - Primary Iron and Steel								
0233603	AL	Rural	33.541515	-86.543034	Huntsville, AL	South Atlantic-Gulf	Bedded Sedimentary Rock	LF
0232705	GA	Rural	34.1769	-84.81757	Atlanta, GA	South Atlantic-Gulf	Bedded Sedimentary Rock	AT, SI
0231610	IL	Urban	41.73503	-87.54159	Chicago, IL	Great Lakes	Bedded Sedimentary Rock	AT, SI
0231002	IN	Rural	40.192049	-84.981029	Dayton, OH	Ohio	Till and Till Over Outwash	LF
0235301	IN	Urban	39.9335	-85.38004	Indianapolis, IN	Ohio	Till and Till Over Outwash	LF
0231911	MI	Urban	43.447145	-83.920814	Flint, MI	Great Lakes	Bedded Sedimentary Rock	WP
0231914	MI	Urban	42.256748	-83.135334	Detroit, MI	Great Lakes	Bedded Sedimentary Rock	AT, SI
0231106	NJ	Rural	40.11836	-74.81713	Philadelphia, PA	Mid-Atlantic	Sand and Gravel	LF
0221207	OH	Urban	40.292475	-84.162526	Dayton, OH	Ohio	Bedded Sedimentary Rock	WP
0223504	OH	Urban	40.850867	-81.763907	Akron/Canton, OH	Ohio	Sand and Gravel	LAU, LF, WP
0232415	OH	Urban	41.457226	-81.688288	Cleveland, OH	Great Lakes	Bedded Sedimentary Rock	AT, SI, WP
0232402	PA	Urban	39.970278	-75.815833	Wilmington, DE	Mid-Atlantic	Metamorphic and Igneous	AT, LF, SI
0232501	PA	Rural	41.26468	-80.4838	Youngstown, OH	Ohio	Bedded Sedimentary Rock	LF, WP
0234904	PA	Rural	41.02221	-75.19536	Allentown, PA	Mid-Atlantic	Bedded Sedimentary Rock	LF
0220102	SC	Urban	32.834906	-79.948129	Charleston, SC	South Atlantic-Gulf	Bedded Sedimentary Rock	WP
0232313	TX	Rural	32.43605	-95.36401	Shreveport, LA	Texas-Gulf	Bedded Sedimentary Rock	AT, LF, SI, WP
0231407	TX	Rural	32.46527	-97.02675	Fort Worth, TX	Texas-Gulf	Bedded Sedimentary Rock	LF
0233601	VA	Urban	38.064696	-78.874709	Roanoke, VA	Mid-Atlantic	Bedded Sedimentary Rock	AT, SI
0232305	VT	Rural	43.969506	-72.689212	Burlington, VT	New England	Unconsolidated and Semiconsolidated Shallow Aquifers	WP
0224002	WI	Urban	43.86402	-91.22462	Moline, IL	Upper Mississippi	Bedded Sedimentary Rock	WP

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Appendix 2A. (continued)

SiteID	State	Urban/ Rural [a]	Latitude	Longitude	Meteorologic Station [b]	Water Resources Region [c]	Ground Water Class [d]	WMU Type
3 - Fertilizer and Agricultural Chemicals								
0331006	AR	Rural	34.563889	-90.652778	Memphis, TN	Lower Mississippi	Alluvial Basins Valleys and Fans	AT, SI
0332707	FL	Rural	27.88554	-81.94815	Tampa, FL	South Atlantic-Gulf	Bedded Sedimentary Rock	LF, WP
0314202	NY	Urban	42.711063	-73.671455	Albany, NY	Mid-Atlantic	Sand and Gravel	LF
0332811	OH	Urban	40.59397	-83.10857	Columbus, OH	Ohio	Bedded Sedimentary Rock	WP
0331902	OK	Rural	36.439167	-99.468611	Dodge City, KS	Arkansas-White-Red	Unconsolidated and Semiconsolidated Shallow Aquifers	AT, SI, WP
0321802	OR	Rural	45.615336	-122.7105	Portland, OR	Pacific Northwest	Alluvial Basins Valleys and Fans	AT, SI, WP
0332104	TX	Rural	35.642778	-101.42694	Amarillo, TX	Arkansas-White-Red	Unconsolidated and Semiconsolidated Shallow Aquifers	AT, LAU, SI, WP
0312301	VA	Rural	38.42827	-78.94495	Roanoke, VA	Mid-Atlantic	Bedded Sedimentary Rock	AT, LAU, SI
4 - Electric Power Generation								
0432011	AL	Rural	34.703889	-87.118889	Huntsville, AL	Tennessee	Bedded Sedimentary Rock	LF
0434505	CA	Rural	32.847146	-115.56736	Phoenix, AZ	California	Sand and Gravel	AT, SI
0435510	IL	Rural	40.27633	-90.08052	Peoria, IL	Upper Mississippi	Bedded Sedimentary Rock	AT, LAU, SI
0433201	IN	Rural	41.21534	-87.0191	South Bend, IN	Upper Mississippi	Till and Till Over Outwash	AT, LF, SI
0431912	KS	Rural	38.35827	-94.63423	Kansas City, MO	Missouri	Bedded Sedimentary Rock	AT, LF, SI
0432716	MN	Rural	47.261	-93.674	Duluth, MN	Upper Mississippi	Bedded Sedimentary Rock	AT, SI
0433408	MT	Rural	45.892	-106.632	Miles City, MT	Missouri	Alluvial Basins Valleys and Fans	AT, SI
0434804	NC	Rural	35.38401	-78.07439	Raleigh-Durham, NC	South Atlantic-Gulf	Metamorphic and Igneous	AT, SI
0436007	NC	Rural	35.5871	-79.04772	Raleigh-Durham, NC	South Atlantic-Gulf	Metamorphic and Igneous	AT, SI
0436108	NC	Rural	35.18328	-81.01201	Charlotte, NC	South Atlantic-Gulf	Metamorphic and Igneous	AT, SI
0430108	NE	Rural	40.36094	-95.64231	Kansas City, MO	Missouri	Alluvial Basins Valleys and Fans	AT, SI, WP
0430412	OH	Rural	41.78825	-81.14677	Cleveland, OH	Great Lakes	Bedded Sedimentary Rock	AT, LF, SI
0432106	PA	Rural	40.79771	-75.11741	Allentown, PA	Mid-Atlantic	Bedded Sedimentary Rock	AT, SI
0433204	SC	Rural	33.330278	-79.357222	Charleston, SC	South Atlantic-Gulf	Unconsolidated and Semiconsolidated Shallow Aquifers	AT, SI
0433404	WY	Rural	42.0824	-104.94946	Cheyenne, WY	Missouri	Alluvial Basins Valleys and Fans	AT, LF, SI
5 - Plastic and Resins Manufacturer								
0534504	GA	Urban	33.84175	-84.23034	Atlanta, GA	South Atlantic-Gulf	Metamorphic and Igneous	AT, SI
0531301	IL	Rural	39.84983	-89.27569	Springfield, IL	Upper Mississippi	Bedded Sedimentary Rock	AT, SI

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Appendix 2A. (continued)

SiteID	State	Urban/ Rural [a]	Latitude	Longitude	Meteorologic Station [b]	Water Resources Region [c]	Ground Water Class [d]	WMU Type
0530901	OH	Rural	41.372916	-82.542933	Cleveland, OH	Great Lakes	Unconsolidated and Semiconsolidated Shallow Aquifers	AT, LAU, SI
0531502	OH	Urban	39.03921	-82.62841	Huntington, WV	Ohio	Unconsolidated and Semiconsolidated Shallow Aquifers	AT, SI
0531702	TX	Rural	35.66336	-101.45024	Amarillo, TX	Arkansas-White-Red	Unconsolidated and Semiconsolidated Shallow Aquifers	LF
0531902	TX	Urban	29.72675	-95.13189	Houston, TX	Texas-Gulf	Sand and Gravel	AT, SI
6 - Inorganic Chemicals								
0622902	AZ	Rural	31.935764	-111.0029	Tucson, AZ	Lower Colorado	Alluvial Basins Valleys and Fans	AT, SI
0625002	GA	Rural	32.2	-81.166667	Savannah, GA	South Atlantic-Gulf	Bedded Sedimentary Rock	AT, LF, SI
0634001	GA	Rural	34.13254	-84.77666	Atlanta, GA	South Atlantic-Gulf	Bedded Sedimentary Rock	AT, SI
0613402	IL	Urban	38.586459	-90.176488	St. Louis, MO	Upper Mississippi	Bedded Sedimentary Rock	AT, SI
0621902	KS	Rural	38.03371	-97.97337	Wichita, KS	Arkansas-White-Red	Alluvial Basins Valleys and Fans	AT, SI
0631903	LA	Urban	30.23167	-93.27781	Lake Charles, LA	Lower Mississippi	Sand and Gravel	AT, LF, SI
0635301	NV	Urban	36.04434	-114.99514	Las Vegas, NV	Lower Colorado	Bedded Sedimentary Rock	AT, SI
0632608	OR	Rural	45.56941	-122.7448	Portland, OR	Pacific Northwest	Alluvial Basins Valleys and Fans	AT, LF, SI
0620401	TX	Urban	29.758611	-95.176389	Houston, TX	Texas-Gulf	Sand and Gravel	AT, SI
0621603	TX	Rural	29.701746	-95.082965	Houston, TX	Texas-Gulf	Sand and Gravel	AT, SI
0625501	TX	Rural	29.99645	-94.96404	Houston, TX	Texas-Gulf	Sand and Gravel	LAU
0631701	TX	Rural	29.71475	-95.07624	Houston, TX	Texas-Gulf	Sand and Gravel	LAU
0632003	TX	Rural	32.437778	-94.688889	Shreveport, LA	Texas-Gulf	Bedded Sedimentary Rock	AT, LF, SI
0632606	TX	Rural	35.48185	-101.0562	Amarillo, TX	Arkansas-White-Red	Unconsolidated and Semiconsolidated Shallow Aquifers	AT, LF, SI
0620604	UT	Rural	40.7375	-111.98814	Salt Lake City, UT	Great Basin	Alluvial Basins Valleys and Fans	AT, SI
7 - Stone, Clay, Glass, and Concrete								
0713705	AZ	Rural	32.833	-111.734	Phoenix, AZ	Lower Colorado	Alluvial Basins Valleys and Fans	AT, LF, SI
0715216	CA	Urban	33.89933	-117.82175	Los Angeles, CA	California	Coastal Beaches	WP
0731411	CA	Rural	37.091066	-120.24545	Fresno, CA	California	Sand and Gravel	WP
0732405	CA	Urban	37.65484	-121.02633	Sacramento, CA	California	Sand and Gravel	WP
0733203	CA	Rural	37.71502	-121.49048	Sacramento, CA	California	Sand and Gravel	AT, SI
0722503	CO	Urban	39.807664	-105.00613	Boulder, CO	Missouri	Bedded Sedimentary Rock	AT, SI

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Appendix 2A. (continued)

SiteID	State	Urban/ Rural [a]	Latitude	Longitude	Meteorologic Station [b]	Water Resources Region [c]	Ground Water Class [d]	WMU Type
0720803	FL	Rural	27.07543	-82.38693	Tampa, FL	South Atlantic-Gulf	Coastal Beaches	AT, LAU, LF, SI
0722107	FL	Rural	26.87084	-82.00256	Tampa, FL	South Atlantic-Gulf	Coastal Beaches	WP
0722505	FL	Urban	25.99577	-80.18024	Miami, FL	South Atlantic-Gulf	Bedded Sedimentary Rock	AT, SI
0730502	IL	Urban	39.00298	-87.748337	Evansville, IN	Ohio	Bedded Sedimentary Rock	AT, SI, WP
0731514	IL	Rural	42.38881	-87.81145	Chicago, IL	Great Lakes	Bedded Sedimentary Rock	AT, LF, SI
0732510	IL	Rural	41.61892	-88.20404	Chicago, IL	Upper Mississippi	Bedded Sedimentary Rock	WP
0716701	IN	Rural	38.06725	-87.26451	Evansville, IN	Ohio	Till and Till Over Outwash	AT, SI
0735309	KS	Rural	37.2165	-95.69048	Tulsa, OK	Arkansas-White-Red	Bedded Sedimentary Rock	AT, LF, SI
0733302	KY	Urban	37.64289	-84.78751	Lexington, KY	Ohio	Bedded Sedimentary Rock	AT, SI, WP
0731412	MA	Rural	42.5495	-71.51555	Boston, MA	New England	Metamorphic and Igneous	AT, SI, WP
0720506	ME	Rural	44.65533	-67.71774	Portland, ME	New England	Sand and Gravel	WP
0721305	MI	Urban	42.27879	-83.12807	Detroit, MI	Great Lakes	Bedded Sedimentary Rock	WP
0724301	MS	Rural	34.786143	-89.449686	Memphis, TN	Lower Mississippi	Sand and Gravel	WP
0724206	NC	Rural	35.77042	-80.60004	Greensboro, NC	South Atlantic-Gulf	Metamorphic and Igneous	AT, SI, WP
0731507	NC	Rural	34.74411	-79.39153	Raleigh-Durham, NC	South Atlantic-Gulf	Unconsolidated and Semiconsolidated Shallow Aquifers	AT, SI, WP
0733501	NC	Rural	35.37242	-82.48649	Asheville, NC	Tennessee	Metamorphic and Igneous	AT, SI
0724909	ND	Rural	48.14514	-103.65068	Miles City, MT	Missouri	Unconsolidated and Semiconsolidated Shallow Aquifers	WP
0731501	NJ	Urban	40.43103	-74.23553	Newark, NJ	Mid-Atlantic	Unconsolidated and Semiconsolidated Shallow Aquifers	AT, SI
0734604	NJ	Urban	39.78529	-74.91227	Philadelphia, PA	Mid-Atlantic	Unconsolidated and Semiconsolidated Shallow Aquifers	WP
0722705	NY	Urban	42.10712	-75.89799	Binghamton, NY	Mid-Atlantic	Sand and Gravel	LF
0731111	NY	Urban	42.15282	-77.0767	Binghamton, NY	Mid-Atlantic	Sand and Gravel	AT, SI
0733210	OH	Rural	40.6764	-80.8992	Akron/Canton, OH	Ohio	Bedded Sedimentary Rock	AT, LF, SI
0713618	OR	Urban	43.21486	-123.32816	Medford, OR	Pacific Northwest	Bedded Sedimentary Rock	AT, SI
0715007	PA	Urban	40.14299	-75.30585	Philadelphia, PA	Mid-Atlantic	Metamorphic and Igneous	WP
0724804	PA	Rural	40.326449	-75.322167	Allentown, PA	Mid-Atlantic	Bedded Sedimentary Rock	WP
0731405	PA	Rural	40.05671	-76.57743	Wilmington, DE	Mid-Atlantic	Bedded Sedimentary Rock	AT, SI
0731703	PA	Rural	40.17826	-75.5409	Philadelphia, PA	Mid-Atlantic	Bedded Sedimentary Rock	LF

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Appendix 2A. (continued)

SiteID	State	Urban/ Rural [a]	Latitude	Longitude	Meteorologic Station [b]	Water Resources Region [c]	Ground Water Class [d]	WMU Type
0732110	PA	Urban	41.347859	-75.747582	Wilkes-Barre, PA	Mid-Atlantic	Unconsolidated and Semiconsolidated Shallow Aquifers	LF
0733404	PA	Rural	41.42468	-78.53219	Williamsport, PA	Mid-Atlantic	Bedded Sedimentary Rock	LF, WP
0733606	PA	Rural	40.10934	-75.23637	Philadelphia, PA	Mid-Atlantic	Metamorphic and Igneous	AT, SI, WP
0723607	TX	Rural	30.77008	-98.67221	Austin, TX	Texas-Gulf	Bedded Sedimentary Rock	AT, SI
0730914	TX	Rural	30.32381	-97.29387	Austin, TX	Texas-Gulf	Bedded Sedimentary Rock	AT, LF, SI, WP
0730407	WV	Rural	39.01759	-80.29334	Pittsburgh, PA	Ohio	Bedded Sedimentary Rock	AT, LF, SI
8 - Pulp and Paper Industry								
0830601	AL	Rural	33.32008	-86.36476	Huntsville, AL	South Atlantic-Gulf	Metamorphic and Igneous	LF
0831406	AL	Rural	32.45003	-87.97949	Meridian, MS	South Atlantic-Gulf	Sand and Gravel	AT, LF, SI
0831904	GA	Rural	30.69851	-83.30035	Macon, GA	South Atlantic-Gulf	Bedded Sedimentary Rock	AT, LAU, LF, SI
0832904	GA	Rural	33.992562	-83.77019	Athens, GA	South Atlantic-Gulf	Metamorphic and Igneous	AT, SI
0832903	LA	Rural	30.70787	-91.33987	Baton Rouge, LA	Lower Mississippi	Sand and Gravel	AT, SI, WP
0831102	ME	Urban	44.55504	-69.62128	Portland, ME	New England	Metamorphic and Igneous	WP
0826707	NC	Rural	36.150715	-80.278929	Greensboro, NC	South Atlantic-Gulf	Metamorphic and Igneous	AT, SI
0833001	NC	Rural	35.549	-82.879	Asheville, NC	Tennessee	Metamorphic and Igneous	LF
0830903	NY	Rural	44.15678	-74.98347	Burlington, VT	Great Lakes	Sand and Gravel	AT, LF, SI
0832909	OH	Urban	39.518638	-84.40415	Dayton, OH	Ohio	Sand and Gravel	AT, SI
0832510	PA	Rural	41.39016	-75.82027	Wilkes-Barre, PA	Mid-Atlantic	Unconsolidated and Semiconsolidated Shallow Aquifers	AT, SI, WP
0834009	PA	Rural	40.06089	-75.26093	Philadelphia, PA	Mid-Atlantic	Metamorphic and Igneous	AT, SI
0832304	WI	Urban	44.495	-88.04	Green Bay, WI	Great Lakes	Sand and Gravel	LF, WP
0833007	WI	Rural	45.04	-87.725	Green Bay, WI	Great Lakes	Sand and Gravel	AT, LF, SI
9 - Primary Nonferrous Metals								
0923004	MI	Rural	42.816435	-85.663736	Grnd Rapids, MI	Great Lakes	Till and Till Over Outwash	WP
0930205	NC	Rural	35.410833	-80.115556	Greensboro, NC	South Atlantic-Gulf	Metamorphic and Igneous	AT, SI, WP
0932507	PA	Urban	40.633611	-76.186944	Allentown, PA	Mid-Atlantic	Bedded Sedimentary Rock	AT, SI, WP
0932103	SC	Rural	33.787222	-81.113889	Columbia, SC	South Atlantic-Gulf	Sand and Gravel	AT, LF, SI, WP
0930702	TX	Rural	30.548	-97.066	Austin, TX	Texas-Gulf	Bedded Sedimentary Rock	AT, LF, SI
0932903	TX	Rural	28.663	-96.542	Houston, TX	Texas-Gulf	Sand and Gravel	AT, LF, SI
0933704	VA	Rural	36.66662	-82.06086	Bristol, TN	Tennessee	Bedded Sedimentary Rock	AT, SI

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Appendix 2A. (continued)

SiteID	State	Urban/ Rural [a]	Latitude	Longitude	Meteorologic Station [b]	Water Resources Region [c]	Ground Water Class [d]	WMU Type
0930301	WA	Rural	45.73123	-120.69753	Yakima, WA	Pacific Northwest	Unconsolidated and Semiconsolidated Shallow Aquifers	AT, LF, SI, WP
0932509	WA	Rural	48.45497	-117.88196	Spokane, WA	Pacific Northwest	Till and Till Over Outwash	AT, LF, SI, WP
10 - Food and Kindred Products								
1032715	AL	Rural	33.96811	-85.96986	Huntsville, AL	South Atlantic-Gulf	Bedded Sedimentary Rock	AT, SI
1033202	AR	Urban	35.425999	-94.329485	Tulsa, OK	Arkansas-White-Red	Bedded Sedimentary Rock	LAU
1034805	AR	Rural	35.7646	-91.644757	Springfield, MO	Arkansas-White-Red	Bedded Sedimentary Rock	AT, SI
1013209	CA	Rural	36.40229	-119.13225	Fresno, CA	California	Sand and Gravel	AT, SI
1031507	CA	Rural	36.94798	-120.072	Fresno, CA	California	Sand and Gravel	AT, SI
1033114	DE	Rural	38.719722	-75.289444	Atlantic City, NJ	Mid-Atlantic	Sand and Gravel	AT, SI
1014805	GA	Rural	30.919	-84.616	Tallahassee, FL	South Atlantic-Gulf	Bedded Sedimentary Rock	LF
1034005	GA	Rural	34.19171	-83.9055	Athens, GA	South Atlantic-Gulf	Metamorphic and Igneous	LAU, WP
1035405	ID	Rural	43.61545	-116.60928	Boise, ID	Pacific Northwest	Unconsolidated and Semiconsolidated Shallow Aquifers	AT, SI
1031503	KS	Rural	38.781171	-97.635899	Wichita, KS	Missouri	Alluvial Basins Valleys and Fans	LAU
1033107	MI	Urban	44.735499	-85.625005	Muskegon, MI	Great Lakes	Till and Till Over Outwash	AT, SI
1033602	MI	Rural	42.42	-85.643	Grand Rapids, MI	Great Lakes	Till and Till Over Outwash	AT, LAU, SI
1035117	MO	Rural	39.24038	-94.4163	Kansas City, MO	Missouri	Alluvial Basins Valleys and Fans	AT, SI
1034406	MS	Rural	33.36092	-91.11143	Jackson, MS	Lower Mississippi	Alluvial Basins Valleys and Fans	AT, SI
1032802	NC	Rural	35.69275	-79.16879	Raleigh-Durham, NC	South Atlantic-Gulf	Metamorphic and Igneous	AT, LAU, LF, SI
1012203	NY	Rural	40.942	-72.616	New York, NY	Mid-Atlantic	Unconsolidated and Semiconsolidated Shallow Aquifers	AT, LF, SI, WP
1023705	NY	Rural	42.893111	-76.985194	Rochester, NY	Great Lakes	Sand and Gravel	AT, SI
1034210	NY	Rural	42.3996	-77.25326	Binghamton, NY	Great Lakes	Sand and Gravel	AT, LAU, SI
1015510	TX	Rural	33.07983	-99.57937	Lubbock, TX	Texas-Gulf	Alluvial Basins Valleys and Fans	LF
1035508	UT	Rural	41.924522	-111.81336	Pocatello, ID	Great Basin	Alluvial Basins Valleys and Fans	AT, LAU, SI
1010805	WA	Urban	46.04296	-118.32333	Pendleton, OR	Pacific Northwest	Unconsolidated and Semiconsolidated Shallow Aquifers	LAU
11 - Water Treatment								
1131802	CA	Rural	38.859145	-120.66389	Sacramento, CA	California	Metamorphic and Igneous	LAU
1131103	LA	Urban	29.952305	-90.07619	New Orleans, LA	Lower Mississippi	Other (Not Classifiable)	AT, SI

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Appendix 2A. (continued)

SiteID	State	Urban/ Rural [a]	Latitude	Longitude	Meteorologic Station [b]	Water Resources Region [c]	Ground Water Class [d]	WMU Type
1134405	MO	Rural	39.67715	-91.40255	Columbia, MO	Upper Mississippi	Sand and Gravel	LAU
1133902	SC	Urban	34.50069	-82.02097	Greenville, SC	South Atlantic-Gulf	Metamorphic and Igneous	LAU
1122705	VA	Rural	37.221	-82.285	Bristol, TN	Ohio	Bedded Sedimentary Rock	AT, SI
1120904	VT	Rural	44.44519	-73.22743	Burlington, VT	Mid-Atlantic	Unconsolidated and Semiconsolidated Shallow Aquifers	AT, SI
12 - Petroleum Refining								
1233101	CA	Urban	33.764167	-118.28333	Los Angeles, CA	California	Sand and Gravel	AT, SI
1236810	CA	Urban	33.931111	-118.06694	Los Angeles, CA	California	Sand and Gravel	WP
1236652	CT	Rural	41.556	-72.756	Hartford, CT	New England	Bedded Sedimentary Rock	AT, SI
1221704	FL	Urban	27.904372	-82.76268	Tampa, FL	South Atlantic-Gulf	Bedded Sedimentary Rock	AT, SI, WP
1212301	MA	Rural	42.138844	-71.077019	Boston, MA	New England	Metamorphic and Igneous	AT, SI
1230517	MD	Rural	39.505833	-76.889444	Baltimore, MD	Mid-Atlantic	Metamorphic and Igneous	AT, SI
1230111	MT	Rural	45.65188	-108.75652	Billings, MT	Missouri	Alluvial Basins Valleys and Fans	AT, SI
1230919	NY	Urban	42.66174	-73.74344	Albany, NY	Mid-Atlantic	Sand and Gravel	WP
1236637	NY	Rural	41.09491	-73.95553	New York, NY	Mid-Atlantic	Unconsolidated and Semiconsolidated Shallow Aquifers	AT, SI
1235205	OK	Rural	34.81205	-96.67695	Oklahoma City, OK	Arkansas-White-Red	Bedded Sedimentary Rock	AT, SI, WP
1223404	PA	Urban	40.071935	-75.295648	Philadelphia, PA	Mid-Atlantic	Metamorphic and Igneous	AT, SI
1236820	PA	Rural	41.785	-76.36	Binghamton, NY	Mid-Atlantic	Unconsolidated and Semiconsolidated Shallow Aquifers	AT, SI
1231705	SC	Rural	32.93092	-79.83102	Charleston, SC	South Atlantic-Gulf	Bedded Sedimentary Rock	AT, LAU, SI
1230206	TN	Rural	35.27079	-89.97744	Memphis, TN	Lower Mississippi	Alluvial Basins Valleys and Fans	AT, SI
1231101	TN	Rural	35.087243	-90.080785	Memphis, TN	Lower Mississippi	Alluvial Basins Valleys and Fans	AT, LAU, SI
1236732	WV	Rural	37.793	-81.206	Roanoke, VA	Ohio	Bedded Sedimentary Rock	WP
13 - Rubber and Miscellaneous Products								
1331103	AL	Urban	34.0079	-85.97295	Huntsville, AL	South Atlantic-Gulf	Bedded Sedimentary Rock	AT, SI
1333701	OH	Urban	41.24763	-80.80961	Youngstown, OH	Ohio	Unconsolidated and Semiconsolidated Shallow Aquifers	WP
1333001	SC	Rural	34.196944	-79.580833	Columbia, SC	South Atlantic-Gulf	Sand and Gravel	LAU
14 - Transportation Equipment								
1415407	AZ	Urban	33.49474	-112.04027	Phoenix, AZ	Lower Colorado	Alluvial Basins Valleys and Fans	WP

(continued)

Appendix 2A. (continued)

SiteID	State	Urban/ Rural [a]	Latitude	Longitude	Meteorologic Station [b]	Water Resources Region [c]	Ground Water Class [d]	WMU Type
1430602	CA	Urban	37.405945	-122.02725	San Francisco, CA	California	Coastal Beaches	AT, SI
1434022	CA	Urban	33.809808	-118.33645	Los Angeles, CA	California	Sand and Gravel	AT, SI
1430404	IN	Urban	39.737695	-86.215746	Indianapolis, IN	Ohio	Sand and Gravel	AT, SI
1430107	KS	Urban	37.62436	-97.280161	Wichita, KS	Arkansas-White-Red	Alluvial Basins Valleys and Fans	AT, LF, SI
1434802	SC	Urban	34.01779	-80.98919	Columbia, SC	South Atlantic-Gulf	Sand and Gravel	AT, SI
1435317	TX	Rural	30.10278	-94.09169	Port Arthur, TX	Texas-Gulf	Sand and Gravel	LF
1431515	UT	Rural	40.66357	-112.0865	Salt Lake City, UT	Great Basin	Alluvial Basins Valleys and Fans	AT, SI
1421506	WA	Urban	47.49002	-122.19757	Seattle, WA	Pacific Northwest	Till and Till Over Outwash	WP
15 - Selected Chemical and Allied Products								
1522504	DE	Rural	39.602886	-75.66059	Wilmington, DE	Mid-Atlantic	Metamorphic and Igneous	LAU
1530808	MI	Rural	42.116201	-83.190811	Detroit, MI	Great Lakes	Bedded Sedimentary Rock	AT, SI
1530605	TX	Rural	29.97179	-94.21806	Port Arthur, TX	Texas-Gulf	Sand and Gravel	AT, LF, SI
1532401	VT	Rural	43.9799	-73.09228	Burlington, VT	Mid-Atlantic	Unconsolidated and Semiconsolidated Shallow Aquifers	WP
16 - Textile Manufacturing								
1633404	AZ	Rural	33.431667	-112.36	Phoenix, AZ	Lower Colorado	Alluvial Basins Valleys and Fans	AT, SI
1633405	CT	Rural	41.55905	-73.40906	Hartford, CT	New England	Metamorphic and Igneous	AT, SI
1621808	GA	Rural	33.30623	-84.567245	Atlanta, GA	South Atlantic-Gulf	Metamorphic and Igneous	AT, LAU, SI
1630106	GA	Rural	34.954444	-83.379167	Asheville, NC	Tennessee	Metamorphic and Igneous	AT, LF, SI, WP
1631701	NC	Rural	35.573	-77.039	Raleigh-Durham, NC	South Atlantic-Gulf	Bedded Sedimentary Rock	AT, LAU, SI
1632106	NM	Urban	32.27424	-106.74707	El Paso, TX	Rio Grande	Alluvial Basins Valleys and Fans	AT, LAU, SI
1632703	SC	Rural	34.50029	-81.61482	Greenville, SC	South Atlantic-Gulf	Metamorphic and Igneous	LF
1635404	SC	Rural	34.783889	-82.687222	Asheville, NC	South Atlantic-Gulf	Metamorphic and Igneous	AT, SI
1630401	TN	Urban	35.984199	-83.913239	Knoxville, TN	Tennessee	Bedded Sedimentary Rock	WP
17 - Leather and Leather Products								
1721603	OR	Rural	45.359719	-122.83344	Portland, OR	Pacific Northwest	Bedded Sedimentary Rock	AT, SI

[a] Based on land use (see Section 4).
[b] Meteorologic station assignment (see Section 4).
[c] USGS first level of classification for hydrologic units (Seaber et al., 1987; see Section 6).
[d] EPACMTP ground water setting (U.S. EPA, 1996).

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Appendix 2B. Facility Location

Because the accuracy of the facility location directly impacts the accuracy of site-based data collected for a site, an effort was conducted to collect the best locations possible. In the 1995 Hazardous Waste Identification Rule (HWIR) proposal, Industrial D facilities were located in an automated fashion using the centroid of the zip codes contained in the 1985 *Screening Survey of Industrial Subtitle D Establishments* (Westat, 1987), which does not contain facility latitude/longitude. Although this was adequate for the risk assessment supporting 1995 HWIR, the 1999 HWIR multimedia, multiple-exposure pathway, multiple-receptor risk assessment (3MRA) relies heavily on a site-based modeling approach and accurate facility locations have become more critical in terms of an accurate risk assessment.

To address the need for better site locations, the locations of the 201 Industrial D facilities addressed in this assessment were improved through a variety of techniques, including the following:

- Matching facilities to EPA's Location Reference Tables (LRT) from the EnviroFacts database to obtain the Agency's best location

- Zip-code centroids using GIS software

- Visual placement using interactive ArcView software based on land use, waste management unit (WMU) features (e.g., large surface impoundments as waterbodies), and topographic maps (when available).

The remainder of this section describes the source for each improved location and the rationale for every site location adjustment. In essence, this effort helped to ensure that all Industrial D locations used in the 3MRA are a reasonable representation of current and future industrial nonhazardous waste management facilities.

2B.1 Data Sources

The HWIR locational improvement effort began with EPA's Locational Reference Tables (LRT) database, which is accessible via EPA's Envirofacts Web Site. The following information was extracted from that Web Site. Additional information on LRT data can be found at:

http://www.epa.gov/enviro/html/lrt/lrt_over.html.

The LRT database serves as a repository for information collected as a result of EPA's 1991 Locational Data Policy (LDP). The primary objective of this effort is to identify, collect, verify, store, and maintain an accurate, consistently documented set of locational data for entities of environmental concern. A secondary objective is to support the infrastructure needed to manage these data in a manner that yields integration across national, regional, tribal, and state systems. The intent is to support EPA's movement toward data integration based on location, thereby promoting the use of EPA's data resources for a wide array of cross-media analysis.

The LRT component of Envirofacts contains data extracted from the Section Seven Tracking System (SSTS), the National Compliance Database (NCDB), the Federal Facility Information System (FFIS), the PCB-Handler Activity Data System (PADS), and five program systems in Envirofacts:

- Aerometric Information Retrieval System (AIRS)/AIRS Facility Subsystem (AIRS/AFS)
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Information System (CERCLIS)
- Permit Compliance System (PCS)
- Resource Conservation Recovery Act Information System (RCRIS)
- Toxics Release Inventory System (TRIS).

These data were geocoded and loaded into the LRT. Envirofacts records in the LRT are updated monthly as part of the Envirofacts refresh.

LRT includes Method Accuracy Description (MAD) codes that provide positional accuracy for each location and are assigned by method. These include derived, provided, and default values. Table 2B-1 shows the MAD codes and their level of accuracy.

Table 2B-1. Method Codes and Accuracy Values Assigned in LRT

Method code	Description	Accuracy (m)
I1	Manual interpolation—map	2.2 to 27.4 (varies)
I2	Manual interpolation—photo	2.2 to 27.4 (varies)
A1	Address matching—house number	150
A4	Address matching—nearest intersection	1,000
AO	Address matching—other	1,000
Z4	ZIP+4 code-Centroid	1,000
A6	Address matching—digitized (computer-mapping)	2,000
Z2	ZIP+2 code-Centroid (averaging multiple street segments; about size of census block group)	6,000
Z1	ZIP code-Centroid	11,000

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2B.2 Review of Locational Accuracy

Additional information on the accuracy of the LRT locations was obtained during the HWIR data collection pilot. Facility front gate locations were obtained using global positioning system (GPS) technology and compared to zip code centroid and the best LRT locations available for five Industrial D facilities. Significant conclusions drawn from these comparisons are the following:

- At Site A (urban setting), an I1 "facility centroid" location was available from LRT. In this case, the LRT location provided a more accurate location for the onsite WMUs (surface impoundments) than did the front gate GPS location.

- At Site B (rural setting), only a zip code centroid location was available from LRT. In this case, the inaccuracy of the zip code centroid would have resulted in a significant difference in population estimates within the area of interest. The zip-code-based area overlapped a nearby town, resulting in a population estimate for the NW quadrant more than an order of magnitude higher than the estimate that would result from the GPS front gate location.

- Site C (rural industrial setting) had three facilities nearby. LRT facility centroid locations for each of these were somewhat offset from the GPS front gate locations, in one case, across a large river from the facility in a swamp. In this case, the GPS locations provided better estimates of WMU locations than the best available LRT locations.

In summary, even the better I1 locations can be somewhat inaccurate, and zip code centroid locations can significantly over- or underestimate population around a site. Based on this experience, a site relocation effort was developed to find, for each facility modeled, reasonable locations that represent likely locations for industrial Subtitle D waste management units (WMUs).

2B.3 Automated LRT Matching through Envirofacts (2,850 Sites)

Figure 2B-1 illustrates the automated methodology used to obtain LRT locations for the entire database of 2,850 Industrial D facilities. This involved using largely automated methods to match facilities in the Industrial D Screening Survey to EPA facility IDs and to obtain the best LRT locations for each facility. The methodology included

- Matching Industrial D Dun and Bradstreet (DUNS) numbers to EPAIDs in Envirofacts databases with DUNS numbers (TRIS, FINDS, and AIRS/AFS)

- Developing DUNS-based "pseudo-EPAIDs" for Industrial D facilities and matching to PCS and other Envirofacts data tables

- Automated and manual matching to Envirofacts LRT data using Industrial D facility zip code and address.

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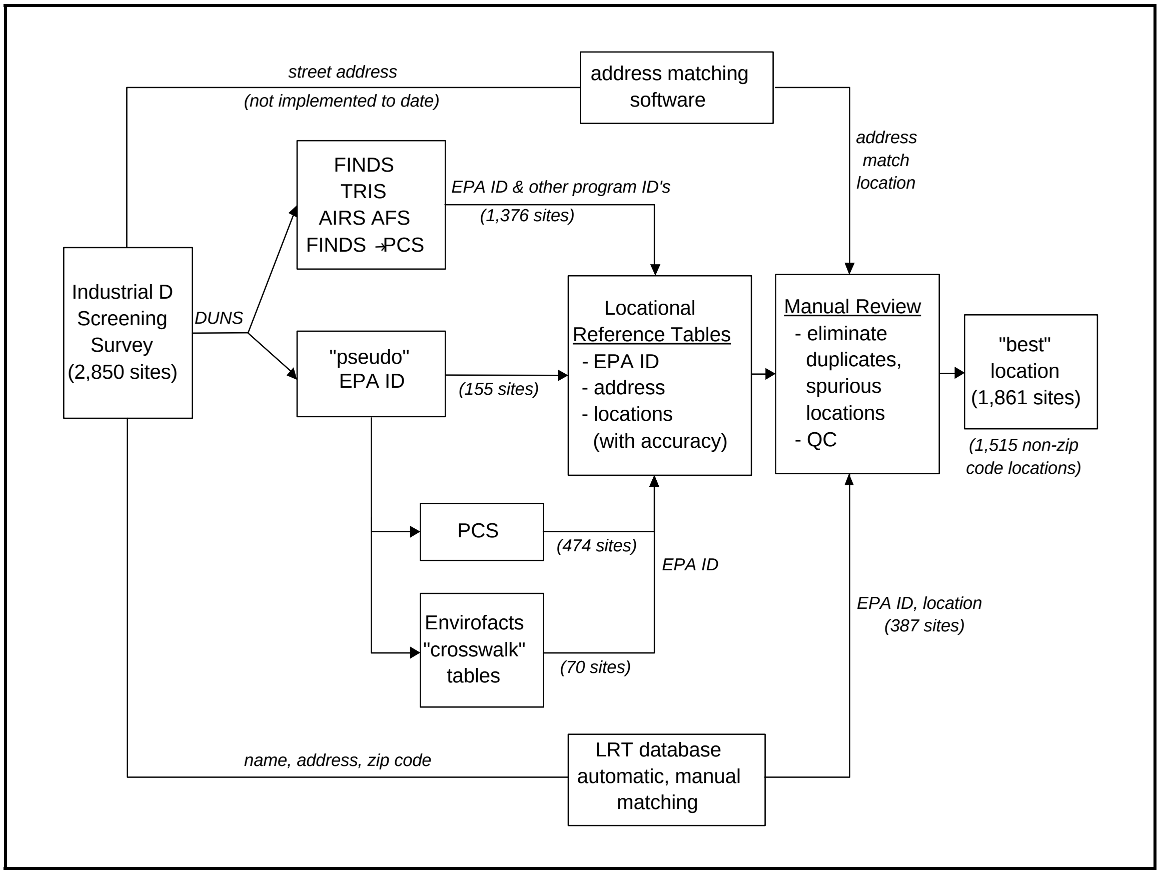

Figure 2B-1. Automated process for improving Industrial D site locations using Envirofacts locational data.

Table 2B-2 shows the results of this effort. Almost 1,900 of 2,850 Industrial D facilities were matched to EPA IDs, which enabled assignment of "better-than-zip-code" locations to over 1,500 facilities in the Industrial D database.

Table 2B-2. Number of Industrial D Sites Matched to LRT Locations

Method	Accuracy (m)	No. Sites
I1, I2	2.2–2.6 20.3–27.4 >150	53 483 3
A1	150	819
A4, AO, Z4	1,000	80
A6	2,000	75
Z2	6,000	33
Z1	11,000	339
Total		1,885

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2B.4 Address Matching and Manual Techniques: 201 Sites

Once the 201 Industrial D sites were selected for the HWIR 3MRA modeling effort, additional effort was made to get improved locations for the 201 sites.

- Manual matching through the Envirofacts query form was done for sites in the 201 that were not already matched to Envirofacts locations. This resulted in an additional 45 sites matched to EPA IDs.

- A table of all available EPA IDs, for 181 of the 201 sites, was then used to query the Envirofacts database to ensure that the best location was obtained for the sites from the LRT. This resulted in 12 new locations being added to the database as well as a few more accurate locations for sites already with LRT locations.

- The remaining sites (without LRT locations) were filled in with zip code centroid latitude and longitudes using the ESRI ArcView Data Disk (data from a Geographic Data Technology, Inc., 1995 database).

Table 2B-3 shows the method and accuracies of the 201 site locations, including 66 locations based on 5-digit zip codes.

2B.5 Manual Location Review and Adjustment

During the initial watershed delineations of the sites, it became apparent that some locations would cause problems in the data collection process if they were not moved. Some locations put WMUs in rivers or other waterbodies. Other sites ended up in areas of inappropriate land use (e.g., residential for large surface impoundments).

To ensure that all sites were in reasonable locations in terms of land use, the GIS coverages imported for data collection (including GIRAS land use, RF3 and National Wetlands Inventory [NWI] waterbodies, and zip code coverages), DeLorme topographic road atlases, and digital USGS topographic quadrangles (where available) were used to review all site locations and adjust inappropriate locations to better locations. In some cases, usually with large surface impoundments, the actual WMUs could be found using the various waterbody coverages provided by GIS or on the topographic maps. Attachment 2B-1 (at the end of this appendix) shows the sites moved from the initial locations described above to the final locations used for data gathering, including an explanation of why each site was moved.

2B.6 Quality Assurance/Quality Control

Quality assurance/quality control (QA/QC) activities for this effort included automated matching of zip codes and addresses between the Industrial D and LRT data to identify spurious facility locations and duplicate locations, which were then screened manually to eliminate duplicates and mismatched data. Manual checks of the matched sites (using facility name, address, and zip code comparisons) were conducted to verify the automated matching process. Whenever zip codes or addresses did not agree, manual verification was conducted. A manual

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Table 2B-3. 201 Site Location Method and Accuracy

Method	Accuracy (m)	No. Sites
I1	2.2–2.6 20.3–27.4	8 43
A1	150	71
A4, AO, Z4	1,000	7
A6	2,000	6
Z2	6,000	2
Z1	11,000	31
Zip Code Centroid		33
Total		201

review of all site locations using the GIS coverages was also done to identify sites that needed to be moved to more appropriate locations.

2B.7 Issues and Uncertainties

Uncertainties associated with the Industrial D facility locations include the following:

For some sites, problems were encountered with even with the most accurate locations from the Envirofacts LRT data. As shown in Attachment 2B-1, even a few facilities with accuracies of 150 meters or less had to be moved due to problems with the original location. One site with an LRT locational accuracy of 2 to 3 m (an I1 location) needed to be moved 10,047 m to remove the facility from a large bay that entirely covered the 2-km radius.

While every attempt was made to move poorly located sites to the best locations possible, there was still no way to know exactly where the actual facility was located. Some facilities with only zip code centroid locations were moved to suitable land use (based on professional judgment) within a rather large area zip code district.

However, these uncertainties should be considered in the context of the **nationwide** nature of this analysis; although site-based data are the basis for this analysis, and the site-based data are determined by where each site is located, the HWIR 3MRA is **not** intended as a site-specific analysis. Within this context, the 201 facilities and their locations as presented herein were derived to adequately represent likely locations of Industrial D facilities across the nation and are not intended to be used for site-specific risk assessments.

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Attachment 2B-1. Initial and Final Industrial D Facility Locations and Distances Moved[a]

Site ID	Initial Latitude	Initial Longitude	Collection Method[b]	Final Latitude	Final Longitude	Distance (m)	Comments/Notes
0114001	40.492134	-80.080149	A1	40.49308	-80.07914	135.72	WMU in river; moved due north to island center
0130207	41.399742	-91.06297	A1	41.399742	-91.06297	0.00	
0131104	42.655934	-89.062147	Z4	42.66416	-89.05569	1059.31	moved site to appropriate land use (LU)
0131207	43.079444	-79.008889	I1	43.079444	-79.00889	0.00	
0131508	36.519722	-82.540556	I1	36.52501	-82.53999	594.48	moved WMU to within LU (I1 location likely NPDES discharge point)
0136703	35.200897	-103.719283	A6	35.19942	-103.7158	357.65	moved large LAU to be between streams
0220102	32.834906	-79.948129	A1	32.834906	-79.94813	0.00	
0221207	40.292475	-84.162526	A1	40.292475	-84.16253	0.00	
0223504	40.850867	-81.763907	A1	40.850867	-81.76391	0.00	
0224002	43.864918	-91.22621	A1	43.86402	-91.22462	162.00	slight adjustment for waterbody
0231002	40.192049	-84.981029	A1	40.192049	-84.98103	0.00	
0231106	40.116667	-74.816667	I1	40.11836	-74.81713	193.67	moved site to center of tailings pile on topo. map
0231407	32.466028	-97.027776	A1	32.46527	-97.02675	127.86	moved LF SSE to within industrial LU (also based on topo. map)
0231610	41.733878	-87.540879	A1	41.73503	-87.54159	141.64	moved WMU behind buildings on topo. map
0231911	43.447145	-83.920814	A1	43.447145	-83.92081	0.00	
0231914	42.256748	-83.135334	A1	42.256748	-83.13533	0.00	
0232305	43.969506	-72.689212	Z1	43.969506	-72.68921	0.00	
0232313	32.436111	-95.366111	I1	32.43605	-95.36401	196.64	moved site to move large landfill out of town (residential land use)
0232402	39.970278	-75.815833	I1	39.970278	-75.81583	0.00	
0232415	41.457226	-81.688288	A1	41.457226	-81.68829	0.00	
0232501	41.26461	-80.482964	A4	41.26468	-80.4838	69.94	moved site out of residential neighborhood;
0232705	34.240689	-84.809157	A4	34.1769	-84.81757	7171.98	moved site to small industrial LU W of town
0233601	38.064696	-78.874709	A1	38.064696	-78.87471	0.00	
0233603	33.541515	-86.543034	A1	33.541515	-86.54303	0.00	
0234904	41.068123	-75.147684	Z1	41.02221	-75.19536	6498.84	moved site to likely LF location on topo. map
0235301	39.921	-85.366	Z1*	39.9335	-85.38004	1837.45	moved site to industrial LU NE of town
0312301	38.434	-78.994	Z1*	38.42827	-78.94495	4289.95	moved site to off Hwy 736 N of town (from Ind. D address)
0314202	42.711063	-73.671455	A1	42.711063	-73.67146	0.00	
0321802	45.615336	-122.710504	A1	45.615336	-122.7105	0.00	
0331006	34.563889	-90.652778	I1	34.563889	-90.65278	0.00	
0331902	36.439167	-99.468611	I1	36.439167	-99.46861	0.00	
0332104	35.642778	-101.426944	I1	35.642778	-101.4269	0.00	
0332707	27.888056	-81.947778	I1	27.88554	-81.94815	280.16	moved site out of lake

(continued)

Attachment 2B-1. (continued)

Site ID	Initial Latitude	Initial Longitude	Collection Method[b]	Final Latitude	Final Longitude	Distance (m)	Comments/Notes
0332811	40.592668	-83.105517	A1	40.59397	-83.10857	294.82	moved site out of residential area
0430108	40.398046	-95.717525	Z1	40.36094	-95.64231	7573.94	moved site to best road atlas location (Ind. D address)
0430412	41.766961	-81.16979	Z2	41.78825	-81.14677	3046.87	moved to better address-match location
0431912	38.334461	-94.756131	Z1	38.35827	-94.63423	10885.75	moved site to industrial LU in RF3 lake (this is the surface impoundment [SI])
0432011	34.703889	-87.118889	I1	34.703889	-87.11889	0.00	
0432106	40.7975	-75.107778	I1	40.79771	-75.11741	806.40	moved site to lake (SI) from RF3
0432716	47.263003	-93.680131	Z1	47.261	-93.674	516.49	moved site to utility LU; RF3 feature is SI
0433201	41.179782	-87.058589	Z1	41.21534	-87.0191	5161.87	moved site to centroid of SI lakes in RF3
0433204	33.330278	-79.357222	I1	33.330278	-79.35722	0.00	
0433404	42.014132	-105.017647	Z1	42.0824	-104.9495	9472.82	site moved to utility LU & RF3 lake (SI) of right size
0433408	45.87786	-106.61743	Z1	45.892	-106.632	1935.62	moved to suitable (industrial) LU
0434505	32.847146	-115.567363	A1	32.847146	-115.5674	0.00	
0434804	35.3775	-78.101944	I1	35.38401	-78.07439	2586.56	moved site to actual SI (NWI lake)
0435510	40.277643	-90.010646	Z1	40.27633	-90.08052	5892.10	moved site to road atlas location (Ind. D address)
0436007	35.540833	-78.989722	I1	35.5871	-79.04772	7347.30	moved site to actual SI (RF3 lake)
0436108	35.189167	-81.012222	I1	35.18328	-81.01201	659.05	moved to actual SI location (NWI lake)
0530901	41.372916	-82.542933	A1	41.372916	-82.54293	0.00	
0531301	39.85	-89.251	Z1*	39.84983	-89.27569	2093.84	moved site (Z1*) to only ind. LU w/in zip
0531502	39.040041	-82.62848	A1	39.03921	-82.62841	93.33	Site moved out of residential area
0531702	35.720214	-101.244738	Z1	35.66336	-101.4502	19502.38	moved to likely LF on topo. map; RF3 "lakes" surrounding new point (these are SIs)
0531902	29.711	-95.159	Z1*	29.72675	-95.13189	3150.39	moved to ind LU, SI locations from topo. map
0534504	33.843732	-84.233559	A1	33.84175	-84.23034	369.48	moved site to just within nearest industrial LU
0613402	38.586459	-90.176488	A1	38.586459	-90.17649	0.00	
0620401	29.758611	-95.176389	I1	29.758611	-95.17639	0.00	
0620604	40.736238	-111.96209	A1	40.7375	-111.9881	2186.42	huge SI, perfect area match with GIRAS/ RF3 lake; moved to lake centroid
0621603	29.701746	-95.082965	A1	29.701746	-95.08297	0.00	
0621902	38.027	-98.087	Z1*	38.03371	-97.97337	9908.45	moved to nearest Ind LU
0622902	31.935764	-111.0029	A1	31.935764	-111.0029	0.00	
0625002	32.2	-81.166667	I1	32.2	-81.16667	0.00	
0625501	30.016308	-94.913917	Z1	29.99645	-94.96404	5309.60	moved 5 mi SW on hwy 90 (Ind. D address)

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Attachment 2B-1. (continued)

Site ID	Initial Latitude	Initial Longitude	Collection Method[b]	Final Latitude	Final Longitude	Distance (m)	Comments/Notes
0631701	29.708333	-95.075	I1	29.71475	-95.07624	721.65	moved site off stream to likely LAU location (cropland LU)
0631903	30.235833	-93.264444	I1	30.23167	-93.27781	1365.25	moved site to likely RF3 feature (SI; delete feature from waterbodies)
0632003	32.437778	-94.688889	I1	32.437778	-94.68889	0.00	
0632606	35.422342	-100.838567	Z1	35.48185	-101.0562	20685.82	moved site to actual SI location (RF3&GIRAS)
0632608	45.570556	-122.743056	I1	45.56941	-122.7448	186.44	moved site away from river w/in Ind. LU
0634001	34.187	-84.82	Z1*	34.13254	-84.77666	7265.34	moved to likely RF3 lake (SI - don't include as waterbody)
0635301	36.036	-114.972	Z1*	36.04434	-114.9951	2267.53	moved to ind. LU within zip
0713618	43.223	-123.366	Z1*	43.21486	-123.3282	3191.00	moved site to nearest ind. LU within zip
0713705	32.720908	-111.917603	Z1	32.833	-111.734	21184.13	moved to approximate location of Peters Rd. (Ind D address)
0715007	40.124	-75.33	Z1*	40.14299	-75.30585	2947.51	moved site to likely land use (cemetery on topo. map)
0715216	33.888	-117.8	Z1*	33.89933	-117.8218	2364.58	moved site to nearest ind. LU
0716701	38.067291	-87.264515	A1	38.06725	-87.26451	4.61	moved WMU to be within ind. LU
0720506	44.67	-67.753	Z1*	44.65533	-67.71774	3233.55	moved site to approx. Ind D address NE of town (no suitable LU)
0720803	27.097	-82.436	Z1*	27.07543	-82.38693	5441.92	moved site to suitable LU
0721305	42.277826	-83.129062	A1	42.27879	-83.12807	135.00	moved site to industrial LU
0722107	26.824	-81.955	Z1*	26.87084	-82.00256	7015.78	moved site to industrial LU
0722503	39.807664	-105.006125	A1	39.807664	-105.0061	0.00	
0722505	26.022	-80.189	Z1*	25.99577	-80.18024	3012.60	moved site to industrial LU
0722705	42.146	-75.886	Z1*	42.10712	-75.89799	4458.57	moved to industrial LU
0723607	30.723	-98.653	Z1*	30.77008	-98.67221	5545.12	moved site to "gravel pit" N of town (topo. map)
0724206	35.790146	-80.610776	Z1	35.77042	-80.60004	2408.95	moved site to actual WMU location (NWI feature is SI; don't make a waterbody)
0724301	34.786143	-89.449686	A1	34.786143	-89.44969	0.00	
0724804	40.326449	-75.322167	AO	40.326449	-75.32217	0.00	
0724909	48.146	-103.603	Z1*	48.14514	-103.6507	3581.00	moved site to likely land use W of town
0730407	38.969558	-80.228076	Z2	39.01759	-80.29334	7768.27	moved site to industrial LU outside of town
0730502	39.00298	-87.748337	A1	39.00298	-87.74834	0.00	
0730914	30.301356	-97.385637	Z1	30.32381	-97.29387	9157.41	moved to industrial LU ~5 mi. SW of town (Ind D address)
0731111	42.128812	-77.037595	Z1	42.15282	-77.0767	4185.44	moved site to industrial LU in town
0731405	40.055278	-76.574722	I1	40.05671	-76.57743	279.59	moved to industrial LU
0731411	37.091066	-120.245446	A1	37.091066	-120.2454	0.00	
0731412	42.5513	-71.531023	A1	42.5495	-71.51555	1278.84	moved site to "barren" LU near A1 location

(continued)

Attachment 2B-1. (continued)

Site ID	Initial Latitude	Initial Longitude	Collection Method[b]	Final Latitude	Final Longitude	Distance (m)	Comments/Notes
0731501	40.443889	-74.244722	I1	40.43103	-74.23553	1634.79	moved site to industrial LU within zip
0731507	34.746389	-79.388333	I1	34.74411	-79.39153	386.37	site moved to actual SI location (RF3 lake)
0731514	42.399	-87.855	Z1*	42.38881	-87.81145	3740.34	site moved to road atlas location on Lake MI
0731703	40.177199	-75.541599	A4	40.17826	-75.5409	132.71	moved WMU out of river
0732110	41.347859	-75.747582	A1	41.347859	-75.74758	0.00	
0732405	37.625	-121.006	Z1*	37.65484	-121.0263	3787.02	site moved to likely LU
0732510	41.61767	-88.20255	A6	41.61892	-88.20404	186.44	site moved to nearby ind. LU
0733203	37.721859	-121.494389	A1	37.71502	-121.4905	839.03	moved to ind. LU near A1 location
0733210	40.6764	-80.8992	Z1	40.6764	-80.8992	0.00	
0733302	37.647	-84.775	Z1*	37.64289	-84.78751	1186.46	moved site to suitable LU in zip
0733404	41.426111	-78.526667	I1	41.42468	-78.53219	485.30	I1 is NPDES discharge pt; moved to likely LF site on topo. map
0733501	35.37606	-82.51622	Z1	35.37242	-82.48649	2708.85	moved to ind. LU within town from Ind. D address
0733606	40.108	-75.28	Z1*	40.10934	-75.23637	3689.65	moved site to between waste pile & old SI on topo. map
0734604	39.779	-74.931	Z1*	39.78529	-74.91227	1739.07	moved site to nearest ind. LU within zip
0735309	37.216505	-95.692613	A6	37.2165	-95.69048	187.51	slight move to best LU
0826707	36.150715	-80.278929	A1	36.150715	-80.27893	0.00	
0830601	33.267	-86.338	Z1*	33.32008	-86.36476	6422.69	moved site to ind. LU in town from Ind. D address
0830903	44.213889	-74.989167	I1	44.15678	-74.98347	6382.38	moved LF out of waterbody
0831102	44.555278	-69.624444	I1	44.55504	-69.62128	252.20	moved WMU from river (I1) to adjacent industrial LU
0831406	32.449444	-87.973333	I1	32.45003	-87.97949	579.49	site moved to SI (RF3 lake) location (don't include these in WB network)
0831904	30.75545	-83.307766	Z1	30.69851	-83.30035	6367.95	site moved to SI feature on topo map and industrial LU
0832304	44.493659	-88.036783	A1	44.495	-88.04	295.74	moved site to be within industrial LU
0832510	41.3925	-75.826111	I1	41.39016	-75.82027	550.95	moved site out of river into SI-looking feature on topo. map
0832903	30.709444	-91.32	I1	30.70787	-91.33987	1906.75	moved to RF3 lake (SI) locations (don't connect these)
0832904	33.992562	-83.77019	A1	33.992562	-83.77019	0.00	
0832909	39.518638	-84.40415	A1	39.518638	-84.40415	0.00	
0833001	35.535278	-82.841111	I1	35.549	-82.879	3735.88	I1 location is plant, not landfill; located landfill at one of the actual landfills using permit information
0833007	45.054396	-87.74886	A1	45.04	-87.725	2467.96	moved landfill to suitable LU and topo. map location
0834009	40.058116	-75.264293	Z1	40.06089	-75.26093	421.26	moved to SI location on topo. map; do not included squarish SIs to the NE
0923004	42.816435	-85.663736	A1	42.816435	-85.66374	0.00	

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Attachment 2B-1. (continued)

Site ID	Initial Latitude	Initial Longitude	Collection Method[b]	Final Latitude	Final Longitude	Distance (m)	Comments/Notes
0930205	35.410833	-80.115556	I1	35.410833	-80.11556	0.00	
0930301	45.732222	-120.698056	I1	45.73123	-120.6975	117.56	moved WMU slightly to fit w/in ind. LU
0930702	30.553889	-97.051111	I1	30.548	-97.066	1568.46	moved site to industrial area near plant; note strip mine LU.
0932103	33.787222	-81.113889	I1	33.787222	-81.11389	0.00	
0932507	40.633611	-76.186944	I1	40.633611	-76.18694	0.00	
0932509	48.474695	-117.946123	A1	48.45497	-117.882	5262.34	moved site to nearest ind. LU in zip
0932903	28.645833	-96.561111	I1	28.663	-96.542	2666.46	moved WMU to area accommodating SI & LF (island likely location for SI, but square WMU won't fit; Sis & LFs in vicinity of new location)
0933704	36.75667	-82.035833	Z1	36.66662	-82.06086	10328.64	moved to ind. LU along Hwy. 11 (Ind D address)
1010805	46.061	-118.332	Z1*	46.04296	-118.3233	2111.80	moved LAU to agricultural LU to S, near commercial LU
1012203	40.941444	-72.495694	I1	40.942	-72.616	10047.53	I1 location in bay/estuary (entire AOI); used directory listing to locate
1013209	36.431	-119.092	Z1*	36.40229	-119.1323	4809.48	moved to approx. location on road atlas (Ind D address)
1014805	30.905339	-84.601838	A1	30.919	-84.616	2032.06	moved to likely LU (mining) using atlas & LU coverage
1015510	33.158	-99.731	Z1*	33.07983	-99.57937	16548.04	moved site to suitable land use "on lake Stamford" (Ind D address)
1023705	42.893111	-76.985194	I1	42.893111	-76.98519	0.00	
1031503	38.781171	-97.635899	A1	38.781171	-97.6359	0.00	
1031507	36.947928	-120.072999	A1	36.94798	-120.072	88.33	moved site to RF3 lake (SI; delete this feature, large SI)
1032715	33.970556	-85.972222	I1	33.96811	-85.96986	348.80	moved site to NWI lakes (SIs; do not incorporate these into waterbody network)
1032802	35.769	-79.175	Z1*	35.69275	-79.16879	8554.84	moved site to actual SI location (LU& map, Ind D address); do not connect feature as waterbody
1033107	44.735499	-85.625005	A1	44.735499	-85.62501	0.00	
1033114	38.719722	-75.289444	I1	38.719722	-75.28944	0.00	
1033202	35.425999	-94.329485	A1	35.425999	-94.32949	0.00	
1033602	42.421948	-85.649703	A1	42.42	-85.643	589.81	moved large LAU to between streams
1034005	34.191708	-83.900498	A1	34.19171	-83.9055	457.53	moved LAU to agricultural area next to industrial area
1034210	42.443997	-77.196368	Z1	42.3996	-77.25326	6803.01	moved to atlas location of Ind D facility
1034406	33.333096	-91.109649	A6	33.36092	-91.11143	3111.08	moved WMU to small SI (RF3 lake near Miss. R; do not connect)
1034805	35.7646	-91.644757	A1	35.7646	-91.64476	0.00	
1035117	39.240922	-94.416439	A1	39.24038	-94.4163	61.89	moved WMU to just within industrial area to SE

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Attachment 2B-1. (continued)

Site ID	Initial Latitude	Initial Longitude	Collection Method[b]	Final Latitude	Final Longitude	Distance (m)	Comments/Notes
1035405	43.617953	-116.611829	A6	43.61545	-116.6093	346.39	moved site (A6) to nearest ind. LU along RR
1035508	41.924522	-111.813356	A1	41.924522	-111.8134	0.00	
1120904	44.484	-73.22	Z1*	44.44519	-73.22743	4363.87	moved to correct street address using atlas
1122705	37.221	-82.285	Z1*	37.221	-82.285	0.00	
1131103	29.952305	-90.07619	A1	29.952305	-90.07619	0.00	
1131802	38.859145	-120.663889	A1	38.859145	-120.6639	0.00	
1133902	34.501	-82.027	Z1*	34.50069	-82.02097	550.46	moved to industrial LU
1134405	39.679462	-91.402836	A1	39.67715	-91.40255	260.23	moved LAU S to likely location based on address, LU
1212301	42.138844	-71.077019	A1	42.138844	-71.07702	0.00	
1221704	27.904372	-82.76268	A1	27.904372	-82.76268	0.00	
1223404	40.071935	-75.295648	AO	40.071935	-75.29565	0.00	
1230111	45.654698	-108.756506	Z1	45.65188	-108.7565	313.07	moved site out of river S of town
1230206	35.273275	-89.982701	A1	35.27079	-89.97744	550.02	moved WMU to industrial LU
1230517	39.505833	-76.889444	I1	39.505833	-76.88944	0.00	
1230919	42.65287	-73.74868	Z1	42.66174	-73.74344	1079.43	moved site to suitable LU within zip
1231101	35.087243	-90.080785	A1	35.087243	-90.08079	0.00	
1231705	32.959089	-79.882761	Z1	32.93092	-79.83102	5744.84	moved to suitable LU within zip
1233101	33.764167	-118.283333	I1	33.764167	-118.2833	0.00	
1235205	34.796771	-96.78958	Z1	34.81205	-96.67695	10363.02	moved site N of airport on highway (Ind D address)
1236637	41.096887	-73.973995	Z1	41.09491	-73.95553	1554.58	moved site into correct zip code & suitable LU
1236652	41.556617	-72.755285	Z4	41.556	-72.756	90.95	moved site to within "barren" LU
1236732	37.793	-81.206	Z1*	37.793	-81.206	0.00	
1236810	33.931111	-118.066944	I1	33.931111	-118.0669	0.00	
1236820	41.785179	-76.359912	Z1	41.785	-76.36	21.31	moved site to ind/"barren" LU with SIs (RF3 lakes; do not connect as waterbodies)
1331103	34.006675	-85.97306	A1	34.0079	-85.97295	137.27	moved to within industrial LU
1333001	34.196944	-79.580833	I1	34.196944	-79.58083	0.00	
1333701	41.242234	-80.904287	Z1	41.24763	-80.80961	7896.26	moved to ind. LU in town (Ind D address)
1415407	33.51	-112.03	Z1*	33.49474	-112.0403	1950.03	site moved to industrial land use within zip
1421506	47.488603	-122.197347	A1	47.49002	-122.1976	157.46	moved site inside adjacent industrial LU
1430107	37.62436	-97.280161	A1	37.62436	-97.28016	0.00	
1430404	39.737695	-86.215746	A1	39.737695	-86.21575	0.00	
1430602	37.405945	-122.027249	A1	37.405945	-122.0272	0.00	
1431515	40.66357	-112.086499	A6	40.66357	-112.0865	0.00	
1434022	33.809808	-118.336446	A1	33.809808	-118.3364	0.00	

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Attachment 2B-1. (continued)

Site ID	Initial Latitude	Initial Longitude	Collection Method[b]	Final Latitude	Final Longitude	Distance (m)	Comments/Notes
1434802	34.026	-81.005	Z1*	34.01779	-80.98919	1715.34	moved to industrial LU within zip
1435317	30.089252	-94.09914	A1	30.10278	-94.09169	1664.00	moved site to likely "waste pile" feature on topo. map
1522504	39.602886	-75.66059	A1	39.602886	-75.66059	0.00	
1530605	30.029167	-94.271111	I1	29.97179	-94.21806	8166.03	moved site to industrial LU using Ind D address
1530808	42.116201	-83.190811	A1	42.116201	-83.19081	0.00	
1532401	44.001412	-73.188314	Z1	43.9799	-73.09228	8042.02	moved to road atlas location (Ind D address)
1621808	33.30623	-84.567245	A1	33.30623	-84.56725	0.00	
1630106	34.954444	-83.379167	I1	34.954444	-83.37917	0.00	
1630401	35.984199	-83.913239	A1	35.984199	-83.91324	0.00	
1631701	35.547778	-77.076944	I1	35.573	-77.039	4426.85	moved site to best possible location out of river; DEMs won't work (flat site)
1632106	32.272848	-106.617001	Z1	32.27424	-106.7471	12191.53	moved to mixed LU in Ind D town
1632703	34.498358	-81.616269	A1	34.50029	-81.61482	253.19	moved site to “commercial & services" LU
1633404	33.431667	-112.36	I1	33.431667	-112.36	0.00	
1633405	41.56	-73.408889	I1	41.55905	-73.40906	107.25	moved site slightly to within suitable LU
1635404	34.783889	-82.687222	I1	34.783889	-82.68722	0.00	
1721603	45.359719	-122.833438	A1	45.359719	-122.8334	0.00	

[a] Initial locations derived from Envirofacts LRT tables, address matching (using Industrial D address data), or zip code centroids (using Industrial D zip codes). Final locations determined using manual review and relocation, as necessary.

[b] Z1* indicates zip code location based on Industrial D zip code; all other initial locations from Envirofacts location reference tables: A1, A6 = address-match; I1 = manual map interpolation; Z1 = zip code centroid (5-digit); Z4 = zip code centroid (9-digit).

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