

3.0 Building the Initial Information

When FEMIS is installed, information is present in the database to enable the immediate use of the system. For example, the database tables used for validation are preset with the correct values, base maps are present in the spatial data, and some facility data is present. This section describes how this initial information was obtained and loaded into the system as part of the installation. At the present time, most CSEPP sites have been installed and are using FEMIS v1.4.7.2 software and databases.

The initial information was grouped into the following three classes:

- CSEPP global – EOCs at all sites contained identical information for this class of tables. Examples are the relational tables named `STATE` and `HAZARD_SITE`.
- Site global – All EOCs at a given site contained identical information for this class of tables. Examples are the relational tables named `ZONE` and `ACCIDENT_CLASS`. This data was obtained from existing sources in electronic form or manually entered.
- EOC specific – Each EOC at the site had distinct information for this class of tables. Examples are the relational tables named `FACILITY` and `MEMO_UNDERSTANDING`. Like the site global data, some of this information was available in electronic form and some was gathered and entered manually.

The latter two classes of data prepared for a site were tailored to conditions present at that site. Factors considered were the number and type of EOCs present, the objectives of the site, and the area of interest for map and GIS theme coverage. Another consideration was the amount of information contained in active Emergency Management Information System (EMIS) and Integrated Baseline System (IBS) databases that could be extracted for the FEMIS system.

Figure 3.1 illustrates the general process of data preparation at a high level. The detailed steps to accomplish this are described in the following paragraphs.

EMIS is currently being used by the US Army as the onpost automation system at most CSEPP sites. EMIS has a centralized database using the Oracle DBMS, and it also has a GIS that is used in somewhat the same manner as ArcView GIS is used in FEMIS. Therefore, EMIS is a source for onpost relational data (such as igloos) and spatial information (such as base maps tailored to the site environment).

IBS was used at some CSEPP sites for offpost EOC automation at the county and state levels. The IBS EOCs tended to operate autonomously so each contained information that was unique. The data contained in IBS was in ASCII files and binary files for the spatial information. In general, data was extracted from each IBS system deployed at the site. Then parts of this data were merged to ensure that common information was consistent. IBS was a source for offpost facility, personnel, and resource information.

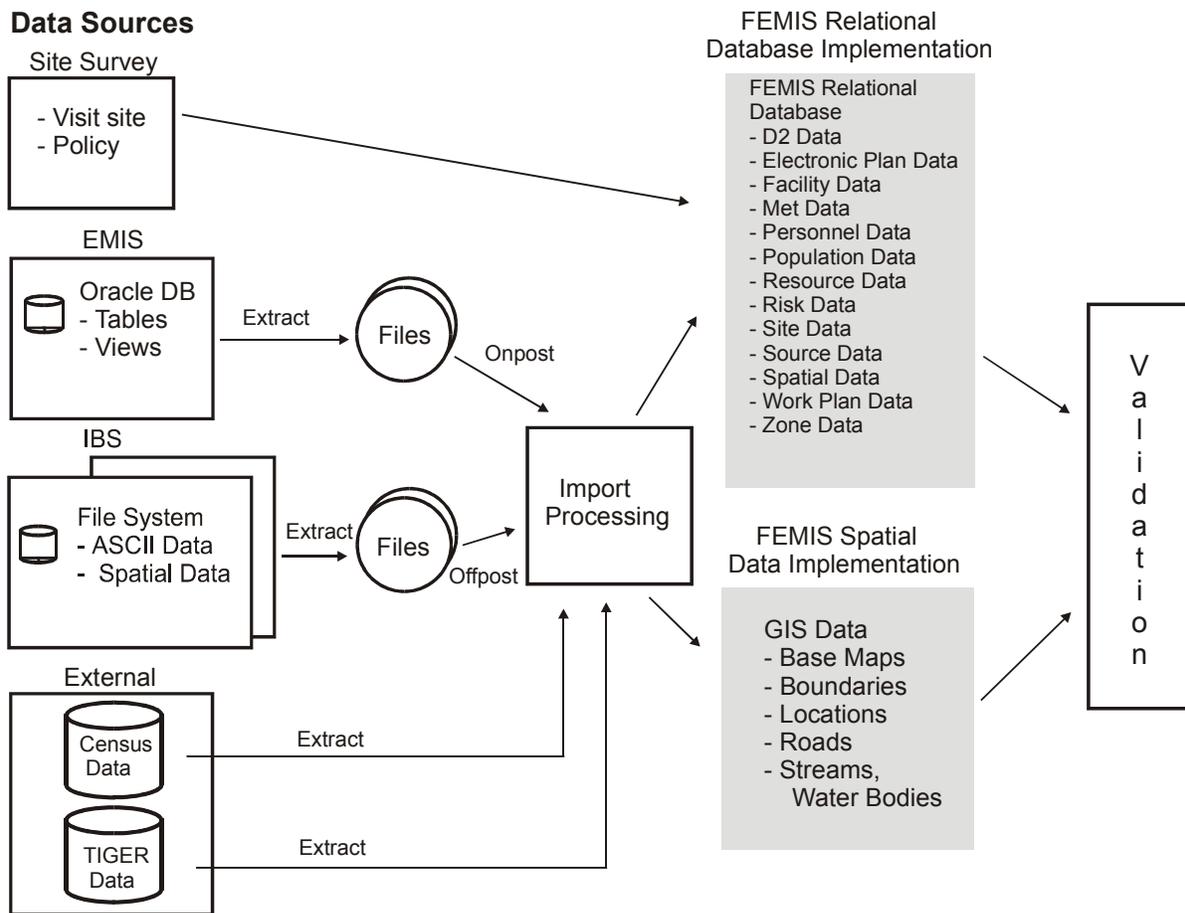


Figure 3.1. General Process of Data Preparation at a High Level

The FEMIS database includes some types of data not present in IBS and EMIS. This type of information was obtained during the Site Survey. Also, the Site Survey was used to validate some of the data captured from IBS and EMIS; more details are provided in Section 3.1, Site Survey.

The extraction and post processing required for relational and spatial data are discussed in Sections 3.2, Building Relational Data and 3.3, Building Spatial Data. In general, each relational table or spatial data file required individualized processing.

Census data and TIGER/Line data provided by the government were important external data sources. As shown in Figure 3.1, subsets of information from these sources were extracted and used for both spatial and relational databases. Section 3.3, Building Spatial Data, discusses how this is accomplished.

The validation step shown in Figure 3.1 was very important. It was accomplished after the spatial and relational databases were created. Even though some validation was done during the import processing, the final validation was needed to ensure consistency between the inter-related tables and files that comprise the FEMIS database.

3.1 Site Survey

Although much of the information needed to preset the FEMIS database was available in electronic format, some information was not. Therefore, a means to collect a varied set of parameters that were not available in IBS, EMIS, or the government-furnished external sources was needed. All sites required a common set of parameters obtained from the Site Survey. Even though IBS and EMIS were used at a given site, additional information was required.

The Site Survey provided default and recommended values in many cases. The EOC personnel reviewed the data provided and modify it directly on the form. The electronic Site Survey form used a computer spreadsheet for capturing extensive amounts of data.

An example of a Site Survey is included in Appendix A to indicate the basic information that was needed for FEMIS. Electronic copies of the survey form were sent to each EOC site for completion. When completed, the survey was returned to the development location for analysis of compatibility with other information. An onsite follow up meeting was held at each site to resolve questions and ensure consensus at the site.

3.2 Building Relational Data

The relational database in FEMIS is managed by Oracle, a commercial DBMS. The distributed processing features of Oracle are used to produce a multi-server distributed data architecture. Data replication is widely used to provide a local copy of most shared tables. This replication is important because it allows an EOC to operate autonomously in case the links to other EOCs are not operational. Also, performance is enhanced because the shared tables are located on the local database.

The FEMIS relational database is comprised of approximately 200 tables. The FEMIS logical data model describes graphically what information is present and how the data objects are interrelated. This model represents a large collection of general purpose tables; such as, evacuation data and GIS and dispersion tables. Appendix B, FEMIS Database Changes, provides the database schema changes that have been implemented to update the database to the current version, FEMIS v1.5. Definitions of the database attributes can be found in Appendix C, FEMIS Data Dictionary. A diagram of the FEMIS model is included in Appendix D, Database Data Model.

Based on design efforts and testing results, each relational database table is either local to an EOC or shared with the other EOCs. Data in the local tables can be accessed only from users logged in to that EOC database. The data in shared tables is available to users at all EOCs. Details of data placement are made transparent to the FEMIS users, so the FEMIS database appears to be a single, unified collection of tables. This physical design of the Oracle database is provided as a part of database implementation and can be tailored for CSEPP sites. Instructions about site tailoring are discussed in Section 2.8, Defining the Database Topology, in the *Installation Guide for FEMIS Version 1.5*.

Approximately one-half of the tables did not contain any information when the system was installed. These are tables, such as the Situation Summary table, that will contain information about the current conditions at the site. As the system is used, data will accumulate in these tables and become a useful resource. The management of these tables is discussed in Section 4.0, Managing Relational Data.

The remaining tables are preset with data as part of the system installation process. Over the life-cycle of FEMIS, some of the data in this class of tables may require updates after installation, which are discussed in Section 4.0, Managing Relational Data. How preset data was collected and processed to become part of the delivered database is the subject of the remainder of this section.

Tables containing preset information that was universal to all sites are called CSEPP Global tables. During FEMIS development, information was assembled from various sources and loaded into this class of tables. Table 3.1 lists the Oracle tables that are in this class, what type of user interface manages the data in the table (all of these tables are managed by the Data Manager included in the FEMIS application), and comments.

Table 3.2. illustrates the source of the information for the CSEPP Global tables, the filename (if appropriate), the loading strategy, and the contents of the information in the table. A PNNL source means that the information was assembled from various sources available to PNNL. Regarding IEM (Innovative Emergency Management, Inc.) as a source, see Section 3.3.1, Data Sources and Import Processing.

The other two table classes with preset information contain site-specific and EOC-specific data. Table 3.3 lists the tables in these two classes illustrating the table name, what type of user interface manages the data in the table, and comments. More complete details for gathering and loading these tables are provided in Table 3.4.

3.3 Building Spatial Data

FEMIS spatial data contains location information in the form of geographic coordinates of points, lines, and polygons that represent physical features and non-physical area boundaries on the surface of the earth. Within FEMIS, this location information is stored as ArcView GIS themes, which are accessed by the FEMIS application via the ArcView GIS software. Each theme represents a coherent set of similar geographic features (e.g., roads, facility locations, census tract boundaries). FEMIS spatial data also contains attribute information that is associated with the geographic features that make up the themes. These attribute values are stored and maintained in the FEMIS relational database. They are attached to the features within the ArcView GIS themes as required by the FEMIS applications.

Figure 3.1 shows the general approach to building the initial FEMIS spatial and relational databases. Data from various information sources must be processed by the appropriate FEMIS data import software programs to extract the required data elements and place them into the proper data structures for storage in the FEMIS relational and spatial databases. All required attributes associated with both geographic and non-geographic data objects are stored in the FEMIS relational database. The

geographic coordinates of the spatial features, together with selected attributes of those features, are stored as ArcView GIS themes in the FEMIS spatial database.

Table 3.1. CSEPP Global Preset FEMIS Tables

Table #	Table Name	User Interface	Comments
1	ACCIDENT_CLASS	DataMgr	
2	ACTIVITY	DataMgr	
3	BUNKER_CONTENT	DataMgr	
4	CHEMICAL_AGENT	DataMgr	
5	CONTROL_POINT	DataMgr	Initial
6	DOSAGE	DataMgr	
7	EP_ERROR_CODES	DataMgr	
8	GOAL	DataMgr	
9	HAZARD_SITE	DataMgr	
10	MEASUREMENT_DEFN	DataMgr	
11	MEASUREMENT_TYPE	DataMgr	
12	MET_PARAMETER	DataMgr	
13	MUNITION	DataMgr	
14	PD_LEVEL	DataMgr	
15	PLAN_DETAIL	DataMgr	Template
16	PLAN_HEADER	DataMgr	Template
17	PRIVILEGE	DataMgr	
18	PROTECTIVE_ACTION	DataMgr	
19	STATE	DataMgr	
20	SYSTEM_PHASE	DataMgr	
21	SYSTEM_STAGE	DataMgr	
22	VAL_LIST	DataMgr	
23	VAL_LIST_DATA	DataMgr	
24	ZONE_TYPE	DataMgr	

Table 3.2. Global Preset Database Tables

Table Loaded	Source	Filename	Load Strategy	Contents
ACCIDENT_CLASS	PNNL	None	SQL load using data acquired during development	Validation for accident classes and descriptions
ACTIVITY	PNNL	None	SQL load using data acquired during development	Validation for activity codes and descriptions
BUNKER_CONTENT	EMIS	AGENT_MN.DAT	SQL load using EMIS data	Agents, munitions and quantities per munition

Table Loaded	Source	Filename	Load Strategy	Contents
CHEMICAL_AGENT	PNNL	None	SQL load using data acquired during development	Agent codes and types
CONTROL_POINT	PNNL	None	SQL load using software control points	Control point names and descriptions
DOSAGE	PNNL	None	SQL load using normal D2PC dosages	Dosage levels and descriptions from D2PC model
EP_ERROR_CODES	PNNL	ERROR.DAT	SQL load using ESIM user manual error codes	Error code with description of error for Evacuation
GOAL	PNNL	None	SQL load with data based on user advisory board	“Save lives, protect property”
HAZARD_SITE	PNNL	None	SQL load using data acquired during development	Compilation of the names, locations, and descriptions for the CSEPP sites
MEASUREMENT_DEFN	PNNL	None	SQL load using data acquired during development	Validation for measurement classes
MEASUREMENT_TYPE	PNNL	None	SQL load using data acquired during development	Validation for measurement types and description
MET_PARAMETER	PNNL	None	SQL load using data acquired during development	Validation for parameter codes and descriptions
MUNITION	PNNL	None	SQL load using normal D2PC munitions	Validation for munitions and descriptions
PD_LEVEL	PNNL	None	SQL load using data acquired during development	Plan level name and number
PLAN_DETAIL	PNNL	None	SQL load using data acquired during development	Plan reference ID; responsible parties; start, finish, and duration times for plan template
PLAN_HEADER	PNNL	None	SQL load with plan data template	Plan reference ID, name, status, and descriptions for initial plan template
PRIVILEGE	PNNL	None	SQL Plus query based on CONTROL_POINT table	Privilege numbers and flags for assigned privileges based on control points
PROTECTIVE_ACTION	PNNL	None	SQL load using data acquired during development	Validation for protective actions and descriptions
STATE	PNNL	None	SQL load using data acquired during development	Validation for state codes and names
SYSTEM_PHASE	PNNL	None	SQL load using data based on user advisory board	Validation for phase names, flags, and descriptions
SYSTEM_STAGE	PNNL	None	SQL load using data based on user advisory board	Validation for modes, phases, and stages
VAL_LIST	PNNL	None	SQL load using data acquired during development	Validation lists the names and descriptions for Visual Basic applications
VAL_LIST_DATA	PNNL	None	SQL load using data acquired during development	Validation lists the data and text
ZONE_TYPE	PNNL	None	SQL load using data acquired during development	Validation for CSEPP zones and descriptions

Table 3.3. Site-Specific and EOC-Specific FEMIS Tables

Table #	Table Name	User Interface	Comments
1	AGENCY	Agency UI	
2	BUNKER	GIS	Read only
3	CENSUS_BLOCK	DataMgr	Read only
4	CENSUS_SUBDIVISION	DataMgr	Read only
5	CENSUS_TRACT	DataMgr	Read only
6	COUNTY	DataMgr	
7	DEPARTMENT	Department UI	
8	EMERGENCY_SUPPORT	DataMgr	
9	EOC	DataMgr	
10	EOC_OBJECTIVE	DataMgr	
11	EOC_ZONE	DataMgr	
12	FACILITY	Facility UI	
13	FEMIS_USER	Manage User UI	
14	GEO_OBJECT	DataMgr	Data captured with GIS load, export
15	GIS_LAYER	DataMgr	Data captured with GIS load
16	GIS_LAYER_DEFINITION	DataMgr	
17	MET_TOWER	DataMgr	Compatibility to Met towers onsite
18	NAME_SUBSTITUTION	DataMgr	
19	PA_UNIT	Community UI	
20	PERSON	Person Form UI	
21	POSITION	DataMgr	
22	POSITION_ASSIGNMENT	DataMgr	
23	RESOURCE_CATEGORY	DataMgr	
24	RESOURCE_DEFINITION	Resource Definition UI	
25	RESOURCE_LOCATION	Facility UI	
26	RESOURCE_OWNER	Facility UI	
27	STORED_AGENT	DataMgr	
28	USER_MODE_PRIV	DataMgr	
29	VAL_POSITION	DataMgr	
30	WK_POSITION	DataMgr	
31	ZONE	DataMgr	
32	ZONE_IN_GROUP	DataMgr	
33	ZONE_RISK_GROUP	DataMgr	

Table 3.4. Site-Specific and EOC-Specific Preset Database Tables

Table Loaded	Source	Filename	Load Strategy	Contents
AGENCY	IEM	AGENCY_LOOKUP.DAT	SQL load with validated data	Agency codes and their associated agency names
BUNKER	EMIS	GISIGL.DAT (onpost)	SQL load with validated data	Igloo names and codes specific to the site
CENSUS_BLOCK	Census	STF1B tape files	SQL load with census data	State and county FIPS codes and block name
CENSUS_SUBDIVISION	Census	STF1B tape files	SQL load with census data	State and county FIPS codes and subdivision name
CENSUS_TRACT	Census	STF1B tape files	SQL load with census data	State and county FIPS codes and tract name
COUNTY	PNNL	None	SQL load with preset data. Use Site Survey results if different.	State and county FIPS codes and county name
DEPARTMENT	PNNL and Site Survey	None	SQL load with Dept_Code set to Agency_Code or Site Survey	Department and agency codes. The department code is generated.
EMERGENCY_SUPPORT	IEM and Site Survey	EF.DAT	SQL load with preset data. Use Site Survey results if different.	Emergency support functions and descriptions
EOC	IEM and Site Survey	None	SQL load with preset data. Use Site Survey results if different.	EOC names, types, number, and description
EOC_OBJECTIVE	Site Survey	None	SQL load with data from Site Survey	EOC name; notify, decision and goal times; and descriptions and dose levels
EOC_ZONE	PNNL	None	Preloaded list of zones associated with an EOC. Use Site Survey results if different.	EOC and zone names
FACILITY	IEM and Site Survey	FACIL.DAT	See Facility Note	Facility names, capacities, and descriptions
FEMIS_USER	Site Survey	None	SQL load with data from Site Survey	User code with encrypted password, account status
GEO_OBJECT	PNNL	None	SQL load with preset data. See GEO_OBJECT Note.	Data for all spatial objects
GIS_LAYER	PNNL	None	SQL load with preset data	Data for existing themes
GIS_LAYER_DEFINITION	PNNL	None	SQL load with preset data	Data for defining themes

Table Loaded	Source	Filename	Load Strategy	Contents
MET_TOWER	Site Survey	METTOWER.DAT	SQL load with data from the Site Survey	Names and locations of Met towers
NAME_SUBSTITUTION	PNNL	None	SQL load with preset data	Standard case naming
PA_UNIT	Site Survey	None	SQL Plus query based on zone and facility tables	Protective action units, type, types names, and zone or facility name
PERSON	IEM	PERSON.DAT	See Person Note	Person reference number, name, and address
POSITION	Site Survey	None	SQL load with data from Site Survey	Position code with address, phone, and description
POSITION_ASSIGNMENT	Site Survey	None	SQL load with data from Site Survey	EOC position that can be assigned to a specify person
RESOURCE_CATEGORY	Site Survey	RESOURCE.DAT	SQL load with data from Site Survey	The category and its description
RESOURCE_DEFINITION	Site Survey	RESOURCE.DAT	SQL load with data from Site Survey	Resource reference number, name, and description
RESOURCE_LOCATION	Site Survey	None	SQL Plus query based on RESOURCE_FACILITY table	Facility where the resource is located
RESOURCE_OWNER	Site Survey	None	SQL load with data from Site Survey	Agency that controls the resource
STORED_AGENT	EMIS	GISIGL.DAT	SQL load with validated data	Bunker name, agent code, and munition type
USER_MODE_PRIV	Site Survey	None	SQL Plus query based on tables PERSON, PRIVILEGE, and SYSTEM_MODE	Control point names, privilege numbers, user codes, and mode names
VAL_POSITION	Site Survey	VAL_POS.DAT	SQL load with preset data. Use Site Survey results if different	Position codes and names
WK_POSITION	Site Survey	POSITION_LOOKUP.DAT	SQL load with validated data	Agency, department, and title of position
ZONE	IEM	Spatial data files	SQL load with validated data	Zone name and type
ZONE_IN_GROUP	Site Survey	None	SQL load with data from Site Survey	List of zones in risk groups
ZONE_RISK_GROUP	Site Survey	None	SQL load with data from Site Survey	Name of risk groups
<p>Facility Note: A temporary table, T_FACILITY is created, loaded, and updated with the data in FACIL.DAT. The data load is completed when the data is copied from the T_FACILITY table to the facility table. Updates from the Site Survey will be included.</p> <p>GEO OBJECT Note: Since the GEO_OBJECT table data represents geographical coordinates for many objects represented</p>				

Table Loaded	Source	Filename	Load Strategy	Contents
				in the relational portions of the database, it has several different SQL Loader control scripts which load data into the table. Examples include the facilities from each EOC, igloos, zones, and counties.
				Person Note: Two temporary tables, T_PERSON and T_AGENCY are created, loaded, and updated with the data from PERSON.DAT. The data load is completed when the data is copied from the T_PERSON table to the person table. Updates from the Site Survey will be included.

3.3.1 Data Sources and Import Processing

The four major sources of FEMIS spatial data are discussed below.

1. **EMIS (Emergency Management Information System).** EMIS was developed for the US Army as an interim onpost emergency management system. EMIS stores and manages spatial data and related attributes for onpost geographic features, model results, and raster image background maps. The attribute information is stored in Oracle relational database tables or ASCII text files.
2. **IEM Data Upgrades.** Over the course of several FEMIS version upgrades, updated background image maps and vector themes have been assembled by IEM and added to the FEMIS spatial database. These themes are in the form of ArcView shapefiles and TIFF format image files of the area surrounding a hazard site. The vector themes are typically US Bureau of the Census TIGER/Line data files that contain detailed location and attribute information for a variety of physical and non-physical features, such as roads, railroads, streams and water bodies, facilities, landmarks, state and county boundaries, census unit boundaries, and other political and administrative boundaries. Other vector coverages such as contour lines and landcover classifications are provided from other sources, as detailed in IEM's site-specific documentation. USGS (United States Geological Survey) geo-registered and tiled raster maps at up to four different scales (1:24,000, 1:100,000, 1:250,000, and 1:500,000) are the major source of the updated background image maps.
3. **Census Statistical Data.** The US Bureau of the Census provides statistical census data files that contain demographic information from the 1990 decennial census, unless otherwise specified. This data consists of large ASCII files, which contain population, family, and household counts within various demographic groupings (i.e., by age, sex, race, household type, income, and other social and economic factors). The information is reported at several geographic levels (e.g., county, subdivision, census tract, block group, and block). Selected portions of this data are required by FEMIS applications and must be extracted and attached as attributes to the corresponding TIGER/Line census area polygons.
4. **Site Configuration Data.** Some spatial data related to planning decisions made at the site (e.g., accident-based planning category boundaries) may not be available from EMIS or any other existing data system. This data must be obtained directly from site personnel and must be entered into ASCII files prior to FEMIS import processing.

The FEMIS spatial data themes are listed and characterized in Table 3.5. They can be divided into three categories as discussed below: static spatial datasets, dynamic spatial datasets, and model-related spatial datasets.

1. Static spatial datasets change infrequently and are managed and controlled by your Database Administrator. Users cannot modify the spatial information contained in these datasets. Examples of static spatial datasets are roads, census blocks, and emergency planning zone boundaries. All of these themes must be initially loaded into the FEMIS spatial database.
2. Dynamic spatial datasets are the themes that can be created and/or modified by users from within certain FEMIS modules. Dynamic themes include facilities, user defined points, traffic control points, sirens, igloos, Met towers, and user defined threat area wedges.
 - The Facilities theme is initially loaded with the locations of facilities that are known to be of interest for emergency planning purposes. Users can then add other facilities to this theme through the FEMIS Facilities interface.
 - User Defined Points are other geographic point locations that users may wish to include as reference points for locating a hypothetical or real event or for other purposes. User defined points data optionally can be initially loaded into the FEMIS database. Users can then add other user defined points to this theme or create other user-defined themes through the FEMIS User Defined Points interface.
 - The Traffic Control Points theme is initially loaded with road and street intersections and other locations where it is expected that roadblocks or other traffic/access control mechanisms would be applied in an emergency. Users can then add other traffic control points through the FEMIS Traffic Control Points interface.
 - The Sirens theme is initially loaded with locational and attribute information on emergency warning sirens. Users can then add other siren locations through the FEMIS Sirens interface.
 - The Igloo theme is initially loaded with locational and attribute information on igloos. Users can then add other igloo locations through the FEMIS Igloos interface.
 - The Met Tower theme is initially loaded with locational and attribute information on Met towers. Users can then add other Met tower locations through the FEMIS Met Towers interface.
 - User defined threat area wedges and D2PC plume-based wedges are not initially loaded into the FEMIS database. They are defined and generated through the FEMIS Threat Area interface.

Table 3.5. Spatial Data Theme Descriptions

Generic Theme (Layer) Description	Data Source	User Directory	Filename	Data Type	User Modify	FEMIS Object ^(a)	Number of Themes
Facilities	FEMIS App	FACILITY	FACILITY	Vector - Point	Yes	Yes	1
D2PC Plume (Dosage)	FEMIS App	D2_<eoc_code>	D<case_id(7)>	Vector - Polygon	Yes	Yes	1 per case per EOC ^(b)
D2PC Plume (Concentration)	FEMIS App	D2_<eoc_code>	K<case_id(7)>	Vector - Polygon	Yes	Yes	1 per case per EOC ^(b)
Threat Area	FEMIS App	D2_<eoc_code>	W<case_id(7)>	Vector - Polygon	Yes	Yes	1 per case per EOC ^(b)
Evacuation Centroids	FEMIS App	EV_<eoc_code> E<exercise_num>	C<case_id(7)>	Vector - Point	Yes	No	1 per case per EOC ^(b)
Evacuation Links	FEMIS App	EV_<eoc_code> E<exercise_num>	L<case_id(7)>	Vector - Line	Yes	No	1 per case per EOC ^(b)
Evacuation Nodes	FEMIS App	EV_<eoc_code> E<exercise_num>	N<case_id(7)>	Vector - Point	Yes	No	1 per case per EOC ^(b)
Census Blocks	IEM	CEDBLOCK	<site_code>_TB	Vector - Polygon	No	No	1
County Boundaries	IEM	BOUNDARIES	<site_code>_SC	Vector - Polygon	No	Yes	1
Accident-Based Planning Categories	Site Configuration	ABPC	<site_code>_PC	Vector - Polygon	No	Yes	1
Igloos (point)	Site Configuration	IGLOO_P	IGLOO_P	Vector - Point	Yes	Yes	1
Emergency Planning Zones	E/MIS	ZONE	<site_code>_EZ	Vector - Polygon	No	Yes	1
Chemical Limited Area	E/MIS	ZONE	<site_code>_DEP	Vector - Polygon	No	No	1
Traffic Control Points	FEMIS App	TCP	TCP	Vector - Point	Yes	Yes	1
User Defined Points	FEMIS App	KNOWN_P	KNOWN_P	Vector - Point	Yes	Yes	1
Met Towers	FEMIS App	METTOWER	METTOWER	Vector - Point	Yes	Yes	1
Sirens	FEMIS App	SIREN	SIREN	Vector - Point	Yes	Yes	1
Administrative Boundaries	IEM	ADMINBND	<site_code>_AB	Vector - Polygon	No	No	1
Detailed Roads	IEM	ROADALL	<county_code>_RA	Vector - Line	No	No	1 per county
Major Roads	IEM	ROADMAJ	<site_code>_RM	Vector - Line	No	No	1
Railroads	IEM	RAILROAD	<site_code>_RR	Vector - Line	No	No	1
Streams, Water Bodies	IEM	STREAM	<site_code>_ST	Vector - Line	No	No	1
Elevation Contours	IEM	CONTOUR	<site_code>C <interval(m)>	Vector - Line	No	No	1 or more
Image Maps	IEM	IMAGES	<site_code><scale><tile>	Image	No	No	1 or more per scale

(a) "Yes" contains entries in the GEO OBJECT table to link spatial and relational data.

(b) D2PC, Threat Area, and Evacuation model themes are temporary themes that are created in and removed from the GIS as required.

3. Model-related spatial datasets are created by the hazard and evacuation models for each model case that is run. These themes are created and stored on the user's PC. Data on these model-related themes are also stored in the relational database to facilitate access by other users. These themes are generated entirely by the FEMIS software under the user's control and are thus not initially loaded.

The following sections briefly discuss typical data sources and import processing for each of the FEMIS spatial themes that must be initially loaded. Management of spatial data, after it has been initially loaded, is the responsibility of the site.

3.3.1.1 Facilities

Facility locations and attributes from FEMIS v1.4.7.2 are copied to the v1.5 RDBMS using SQL scripts during the v1.5 installation. As with all FEMIS dynamic themes, the facility ArcView shapefile will be generated when the FEMIS GIS is initially launched from FEMIS. The FEMIS application may be used to add, delete, or edit the Facilities theme, which automatically updates the shapefile and RDBMS.

3.3.1.2 D2PC Plume Themes

D2PC Plume (Dosage and Concentration) themes and plume-based wedge themes are dynamic model-related themes generated within FEMIS. They are based on output from the D2PC model. D2PC cases may be imported from IBS or EMIS, or they may be created by running D2PC from within FEMIS.

3.3.1.3 Evacuation Themes

Evacuation themes (centroids, links, and nodes) are dynamic model-related themes generated in support of the Evacuation SIMulation (ESIM), part of the Oak Ridge Evacuation Modeling System (OREMS) model within FEMIS. A set of evacuation theme files should be set up for each case on every PC that will be used for evacuation modeling. Evacuation cases may be imported from IBS or OREMS, or they may be created from within FEMIS.

3.3.1.4 Census Blocks

The Census Block theme contains 1997 Census TIGER/Line census block boundaries and attributes are stored in the form of an ArcView shapefile.

3.3.1.5 County Boundaries

The County Boundary theme contains 1997 Census TIGER/Line census block boundaries and attributes are stored in the form of an ArcView shapefile.

In FEMIS v1.4.6, general hazard functionality was added, allowing non-CSEPP based general hazard “zones”. For most of the CSEPP sites, the county boundary layer was used as this general hazard “zone” layer. If the County Boundary theme was used as a general hazard layer, the v1.5 GIS should update this theme’s attributes to match the RDBMS records, as specified in Section 3.0, FEMIS GIS Migration and Configuration in the *Installation Guide for FEMIS Version 1.5*.

3.3.1.6 Accident-Based Planning Categories

For planning purposes, each CSEPP site determines the geographic boundaries of several categories of potential accidents. The categories represent different levels of impact severity and are typically represented geographically by concentric circles of differing radii centered on the site’s Chemical Limited Area (CLA). Given the number of categories and the center and radius of each category’s circle, the theme is generated by running an ArcView GIS/Avenue script using the appropriate input parameters for each circle.

3.3.1.7 Igloos

Igloo locations and attributes from FEMIS v1.4.7.2 are copied to the v1.5 RDBMS using SQL scripts during the v1.5 installation. As with all FEMIS dynamic themes, the igloo ArcView shapefile will be generated when the FEMIS GIS is initially launched from FEMIS. The FEMIS application may be used to add, delete, or edit the Igloo theme, which automatically updates the shapefile and RDBMS. This file can be directly loaded as a point theme into ArcView GIS.

3.3.1.8 Emergency Planning Zones

The Emergency Planning Zones boundary theme contains the CSEPP Emergency Planning Zone boundaries for your site are stored in the form of an ArcView shapefile.

3.3.1.9 Depot Zones (Chemical Limited Area)

At a minimum, the Depot Zones theme will contain the CLA boundary. For some CSEPP sites, the Depot Zones theme may also contain other onpost zones, sub-zones, or other designated non-overlapping areas within the depot boundary. The CLA and any other onpost zone boundary data to be included are obtained from EMIS text files, imported into an ARC/INFO coverage, and then converted to shapefiles which can be directly loaded into ArcView GIS.

3.3.1.10 Traffic Control Points

Existing Traffic Control Point Locations and attributes from FEMIS v1.4.7.2 are copied to the v1.5 RDBMS using SQL scripts during the v1.5 installation. As with all FEMIS dynamic themes, the traffic control point ArcView shapefile will be generated when the FEMIS GIS is initially launched from FEMIS. The FEMIS application may be used to add, delete, or edit the Traffic Control Point theme, which automatically updates the shapefile and RDBMS. This file can be directly loaded as a point theme into ArcView GIS.

3.3.1.11 User Defined Points

User Defined Point locations normally are not initially loaded into a FEMIS database unless the site desires specific point information that does not fit the data type of any of the other predefined FEMIS point themes. Existing User Defined locations and attributes from FEMIS v1.4.7.2 are copied to the v1.5 RDBMS using SQL scripts during the v1.5 installation. As with all FEMIS dynamic themes, the user defined ArcView shapefile will be generated when the FEMIS GIS is initially launched from FEMIS. The FEMIS application may be used to add, delete, or edit the User Defined theme, which automatically updates the shapefile and RDBMS. This file can be directly loaded as a point theme into ArcView GIS.

3.3.1.12 Met Towers

Existing Met tower locations and attributes from FEMIS v1.4.7.2 are copied to the v1.5 RDBMS using SQL scripts during the v1.5 installation. As with all FEMIS dynamic themes, the Met tower ArcView shapefile will be generated when the FEMIS GIS is initially launched from FEMIS. The FEMIS application may be used to add, delete, or edit the Met Tower theme, which automatically updates the shapefile and RDBMS. This file can be directly loaded as a point theme into ArcView GIS.

3.3.1.13 Sirens

Existing siren locations and attributes from FEMIS v1.4.7.2 are copied to the v1.5 RDBMS using SQL scripts during the v1.5 installation. As with all FEMIS dynamic themes, the siren ArcView shapefile will be generated when the FEMIS GIS is initially launched from FEMIS. The FEMIS application may be used to add, delete, or edit the Siren theme, which automatically updates the shapefile and RDBMS. This file can be directly loaded as a point theme into ArcView GIS.

3.3.1.14 Administrative Boundaries

Data on Administrative Boundaries (e.g., national forests, state parks, Native American reservations) are provided by 1997 Census TIGER/Line data in the form of an ArcView shapefile.

3.3.1.15 Road Themes (Detailed, Major)

The detailed and major Roads themes are provided by 1997 Census TIGER/Line data in the form of an ArcView shapefiles.

3.3.1.16 Railroads

The Railroads theme is provided by 1997 Census TIGER/Line data in the form of an ArcView shapefile.

3.3.1.17 Streams and Water Bodies

The Streams and Water Bodies themes are provided by 1997 Census TIGER/Line data in the form of an ArcView shapefile.

3.3.1.18 Elevation Contours

The Elevation Contour theme was generated from USGS 3-arc-second digital elevation model (DEM) data and stored in the form of an ArcView shapefile.

3.3.1.19 Image Maps

Background Image Maps of the area surrounding the hazard site were obtained from USGS maps or other sources. Some of these image files have been added to the spatial database or updated by one or more IEM FEMIS GIS upgrades. Images at up to five different scales (1:24,000, 1:100,000, 1:250,000, 1:500,000, and 1:1 million) are incorporated into the FEMIS spatial database.

3.3.1.20 Other Themes

Other spatial data themes may be incorporated into a site-specific spatial database as required by the site. These themes may include (but are not limited to) interstate highways, interstate exits, populated places, place name boundaries, emergency route alerts, fire district boundaries, daytime population centroids, and nighttime population centroids. The procedures used to prepare and import these datasets into ArcView GIS vary depending upon the source and format of the original data.

3.3.2 TIGER/Line Data

The TIGER/Line files, available on a CD, contain coordinates of points, lines, and polygons that represent physical features (e.g., roads, streams and water bodies, landmarks) and non-physical boundaries (e.g., states and counties, 1990 census tracts and blocks, state parks). The files also contain attribute information (e.g., feature name, feature type, census unit identifier) associated with each point, line, and polygon feature. The attribute information can be used by the ARC/INFO GIS software to select individual features by name or to select a group of features by feature type (e.g., interstate highways). The TIGER/Line files also contain topological information (left and right area identifiers for a line segment) that allows ARC/INFO to construct polygons and to link the polygon areas to their associated arcs, label points, and area attributes. TIGER/Line files do not contain statistical census demographic data.

Each TIGER/Line dataset represents one county in a given state and may contain up to 12 different record (file) types. Some of the record types are optional, and thus not all county datasets have all 12 files. The format and content of these 12 file types are documented in the *Technical Documentation for TIGER/Line Census Files, 1990* (US Department of Commerce, Bureau of the Census, Washington, D.C., 1991).

ARC/INFO provides two commands that can be used to convert TIGER/Line data to ARC coverages and associated INFO attribute files. The TIGERARC command performs the basic conversion of point, line, and attribute data and completes the conversion rather quickly (usually 3 to 5 minutes). The TIGERTOOL command performs a comprehensive conversion using a macro supplied with ARC/INFO, versions 6.0 and higher. TIGERTOOL runs TIGERARC and also builds the line and polygon coverages, relates those coverages to the Info files that contain the various attributes associated with the geographic objects, and checks for and reports detectable errors or inconsistencies in the data. TIGERTOOL takes approximately 15 to 20 minutes to complete for a typical county dataset.

The syntax for the TIGERTOOL command for use within FEMIS is as follows:

```
TIGERTOOL <tiger_line_file_prefix> <out_cover_prefix> VTD
```

Each TIGER/Line county dataset contains a set of files with names that are identical except for the last character in the filename. The second item in the command line, <tiger_line_file_prefix>, should be set to this common part of the filename. The last character appended to the common filename indicates the file type. The 12 file types are described via an example dataset in the following paragraphs. Similarly, <out_cover_prefix> is the filename prefix to be used to identify the output coverages to be created by TIGERTOOL. The VTD option instructs TIGERTOOL to extract and store the Voting Tabulation District boundaries.

The set of TIGER/Line files for Gilliam County, Oregon (State FIPS Code 41, County FIPS Code 021) is given below as an example.

Note: The filenames contain a common prefix (tgr41021.f4) followed by a single character denoting the file type.

```
tgr41021.f41 - Type 1: Basic data records  
tgr41021.f42 - Type 2: Shape coordinate points  
tgr41021.f43 - Type 3: Additional census geographic area codes  
tgr41021.f44 - Type 4: Index to alternate feature names  
tgr41021.f45 - Type 5: Feature name list  
tgr41021.f47 - Type 7: Landmark features  
tgr41021.f48 - Type 8: Area landmarks  
tgr41021.f4a - Type A: Additional polygon geographic area codes  
tgr41021.f4i - Type I: Area boundaries  
tgr41021.f4p - Type P: Polygon locations (internal points)  
tgr41021.f4r - Type R: Record number ranges
```

There was no Type 6 data file (additional address range and zip code information) available for Gilliam County. Because the TIGERTOOL user documentation suggests that Type 4, 5, and 6 files should not be converted if the information in them is not needed, these files can be renamed so TIGERTOOL will not find them under the input file prefix tgr41021.f4.

TIGERTOOL creates three output coverages:

1. <outcover_prefix>1 – contains arc (line) coordinates and polygon topology extracted from the basic data records (Type 1) and the shape coordinate points (Type 2)
2. <outcover_prefix>2 – point coverage containing polygon label points from Type P records
3. <outcover_prefix>3 – point coverage containing point landmark features from Type 7 records.

In addition, TIGERTOOL creates a collection of ARC/INFO attribute files that contain the attributes of points, lines, and polygons contained in the three GIS coverages. TIGERTOOL also builds a set of “relates” (relational joins) to link these Info attribute files to the arc attribute table (AAT) and point/polygon attribute table (PAT) files of the coverages. These “relate” definitions are named and stored in a file named <outcover_prefix>.rel and can be activated in ARC/INFO by using the `RELATE RESTORE <file_name>` command. Items (columns) in the related attribute files can then be accessed in ARC/INFO commands as though they were an item in the PAT or AAT file by using the syntax <relate_name>///<item_name>. The attribute files created by TIGERTOOL and their associated relate names are listed below.

1. <outcover_prefix>1.acode – arc attributes from Type 1 records. Relate name: `ACODE`.
2. <outcover_prefix>1.type3 – additional census geographic area codes, including voter tabulation districts, from Type 3 records. Relate name: `TYPE3`.
3. <outcover_prefix>1.pcode – polygon (area) attributes from Type 1 records. Relate name: `PCODE`.
4. <outcover_prefix>2.typea – additional polygon geographic area codes, including congressional districts, from Type A records. Type A files also have reserved placeholders for possible future storage of school district boundaries, traffic analysis zones, and urbanized area codes. Relate name: `ACODE`.
5. <outcover_prefix>2.xcode – polygon label points from Type P records. Relate name: `XCODE`.
6. <outcover_prefix>2.typei – area boundary identifiers from Type I records (contains both Type 1 record numbers and Type P polygon identifiers). Links Type 1 line segment records to the corresponding Type P polygon records (left and right). Relate name: `TYPE1`.
7. <outcover_prefix>3.xcode – attributes of point and area landmark features and longitude/latitude coordinates of point landmarks from Type 7 records. Relate name: `TYPE7`.
8. <outcover_prefix>3.type8 – polygon identifiers for area landmarks from Type 8 records. Relate name: `TYPE8`.

These ARC/INFO attribute files and the predefined relates allow users of Arcplot (ARC/INFO map display subsystem) to select and display a specific theme (e.g, all hydrographic features) or a subset of features (e.g., primary and secondary divided highways) by relating the coverage to the Census Feature Class Code (CFCC) attribute and selecting CFCC values that correspond to the desired feature types. Individual features (e.g., Interstate Highway 84) can be selected by feature name. Polygons of a specific type (e.g., census blocks boundaries) can be displayed by selecting all the line segments for which the left area identifier (e.g., census block identifier) differs from the right area identifier. Once the user has selected a group of similar features, these features can be extracted into an ARC/INFO coverage and then exported to an ArcView GIS theme for use within FEMIS.