

8.0 FEMIS GIS Database

The FEMIS spatial data resides on the UNIX server and on each PC that is running FEMIS. The master copy of the spatial database resides on the server and contains the static GIS themes; the unloaded FEMIS ArcView GIS project file (`FEMISGIS.APR`); an ArcView project file containing several GIS utilities (`FEMISGIS_UTILITIES.APR`); small, medium, and large versions of the GIS initialization file (`FGIS_SM.INI`, `FGIS_MD.INI`, `FGIS_LG.INI`); two map symbol files (`MARKERDF.AVP` and `OBJ_TYPE.LUT`); and several bitmap (`.BMP`) files that provide images for special-purpose buttons on the custom ArcView GIS interface.

When FEMIS is first installed on each PC, the spatial database files for the relevant CSEPP hazard site are copied from the server to the GIS root directory (usually `\FEMIS\GIS\<SITE CODE>`) and associated subdirectories on the PC. During subsequent FEMIS version upgrades, selected spatial data files may be copied to a PC as necessary to apply changes or additions to the spatial data.

The following paragraphs discuss the components of the spatial database and the methods used to maintain, configure, customize, backup, and troubleshoot the spatial database.

8.1 Spatial Data Description

The FEMIS spatial database is made up of a number of themes or layers. Each theme contains data (location information and descriptive attributes) representing a collection of geographic objects of a particular type (e.g., roads, political boundaries, meteorological towers, and emergency planning zones).

The spatial database also contains a customized ArcView GIS project file, an initialization file that tells ArcView GIS what themes are to be loaded into the project file and how to display them, and an optional legend file associated with each theme that provides additional information on how to display the theme's data on the map. For detailed descriptions of the individual FEMIS spatial data themes, see Section 3.3, Building Spatial Data, in the *Data Management Guide for FEMIS Version 1.5*.

8.2 Spatial Data Maintenance

The static spatial data themes are built from various data sources. These themes normally change infrequently, and such changes are made either by regenerating the entire theme from new or updated data sources or by making minor editing changes in the existing theme data. For detailed information on how to maintain or upgrade the static data themes, see Section 5.0, Managing Spatial Data, in the *Data Management Guide for FEMIS Version 1.5*.

As FEMIS is being run, the data in the relational database that corresponds to the dynamic spatial data themes (e.g., facilities) may be altered by users that have the appropriate FEMIS privileges. As necessary during its operation, FEMIS automatically regenerates the spatial data files for these

dynamic themes on each PC based on the current data in the relational database. No additional action by your System or Database Administrator is necessary to maintain these themes under normal circumstances.

8.3 GIS Utilities

The GIS Utilities are a set of utilities for System Administrators to use to update GIS information.

The GIS Utilities will load the GIS static and dynamic themes in the View when opened. To make sure that the latest dynamic themes information is updated, log into FEMIS, and open the GIS. After the dynamic themes have loaded, close the GIS, and leave FEMIS open.

Be sure FEMIS is still open before starting the GIS Utilities. You will be prompted to login to your EOC's database.

8.3.1 Loading the GIS Utilities

A copy of the GIS Utilities ArcView Project file (`FEMISGIS_UTILITIES.APR`) is stored in the `/home/femis/gis` directory on your server. To get a local copy of the GIS Utilities on your PC, perform the following:

1. Map the `I:\` drive on the PC to the server's `/home/femis` directory. Connect to the drive as the user `femis`.
2. Open FEMIS v1.5.
3. Log in as a user with full GIS privileges.
4. Select `Operations Mode`. Click `OK`.
5. Open the GIS. Wait for the themes to fully load.
6. Close the GIS. Leave FEMIS open.
7. Open the GIS Utilities on the PC by double clicking on the `I:\GIS\FEMISGIS_UTILITIES.APR` file using Windows Explorer.
8. Verify the themes have finished loading, and then save the file as `FEMISGIS_UTILITIES.APR` in your local GIS directory. Replace the file if it exists.
9. Click `OK` at the prompt that the `FEMISGIS_UTILITIES.APR` has successfully loaded with themes.
10. Select the `Local EOC Code` at the database login window, and click `OK`.

11. Login at the ODBC Login prompt with the Database user name (<Application Schema>a) and password. Click OK.

8.3.2 Opening the GIS Utilities

If the GIS Utilities have not been loaded on this PC, load and save the GIS Utilities by performing the steps in Section 8.3.1, Loading the GIS Utilities.

1. Open FEMIS v1.5.
2. Log in as a user with full GIS privileges.
3. Select `Operations Mode`. Click OK. **Do not open the GIS.** If the GIS opens, close it.
4. Open the local copy of the GIS Utilities on the PC by double clicking on the `FEMISGIS_UTILITIES.APR` file in the local GIS directory using Windows Explorer.
5. Select the `Local EOC Code` at the database login window, and click OK.
6. Login at the ODBC Login prompt with the Database user name (<Application Schema>a) and password. Click OK.

8.4 Zone Editor

The FEMIS Zone Editor allows the user to update the CSEPP Emergency Zones theme or any hazard map layer (GIS zone theme). Zone editing functionality exists in the GIS Utilities and assists the experienced System Administrator to modify the EOC's Emergency Zones themes. The zone themes are not dynamic themes and should not be modified frequently.

The term GIS Zone theme is used to describe any polygonal GIS theme that is defined in the relational database as a `Hazard Zone Map Layer`, i.e., a theme that contains the boundaries of areas used to define emergency planning zones for one or more specific potential hazards. Such themes include the CSEPP emergency zones theme and can also include a county boundaries theme, a township boundaries theme, or any other polygonal theme. Changes can only be made to a GIS Zone theme at the EOC where it is owned (e.g., a site's CSEPP Emergency Zones theme is owned by the depot.)

The process for updating a GIS Zone theme consists of three major steps:

1. On a FEMIS PC, use the Zone Editor functions in the GIS Utilities to make changes to the GIS Zone theme boundaries and/or attributes, save the edited theme files, and create a set of text files that capture these changes (see Section 8.4.1, Editing the Zone Theme).

2. On the EOC's UNIX server, run a script that reads the text files created by the GIS Zone Editor and applies the changes to the FEMIS Oracle database (see Section 8.4.2, Updating the FEMIS Database).
3. Distribute the updated GIS Zone theme files to all FEMIS PCs at the site (see Section 8.4.3, Distributing the New GIS Zone File).

Note: Additions or deletions of zones or changes to the boundaries of existing zones could make existing Risk Areas invalid. It may be desirable to identify existing Risk Areas that include changed zones, delete these Risk Areas from the database, and then re-create and save new Risk Areas as needed after the zone changes are in place.

8.4.1 Editing the Zone Theme

To edit zone themes, complete the following steps.

Step 1: Open the GIS Utilities

If the GIS Utilities have not been loaded on this PC, load and save the GIS Utilities by performing the steps in Section 8.3.1, Loading the GIS Utilities. Open the GIS Utilities by performing the steps in Section 8.3.2, Opening the GIS Utilities. Ensure you have GIS Full Access privileges. Log in to FEMIS. Do not open the FEMIS GIS while performing the Zone Editing operations, as there may be problems with file sharing.

Step 2: Start Zone Editing

To start the zone editing process, select *Zone Editor* → *Start Zone Editing* from the GIS menu. An editable copy of the Zone theme named *NEWZONES.SHP* will open in the GIS View. If an EOC has more than one GIS Zone theme, you will be prompted to select the theme to edit before the *NEWZONES.SHP* file opens. If the *NEWZONES.SHP* file exists from a previous session, it will be opened in the View. If you do not wish to use the *NEWZONES.SHP* theme from a previous Zone Editing session, close the GIS Utilities, delete the *NEWZONES.SHP* files, and reopen the GIS Utilities.

All edits will be made to the *NEWZONES.SHP* theme to preserve the original GIS Zone theme until the Zone Editing process is complete.

Step 3: Edit the NewZones.shp Theme

You will be prompted to make the *NEWZONES.SHP* theme editable by activating the theme, then selecting *Theme* → *Start Editing*. Edit the *NEWZONES.SHP* theme's spatial features and attributes using standard ArcView GIS editing functionality. See the FEMIS Help topic GIS - Edit Polygon for additional instructions on ArcView theme editing. Zone Editing sessions may be stopped and restarted at a later time.

Step 4: Change Zone Attributes

The `Change Zone Attributes` option lets the user modify the zone name and type for all selected zones. You may repeat the operation several times, if needed. The name and ID changes are immediate. If you make an error, you can repeat the operation with the correct information. If necessary, you can delete the `NEWZONES.SHP` file and begin again.

Select one or more Zones for which you wish to modify the name and/or type, and select `Change Zone Attributes` from the `Zone Editor` menu. All new Zones must have attributes added.

Step 5: Stop Zone Editing

When you are done editing the `NEWZONES.SHP` theme, select `Stop Zone Editing` from the `Zone Editor` menu. You will be prompted to end the editing session on the `NEWZONES.SHP` theme by activating the theme, then select `Theme → Stop Editing`.

This option ends the editing session and creates the input files needed to promote the changes to the database as described in Section 8.4.2, `Updating the FEMIS Database`. The files created are `ZONENAMECHANGES.TXT`, `ZONETYPECHANGES.TXT`, `LAYERDEF.TXT`, and `FACWITHZONECHANGES.TXT`. These files will be written in the GIS home directory (specified as the `GISTopDirPC` in the `FEMIS.INI` file). The option creates the files by comparing the old and new zone shape files and writing the changes to the files.

Before performing any comparisons, this option checks whether the zone IDs and names are unique. If not, the user will be notified and no comparisons will be performed. The user will need to return to Steps 2 or 3 to make zone names and IDs unique.

The format of the `ZONETYPECHANGES.TXT` is as follows:

```
|ID|old_type|new_type|class_id|subclass_id
```

There will be one record in the `ZONETYPECHANGES.TXT` file for each renamed or added zone.

Renamed zones will have all fields. The `old_type` may be the same as the new type if there was only a zone name change.

New zones have a null `old_type` and the appropriate zone type in the `new_type` field.

The format of the `ZONENAMECHANGES.TXT` is as follows:

```
|ID|old_name|new_name|zone_type|class_id|subclass_id|zone_num|eoc_name|
```

There will be one record in the ZONENAMECHANGES.TXT file for each deleted, renamed, or added zone. Except as noted below, none of the fields should contain null values.

- Deleted zones will appear as the first records in the ZONENAMECHANGES.TXT file. For deleted zones, the new_name is null. The deleted IDs will not be listed in the Type file.
- Renamed zones records will follow the deleted zone information in the text file. For name changes, the record lists the zone ID, the old zone name, new zone name, and zone type.
- New zones will list the zone number, a null old_name, and the EOC name with primary responsibility for the zone.

The format of the FACWITHZONECHANGES.TXT file is as follows:

```
|facility_name|eoc_name|old__zone_name|new_zone_name|
```

The file contains a record for every facility that has been affected by the zone changes.

- If a facility used to be inside a zone's boundary but now falls outside all zone boundaries, then the new_zone_name will be set to null.
- If a facility used to be outside all zone boundaries but is now within a zone, then the old_zone_name will be null.
- If a zone boundary change changes the zone in which a facility is located, then all fields will contain data.

The format of the LAYERDEF.TXT is as follows:

```
|layer_name|eoc_code|exercise_num|
```

The number of changed records and the list of changes are also reported to the user in an interactive message.

Step 6: <<Optional>> Generate Facility Data for Exercises

Exercise data may be retained by creating Facility-In-Zone reports for each Exercise. Otherwise, the Exercises will have to be deleted and recreated to reflect the Zone Edit updates.

Note: Make sure that your facility theme data is current by closing the GIS Utilities, opening the GIS from FEMIS, and switching to each Exercise before creating the Facility-In-Zone reports. The facility data will automatically update the themes with the most current data from the FEMIS database as the themes regenerate. Repeat for each Exercise that you wish to update with the new zone edit changes, and then reopen the GIS Utilities.

For each Exercise, change modes to an Exercise, and select `Zone Editor` → `Facility Report` for Exercise Data. A Facility-In-Zone report will be generated with the Exercise number included in the filename (e.g., `FacWithZoneChanges0.txt`). Repeat for each Exercise that you wish to update with the new zone edit changes.

Step 7: Examine the Text Files and Make Corrections Where Necessary

It is essential that the `.TXT` files are correct to avoid corrupting the Oracle database. Review the files using a text editor to make sure the following conditions are met.

Ensure that each file ends with a carriage return.

Null values are not allowed in the first field (ID) in any of these files. The other parameters must be compatible with the format of the fields in the database. For example, for zone name changes, the `old_name` and `new_name` must be 30 characters or less and must begin with an alpha character.

For the `ZONETYPECHANGES.TXT` file, nulls are only allowed for the following condition. All other nulls should be replaced with the appropriate information.

- `old_type` is null for new zones.

For the `ZONENAMECHANGES.TXT` file, nulls are only allowed for the following conditions. All other nulls should be replaced with the appropriate information.

- `old_zone_name` is null for new zone records.
- `new_zone_name` is null for deleted zones.
- `zone_type` may be null for deleted zones.
- `Class_id` and `Subclass_id` may be null for renamed zones and deleted zones.
- `eoc_name` may be null for renamed or deleted zones. Ensure it is the `eoc_name` rather than the `eoc_code`.

For the `FACWITHZONECHANGES.TXT` file, ensure there are no null fields and that the `eoc_name` field contains the `eoc_name` rather than the `eoc_code`. (In certain cases, the GIS cannot determine the `eoc_name`, so inserts the `eoc_code` instead.) Use the editor to replace the `eoc_code` with the `eoc_name`.

8.4.2 Updating the FEMIS Database

When the GIS zone editing has been completed, follow the steps below on the UNIX server to update the FEMIS database. The steps assume the user is familiar with text editing and updating the Oracle database and using SQL scripts. If you intend to save several of the exercises in the database, special considerations apply. In general, always follow the steps below to update the operational data first. After this is successful, then the steps can be rerun for each exercise.

1. Ensure the `/home/femis/database/zonedt` directory exists. If zone editing has been done before, the directory will exist; you may want to rename or move the existing `*.txt` and `*.sql` files to preserve the previously edited files. If this directory does not exist, create it.
2. Move the four output files created in Section 8.4.1 Editing the Zone Theme, from the PC to the UNIX server into the `/home/femis/database/zonedt` directory. Copy the `zone_edit_db.sh` file from the `/home/femis/database/dba` directory to the `/home/femis/database/zonedt` directory. After copying the file, verify that the file contains “execute” privileges. Change the file privileges if necessary.
3. Execute the UNIX shell script named `zone_edit_db.sh`. The script will check on environment variables and for the presence of the `eoclist.dat` and `eocnum.dat` files in the `/home/femis/etc` directory.

If all conditions are met, the script will read the four `*.txt` input files and produce one output file, which contains the actual SQL script to modify the database. The output file is named `zone_edit_change.sql`. Review this file to ensure all changes have been included by comparing it to the `*.txt` files.

4. Verify that you know all of the Oracle EOC database passwords, and reset them to the default values if required. See Section 12.2.2, Modifications to the Manage Database Passwords Tool, for instructions.
5. Test the database changes by running the output script using the SQL*Plus tool. The script will ask the user to enter `o` the first time it is run or if there are any errors. You should enter `o` at each prompt to make sure the entire set of database changes are correct.

To do this step, login to UNIX as `femis`, move to the `zonedt` directory, start `sqlplus`, and run the script as follows:

```
% su - femis
% cd /home/femis/database/zonedt
% sqlplus /nologin
SQL> @zone_edit_change.sql
SQL> {a series of outputs will be displayed, look for any errors}
SQL> exit
>
```

6. Repeat the process when Step 5 runs without errors, but this time enter 1 at the prompts to commit the changes to the database.
7. Reset the Oracle database passwords to their more secure values, if they were modified in Step 4, Change Zone Attributes. See Section 12.2.2, Modifications to the Manage Database Passwords Tool, for instructions.

8.4.3 Distributing the New Zone File

To complete the zone editing process, complete the following steps:

1. Rename or delete the original zone theme shape files (e.g., `<0sitecode>_ez.{shp,shx,dbf}`).
2. Rename the `NewZones.{shp,shx,dbf}` shape files to the corresponding names of the original zone theme shape files.
3. Copy the new shape files to the GIS directory of all the PCs in all EOCs, replacing the original shape files. The `FUPDATE` utility, described in Section 15.2, `FUPDATE.BAT`, may be used.

The zone shape files on the master copy of the spatial database, which resides on the server, must be replaced so future FEMIS installations will use the updated zone theme files.

8.5 General Hazard Theme (GIS Zone Theme) Definition

Adding a new GIS Zone theme for use in general hazards modifies an existing polygonal theme to have the required properties of a GIS Zone theme so the polygons can be added as “emergency zones” in the database.

You will use the GIS Utilities (`FEMISGIS_UTILITES.APR`) to add a new General Hazard theme. No privileges are needed to access Add New General Hazard Theme, but you must have file write privileges to overwrite the theme files.

Note: If the polygonal theme does not exist in the GIS, it must be added via the GIS Configuration Editor.

8.5.1 Adding a New General Hazard Theme

To add a new general hazard theme, complete the following:

1. Select a polygonal theme by clicking on the theme legend in the GIS Utilities. The theme shows that it is selected when the legend appears to be raised.

Note: Inspect the polygonal theme to verify that it is not already in General Hazard/GIS Zone Theme format. This can be done by selecting the theme and clicking the `Open Theme Table` button (grid/spreadsheet symbol).

Look for the following sequence of attributes (column names) in the theme table:
`Shape, Zone_id, Zone, Type, Par_pad, Risk_area, Objectname, Objecttype, Objectid, and EOC_name`. If all of these attributes are present, then the theme is in the proper format to be used as a General Hazard/GIS Zone theme, and you do not need to complete the remaining steps in this section.

2. Open the GIS Utilities (`FEMISGIS_UTILITES.APR`) and select `General Hazard` → `Add New General Hazard Theme`. You will be asked if you wish to continue with the selected theme. Click `Yes` to continue.
3. Select a unique name field. FEMIS requires that all zones of the same polygonal theme have unique names. If you are unsure, click the `Cancel` button, find a field that you wish to use as the name field, make sure all of the names are unique, and start again. If some of the names are not unique, select another field or use ArcView theme editing capabilities to rename the polygons.
4. Enter a `Type` for each polygon. The theme will have one or more `Types`.

For example, if a county theme is being used, the type may be `WA` for all the counties in Washington and `OR` for all the counties in Oregon. Each type can have a unique GIS symbol.

5. Enter the EOC that administers the polygon from the drop-down list. Each polygon will have an EOC that makes protective action decisions for the polygon to indicate what protective actions it will perform in case of an event.

For example, a county could be administered by its own county's EOC, a neighboring county's EOC, or by the state EOC. A township could be administered by the county that it resides in, or by the state EOC.

You will be prompted to repeat Steps 4 and 5 for each polygon.

When you are done, you will need to create the General Hazard Database Reports.

8.5.2 General Hazard Database Reports

Creating General Hazard Database Reports creates the report files needed to add a theme's polygons as emergency zones in the database.

You will use the GIS Utilities (`FEMISGIS_UTILITES.APR`) to create the General Hazard Database Reports.

Note: A theme must be in General Hazard format. To create a theme in General Hazard format, see Section 8.5.1, Adding a New General Hazard Theme.

Four text files will be generated for the FEMIS database processing:

```
hazard_parameters.txt  
hazard_subtype.txt  
hazard.txt  
facwithzonechanges.txt
```

To create the General Hazard Database Reports:

1. Open the GIS Utilities. Select the polygonal theme in General Hazard format by clicking on the theme legend in the GIS Utilities. The theme shows that it is selected when the legend appears to be raised. You must select only one polygonal theme at a time.
2. Select `General Hazard` → `Create General Hazard Database Reports`. You will be prompted to continue or quit. Click `yes` to continue.

General Hazard Theme Parameters Report (`hazard_parameters.txt`). This report contains information on the theme and the owner of the layer. Much of the information will be pre-populated based on the system's best guess. Edit the fields as desired.

GIS Layer Name:	A short name describing the theme. This name must be a unique GIS layer name in the FEMIS database.
GIS Legend Name:	Text description visible in the GIS legend.
GIS Layer Description:	Long description of the theme and its contents.
Hazard Zone Flag:	Must be <code>Y</code> . Not editable.
Location Type:	Object type (category) of spatial data. Must match the Object Lookup Category column in the <code>FEMISGIS.INI</code> file for this theme.
EOC Name:	Official EOC Name of the EOC that owns and created the theme. Not editable.

General Hazard Theme Subtype Report. This report contains information on the zone `Types` and prompts the user for a detailed description of the zone `Types`.

Zone Description:	Long description for each type.
--------------------------	---------------------------------

8.5.3 Modifying General Hazard Theme Display Attributes

Once a theme has been modified to be a GIS Zone Theme, the theme must be set up to display correctly.

If the new GIS Zone theme did not previously exist in FEMIS, it must be added to the `FEMISGIS.INI` file and the `OBJ_TYPE.LUT` file. If it is an existing theme, then the existing entries in the `FEMISGIS.INI` file and `OBJ_TYPE.LUT` file should be modified. Both of these modifications can be done from the GIS Configuration Editor.

1. Close the GIS Utilities.
2. Open FEMIS.
3. Log in as a user with full GIS privileges.
4. Open the GIS.
5. Open the GIS Configuration Editor.
6. Click the `Add` button for a new theme or `Details` for an existing theme on the GIS Configuration Editor window.

Theme Tab

Theme Name:	This will be the theme name FEMIS reads and must match the database entry (<code>GIS_Layer_Name</code>) for this theme.
Legend Name:	This will be the theme name the user sees.
Theme Type:	Select <code>Polygon</code> .
FEMIS Access:	Select <code>Yes</code> .
Object Category:	This must be the Location Type as defined in the General Hazard Theme Parameters Report. Examine the <code>hazard_parameters.txt</code> file if necessary.
Classification:	<code>Objecttype</code> .
Label Field:	<code>Objectname</code> .
Default Legend:	<code>Classified</code> .
Relative Path:	This is the path relative to the FEMIS GIS directory of where the new GIS Zone theme will be located when it is installed on all PCs.
Load Theme:	<code>Yes</code> .

Click the `Map Select` button to select a default line and polygon fill pattern.

Legend Symbol Tab

For each GIS Zone Type defined in the General Hazard Theme Subtype Report, enter the GIS Zone Type and define a polygon line and fill pattern by pressing the `Map Select` button.

Click `OK` to close the GIS Configuration Editor Details window. The changes will be saved to the Symbol Lookup file (`/lookup/obj_type.lut`).

8.5.4 Distributing the New GIS FEMISGIS.INI and Symbol Lookup Changes

In order for all users to use the new GIS Zone Theme, the modifications to the FEMISGIS.INI file and the Symbol Lookup Table (/lookup/obj_type.lut) must be updated on the server and distributed to the users.

The new/modified line in the FEMISGIS.INI file should be saved to all versions of the FEMISGIS.INI file on the server. The updates can be made with a text editor. The files are

```
/home/femis/gis/<site code>_apr/fgis_lg.ini  
/home/femis/gis/<site code>_apr/fgis_md.ini  
/home/femis/gis/<site code>_apr/fgis_sm.ini
```

The modified Symbol Lookup table can be updated on the server by replacing the server's obj_type.lut file with the modified file on the local PC. The file can be found at

```
/home/femis/gis/<site code>/lookup/obj_type.lut
```

To distribute the new GIS zone theme, follow the steps in Section 8.4.3, Distributing the New Zone File.

8.6 GIS Configuration

When you install FEMIS using the full GIS installation option, the complete GIS directory structure and all data files referenced by the selected FEMISGIS.INI file (see the following paragraph) are copied from the server to the \FEMIS\GIS\<SITE CODE> directory and associated subdirectories on your PC. This may take several minutes, depending on the volume of data to be copied for your site and the speed of the network.

You will be given an option to choose from among several versions of the FEMISGIS.INI file. The FEMISGIS.INI file specifies primarily the spatial themes that are to be installed and used to build the operational ArcView GIS APR file for use with FEMIS. For most CSEPP sites, the three choices available are small, medium, and large.

A small or minimum FEMISGIS.INI file installs only the theme files that are essential for running FEMIS (e.g., zone boundaries, igloos, and facilities) or to provide a minimum map background for location reference (e.g., state and county boundaries, major roads, and populated place names). The medium size FEMISGIS.INI file includes most of the themes but does not include large image files and other large nonessential themes (e.g., contour lines and streams). A large, or maximum, FEMISGIS.INI file installs all of the currently available GIS themes for the site.

To have the most complete GIS, choose the largest `FEMISGIS.INI` option that will comfortably fit within the available memory space on your hard drive. However, additional themes may negatively impact the speed of GIS response. The setup program will provide information on the space required to install each option and the amount of space available on your hard drive. To create a custom GIS configuration that is different from any of the three optional predefined configurations (`FEMISGIS.INI` files), you will need to copy the largest `FEMISGIS.INI` file to your PC and then edit it according to the instructions in Section 8.7, Customizing the FEMIS Map.

Upon completion of the GIS data installation, the `\FEMIS\GIS` directory will contain the `FEMPTY.APR` and one or more `<SITE CODE>` subdirectories. Each `\FEMIS\GIS<SITE CODE>` directory will contain a number of subdirectories, each subdirectory containing the data files for one or more specific themes. The main `\FEMIS\GIS<SITE CODE>` directory will also contain the `FEMISGIS.APR` and `FEMISGIS.INI` files. A special subdirectory, `\FEMIS\GIS<SITE CODE>\LOOKUP`, contains several bitmap (`.BMP`) files that provide images for special-purpose buttons on the custom ArcView GIS window, and two symbol files (`MARKERDF.AVP` and `OBJ_TYPE.LUT`) that include information used to generate the theme classification legends. These legends are used to display different map symbols or icons based on the value of a designated attribute within a GIS theme. For example, facilities can be assigned symbols based on the facility type, such as schools or hospitals. The following section discusses methods you can use to modify symbols in the default symbol lookup table, add new symbols to this table, and change the assignment of symbols to classes of attributes (e.g., facility types) in the FEMIS spatial themes.

8.6.1 Symbol Lookup Table

The symbol lookup table is located in the `<GIS INSTALL DRIVE>\FEMIS\GIS<SITE CODE>\LOOKUP` directory under the file name `OBJ_TYPE.LUT`. The lookup table specifies the symbols to be used to create the theme legends.

Each line consists of seven entries separated by vertical bars as delimiters. Lines that begin with a single quote are comment lines and will be ignored by FEMIS. Blank lines are also ignored.

The first five fields are numbers corresponding to a symbol type, color, size, background color, and outline color. These numbers reference symbol attributes from within the active symbol palettes in ArcView GIS. The fourth and fifth fields are only used in polygonal themes. The sixth entry specifies the theme type or object category, and the last entry specifies the theme subtype or classification label. The symbol type and color numbers designate the order in which the symbols are listed in the FEMIS GIS palette window using 0 for the first element. The symbol size is measured in points (1/72 of an inch). In polygonal themes, the “size” number is used to set the outline width. If the classification label is missing, it should be set to `none`.

An example of the lookup table is listed below. From the facility entries, we can see that school facilities are represented with the 89th symbol, colored with the 46th color, and measure 12/72 of an inch. To customize the lookup table, use the GIS Configuration Editor (see Section 8.7.3) or edit the file using a text editor.

'Symbol 'number	Foreground color	Symbol size	Background Color	Outline Color	Object Category	Classification Label
6	16	2	0	14	zone	Depot
7	16	2	0	14	zone	IRZ
9	16	2	0	14	zone	PAZ
8	1	2	0	4	county	OR
8	1	2	0	44	county	WA
0	8	2			road	Primary
0	8	1			road	Secondary
1	7	1			road	Local
.						
.						
26	46	10			tcp	Access
26	51	10			tcp	Traffic
26	50	10			tcp	Traffic/Access
26	51	10			tcp	#NULL#
.						
.						
125	51	10			facility	airport
89	46	12			facility	school
96	46	14			facility	shelter
.						
.						
.						

8.6.2 Symbol Defaults

The `MARKERDF.AVP` file contains the symbols loaded in the default FEMIS symbol palette. You may change these symbols using the generic ArcView GIS palette window functionality. You may use any of the other symbols provided by ArcView GIS in the `C:\ESRI\AV_GIS30\ARCVIEW\SYMBOLS` directory. You may also import symbols from ARC/INFO or icons in raster format. If you delete or change the sequence of the existing symbols, then some of the FEMIS GIS “look and feel” will change. For example, if you change the 42nd symbol from a cross hair (⊕) to an asterisk (*), then the object (e.g., facility) locations in the FEMIS GIS will be depicted with an asterisk instead of the familiar cross hair. You may add new symbols at the end of the palette and use the symbol lookup table (Section 8.6.1, Symbol Lookup Table) to refer to the new symbols.

8.7 Customizing the FEMIS Map

You can customize the content and appearance of the FEMIS map by editing the original `FEMISGIS.INI` file or any of the alternate `INI` files to create a custom `FEMISGIS.INI` file that can then be used to create a custom `APR`. The GIS Configuration Editor, described in Section 8.7.3, can help you edit the `FEMISGIS.INI` file and the lookup table. You can add new themes; delete existing

themes; change the minimum or maximum scale display thresholds; modify the type, color, and size of line or point map features; change the legend names; designate the label (and if applicable, classification fields); specify the default classification fields; designate an alternative directory (and if needed, an alternate drive) for the data source of non-point themes; and control which themes are visible by default when the GIS is first started. A detailed description of the fields in the `FEMISGIS.INI` file is in Section 8.7.1, Customizing the FEMISGIS.INI File. You can also import your own symbols from other ArcView GIS, ARC/INFO, or raster icons by changing the symbol lookup table and the FEMIS default palette as described in Section 8.6.1, Symbol Lookup Table.

If you customize your FEMIS map, please keep track of the changes to ensure they can be retained during future FEMIS or GIS upgrades.

8.7.1 Customizing the FEMISGIS.INI File

The `FEMISGIS.INI` file contains data required to initialize GIS parameters that generate the `FEMISGIS.APR` and to ensure proper GIS contents each time the FEMIS GIS is invoked by the FEMIS application. The contents of the `FEMISGIS.INI` file are discussed below.

The `FEMISGIS.INI` file is automatically updated anytime you define a new dynamic theme or modify an existing one. If you have an abnormal termination of the FEMIS or the GIS, the dynamic themes section of the `FEMISGIS.INI` file may be corrupted. To restore the file, you can delete all of the theme entries below the facilities theme. These entries are for the user-defined themes, and they will be regenerated the next time you start FEMIS.

Blank lines are ignored in the `FEMISGIS.INI`. Lines with a single quote in the first column are recognized as comment lines and are ignored. Vertical bars (|) delimit the data fields in the `FEMISGIS.INI`. No data value should contain a vertical bar. String values do not need to be quoted.

The `[FEMIS_VERSION]` section specifies the FEMIS version for which this `.INI` file can be used. The next line specifies the size of the themes in the current `.INI` file. Valid size values are small, medium, or large.

The `[SITE_CODE]` section specifies the CSEPP site code that the GIS data describes. This parameter should be identical to the corresponding site code in the `FEMIS.INI` file; otherwise the GIS will not work.

The `[DEFAULT_HAZARD_THEME]` specifies the theme that is to be used as the “zone” theme for the default hazard (normally CSEPP). Zone themes within FEMIS are used to create Risk Areas and Protective Action Decisions. Each hazard that is defined in FEMIS has a zone theme specified for use with that hazard.

The `[PROJECTION_PARAMETERS]` section specifies the UTM (Universal Transverse Mercator) projection and coordinate system parameters required for the site. The parameters shown in the example are for UTM Zone 16 (appropriate for the Anniston, Alabama site).

The `[AREA_OF_INTEREST]` section specifies a geographic area of interest. The area of interest for FEMIS has been set as a rectangle that starts at the origin (lower left corner) of -126.00 degrees longitude, 23.00 degrees latitude, spans 58 degrees longitude (first size parameter), and 27 degrees latitude (second size parameter). This covers the continental United States. The area of interest is specified to minimize the consequences of ill-defined data points. In certain circumstances, the user is given the opportunity to define the longitude and latitude where an event has occurred. The FEMIS GIS does not allow the specification of plumes or threat wedges that originate outside the area of interest.

The theme description sections specify the configuration for the themes to be loaded in the FEMIS GIS. The two sections are `[STATIC_THEMES]` and `[DYNAMIC_THEMES]`. Dynamic themes are those themes that can be completely regenerated from information in the FEMIS Oracle database. Parameters for each theme are discussed below. The same information is included as comments in the `FEMISGIS.INI` file itself. It has been omitted from the following example to conserve space.

- `Theme Name` – Indicates the theme (layer) name in the GIS and in the FEMIS database if the theme is FEMIS accessible.
- `FEMIS Accessible` – For feature themes, this column contains `Yes` or `No` to indicate whether the theme is referenced by the `GIS_LAYER` database table and can thus be accessed directly by the FEMIS software. If this column contains `Yes`, the `Theme Name` column in this line should contain the same name as the corresponding `GIS_Layer_Name` in the FEMIS Oracle database. For image themes, this column contains the name of an image catalog to be created, or `None`. If the name of an image catalog is listed, the image catalog must be defined in another theme description line in this `.INI` file.
- `Type` – The `Type` column must contain one of the following valid types: `Image`, `ImgCat`, `point`, `line`, or `polygon`.
- `Load Flag` – This column indicates whether to load the theme (`Yes`) or not to load the theme (`No`).
- `Visible Flag` – Indicates the visibility of the theme when forming the `.APR`.
- `Display Order` – Indicates the order in which themes will appear in the GIS Table of Contents. The theme indicated by the smallest `Display Order` number will appear at the top of the table of contents and will be loaded last (on top of all the other themes). The display order number may be negative.
- `Label Field` – Indicates the field name to be used as the default labeling field.
- `Object Lookup Category` – Indicates the FEMIS theme category. The value must be one of the types listed in the `\...\LOOKUP\OBJ_TYPE.LUT` file. Currently, valid values are `zone`, `county`, `igloo`, `facility`, `tcp`, `road`, and `siren`. If the value is `None`, indicating that a classification

legend will not be displayed for the theme, then the classification field should also be set to `None` and the default legend field should be set to `simple`.

- `Default Legend` – Indicates whether a simple or classified legend is used. Valid values are `simple`, `none`, and `classify`. `Simple` indicates a simple legend that uses one symbol to depict all the theme data. For image themes `none` is used, for which a classify legend does not apply.
- `Classification Field` – Indicates the field to be used to classify the legend. If the classified legend file does not exist, it will be created.
- `Min Scale` – Indicates the minimum scale denominator (`1 : Min Scale`) at which a theme will be displayed.
- `Max Scale` – Indicates the maximum scale denominator (`1 : Max Scale`) at which a theme will be displayed.
- `Legend Name` – Indicates the name to be used in the theme's legend in the Table of Contents.
- `Customize Flag` – For dynamic themes, `Yes` indicates the current symbol parameters listed in later columns of this record should always be used and should not be overwritten when this dynamic theme is updated. `No` indicates the symbol parameters in this record should be overwritten with values from the FEMIS Oracle database when this dynamic theme is updated. The `Customize Flag` does not apply to static themes, so the field should contain `N/A` for static themes.
- `Symbol` – Indicates the numeric palette index for the symbol (point icon, line type, or polygon fill pattern) to be used in the theme's simple legend.
- `Color` – Indicates the numeric palette index for the foreground color of the theme's symbol.
- `Size` – Indicates the symbol size. For linear and polygonal themes, this is the line width.
- `Back Color` – Indicates the background color for polygonal fill symbols.
- `Outline Color` – Indicates the outline color of polygonal fill symbols.
- `Path` – Indicates the relative path of the file for the theme. The relative path is appended to the GIS home directory (root path) as specified in the `FEMIS.INI` file by the keyword `FemisGISTopDirPC`.
- `Alternate Prefix` – Indicates that the theme files for this theme are located relative to a different GIS home directory than the one specified in the `FEMIS.INI` file. The script that loads the themes appends the relative path to this prefix to locate and read an alternate source directory. This parameter can be used to access data located somewhere other than the default

GIS home directory on your PC hard drive (e.g., on a CD-ROM). Any auxiliary files that FEMIS needs to create (e.g. the theme legend files) will be written using the default GIS home prefix.

8.7.2 Altering the Default FEMIS Map

To alter the default appearance of the FEMIS map, use the `Use at Startup` option for FEMIS GIS ViewMarks (see the FEMIS Help). For more extensive or permanent changes, complete the following steps:

1. Make a backup copy of the original `\FEMIS\GIS\<SITE CODE>\FEMISGIS.INI` file to a different directory or to a different file name in the same directory (e.g., `FGISORIG.INI`) so you can retrieve it and use it later, if necessary. Do the same with the original `.APR` (e.g., copy it to `FGISORIG.APR`). Use the GIS Configuration Editor (Section 8.7.3) or manually edit the `.INI` file:
 - a) Themes defined by lines in the `[STATIC_THEMES]` or `[DYNAMIC_THEMES]` sections can be excluded from loading into the ArcView Project. The preferred method of excluding themes is to change the `Load Flag` column from `YES` to `NO`. Alternatively, you can comment out the line by inserting a single quote as the first character of the line; or, you can simply remove the line.
 - b) You can add lines to the `[STATIC_THEMES]` section to define new themes.
 - c) You can modify appropriate parameters of existing themes as desired.
2. Run ArcView GIS using the empty project file, `\FEMIS\GIS\FEMPTY.APR`, by double clicking on the file name in the Windows Explorer. When the ArcView Project (`.APR`) has finished loading, it will contain the FEMIS static themes indicated in the `FEMISGIS.INI` files. The ArcView Project will be saved to the `FEMISGIS.APR` file in the GIS home directory. Later, when the FEMIS application loads the `FEMISGIS.APR`, any changes made to the configuration of the dynamic themes will also be depicted.
3. Examine the theme legends to see that the correct set of static themes are loaded and the correct ones are visible. The dynamic themes will not appear in the legend at this time. These themes are loaded when FEMIS activates the `FEMISGIS.APR`. Then examine each theme to see that it displays correctly (check the checkbox in the legend to make visible the themes that are invisible by default). For themes that have both a simple and a classified legend, toggle the legend between both legend types using the `Toggle active theme legends` button on the GIS tool bar. If some themes are not displayed correctly, recheck the `.INI` file. If necessary, exit ArcView GIS, edit the `.INI` file to make corrections, and then repeat Steps 2 and 3.
4. Exit ArcView GIS. The `FEMISGIS.INI` and `FEMISGIS.APR` files you just created will be used each time the GIS is started.

8.7.3 GIS Configuration Editor

The GIS Configuration Editor is a stand-alone program that provides an easy to use interface for modifying the `FEMISGIS.INI` and `OBJ_TYPE.LUT` files.

Note: Make a backup copy of the `FEMISGIS.INI` and `OBJ_TYPE.LUT` files so that you can recover from an unsatisfactory editing session.

The `[SITE_CODE]`, `[DEFAULT_HAZARD_THEME]`, `[PROJECTION_PARAMETERS]`, and `[AREA_OF_INTEREST]` sections of the `FEMISGIS.INI` file can be modified on the main window. The `[STATIC_THEMES]` and `[DYNAMIC_THEMES]` sections are displayed in a spreadsheet on the main window. Lines with a single quotation mark in the first column are recognized as comment lines and are ignored.

To modify an individual spreadsheet entry, select the row and click the `Details` button or double-click on the row. The GIS will be started and a `Details` window will be displayed for that row. All the fields are described in Section 8.7.1, *Customizing the FEMISGIS.INI File*. The symbol parameters for shape, color, and size can be entered using the text boxes or by clicking the `Map` button and selecting a symbol and color from the palette. The GIS can be used to preview the symbols and determine the appropriate symbol parameters.

If the `Map` button is pressed, the GIS will be brought to the foreground with the ArcView GIS palette active.

Use the ArcView GIS palette to modify the color, shape or fill pattern, and size of the drawn symbol. When satisfied with the symbol appearance, click the `Pyramid` button (*Return the Selected Symbol*). The appropriate numbers for the symbol's color, shape or fill pattern, and size will be returned to the `Details` window. The size is measured in 1/72 of an inch. For lines, it designates width. For polygons, the size is used for the width of the outline.

The `Legend Symbol` tab is used to add, edit, or delete entries from the `OBJ_TYPE.LUT` file. The symbol parameters for shape, color, and size can be entered by using the text boxes or by clicking the `Map` button. The GIS can be used to preview the symbols and determine the appropriate symbol parameters.

If dynamic themes or the `OBJ_TYPE.LUT` file have been modified and saved, close the GIS, and restart to implement the changes. For static themes, once the changes have been saved to the `FEMISGIS.INI` file, follow the instructions found in Section 8.7.2, *Altering the Default FEMIS Map*, to alter the default FEMIS map.

8.7.4 Theme Projection Utility

FEMIS uses theme data that has been projected in Universal Transverse Mercator (UTM) coordinate system in order to avoid re-projecting geographic coordinates each time the view is refreshed. To

include new themes in FEMIS, they should be converted to UTM. The Theme Projection Utility converts feature themes in geographic coordinates to UTM coordinates for the desired CSEPP site. Image themes, which are required to be in projected coordinates, are skipped by the Theme Projection Utility. Image themes not already in UTM would need to be projected using other software such as ARC/INFO.

When you open `PROJECTION_UTILITY.APR`, ArcView GIS will start, and a window containing two Views will display. View1 (the work area) is on the left side; and View2 (where the results are depicted) is on the right side.

The Theme Projection Utility assumes that the input themes are in geographic coordinates and will let you select and load themes in View1 so they can be exported as projected shape files using the currently specified View1 projection. The projected themes are added to View2.

To use the Theme Projection Utility, complete the following steps:

1. Double-click on the `PROJECTION_UTILITY.APR` (usually located in your `C:\FEMIS\GIS` directory).
2. Click `View` → `Properties` → `Projection`.
3. Select the `Standard` radio button, and `Geographic` will display in the `Type` field.
4. Load the themes you want to project. Click the `+` (`Add Theme`) button.
5. Click the `Export Projected` item under `Utilities`, and click `OK` on the brief information window that displays.
6. Select the desired CSEPP site from the list, and click `OK`.
7. Make any necessary adjustments to the UTM projection parameters for the selected site, and click `OK`.
8. Navigate to the desired directory or accept the default (usually `C:\TEMP`), and click `OK`.
9. Select the themes you want to export from the list of the themes in View1, and click `OK`.

If the name of the theme being converted already exists in the selected directory, a temporary name will be suggested for the converted theme. Click `OK` to accept the temporary theme name.

The conversion process will start and the status bar will indicate the progress of conversion. The new theme(s) will be loaded in View2 so you can visually verify the results. You may want to load some of your other themes, like raster images, to check how well the projected coordinate match the existing themes.

10. Click `Exit` under the `File` menu to close the `PROJECTION_UTILITY.APR` file. Click `No` on the message about saving changes to this file.

8.7.5 Adding Orthophotos

Orthophotos can be added to the FEMIS GIS from the GIS Configuration Editor like any other map theme. However, it should be noted that Orthophotos can be extremely large files, and if a large number of files are used, it is recommended that they be in a compressed image format such as compressed TIFF, JPEG, or MrSid. It is also recommended that multiple contiguous image files of the same scale be put in an image catalog to make viewing easier for the user.

8.8 Backup Procedures

The installation directory for the spatial data on the UNIX server is `/home/femis/gis`. The current operational GIS data is copied from this directory and included subdirectories to the PCs when FEMIS is installed or upgraded. It is recommended that a backup copy (tar tape) of this directory be made each time a new version of FEMIS is received. The tape should be labeled `FEMIS GIS Data` with the date and FEMIS version number included. If the GIS data on the server should become corrupted or deleted, the spatial data can be restored from the backup tar tape without having to perform a reinstallation of FEMIS on the server.

If a site or EOC customization of the spatial data and/or the `.APR` and `.INI` files is to be done, the original GIS data directory should first be copied to another directory (e.g., `/home/femis/data/v<x.y>/gis`, where `<x.y>` is the FEMIS version number associated with the released data. A second tar tape of the GIS directory should be made following the completion of the GIS customization.