DOCUMENTATION FOR THE FRAMES-HWIR TECHNOLOGY SOFTWARE SYSTEM, VOLUME 4: SITE DEFINITION PROCESSOR

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Summary

The U.S. Environmental Protection Agency (EPA) is developing a comprehensive environmental exposure and risk analysis software system for agency-wide application. The software system will be applied to the technical assessment of exposures and risks relevant to the Hazardous Waste Identification Rule (HWIR). The software system adapted to automate this assessment is the Framework for Risk Analysis in Multimedia Environmental Systems (FRAMES), developed by the Pacific Northwest National Laboratory. The process used to develop the FRAMES-HWIR Technology Software System includes steps for requirements analysis, design, specification, and development with testing and quality assurance composing a critical portion of each step. This report documents that process for one of the key components of the system: the Site Definition Processor (SDP).

The general purpose of the SDP is to gather data from the Site Variable Distribution Table, Regional Variable Distribution Table, and National Variable Distribution Table in a logical and organized manner and transfer that data to the appropriate site simulation file (SSF). After the SDP has generated the SSF, subsequent processors of the FRAMES-HWIR Technology Software System can access it to simulate the source release, fate and transport, exposure, and potential risk impact from a site. The following is a description of the process used for transferring data and populating the SSFs.

The SDP will

1) Access the specified database and tables to obtain the site layout data (which describes the layout of the physical waste units, environmental setting, and receptor distributions)
2) Populate the site-layout SSFs with all the data necessary to conduct the HWIR multimedia multipathway exposure and risk assessment
3) Populate the SSFs using a hierarchical scheme to access the database tables
4) Require the SSFs to contain data groups that may include, but are not limited to
   - header
   - site layout
   - source data
   - air data
   - vadose zone data
   - aquifer data
   - watershed data
   - waterbody network data
   - farm, terrestrial, and aquatic foodchain data
   - human and ecological receptor/exposure data
   - human and ecological risk data
   - chemical properties data.
5) Report any processor-specific warnings or errors to the system user interface
6) Conduct boundary condition and Site Layout Data Group verification checks on the input databases
7) Allow and account for the cross-correlation between variables. The SDP invokes statistical sampling routines to derive values for uncertain variables.

Acronyms and Abbreviations

AF	Aquatic Foodweb
AL	Longitudinal Dispersivity
AQ	Saturated Zone
AR	Air
ASCII	American Standard Code for Information Interchange
AT	Aerated Tank
Bdens	Bulk Density
CDF	Cumulative Distribution Function
COP	Computational Optimization Processor
CPP	Chemical Properties Processor
C_w	Waste Level Concentration
DIC	Dictionary File
DLL	dynamic link library
DP II	Data Processor II
DSP	Distribution Statistics Processor
EE	Ecological Exposure
ELP I	Exit Level Processor I
ELP II	Exit Level Processor II
EPA	U.S. Environmental Protection Agency
ER	Ecological Risk
FF	Farm Foodchain
FRAMES	Framework for Risk Analysis in Multimedia Environmental Systems
GRF	Global Results Files
HE	Human Exposure
HR	Human Risk
HWIR	Hazardous Waste Identification Rule
LAU	Land Application Unit
LF	landfill
MET	meteorological
MMSP	Multimedia Multipathway Simulation Processor
OCRWM	Office of Civilian Radioactive Waste Management
OPPI	Office of Policy, Planning and Information
OSW	Office of Solid Waste
PNNL	Pacific Northwest National Laboratory
Por	Porosity
PSOF	Protective Summary Output File

RCRA	Resource Conservation and Recovery Act
RSOF	Risk Summary Output File
SDP	Site Definition Processor
SHight	Source Height
SI	Surface Impoundment
SL	Site Layout
SSF	Site Simulation Files
Stat DLL	Statistical Dynamic Link Library
SUI	System User Interface
SW	Surface Water
TF	Terrestrial Foodweb
VZ	Vadose Zone
WMU	Waste Management Unit
WP	Waste Pile
WS	Watershed

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1.0 Introduction

The U.S. Environmental Protection Agency (EPA) is developing a comprehensive environmental exposure and risk analysis software system for agency-wide application. The software system will be applied to the technical assessment of exposures and risks relevant to the Hazardous Waste Identification Rule (HWIR). The HWIR is designed to determine quantitative criteria for allowing a specific class of industrial waste streams to no longer require disposal as a hazardous waste (that is, allow such streams to "exit" Resource Conservation and Recovery Act [RCRA] Subtitle C) and to allow disposal in RCRA Subtitle D facilities as industrial waste. Hazardous waste constituents with concentrations less than these exit criteria levels would be reclassified as nonhazardous wastes under RCRA.

The software system adapted to automate this assessment is the Framework for Risk Analysis in Multimedia Environmental Systems (FRAMES), developed by the Pacific Northwest National Laboratory (PNNL). The FRAMES-HWIR Technology Software System consists of a series of components within a system framework (Figure 1.1). The process used to develop the FRAMES-HWIR Technology Software System includes steps for requirements analysis, design, specification, and development, with testing and quality assurance composing a critical portion of each step.

This report documents the requirements for one of the major components of the system: the Site Definition Processor (SDP). The purpose of the SDP is to gather data from the Site Variable Distribution Table, Regional Variable Distribution Table, and National Variable Distribution Table in a logical and organized manner and transfer that data to the appropriate site simulation file (SSF). These data are required to simulate the release of contaminants, their transport through the environment, human and ecological exposure, and hazard/risk assessment. Additional data that control the flow of information and account for model error are also included.

This report includes information on requirements of the SDP, design elements to meet those requirements, testing plans and results, and the quality assurance program. References cited in the text are listed in Section 6.0. Appendix A provides additional details on the testing program for the SDP. Other components developed by PNNL are described in companion documents, which are listed in the reference list; the system itself is documented in a summary report entitled *Overview of the FRAMES-HWIR Technology Software System.*

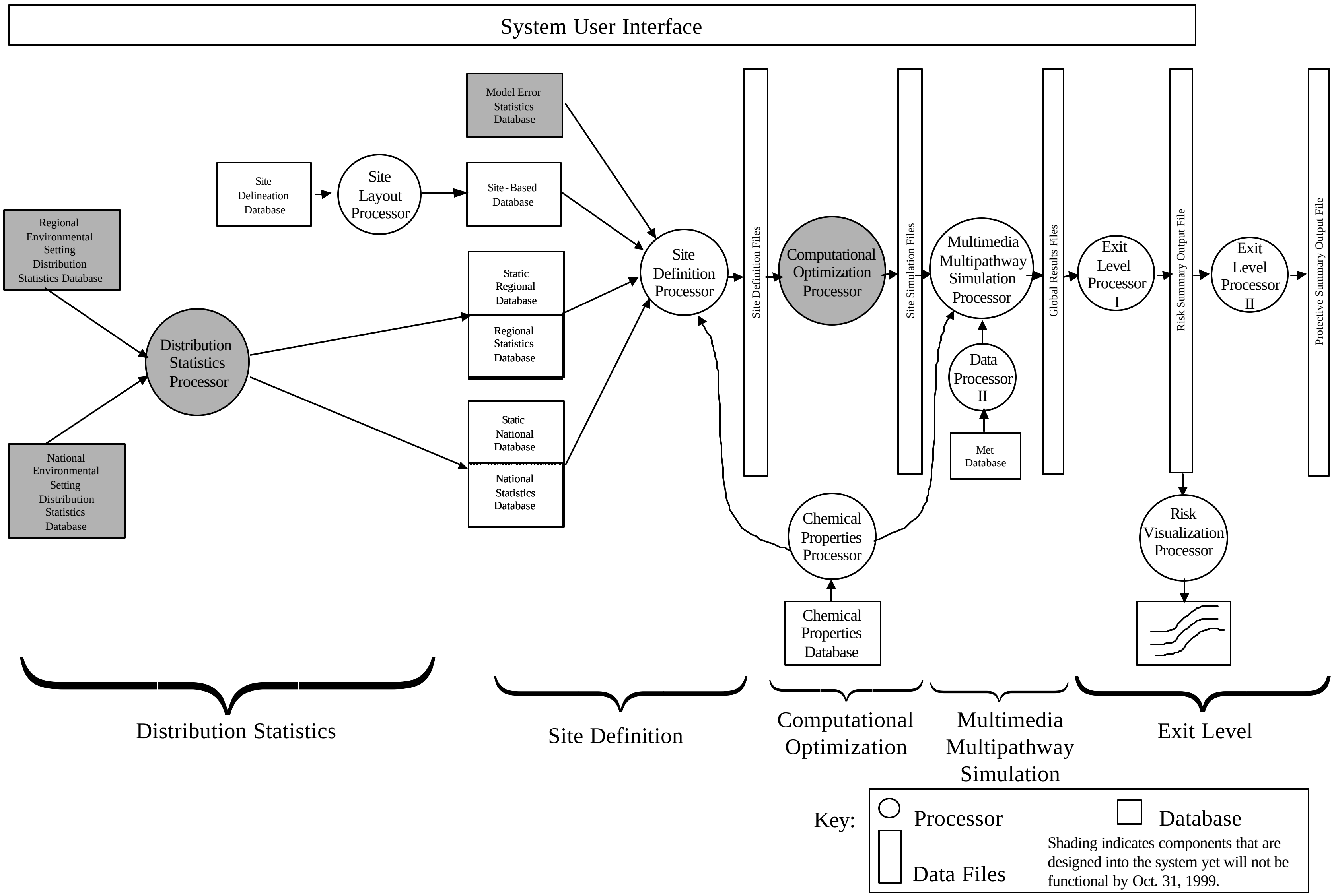

Figure 1.1 Overview of the FRAMES-HWIR Technology Software System

2.0 Requirements

Requirements are characteristics and behaviors that a piece of software must possess to function adequately for its intended purpose. The user begins the site-simulation process by activating the System User Interface (SUI) of the FRAMES-HWIR Technology Software System. The user selects the appropriate sites, chemicals, source types, and concentration of the contaminant in the waste stream (waste levels) in the SUI. The SUI generates a header file that contains all the information specified by the user. The SDP reads in the Header File information to determine the site and scenario to be simulated and creates a complete set of SSFs for the simulation. The SSFs will be flat-ASCII files, as described in the *Documentation for the FRAMES-HWIR Technology Software System, Volume 8: Specifications*, Appendix A. The SSFs are created by extracting information from existing databases or randomly generating data using distribution information and statistical subroutines. The Multimedia Multipathway Simulation Processor (MMSP), which executes the site simulation, will use the generated SSF as input.

The general requirements of the SDP are to generate and populate the SSF with all the data necessary to conduct the HWIR multimedia multipathway exposure and risk assessment. The SSF may include, but not be limited to, the following data groups:

- site layout
- source data
- air data
- vadose zone data
- aquifer data
- watershed data
- waterbody network data
- farm, terrestrial, and aquatic foodchain data
- human and ecological exposure data
- human and ecological risk data
- chemical properties data.

The SDP also accesses databases that represent different levels of data: site, regional, and national. These data are both constant and stochastic data, with cross-correlation data associated with the appropriate variables. The SDP generates the SSF using a hierarchical scheme in which the site data are accessed first for actual site data that are constants, and then the stochastic site data are accessed. Then the regional data are accessed to fill in data not in the site data for constant and then stochastic data, and then the national data are accessed to fill in any remaining missing constant and stochastic data. All data required to assess a site must be in the SSF, and the SDP checks to ensure that the SSF is complete. The SDP will use the Statistical Dynamic Link Library (Stat DLL) to obtain parameter values, based on distribution data, when discrete values are not available in the databases. The SDP conducts boundary condition and Site Layout Data Group verification checks on the input databases (for example, no wind data for subsurface simulations) and accounts for the cross-correlation between variables. The SDP also reports any processor-specific warnings or errors to the SUI. For each Setting ID and iteration, the SDP will compute a unique seed to initialize the Stat DLL before any sampling is done.

2.1 Input Requirements for the Site Definition Processor

The SDP is required to read information from several database types, including site, regional, and national databases, that are generated by EPA. A multiple looping process reads and analyzes the databases. It must be emphasized that many variables need to be matched with the appropriate modules in the correct format and units. These linkages represent the most intricate and complex aspects of the SDP.

The SDP will use these databases to develop the SSF, which supplies information for each simulation conducted by the MMSP. The SDP will generate and populate the SSF using a hierarchical scheme. When a simulation requires a value for a parameter, the value will be obtained by sampling the site data, then the regional data, and then the national data and by using the most site-specific value. For some parameters, discrete parameter values are not available in any of the databases. In these situations, the SDP will use the Stat DLL to obtain parameter values based on distribution information. Standard distributions (for example, normal, log normal, etc.) or user-defined distributions can be entered into the databases. Parameter values that are determined in this way can also be cross-correlated to other parameters via a cross-correlation table located in the databases.

The Site Layout Data Group is part of the overall data that are populated in the SSF. These data are verified for consistency and correctness. These verification checks include boundary-condition and site-layout reality checks on the input databases (that is, no wind data for subsurface simulations). The Site Layout Data Group is also verified to confirm that all the data groups required for the simulation are processed.

2.2 Scientific Requirements for the Site Definition Processor

The SDP has several algorithms that are required to populate the SSFs when data are missing, or correlated variables need to be computed. The missing data algorithms are used for groundwater data where the aquifer saturated hydraulic conductivity (AquSATK), aquifer gradient (AquGRAD), aquifer thickness (AquThick), and vadose zone thickness (VadThick) are correlated variables. If one or more values are empty (value = -999), then an algorithm is applied iteratively to obtain the missing values. Input to these algorithms includes the corresponding data for these parameters found in the cross-correlation table, for the specific groundwater class (setting_id = GWClass). If any of the 4 variables are still missing after 10 iterations of the algorithm, then the maximum value is assigned to that variable. All 4 variables are then written to the Site Layout SSF. A detailed description of the algorithms can be provided by EPA.

2.3 Output Requirements for the Site Definition Processor

Output from the SDP will be SSFs populated with all the required data to conduct a multimedia multipathway exposure and risk assessment for a simulation. The SSFs are either processed by the Computational Optimization Processor (COP) and modified or are not modified by the COP and are used as direct input to the MMSP. The SDP will also create warning and error files, which will be available to the SUI for communication to the user, regarding the status of the simulation (System Status Screen in the SUI). The specifications for the SSFs and the error and warning files are described in the *Documentation for the FRAMES-HWIR Technology Software System, Volume 8: Specifications*, Section 4.0.

3.0 Design Elements

The SDP is designed to meet the requirements identified in Section 2.0. Key to meeting those requirements is the linkage between the various databases associated with the SDP. The following subsections describe the databases, the implementation of the SDP, and the SSF generated by the SDP.

3.1 Databases Providing Input to the Site Definition Processor

There are four general types of databases accessed by the SDP: site-specific, regional, national, and correlated data. These data are located in different databases that are defined by EPA and specified by the user in the SUI. All the data required to develop the site layout and other SSFs are contained in these databases. The following are short descriptions of these data types.

- *Site-Specific Data*. This database contains site-specific data that the EPA Office of Solid Waste collected for HWIR. These data represent discrete values without statistics. When discrete values are not available, distribution information must be provided so that a value can be obtained using the Stat DLL. Inherently built into this data file is site-layout information that reflects a conceptualization of a site, using data specifically collected for the site, to describe the layout of the physical waste units, environmental setting, and receptor locations. This database contains the following information, when and where appropriate:

  - source data, including waste management unit and waste characteristics
  - air data
  - vadose zone data
  - aquifer data
  - watershed data
  - waterbody network data
  - terrestrial, aquatic, and farm foodchain data
  - human receptor and risk data
  - ecological receptor and risk data.

- *Regional Data*. This database provides input to the site-layout data. The inputs may be used to fill gaps in information about the specific site or to build a conceptualized site. The regional data reflect data specifically collected for the region to describe the layout of the physical waste units, environmental settings, and receptor distributions. This database will contain information similar to that outlined in the site-specific database, although its information may not be complete enough to fully implement a site simulation. The regional database contains both constant and stochastic variable information.

- *National Data*. As with the regional statistics database, the national statistics database provides input to the site-layout data to fill gaps in site-specific and conceptual analyses. The national data reflect nationwide descriptions of physical waste units, environmental settings, and receptor distributions. This database contains information similar to that outlined in the site-specific database. Although its information may not be complete enough to fully implement a site simulation, it should be sufficient to fill in all required simulation data not found in the site and regional data. The national database contains both constant and stochastic variable information.

- *Correlated Data*. This database specifies the cross-correlation for variables identified by Setting ID, data group name, and variable name. The SDP expects the correlation data to be populated for the lower half of the cross-correlation matrix only.

3.2 Implementation of the Site Definition Processor

The SDP will access each of the databases, where appropriate, and develop the SSF that contains the data associated with site layout, site, chemical, source type, and waste level. Control information identifying the modules of the MMSP required to assess the release, transport, exposure, and risk/hazard from source to receptor are included in the SSF. Access of the SSF occurs through a multiple looping process specified by the user through the SUI. It must be emphasized that many variables need to be matched with the appropriate modules in the correct format (for example, integer and float) and units. The specific format to which the data must adhere is specified in each data group dictionary file. These linkages represent the intricate and most complex aspects of the SDP.

3.2.1 Database Hierarchical Scheme

The SDP will verify the appropriateness of data by testing the assumptions (or assertions) by the module developers. For example, if a relationship exists between bulk density and total porosity, and that relationship is described in the cross-correlation table, it will be checked by the SDP.

The SDP represents the entry point of the inner loop in the FRAMES-HWIR Technology Software System. The inner loop represents a process (that may be random) of selecting the site. The SDP will eventually operate by selecting (and then holding static) and processing all 200 sites with their full complement of data.

Under the HWIR Assessment Strategy, each defined waste management unit (source type) per site will be assigned, and only the defined site assessment will be implemented. Only the 200-site assessment will be described in this document.

Defined Site Assessment
For each **Site**
  For each **Source Type**
    For each **Chemical**
      For each **Waste Level**, accounting for the possibility that parameters may depend on waste level concentration (C_w)
      — Specify site layout and transfer all information from the Site Variable Distribution Database to SSF.
      — For each variable that has not been defined in the Site Database, transfer all constant variables and stochastic variables (distributions with mean, variance, and range) information, based on the scenario definition (including chemical information for all available chemicals), from the regional statistics database to SSF.

— For each variable that has not been defined in the Site and Regional Database, transfer all constant variables and stochastic variables (distributions with mean, variance, and range) information, based on the scenario definition (including chemical information for all available chemicals), from the national database to SSF.

End loop on **Waste Level**

End loop on **Chemical**

End loop on **Source Type**

End loop on **Site**.

3.2.2 Generating the Random Seed for the Statistical Sampling

The SDP initializes the Stat DLL with a seed before any sampling. To ensure variablility in the sampled values for multiple iterations across settings, the SDP performs the following steps. It first initializes the Stat DLL to the user's seed entered into the SUI. Then the SDP sums the ASCII value (ex: 'A'=65, 1=49) of each character of the Setting ID and calls the Stat DLL to sample a uniformly distributed integer that many times (the sum). The SDP then reinitializes the Stat DLL with the final sampled value. If the iteration of this SDP is greater than 1, the Stat DLL is again called upon to generate a uniformly distributed integer iteration minus one times. The final sampled value is used to reinitialize the seed of the Stat DLL.

3.2.3 Populating the Site Layout SSF

The SDP will generate the Site Layout SSF for the simulations. To select the appropriate hydrogeologic variables, the processor must first get the soil type from the Site Variable Distribution Table. The soil type along with the source type will determine the site-layout variables needed for the SSF. After getting the soil type (VadSoilType), the basic process described above can be run for the Site Variable Distribution Table.

The SDP will then retrieve the groundwater class (GWClass) and hydrogeologic region (HydrologicRegion) back from the Site Layout SSF for use in updating the hydrogeologic properties. An additional value, groundwater class index (GWClassIndex) will be collected from the Regional Variable Distribution Table for that groundwater class (setting_id=GWClass). At this point, four records are expected to be sampled from the Regional Variable Distribution Table: AquSATK, AquGRAD, AquThick, and VadThick.

If one or more values are empty (value = -999), then an algorithm from Hydrogeologic is applied 1 to 10 times to obtain the missing value. Input to this algorithm includes the corresponding data for these parameters found in the cross-correlation table, for the specific groundwater class (setting_id = GWClass). If any of the four variables are still missing, the maximum value is then assigned. All four variables are then written to the Site Layout SSF.

Any variables still missing from the SSF are sent through the basic process described above for the Regional Variable Distribution Table. Then any variables that are still missing are obtained by applying the basic process to the National Variable Distribution Table.

The final modifications to the Site Layout SSF will be to modify variables for consistency and to handle data exceptions. First, the value for the human receptor pH (HumRcpPH) is set equal to the value of the Aquifer pH (AquPH). Second, when the number of selected air points in the waterbody network reach is zero (WBNRchNumAir=0), the waterbody network reach air fraction (WBNRchAirFrac), and waterbody network reach air index (WBNRchAirIndex) should be ignored. Third, when the number of wells in an aquifer is 0 (NumAquWell=0), then all data items related to the well aquifer relationship (AquWell*) should be ignored.

Finally, if the number of aquifers is greater than 1 (NumAqu > 1), then the SDP will sample an aquifer from the available aquifers in the Site Layout SSF and update respective variables into the first aquifer data location. All data relating to the other aquifers will be ignored. Likewise, if the number of vadose zones is greater than 1, then the SDP will sample a vadose zone from the available vadose zones in the Site Layout SSF and update respective variables into the location of the data for the first vadose zone. All data relating to the other vadose zones will be ignored.

3.2.4 Populating the Source SSF

To populate the Source SSF, the SDP must first determine if the source type is an aerated tank. If the source type *is not* an aerated tank, then the waste level inner loop process discussed in Section 3.2.1 will be followed and applied to the site, regional, and national data tables as described above and according to the SI.DIC, WP.DIC, LF.DIC, and LA.DIC dictionary files corresponding to surface impoundment, waste pile, landfill, and land application units (LAUs), respectively.

If the source type *is* an aerated tank, then the maximum source area (MaxSrcArea) and the aerated tank index (ATIndex) are read from the Site Layout SSF. The Site Layout Data Group for this index (index_1=ATIndex) is then gathered from the national table. The tank source area (SrcArea) of the selected data is then compared to the maximum source area (MaxSrcArea). If the tank source area is larger than the maximum source area (SrcArea > MaxSrcArea), then the tank index is resampled. This resampling continues until a tank source area is found that is not larger than the maximum source area. At this point, the data associated with the successful source area is given an index of 0. The source area (SrcArea) in the Site Layout SSF is then set equal to the tank source area. The source local watershed subarea area (SrcLWSSubAreaArea) is also set equal to the source area (SrcArea). The data processed for the aerated tank meets the specifications of the dictionary file AT.DIC as it is for other source types.

Before completing the population of the Source SSF, the liquid or solid C_w is updated based on the source type. The liquid C_w (C_in with units of total contaminant mass per total volume) is obtained from the chemical properties processor (CPP) for aerated tank (AT) or surface impoundment (SI) and the solid C_w (CTPwaste) for waste pile (WP), landfill (LF), and land application unit (LAU). C_w has units of total contaminant mass per dry mass of solids for landfills and waste piles, and total contaminant mass per wet mass of solids for LAUs.

3.2.5 Populating the Vadose Zone SSF

If the number of vadose zones is greater than 0 (NumVad > 0), then the basic process will be followed and applied to the site, regional, and national data tables as described in the waste level inner loop process discussed in Section 3.2.1, to populate the Vadose Zone SSF as directed by the VZ.DIC. However, an additional required parameter must be computed based on database information. The variable vadose zone thickness (VadThick) is read from the Site Layout SSF and used to calculate the dispersivity. Dispersivity is then updated in the Vadose Zone SSF.

Equation for Dispersivity:

$$Dispr = 0.02 + (0.022 \times VadThick)$$

3.2.6 Populating the Aquifer SSF

If the number of aquifers is greater than 0 (NumAqu > 0), then the waste level inner loop process will be followed and applied to the site, regional, and national data tables, as described in Section 3.2.1, to populate the Aquifer SSF according to the AQ.DIC dictionary file. However, before the variables longitudinal dispersivity (AL), porosity (Por), and bulk density (BDens) must be calculated using specific algorithms.

3.2.7 Populating Surface Water SSF

If the number of surface water networks is greater than 0 (NumWBN > 0), then the waste level inner loop process will be followed and applied to the site, regional, and national data tables, as described in Section 3.2.1, to populate the Surface Water SSF according to the SW.DIC dictionary file. However, prior to fully populating the Surface Water SSF, the single value for concentration upstream (c_upstream) is written for index_1=1, 2 and 3.

3.2.8 Populating the Air SSF

If the number of air points is greater than 0 (NumAir > 0), then the waste level inner loop process will be followed and applied to the site, regional, and national data tables, as described in section 3.2.1 above, to populate the Air SSF according to the AR.DIC dictionary file. However, if the source is also a tank, the source height (SHight) must be collected from the National Variable Distribution Table. This variable dimension must be augmented with the aerated tank index (ATIndex) before updating this value in the Air SSF.

3.2.9 Populating the Watershed SSF

If the number of watershed subbasins is greater than 0 (NumWSSub > 0), then the waste level inner loop process will be followed and applied to the site, regional, and national data tables, as described in Section 3.2.1, to populate the Watershed SSF according to the WS.DIC dictionary file.

3.2.10 Populating the Aquatic Food Chain SSF

If the number of waterbody networks is greater than 0 (NumWBN > 0), then the waste level inner loop process will be followed and applied to the site, regional, and national data tables, as described in section 3.2.1 above, to populate the aquatic Foodweb SSF according to the AF.DIC dictionary file.

3.2.11 Populating the Farm SSF

If the number of farms or human receptors is greater than 0 (NumFarm > 0 or NumHumRcp > 0), then the waste level inner loop process will be followed and applied to the site, regional, and national data tables, as described in Section 3.2.1, to populate the Farm Foodchain SSF according to the FF.DIC dictionary file.

3.2.12 Populating the Human Risk and Exposure SSF

If the number of farms or human receptors is greater than 0 (NumFarm > 0 or NumHumRcp > 0), then the waste level inner loop process will be followed and applied to the site, regional, and national data tables, as described in Section 3.2.1, to populate the Human Receptor and Human Exposure SSF according to the HR.DIC and HE.DIC dictionary files.

3.2.13 Populating the Terrestrial Food Chain SSF

If the number of habitat regions is greater than 0 (NumHab > 0), then the waste level inner loop process will be followed and applied to the site, regional, and national data tables, as described in Section 3.2.1, to populate the Terrestrial Foodweb SSF according to the TF.DIC dictionary file.

3.2.14 Populating the Ecological Risk and Exposure SSF

If the number of habitat regions is greater than 0 (NumHab > 0), then the waste level inner loop process will be followed and applied to the site, regional, and national data tables, as described in Section 3.2.1, to populate the Ecological Risk and Ecological Exposure SSF according to the ER.DIC and EE.DIC dictionary files respectively.

3.3 Output of the Site Definition Processor: Site Simulation Files

An order of priority is assigned to the variables that populate the SSF. The highest priority is given to the site-layout information. The site-layout information identifies the environmental media, and the assessment scenarios determine the data required for a particular analysis. For example, data for a vadose zone should not be required if the site-layout scenario does not call for a vadose zone. The site-layout information will be the first data items checked for completeness.

The SSF will contain all the input variables necessary to implement the MMSP modules. The data are stored in a sequence-independent manner. Sequence independence implies that the information is stored by name and index, rather than by actual location in a file. The data items in the SSF are as follows:

Data Set Name (string)
Variable Name (string)
Indexes (set of integers)
Units (string)
Type (choice of type)
Value (float, integer, string, logical)

For more details on the data and file format of the SSF, refer to the *Documentation for the FRAMES-HWIR Technology Software System, Volume 8: Specifications,* Section 7.2 (see Section 6.0).

The header information, site layout, and source data are the minimal data required in the SSF. A dynamic link library (DLL) for input and output (HWIRIO.DLL) was developed to access the SSF data by data set name, variable name, and indexes. This DLL is available to module developers. A DLL is a set of routines that comes with or can be added to a software system. Each DLL file has a ".DLL" extension. DLL files are dynamically linked with the program that uses them during program execution, instead of being compiled with the main program. For more details on the HWIRIO.DLL and other DLLs, refer to the *Documentation for the FRAMES-HWIR Technology Software System, Volume 8: Specifications*, Section 2.0, and *Documentation for the FRAMES-HWIR Technology Software System, Volume 10: Facilitating Dynamic Link Libraries* (see Section 6.0).

4.0 Testing Approach and Results

The purpose of the SDP is to gather data from the Site Variable Distribution Table, Regional Variable Distribution Table, and National Variable Distribution Table in a logical and organized manner and transfer that data to the appropriate SSFs. The SDP primarily transfers data directly from the databases; however, certain parameter values are determined via statistical sampling or are computed by the SDP based on database entries. The following paragraph describes the process used by the SDP to transfer data to the SSF. Most of the data group SSFs are populated using this basic process; however, several of the data groups contain parameters that need to be addressed specially. The data groups that require special handling will be discussed in specific test cases for data groups.

The SDP uses a two-step process to search a database table for the data necessary to populate a specified data-group SSF. In the first step, the SDP searches the table for all data-group parameters that have the distribution type "constant" and populates the data-group SSF with those values. The SDP uses the data group's dictionary file (*.DIC) to determine the parameters to search for. In the second step, the SDP selects appropriate records from the cross-correlation table, if they exist, samples from those records, and populates the data-group SSF with those values. This two-step process is first applied to the Site Variable Distribution Table. If any parameters are missing, the process is applied to the Regional Variable Distribution Table. And finally, the process is applied to the National Variable Distribution Table to fill in the remaining parameter values. While some of the SSF categories have variable exceptions, this process is generally followed, and exceptions will be called out as the specific SSF population is discussed. Associated with this processor are several subcomponents, including the following items:

- *Chemical Properties Database*. This database supplies information on all chemicals required by the HWIR Assessment Strategy and physical and chemical properties required by the MMSP to the SDP through the CPP.
- *Site Variable Distribution Database*. This database supplies site-specific information, including site-layout data, which reflects the site conceptual model, to the SDP.
- *Regional Statistics Database*. This database, created by the Distribution Statistics Processor (DSP), supplies statistically derived regional data to the SDP. Regional data will be used when site-specific data are not available.
- *Static Regional Database*. This database supplies static regional data to the SDP. Regional data will be used when site-specific data are not available.
- *National Statistics Database*. This database, created by the DSP, supplies statistically derived national data to the SDP. National data will be used when site-specific and regional data are not available.
- *Static National Database*. This database supplies static national data to the SDP. National data will be used when site-specific and regional data are not available.
- HWIRIO.DLL. This input/output DLL is used by the SDP and other system processors to read and write data to the SSF and Global Results Files (GRF).
- Stat DLL. This DLL is used by the SDP to obtain values for parameters that have distribution information (for example, mean, range, variance) instead of discrete values in the various databases.

- SSFs. These files are produced by the SDP and provide input to the MMSP.

The following section describes the type of testing conducted for the SDP, summarizes the requirements on which testing was based, and describes test cases and results of their implementation. Appendix A contains instructions for executing the SDP using the HWIR SUI.

4.1 Type of Testing

Software can be tested at the unit and system levels. Unit testing evaluates individual components in isolation from other components (for example, the SDP in isolation from the FRAMES-HWIR Technology Software System). System testing evaluates the performance of groups of components functioning together, data communication between the components that make up the system (also called integration testing), and the overall performance of the system (for example, testing the functioning of the SDP within the FRAMES-HWIR Technology Software System). This test plan addresses unit testing of the SDP.

4.2 Summary of Requirements

Requirements for the SDP are summarized in Section 2.0 of this document. These requirements were reworded into the list in Table 4.1. They were stated as concise, fundamental requirements that are testable. It should be noted that this test plan addresses the SDP functionality required for an EPA deliverable, and for this reason, some requirements in Section 2.0 will not be addressed in this document.

Table 4.1 Fundamental Requirements for Testing the Site Definition Processor

Requirement Number	Requirement
1	Populate the SSF with data groups that may include header; site layout; landfill; LAU; waste pile; aerated tank; surface impoundment; air; vadose zone; aquifer; watershed; waterbody network; farm, terrestrial, and aquatic foodchain; human and ecological exposure; and human and ecological risk with all the data necessary to conduct the multimedia multipathway exposure and risk assessment.
2	Transfer and populate certain parameters conditionally, depending on the modeling scenario.
3	Access six specified databases: the Chemical Properties, Site Variable Distribution, Regional Statistics, Static Regional, National Statistics, and Static National (see Figure 1.1).
4	Populate the SSF using a hierarchical scheme. When a simulation requires variable data, the actual value will be obtained by sampling the Site Variable Distribution, Regional, and National databases and using the most site-specific values.
5	Use the Stat DLL to obtain parameter values, based on distribution data, when discrete values are not available in the databases.
6	Report any processor-specific warnings or errors to the SUI.
7	Conduct boundary-condition checks on parameters in the input databases.

Requirement Number	Requirement
8	Conduct Site Layout Data Group verification checks on parameters in the input databases (for example, no wind data in vadose zones).
9	Allow and account for the cross-correlation between variables (for example, bulk density and total porosity).
10	Allow the user to enter user-defined distributions for parameters when discrete values are not available in the databases.
11	Be testable, independent of the other FRAMES-HWIR Technology Software System processors.
12	Use the HWIRIO.DLL to write out data to the SSF in the correct flat-ASCII format.

To ensure the SDP meets the requirements listed in Table 4.1, the following test cases were developed to verify the performance of the SDP. Table 4.2 shows the relationship between these requirements and the test cases, which are described below.

Table 4.2 Relationship Between Test Cases and Fundamental Requirements

		Test Case Number													
		01	02	03	04	05	06	07	08	09	10	11	12	13	14
Requirement	1	X													
	2			X	X	X	X	X	X	X	X				
	3	X													
	4	X													
	5		X												
	6											X			
	7											X			
	8													X	
	9														X
	10												X		
	11	X													
	12	X													

4.3 Test Cases and Baseline Testing Results

All tests are to be conducted under Windows® 95, which represents the required operating system for implementing the HWIR Assessment Strategy. Because the SDP requires input from the Header File and also from specified databases, all test cases evaluate the ability of the SDP to obtain input from these sources. The Stat DLL implemented as part of the SDP was coded previously and has undergone independent testing separately from the SDP. Checks will be made to ensure that the SDP makes proper calls to the Stat DLL.

The general procedure for all test cases will be to check the databases for certain parameter values and then check the corresponding SSFs to verify that the database values were transferred correctly. Certain parameters will be transferred conditionally, depending on the modeling scenario. These conditionally populated parameters will be checked in detail. Also, as noted previously, certain parameter values are determined via statistical sampling or are computed by the SDP, based on database entries. These parameters will also be checked.

Data groups that follow the basic procedure exactly and do not require any additional logic to populate their SSFs will be sufficiently examined in the first test case. Data groups that require additional logic will be examined in more detail in separate test cases.

4.3.1 SDP_01

4.3.1.1 Description and Rationale

This test case addresses the basic functionality of the SDP; therefore, several of the requirements are addressed in this case. The requirements addressed are listed below. These requirement numbers are referenced in the expected results and results sections. (Note: the requirement numbers used below do not correspond to the requirement numbers listed in Table 4.1.)

1) The SDP should be able to populate all possible data group SSFs. Also, a random sampling of three parameters in each data group SSF will be checked to ensure that the parameter values are being transferred correctly from the databases. Parameters that require special treatment (that is, statistical or mathematical manipulation or have a distribution type other than “constant”) will not be checked in this test case. Two runs will need to be made to ensure that all five waste management unit (WMU) type SSFs are created.

2) The SDP should access the six specified databases to obtain data. Regional and national statistics databases do not currently exist, and therefore accessing them will not be verified.

3) The SDP should use a hierarchical scheme to obtain data.

4) The SDP should use the HWIRIO.DLL to write out data to the SSFs.

5) The SDP should be testable independent of the other HWIR processors.

4.3.1.2 Input Data

Two sites will be used for testing purposes. The sites and control information are listed in Table 4.3. As shown, all five WMU types are covered.

Table 4.3 Two Sites and Associated Control Information

Site ID	WMU	Chemical	Cw	Seed Value
0223504	WP,LAU,LF	2,3,7,8,TCDD	3	11031
1632106	LAU,SI,AT	benzene	3	11031

The contents of the databases used in this test case are extremely large and thus were not included in this document. Electronic copies can be made available upon request.

4.3.1.3 Expected Results

1) Table 4.4 shows the three parameters for each data group that should be transferred directly to the SSF. All parameters listed below have discrete values in the databases (that is, all of these parameters had a distribution type of "constant"). When the "Site ID" is listed as "National Database" or "Regional Database," this indicates that the parameter values were taken from these tables. This indicates that the values were missing from the site-based table and thus the SDP should search the other tables for the missing data. The presence of these values in the SSF will indicate that the SDP searched the hierarchies correctly.

Table 4.4 Parameters (with Their Units, Type, Indexes, and Value) for Each Data Group Transferred Directly to the SSF

Site ID	Data Group	Parameter	Units	Type	Indexes	Value
National Database	Landfill (LF)	mcW	volume percent	float	0,0,0,0,0,0	50
		deltDiv	unitless	integer	0,0,0,0,0,0	1
		RunID	unitless	string	0,0,0,0,0,0	Run KKMA
National Database	Aerated Tank (AT)	w_imp	rad/s	float	0,0,0,0,0,0	126
		n_imp	unitless	integer	508,0,0,0,0,0	1
		Q_wmu	m3/s	float	231,0,0,0,0,0	0.00077
National Database	Waste Pile (WP)	RunID	unitless	string	0,0,0,0,0,0	Run KKMA
		thetawZ2d	volume fraction	float	0,0,0,0,0,0	0
		CutOffYr	year	integer	0,0,0,0,0,0	30

Site ID	Data Group	Parameter	Units	Type	Indexes	Value
National Database	Land Application Unit (LAU)	zava	m	float	0,0,0,0,0,0	0
		deltDiv	unitless	integer	0,0,0,0,0,0	1
		asdm	mm	float	0,0,0,0,0,0	5
National Database	Surface Impoundment (SI)	EconLife	year	integer	0,0,0,0,0,0	50
		MWt_H2O	g/mol	integer	0,0,0,0,0,0	18
		d_imp	cm	float	0,0,0,0,0,0	61
National Database	Air (AR)	MASSFRAX-Option	unitless	logical	0,0,0,0,0,0	true
		AirSplineAngle	degrees	float	7,0,0,0,0,0	270
		WetDpStr	unitless	string	0,0,0,0,0,0	WETDPLT
AT1632106	Site Layout (SL)	AirLocY	m	float	68,0,0,0,0,0	1200.25
		HabRangeRec-Index	unitless	integer	8,1,0,0,0,0	3
		WBNDOC	mg/L	float	3,0,0,0,0,0	3.7
WP0223504	Vadose Zone (VZ)	POM	g/g	float	0,0,0,0,0,0	3.8
		RHOB	g/cm3	float	0,0,0,0,0,0	1.4575
		Only two parameters are constants.				
national database	Saturated Zone (AQ)	ALATration	m	float	0,0,0,0,0,0	8
		ALAVration	m	float	0,0,0,0,0,0	160
		Only two parameters are constants.				
regional database and WP0223504	Watershed (WS)	a_BF	m/d	float	0,0,0,0,0,0	0.00000311
		b_BF	unitless	float	0,0,0,0,0,0	1.17
		WCS	volume fraction	float	8,0,0,0,0,0	0.45
national database	Surface Water (SW)	rhoDBenthos	g/mL	float	1,0,0,0,0,0	1.1
		TrophicIndex	untiless	integer	0,0,0,0,0,0	3
		v_bury	mm/yr	float	3,0,0,0,0,0	10
national database	Farm Foodchain (FF)	Fw_exveg	untiless	float	0,0,0,0,0,0	0.6
		Rp_silage	unitless	float	0,0,0,0,0,0	0.44

Site ID	Data Group	Parameter	Units	Type	Indexes	Value
		MAFroot	percent	float	0,0,0,0,0,0	87.32
national database	Terrestrial Foodweb (TF)	tp_exfruit	y	float	0,0,0,0,0,0	0.123
		rho_leaf	g/L FW	float	0,0,0,0,0,0	770
		VGag_forage	unitless	float	0,0,0,0,0,0	1
national database	Aquatic Foodweb (AF)	MaxPreyPref	unitless	float	5,5,1,0,0,0	-999
		MusWaterFrac	unitless	float	0,0,0,0,0,0	0.79
		c_fish	unitless	float	0,0,0,0,0,0	0.72
national database	Human Exposure (HE)	Fm_f	fraction	float	0,0,0,0,0,0	0.254
		Rshower	L/min	float	0,0,0,0,0,0	5.5
		fbp	fraction	float	0,0,0,0,0,0	0.65
national database	Ecological Exposure (EE)	MinPreyPref_HabRange	unitless	float	6,17,13,0,0,0	0.13
		NumPrey	unitless	integer	0,0,0,0,0,0	20
		BodyWt_rec	kg	float	5,0,0,0,0,0	3.75
national database	Human Risk (HR)	LifeTime	unitless	float	0,0,0,0,0,0	76.5
		ExDur_NCar_Block	unitless	integer	0,0,0,0,0,0	1
		RegPercentile	unitless	float	0,0,0,0,0,0	90
national database	Ecological Risk (ER)	EcoRegPercentile	unitless	float	0,0,0,0,0,0	95
		NumHabitat	unitless	integer	0,0,0,0,0,0	12
		HabitatIndex	unitless	integer	11,0,0,0,0,0	11

2) It is expected that the SDP will access the four databases that are currently available. The presence of the CPSR.SSF will indicate that the chemical properties database was accessed.

3) It is expected that the above parameters located in the regional and national static databases will be populated in the appropriate SSFs. This will verify that the SDP used the hierarchical scheme to obtain data. Any data not found in the site-based database will be searched for in the regional and then national databases in that order.

4) It is expected that the data will be written to the SSFs, which will indicate that the SDP used the HWIR.DLL.

5) It is expected that the SDP will operate independent of the other HWIR processors. The SUI is being used to create the header file and to fire off the SDP. The header file can alternatively be created by hand, and the SDP can be executed via command-line arguments. The SUI is being used to make the process easier and to ensure that mistakes are not made in creating the header file.

4.3.1.4 Conducting the Test

Bring up the SUI and enter the data listed in the input section for site “0223504.” Instructions for operating the SUI are located in Appendix A. After the data have been entered, click on the ‘Start’ button to execute the SDP. Repeat the process by entering the data for site “1632106.” After the runs are complete, check the SSFs to see if the data were transferred correctly.

4.3.1.5 Results

1) The parameters listed in the previous section were searched for in the SSF. The SSF files are listed by data group. In the interest of conserving paper, only the records for the selected parameters are shown. The parameter values of interest are in bold and shadowed.

Landfill Data Group (LFLF0223504.ssf)

1. "mcW",0,"FLOAT",0,"volume percent",
   50,
2. "deltDiv",0,"INTEGER",0,"unitless",
   1,
3. "RunID",0,"STRING",0,"",
   "**Run KKMA**",

Aerated Tank Data Group (ATAT1632106.ssf)

1. "w_imp",0,"FLOAT",0,"rad/s",
   126,
2. "n_imp",0,"INTEGER",0,"unitless",
   1,
3. "Q_wmu",0,"FLOAT",0,"m3/s",
   0.0007736092098,

Waste Pile Data Group (WPWP0223504.ssf)

1. "RunID",0,"STRING",0,"",
   "**Run KKMA**",
2. "thetawZ2d",0,"FLOAT",0,"volume fraction",
   0,

3. "CutOffYr",0,"INTEGER",0,"year",
30,

Land Application Unit Data Group (LALA1632106.ssf)

1. "zava",0,"FLOAT",0,"m",
0,
2. "deltDiv",0,"INTEGER",0,"unitless",
1,
3. "asdm",0,"FLOAT",0,"mm",
5,

Surface Impoundment Data Group (SISI1632106.ssf)

1. "EconLife",0,"INTEGER",0,"year",
50,
2. "Mwt_H2O",0,"FLOAT",0,"g/mol",
18,
3. "d_imp",0,"FLOAT",0,"cm",
61,

Air Data Group (ArLA1632106.ssf)

1. "MASSFRAXOption",0,"LOGICAL",0,"",
"**T**",
2. "AirSplineAngle",1,"FLOAT",0,"degrees",
8,0,45,90,135,180,225,**270**,315,
3. "WetDpStr",0,"STRING",0,"",
"**WETDPLT**",

Site Layout Data Group (SLAT1632106.ssf)

1. "AirLocY",1,"FLOAT",0,"m",
468,1800.25,1100.25,1700.25,2100.25,1400.25,1800.25,800.25,1400.25,2000.25,
1300.25,-299.75,-899.75,-699.75,100.25,400.25,-99.75,700.25,-
399.75,1100.25,0.25,1000.25,-199.75,-
1199.75,1400.25,700.25,500.25,0.25,500.25,700.25,800.25,-199.75,100.25,-
999.75,500.25,500.25,-1399.75,-1599.75,-1099.75,-1299.75,-399.75,-999.75,-
699.75,-1799.75,-1899.75,-599.75,-1699.75,-1799.75,-1599.75,-2199.75,-
1199.75,-399.75,-1499.75,-1699.75,400.25,0.25,400.25,-
199.75,1200.25,200.25,1600.25,1500.25,1000.25,1300.25,1400.25,1700.25,1800.25,
900.25,**1200.25**,100.25,1800.25,500.25,1300.25,1200.25,1400.25,1200.25,1000.25,1
300.25,1400.25,1100.25,1000.25,1400.25,1700.25,1800.25,1900.25,1700.25,1800.
25,1800.25,-1699.75,-1899.75,-1999.75,-1399.75,-1699.75,-1899.75,-1499.75,-
1899.75,-1499.75,-1599.75,-1499.75,-1599.75,-1099.75,-1599.75,-899.75,-
1799.75,-999.75,-299.75,0.25,-199.75,-1499.75,-799.75,-999.75,-399.75,500.25,-
999.75,-699.75,800.25,300.25,400.25,-799.75,500.25,-999.75,-999.75,-1299.75,-
899.75,500.25,-1599.75,-899.75,-1799.75,700.25,-899.75,-799.75,700.25,-

1099.75,600.25,-199.75,600.25,-1199.75,-1399.75,700.25,-199.75,500.25,-
499.75,-1099.75,-1699.75,-1899.75,-699.75,-1899.75,-899.75,-999.75,-99.75,-
999.75,-99.75,-899.75,-899.75,-699.75,-399.75,800.25,-1099.75,-1699.75,-
1099.75,-999.75,0.25,-
1299.75,1000.25,500.25,600.25,400.25,500.25,700.25,500.25,600.25,900.25,1100.
25,400.25,800.25,500.25,700.25,700.25,900.25,600.25,900.25,900.25,700.25,700.
25,-599.75,-799.75,-1699.75,-599.75,-299.75,-1199.75,200.25,-199.75,-1699.75,-
199.75,-499.75,-199.75,100.25,-299.75,400.25,-899.75,-599.75,-1399.75,0.25,-
299.75,-499.75,-699.75,0.25,-699.75,0.25,-199.75,-199.75,-399.75,-299.75,-
199.75,-499.75,-399.75,-599.75,-599.75,-99.75,-199.75,0.25,-599.75,-99.75,-
499.75,-99.75,0.25,-499.75,0.25,100.25,100.25,-399.75,-399.75,-399.75,-
499.75,-299.75,-299.75,-399.75,-499.75,-699.75,-299.75,-899.75,-699.75,-
799.75,-499.75,-599.75,-699.75,-599.75,-499.75,-899.75,-1099.75,-399.75,-
1599.75,-1299.75,-1399.75,-1699.75,-1699.75,-1799.75,-1299.75,-1299.75,-
1199.75,-1199.75,-1299.75,-1399.75,-1299.75,-1199.75,-1899.75,-1599.75,-
1699.75,-1299.75,-
1199.75,2033.180786,2020.854004,1999.219482,2045.149658,1931.522217,1993.
363037,1912.909668,1996.238159,1860.33374,1945.071289,-89.772972,259.092163,-
102.222595,17.759214,46.321632,-26.795076,-130.559479,-14.828989,-
1.367935,32.482258,1909.573364,-32.60038,-55.874882,3.977315,-80.884697,-
229.686462,-236.243454,-115.144028,-159.243423,-152.921967,-
259.081329,1809.090332,-219.336868,-308.061127,-183.431458,32.43082,-
20.20853,-400.753998,-55.541386,-279.120026,-284.290619,-
117.581886,1860.847168,-330.572662,-372.25415,-279.958984,-362.719543,-
361.606445,-410.621094,-367.842926,-405.68277,-445.905487,-
411.415375,1926.652588,-460.693298,-497.686279,-506.58963,-251.93544,-
533.274841,-497.711639,-479.379791,-476.14801,-556.932129,-
331.519165,1831.228394,-541.31073,-538.328308,-377.132843,-590.613647,-
602.817383,-624.482239,-547.893799,-582.075623,-637.096069,-
668.372192,1803.648438,-620.713135,-710.396484,-667.203918,-713.916626,-
729.339905,-516.124634,-772.374023,-839.51178,-776.996704,-
805.716125,1764.612915,-860.099792,-845.866089,-797.209656,-629.683594,-
967.93042,-966.489563,-942.79364,-912.328247,-830.162231,-
1094.541748,1806.154175,-1118.358765,-1243.506104,-1043.115356,-1260.419678,-
1210.251709,-1221.704712,-1232.152588,-1404.12085,-1331.11438,-
1512.562134,1822.507202,-1551.493774,-1408.660889,-1641.944946,-1739.342896,-
1706.921753,-1703.620605,-1904.209351,-1878.774902,-1988.809082,-
1987.897461,1704.133911,-
1983.063232,1727.152832,1734.473755,1749.784546,1724.119385,1734.792847,1689.
095215,1639.77832,1708.562134,1539.141113,1608.813721,1552.522583,1570.205566,
1516.731323,1540.473267,1439.072632,1360.215942,1429.613403,1394.519287,1373.
203247,1416.301025,1324.241943,1387.570923,1362.546631,1253.523804,1329.
725708,1290.420288,1270.530884,1245.117554,1107.569702,1207.792114,1100.
090332,1101.837524,985.094727,1122.42627,917.437256,1067.384644,894.937561,
956.240295,725.281677,640.721008,511.698456,599.989746,371.32605,513.007019,
369.864471,454.730743,565.35199,629.958679,313.876221,429.752319,267.933502,
226.530502,210.105209,360.452637,372.694061,334.304199,409.414825,334.114441,
315.539215,283.125427,162.629517,252.828003,259.99472,261.188324,252.763748,
455.56839,222.179779,202.66687,75.774521,194.550476,65.656319,97.580406,14.
639831,144.738754,-29.926208,87.170898,-35.338997,99.106873,
2. "HabRangeRecIndex",2,"INTEGER",0,"unitless",

```
  8,
   7,3,18,30,2,14,45,48,
  16,3,16,18,23,34,46,9,39,27,57,8,15,37,45,47,48,
  14,3,16,18,30,9,32,39,2,11,14,15,45,47,48,
  16,3,16,18,23,34,46,9,39,27,57,8,15,37,45,47,48,
  7,3,18,30,2,14,45,48,
  21,7,18,23,25,30,34,38,42,54,6,29,33,57,5,8,12,15,26,37,45,47,
  16,3,16,18,23,34,46,9,39,27,57,8,15,37,45,47,48,
  15,3,16,18,23,34,32,39,2,14,57,8,15,37,45,47,
3. "WBNDOC",1,"FLOAT",0,"mg/L",
  3,3.7,3.7,3.7,
```

Vadose Zone Data Group (VZWP0223504.ssf)

```
1. "POM",0,"FLOAT",0,"g/g",
  3.8,
2. "RHOB",0,"FLOAT",0,"g/cm3",
  1.4575,
```

Saturated Zone Data Group (AQ01.ssf from case WP0223504)

```
1. "ALATRatio",0,"FLOAT",0,"m",
  8,
2. "ALAVRatio",0,"FLOAT",0,"m",
  160,
```

Watershed Data Group (WSWP0223504.ssf)

```
1. "a_BF",0,"FLOAT",0,"m/d",
  3.11e-006,
2. "b_BF",0,"FLOAT",0,"unitless",
  1.17,
3. "WCS",1,"FLOAT",0,"volume fraction",
  12,0.45,0.45,0.45,0.45,0.45,0.45,0.45,0.45,0.45,0.45,0.45,0.45,
```

Surface Water Data Group (SW1.ssf from case WP0223504)

```
1. "rhoDBenthos",1,"FLOAT",0,"g/mL",
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2. "TrophicIndex",1,"INTEGER",0,"",
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3. "v_bury",1,"FLOAT",0,"mm/yr",
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Farm Foodchain Data Group (FFLA1632106.ssf)

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1. "Fw_exveg",0,"FLOAT",0,"unitless",
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2. "Rp_silage",0,"FLOAT",0,"unitless",
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3. "MAFroot",0,"FLOAT",0,"percent",
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Terrestrial Foodweb Data Group (TFLA1632106.ssf)

1. "tp_exfruit",0,"FLOAT",0,"y",
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2. "rho_leaf",0,"FLOAT",0,"g/L FW",
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3. "VGag_forage",0,"FLOAT",0,"unitless",
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Aquatic Foodweb Data Group (AFWP0223504.ssf)

1. "MaxPreyPref",3,"FLOAT",0,"unitless",
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Human Exposure Data Group (HEWP0223504.ssf)

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Ecological Exposure Data Group (EELA1632106.ssf)

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999,0.01,-999,-999,0,
20,0,0.1,0,-999,-999,0,0.1,0.1,0.1,0.1,-999,-999,-999,-999,-999,-
999,0.01,0.01,0.01,0,
20,-999,-999,0,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,-
999,0.01,-999,-999,0.5,
20,-999,0.5,-999,-999,-999,-999,0,0,-999,-999,-999,-999,-999,-999,-999,-
999,0.01,0.01,0.01,-999,
20,-999,0.5,-999,-999,-999,-999,-999,-999,-999,-999,0,-999,0,-999,-999,-
999,0.01,-999,-999,-999,
20,-999,0.5,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,0,-999,-
999,0.01,-999,-999,-999,
20,-999,-999,-999,-999,-999,-999,-999,-999,-999,0,0.1,0,0.5,0,-999,0,0.01,-
999,-999,-999,
57,
20,-999,0,0,-999,-999,-999,0.2,0.2,0.2,0,0,-999,-999,-999,-999,-999,-
999,0.01,0.01,0.2,
20,0,0.25,0,-999,-999,0,-999,-999,-999,-999,-999,-999,-999,-999,-999,-
999,0.01,-999,-999,0.02,
20,0.15,0.08,-999,-999,-999,-999,-999,-999,-999,-999,0.07,-999,0,-999,-999,-
999,0.01,-999,-999,-999,
20,0.6,0.01,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,0,-999,-999,-
999,0.01,-999,-999,-999,
20,-999,0,0.1,0,0,0.02,-999,0.25,0.25,-999,-999,-999,-999,-999,-999,-
999,0.01,0.01,0.01,0,

20,-999,-999,-999,-999,-999,-999,-999,-999,-999,0.1,-999,-999,0.2,-999,0.01,-
999,0.01,0.01,0.01,-999,
20,-999,0.2,0,-999,-999,-999,0,0.5,-999,-999,-999,-999,0,-999,-999,-
999,0.01,0.01,0.01,0,
20,-999,0.3,0.01,0,0,-999,0,0,0,-999,0.3,0,0.05,-999,0,0,0.01,0.01,0.01,0,
20,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,0.9,-999,-999,-
999,0.01,-999,-999,-999,
20,-999,0.1,0,-999,-999,0,0.05,0,-999,0,-999,-999,0,-999,-999,-
999,0.01,0.01,0.01,0.05,
20,-999,0.01,0.09,-999,-999,0,-999,-999,-999,-999,-999,-999,-999,-999,-999,-
999,0.01,-999,-999,0,
20,-999,0,-999,-999,-999,-999,-999,-999,-999,0,-999,-
999,0.2,0.2,0,0.2,0.01,0.01,0.01,-999,
20,-999,0.95,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,-
999,-999,0.01,-999,-999,-999,
20,-999,-999,0.15,-999,-999,0.29,-999,-999,-999,-999,-999,-999,-999,-999,-
999,-999,0.01,-999,-999,-999,
20,-999,0.01,0.05,0,0,0.03,-999,-999,-999,-999,0.05,-999,-999,-999,-999,-
999,0.01,-999,-999,0,
20,-999,0.07,-999,-999,-999,-999,-999,-999,-999,-999,0.01,0,0,0.12,-999,-
999,0.01,-999,-999,-999,
20,0.03,0.08,0,-999,-999,-999,-999,-999,-999,-999,0.05,0,0.13,-999,-999,-
999,0.01,-999,-999,0,
20,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,0.17,-999,-
999,0,0.01,-999,-999,-999,
20,0,0.1,-999,-999,-999,-999,0,-999,-999,-999,-999,-999,-999,-999,-999,-999,-
999,0.01,0.01,0.05,
20,-999,0.95,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,-
999,-999,0.01,0.01,0.01,-999,
20,-999,0,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,-
999,0.01,0.01,0.01,0,
20,-999,0.2,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,0,0.2,-999,-
999,0.01,-999,-999,-999,
20,-999,0.02,0.03,-999,-999,0,0,0.05,0.05,0.01,-999,-999,0.01,-999,-999,-
999,0.01,0.01,0.01,0.04,
20,0.15,0.02,-999,-999,-999,-999,0,0,-999,0.01,-999,-999,0.01,-999,-999,-
999,0.01,0.01,0.01,0,
20,0,0.01,0,-999,-999,-999,-999,0.4,-999,0,-999,-999,0,-999,-999,-
999,0.01,0.01,0.01,0.01,
20,0,0.1,0.05,-999,-999,0.01,0.1,0.05,0.05,0,0,-999,0,-999,-999,-
999,0.01,0.01,0.01,0,
20,-999,0,0.25,0.2,0.2,0,-999,-999,-999,-999,0,-999,0,-999,-999,-999,0.01,-
999,-999,0,
20,-999,0,0.5,-999,-999,0,-999,-999,-999,-999,-999,-999,-999,-999,-999,-
999,0.01,-999,-999,-999,
20,-999,0.1,-999,-999,-999,-999,0,-999,-999,0,0,-999,0,0.1,-999,-
999,0.01,0.01,0.01,-999,
20,-999,0.95,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,-
999,-999,-999,-999,-999,-999,
20,-999,0.24,0.28,-999,-999,0.28,-999,-999,-999,-999,-999,-999,-999,-999,-
999,-999,0.01,-999,-999,0,

20,0,0,0.14,0,0,0,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,0.01,-
999,-999,-999,
20,-999,0.1,-999,-999,-999,-999,0,0,-999,0,0,-999,0,0.5,0,0,0.01,0.01,0.01,-
999,
20,-999,0.95,-999,-999,-999,-999,0,-999,-999,-999,-999,-999,-999,-999,-999,-
999,0.01,-999,0.01,-999,
20,-999,0.01,-999,-999,-999,-999,-999,-999,-999,-
999,0.01,0,0.5,0,0.01,0,0.01,-999,-999,-999,
20,-999,0,0.1,0.1,-999,0,-999,0,0,-999,-999,-999,-999,-999,-999,-
999,0.01,0.01,0.01,0.02,
20,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,0.1,0,0.5,0,-999,0,0.01,-
999,-999,-999,
20,-999,-999,-999,-999,-999,-999,0,0,-999,0.12,-999,0,0.02,0,0,-
999,0.01,0.01,0.01,0,
20,-999,0,-999,-999,-999,-999,-999,-999,-999,-999,0,-999,0,0.21,-999,-
999,0.01,-999,-999,-999,
20,-999,0,0,-999,-999,-999,0,0.5,0.3,-999,-999,-999,-999,-999,-999,-999,-
999,0.01,0.01,0.14,
20,-999,-999,0,-999,-999,0,-999,0.25,0.25,-999,-999,-999,-999,-999,-999,-
999,0.01,0.01,0.01,0,
20,-999,0,-999,-999,-999,-999,-999,0,-999,0.5,-999,-999,-999,-999,-999,-
999,0.01,0.01,0.01,-999,
20,-999,0,-999,-999,-999,-999,-999,-999,-999,-999,0,0,0.25,0,0.25,-999,0.01,-
999,-999,-999,
20,-999,0,-999,-999,-999,-999,-999,-999,-999,-999,0,0,0.5,0,0.1,-999,0.01,-
999,-999,-999,
20,0,0,0,-999,-999,0,0,0,0,-999,0.25,-999,0.1,0,0,0,0.01,0.01,0.01,0,
20,-999,0.1,0.1,-999,-999,0,-999,-999,-999,-999,-999,-999,-999,-999,-999,-
999,0.01,-999,-999,0.1,
20,-999,0,0.1,0,0,0,-999,-999,-999,-999,0.1,-999,0,-999,-999,-999,0.01,-999,-
999,-999,
20,0,0,0.1,0,0,0,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,0.01,-999,-
999,0,
20,-999,0,0,-999,-999,0,0,0.25,0.25,-999,-999,-999,-999,-999,-999,-
999,0.01,0.01,0.01,0,
20,0.25,0.1,0,-999,-999,-999,-999,-999,-999,-999,0,0,-999,-999,-999,-
999,0.01,-999,-999,-999,
20,-999,0,0.5,-999,-999,0,-999,-999,-999,-999,-999,-999,-999,-999,-999,-
999,0.01,-999,-999,0,
20,0,0.1,0,-999,-999,0,0.1,0.1,0.1,0.1,-999,-999,-999,-999,-999,-
999,0.01,0.01,0.01,0,
20,-999,-999,0,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,-
999,0.01,-999,-999,0.5,
20,-999,0.5,-999,-999,-999,-999,0,0,-999,-999,-999,-999,-999,-999,-999,-
999,0.01,0.01,0.01,-999,
20,-999,0.5,-999,-999,-999,-999,-999,-999,-999,-999,0,-999,0,-999,-999,-
999,0.01,-999,-999,-999,
20,-999,0.5,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,0,-999,-
999,0.01,-999,-999,-999,
20,-999,-999,-999,-999,-999,-999,-999,-999,-999,0,0.1,0,0.5,0,-999,0,0.01,-
999,-999,-999,

2. "NumPrey",0,"INTEGER",0,"unitless",
20,
3. "BodyWt_rec",1,"FLOAT",0,"kg",
62,50.396842,0.1189153391,0.0773,0.1774732496,**3.75**,19.30859066,0.1470570683,
128.874222,2.417022962,0.249,0.1516243278,2.996629957,0.009,0.4048645927,13.
12889529,0.0196,0.3817513128,1.226135331,0.001915678448,0.006873863542,0.
08424369413,0.01773521089,2.229,0.0491,0.2260353955,1.091233068,1.799323202,0.
04083030278,0.7923896273,0.008789197916,0.047,0.1886469524,1.170158282,0.
01060659515,0.0208217222,0.9924225971,75.47001794,0.873,0.1912576396,0.
2084946042,1.601382632,0.2389835129,0.02528596804,0.04156701674,5.691468746,0.
113678197,4.532144522,1.130926184,8.660254038,0.015,0.2015302847,5.295592583,
0.1002456207,0.0425,0.02095,0.1064424727,69.41716207,0,0,0,0,0,

Human Risk Data Group (HRLA1632106.ssf)

1. "LifeTime",0,"FLOAT",0,"unitless",
76.5,
2. "ExDur_NCar_Block",0,"INTEGER",0,"unitless",
1,
3. "RegPercentile",0,"FLOAT",0,"unitless",
90,

Ecological Risk Data Group (ERWP022304.ssf)

1. "EcoRegPercentile",0,"FLOAT",0,"unitless",
95,
2. "NumHabitat",0,"INTEGER",0,"unitless",
12,
3. "HabitatIndex",1,"INTEGER",0,"unitless",
12,1,2,3,4,5,6,7,8,9,10,**11**,12,

2) The presence of all the data correctly populated in the SSFs indicates that the site variable distribution, static regional, and static national databases were accessed. The presence of the CPSR.SSF indicates that the chemical properties database was accessed.

3) The parameters that were located in the regional and national static databases were populated in the appropriate SSFs.

4) All of the above data were populated in the appropriate SSFs.

5) The SDP executed without error, independent of the other HWIR processors.

4.3.2 SDP_02

4.3.2.1 Description and Rationale

The SDP will use the Stat DLL to obtain parameter values, based on distribution data, when discrete values are not available in the databases. Verification that the Stat DLL itself is operating correctly is beyond the scope of this test plan. The ability of the SDP to correctly use the Stat DLL, however, will be examined. Instead of performing specific tests, the source code for calling the Stat DLL has been included. The logic of the source code can be followed to check that it will make the correct calls to the Stat DLL.

The SDP reads the "Distribution_Type" field for each database parameter to determine if the parameter has a constant value or will require statistical modification. The distribution types available are "constant," "normal," "log normal," "exponential," "uniform," "integer uniform," "triangular," "empirical," "user-defined," "weibull," "gamma," "transform log normal," "transform Johnson SB," "transform Johnson SU," "Johnson SB," and "Johnson SU." The following is a key in the code to convert the actual distribution read into the variable name that is used in the code.

```
*************************************************************************************

 if (strcmpi(s,“constant”)==0) return DS_CONSTANT;
 if (strcmpi(s,“normal")==0) return DS_NORMAL;
 if (strcmpi(s,“logNormal”)==0) return DS_LOGNORMAL;
 if (strcmpi(s,“exponential”)==0) return DS_EXPONENT;
 if (strcmpi(s,“uniform”)==0) return DS_UNIFORM;
 if (strcmpi(s,“intUniform”)==0) return DS_INTUNIF;
 if (strcmpi(s,“triangular”)==0) return DS_TRIANGLE;
 if (strcmpi(s,“empirical”)==0) return DS_EMPIRICAL;
 if (strcmpi(s,“user-defined”)==0) return DS_EMPIRICAL;
 if (strcmpi(s,“weibull”)==0) return DS_WEIBULL;
 if (strcmpi(s,“gamma”)==0) return DS_GAMMA;
 if (strcmpi(s,“TrnLogNormal”)==0) return DS_TRNLOGNOR;
 if (strcmpi(s,“TrnJohnsonSB”)==0) return DS_TRNJSB;
 if (strcmpi(s,“TrnJohnsonSU”)==0) return DS_TRNJSU;
 if (strcmpi(s,“JohnsonSB”)==0) return DS_JSB;
 if (strcmpi(s,“JohnsonSU”)==0) return DS_UNKNOWN;
*************************************************************************************
```

The actual source code that makes the call to the Stat DLL is listed below. As stated previously, the code logic can be followed to check that correct calls are being made to the Stat DLL.

```
    if ((stat==DS_NORMAL)
        || (stat==DS_LOGNORMAL) || (stat==DS_TRNJSB) || (stat==DS_TRNJSU)
        || (stat==DS_TRNLOGNOR) || (stat==DS_GAMMA) || (stat==DS_WEIBULL)
        || (stat==DS_JSB))
     {
     central = qry->Fields[FI_CT]->AsFloat;
     variance = qry->Fields[FI_VAR]->AsFloat;
     minimum = qry->Fields[FI_MIN]->AsFloat;
     maximum = qry->Fields[FI_MAX]->AsFloat;

     if (stat==DS_NORMAL)
       StatNormal(central, variance, minimum, maximum);
```

```
        else if (stat==DS_LOGNORMAL)
          StatLogNormal(central, variance, minimum, maximum);
        else if (stat==DS_TRNJSB)
          {
          StatSB(central, variance, minimum, maximum);
          }
        else if (stat==DS_TRNJSU)
          {
          StatSU(central, variance, minimum, maximum);
          }
        else if (stat==DS_TRNLOGNOR)
          StatTrnLogNormal(central, variance, minimum, maximum);
        else if (stat==DS_GAMMA)
          {
//        StatDebugOn();   // turn on statistics debugging
          alpha = pow(central / variance,2.0);
          beta = (central / alpha);
          StatGamma(alpha, beta, minimum, maximum);
          }
        else if (stat==DS_WEIBULL)
          {
          StatWeibull(central, variance, minimum, maximum);
          }
        else if (stat==DS_JSB)
          StatJohnsonSB(central, variance, minimum, maximum);
        }
      else if (stat==DS_EXPONENT)
        {
        central = qry->Fields[FI_CT]->AsFloat;
        minimum = qry->Fields[FI_MIN]->AsFloat;
        maximum = qry->Fields[FI_MAX]->AsFloat;
        StatExponential(central, minimum, maximum);
        }
      else if (stat==DS_UNIFORM || stat==DS_INTUNIF)
        {
        minimum = qry->Fields[FI_MIN]->AsFloat;
        maximum = qry->Fields[FI_MAX]->AsFloat;
        if (stat==DS_UNIFORM)
          StatUniform(minimum, maximum);
        else
          StatIntUniform(minimum,maximum);
        }
      else if (stat==DS_EMPIRICAL)
        {
        astr = qry->Fields[FI_UD]->AsString;
        strcpy(dt,astr.c_str());
        minimum = qry->Fields[FI_MIN]->AsFloat;
```

```
    maximum = qry->Fields[FI_MAX]->AsFloat;
    numEmp = getUserDefined(dt, &minimum, &maximum, &empVal, &empProb);
    if (ErrorExists) return false;
    StatEmpirical(minimum, maximum, numEmp, empVal, empProb);
    if (numEmp>0)
      {
      delete[] empVal;
      delete[] empProb;
      }
    }
  else if (stat==DS_TRIANGLE)
    {
    central = qry->Fields[FI_CT]->AsFloat;
    minimum = qry->Fields[FI_MIN]->AsFloat;
    maximum = qry->Fields[FI_MAX]->AsFloat;
    StatTriangular(central, minimum, maximum);
    }
```

4.3.2.2 Expected Results

It is expected that the SDP will follow the above logic to call the appropriate Stat DLL function, depending on the distribution type for the parameter.

4.3.2.3 Results

There are no test results to be reported for this test case

4.3.3 SDP_03

4.3.3.1 Description and Rationale

In this test, the database tables and the SLWP0223504.SSF created in test case SDP_01 will be examined to verify that the SDP modifies variables for consistency and handles data exceptions in creating the Site Layout SSF. The specific rules are listed below. The requirement numbers will be referenced in the expected results and results sections. (Note: the requirement numbers used below do not correspond to the requirement numbers listed in Table 4.1.)

1) Set the human receptor pH (HumRcpPH) equal to the aquifer pH (AquPH).

2) When the number of selected air points in a waterbody network reach is 0 (WBNRchNumAir = 0), the waterbody network reach air fraction (WBNRchAirFrac) and waterbody network reach air index (WBNRchAirIndex) should be ignored.

3) When the number of wells in an aquifer is 0 (NumAquWell = 0), all aquifer-well parameters (AquWell*) should be ignored.

4) The SL.SSF can contain data for only one aquifer. If the number of aquifers is greater than 1 (NumAqu > 1) , then the SDP should pick an aquifer from the available aquifers and update that aquifer's data into the first aquifer data location. All data referring to the other aquifers should be ignored.

5) The SL.SSF can contain data for only one vadose zone. If the number of vadose zones is greater than 1 (NumVad > 1), then the SDP should pick a vadoze zone from the available vadose zones and update that vadose zone's data into the location of the data for the first vadose zone. All data referring to the other vadose zones should be ignored.

6) To select the appropriate hydrogeologic variables, the processor must first get the soil type from the Site Variable Distribution Table. The soil type along with the source type will determine the site-layout variables needed for the SSF. After getting the soil type (VadSoilType), the basic process described above can be run for the Site Variable Distribution Table.

   The SDP will then retrieve the groundwater class (GWClass) and hydrogeologic region (HydrologicRegion) back from the Site Layout SSF for use in updating the hydrogeologic properties. An additional value, groundwater class index (GWClassIndex) will be collected from the Regional Variable Distribution Table for that groundwater class (setting_id=GWClass). At this point, four records are expected to be sampled from the Regional Variable Distribution Table, aquifer saturated hydraulic conductivity (AquSATK), aquifer gradient (AquGRAD), aquifer thickness (AquThick), and vadose zone thickness (VadThick).

   If one or more values are empty (value = -999), then an algorithm is applied 1 to 10 times to obtain the missing value. Input to this algorithm includes the corresponding data for these parameters found in the cross-correlation table, for the specific groundwater class (setting_id = GWClass). If any of the four variables are still missing, the maximum value is then assigned. All four variables are then written to the Site Layout SSF.

4.3.3.2 Input Data

The same input data used in case SDP_01 were used.

4.3.3.3 Expected Results

It is expected that the SDP will follow the above logic and that the correct parameter values will be found in the SLWP0223504.SSF. The numbers listed below correspond to the requirement number listed in the requirement section above (Section 4.3.3.1).

1) It is expected that human receptor pH (HumRcpPH) will be equal to the aquifer pH (AquPH) in the SLWP0223504.SSF.

2) It is expected that when the number of selected air points in a waterbody network reach is 0 (WBNRchNumAir=0), the waterbody network reach air fraction (WBNRchAirFrac) and waterbody network reach air index (WBNRchAirIndex) will be ignored. In other words, WBNRchAirFrac and WBNRchAirIndex should not appear in the SSF.

3) It is expected that when the number of wells in an aquifer is 0 (NumAquWell = 0), all aquifer-well parameters (AquWell*) will be ignored. In other words, all parameters beginning with AquWell should not appear in the SSF.

4) It is expected that if the number of aquifers is greater than 1 (NumAqu > 1), then the SDP will pick an aquifer from the available aquifers and update that aquifer's data into the first aquifer data location. All data referring to the other aquifers should be ignored.

5) It is expected that if the number of vadose zones is greater than 1 (NumVad > 1), then the SDP should pick a vadose zone from the available vadose zones and update that vadose zone's data into the location of the data for the first vadose zone. All data referring to the other vadose zones should be ignored.

6) It is expected that the SDP will correctly populate the Site Layout SSF with values for the parameters aquifer saturated hydraulic conductivity (AquSATK), aquifer gradient (AquGRAD), aquifer thickness (AquThick), and vadose zone thickness (VadThick). The presence of these parameters in the Site Layout SSF either means that valid database entries were available or the hydrogeologic algorithm was called.

4.3.3.4 Conducting the Test

The SDP will not be executed again for this test case. The Site Layout SSF created in test case SDP_01 will be examined in greater detail. The check will consist of checking the database for parameter values and then checking the Site Layout SSF to validate that the above rules were followed correctly.

4.3.3.5 Results

As noted above, the results are listed by number. The number correlates back to the requirements and expected results sections above. All checks were made in SLWP0223504.ssf.

1) The aquifer and human receptor pH values were both set to the same value.

```
"AquPh",0,"FLOAT",0,"pH units",
8.762929432,
```

and

```
"HumRcpPh",0,"FLOAT",0,"pH units",
8.762929432,
```

2) The values for WBNRchNumAir were all zeroes as shown below, and the parameters WBNRchAirFrac and WBNRchAirIndex were not found.

```
"WBNRchNumAir",2,"INTEGER",0,"",
1,
8,0,0,0,0,0,0,0,0,
```

3) In this case, NumAquWell was equal to 125 as shown below; therefore, the AquWell parameters were populated.

```
"NumAquWell",0,"INTEGER",0,"",
125,
```

4) In this particular case, NumAqu was equal to one.

5) In this particular case, NumVad was equal to one.

6) The parameters aquifer saturated hydraulic conductivity (AquSATK), aquifer gradient (AquGRAD), aquifer thickness (AquThick), and vadose zone thickness (VadThick) were found and are listed below.

```
"AquSATK",1,"FLOAT",0,"m/yr",
1,31500,

"AquGrad",1,"FLOAT",0,"",
1,0.001,

"AquThick",1,"FLOAT",0,"m",
1,24.4,

"VadThick",1,"FLOAT",0,"m",
1,30.5,
```

4.3.4 SDP_04

4.3.4.1 Description and Rationale

In this test, the database tables and the SLAT1632106.SSF and ATAT1632106.SSF created in test case SDP_01 will be examined to verify that the SDP modifies variables for consistency and handles data exceptions in creating the Site Layout Data Group and Aerated Tank SSFs. The specific rules are listed below. The requirement numbers will be referenced in the expected results and results sections. (Note: the requirement numbers used below do not correspond to the requirement numbers listed in Table 4.1.)

To populate the Source SSF, the SDP must first determine if the source type is an aerated tank. If the source type is not an aerated tank, then the basic process will be followed and applied to the site, regional, and national data tables as described previously to populate the Source SSF according to the SI.DIC, WP.DIC, LF.DIC, and LA.DIC dictionary files.

1) If the source type is an aerated tank, then the maximum source area (MaxSrcArea) and the aerated tank index (ATIndex) are read from the Site Layout SSF. The Site Layout Data Group for this index (index_1=ATIndex) is then gathered from the national table. The tank source area (SrcArea) of the selected data group is then compared to the maximum source area (MaxSrcArea). If the tank source area is larger than the maximum source area (SrcArea > MaxSrcArea), then a resampling is done. This resampling continues until a tank source area is

found that is not larger than the maximum source area. At this point, the data group associated with the successful source area is given an index of 0. The source area (SrcArea) can then be updated in the Site Layout SSF.

2) Each source local watershed subarea area (SrcLWSSubAreaArea) is also set equal to the source area (SrcArea).

3) Before completing the population of the Source SSF, for all source types, the liquid or solid C_w must be updated based on the source type. The SDP makes a call to the CPP to obtain values necessary to update the liquid C_w (C_in) for AT or SI and the solid C_w (CTPwaste) for WP, LF and LAU.

The Site Layout SSF (SLAT1632106.SSF) will be checked for the values of MaxSrcArea, and SrcArea for the first requirement. The values for each watershed sub area will be checked to verify that they are all equal to the SrcArea value to address the second requirement. The presence of the C_in will be checked in the Aerated Tank SSF (ATAT1632106.SSF) to address the third requirement.

4.3.4.2 Input Data

The same input data used in case SDP_01 were used.

4.3.4.3 Expected Results

The expected results are listed by number, which corresponds to the requirements listed in Section 4.3.4.1.

1) It is expected that the value of SrcArea in SLAT1632106.SSF will be less than or equal to the value of MaxSrcArea in the same file.

2) In this case, there is only one local watershed subarea. It is expected that the area for the local watershed subarea is set equal to the SrcArea value.

3) It is expected that the parameter C_in will be populated in ATAT1632106.SSF.

4.3.4.4 Conducting the Test

The SDP will not be executed again for this test case. The Site Layout SSF created in test case SDP_01 will be examined in greater detail. The check will consist of checking the database for parameter values and then checking the Site Layout SSF to validate that the above rules were followed correctly.

4.3.4.5 Results

The results are listed by number, which corresponds to the requirements and expected results listed in the sections above.

1) The values for SrcArea and MaxSrcArea were found in SLAT1632106.SSF and are listed below.

```
"MaxSrcArea",0,"FLOAT",0,"m^2",
16188,

"SrcArea",0,"FLOAT",0,"m^2",
10.14818302,
```

2) The values for SrcArea and SrcLWSSubAreaArea were found in SLAT1632106.SSF and are listed below.

(Note: SDP version 56 was used for verification. In checking the results for this particular requirement, an error was found in the ordering of the call arguments used to call the IODLL. The error was fixed, and a new version of the SDP was compiled. The below results were produced by the corrected SDP.)

```
"SrcArea",0,"FLOAT",0,"m^2",
10.14818302,

"SrcLWSSubAreaArea",2,"FLOAT",0,"m2",
1,
1,10.14818302,
```

3) The parameter C_in was found in ATAT1632106.SSF and is listed below.

"C_in",0,"FLOAT",0,"mg/L",
0.1,

4.3.5 SDP_05

4.3.5.1 Description and Rationale

If the number of vadose zones is greater than 0 (NumVad > 0), then the basic process will be followed and applied to the site, regional, and national data tables as described above to populate the Vadose Zone SSF as directed by the VZ.DIC. However, an additional required parameter must be computed based on database information. The variable vadose zone thickness (VadThick) must be read from the Site Layout SSF and used to calculate the dispersivity. Dispersivity is then updated in the Vadose Zone SSF.

Equation for dispersivity:

Dispr = 0.02 + (0.022 x VadThick)

The results from test SDP_01 involving site 0223504 and a waste pile will be checked. The Site Layout Data Group section of the Site Layout SSF (SLWP0223504.SSF) will be checked for the value of VadThick. The equation above will then be used to compute a value for dispersivity. The actual value of dispersivity that was written to the VZWP0223504.SSF will be checked.

4.3.5.2 Input Data

The same input data used in case SDP_01 were used.

4.3.5.3 Expected Results

The value for VadThick taken out of the file SLWP0223504.SSF was 50.8 m as shown below.

```
"VadThick",1,"FLOAT",0,"m",
1,50.8,
```

Dispersivity was computed to be 1.1376 m as shown below using the value of VadThick.

Dispr = 0.01 + (0.022 × 50.8 m) = 1.1376 m

4.3.5.4 Conducting the Test

The SDP will not be executed again for this test case. The Site Layout and Vadose Zone SSFs created in test case SDP_01 will be examined in greater detail. The check will consist of checking the database for parameter values and then checking the Site Layout and Vadose Zone SSFs to validate that the above rules were followed correctly.

4.3.5.5 Results

The value for dispersivity that was found in the VZWP0223504.SSF is shown below.

```
"DISPR",0,"FLOAT",0,"m",
1.1376,.
```

4.3.6 SDP_06

4.3.6.1 Description and Rationale

If the number of aquifer points is greater than 0 (NumAqu > 0), then the basic process will be followed and applied to the site, regional, and national data tables as described above to populate the Aquifer SSF according to the AQ.DIC dictionary file. However, before completing the population of the Aquifer SSF, the variables AL, Por, and BDens must be calculated.

The results from test case SDP_01 involving site 1632106 and a LAU will be checked. The purpose of this test case is to verify that the SDP is correctly calling the EPA provided algorithms. The existence of the parameters AL, BDENS, and POR in the Aquifer SSF will indicate that the algorithms were called. The Aquifer SSF (AQ01.SSF) will be checked to see if values for AL, BDENS, and POR have been populated.

4.3.6.2 Input Data

The same input data used in case SDP_01 were used.

4.3.6.3 Expected Results

The site-layout section of the site_variable_distribution_data table was checked for the value of NumAqu. The value of NumAqu was 1; therefore, it is expected that the SDP will make calls to the EPA provided subroutines to obtain values for the parameters AL, BDENS, and POR. The SDP should then populate the Aquifer SSF with those values.

4.3.6.4 Conducting the Test

The SDP will not be executed again for this test case. The Aquifer SSF created in test case SDP_01 will be examined in greater detail. The check will consist of checking the database for parameter values and then checking the Aquifer SSF to validate that the above rules were followed correctly.

4.3.6.5 Results

The following results were pulled out of the AQ01.SSF.

```
"AL",0,"FLOAT",0,"m",
67.69626174,

"BDENS",0,"FLOAT",0,"g/cm3",
1.36628892,

"POR",0,"FLOAT",0,"",
0.2227625536,
```

4.3.7 SDP_07

4.3.7.1 Description and Rationale

If the number of surface water points is greater than 0 (NumWBN > 0), then the basic process will be followed and applied to the site, regional, and national data tables as described above to populate the Surface Water SSF according to the SW.DIC dictionary file. However, before completing the population of the Surface Water SSF, the first index for concentration upstream (c_upstream) must be set equal to 1.

The results from test SDP_01 involving site 1632106 and a land application unit will be checked. The Site Layout Data Group section of the site_variable_data table will be checked for the parameter NumWBN, and then the Surface Water SSF (SW1.SSF) will be checked for the value of c_upstream.

4.3.7.2 Input Data

The same input data used in case SDP_01 were used.

4.3.7.3 Expected Results

If NumWBN is greater than 0, then the value of parameter c_upstream in the file SW1.SSF should equal 1.

4.3.7.4 Conducting the Test

The SDP will not be executed again for this test case. The Surface Water SSF created in test case SDP_01 will be examined in greater detail. The check will consist of checking the database for parameter values and then checking the Surface Water SSF to validate that the above rule was followed correctly.

4.3.7.5 Results

The value of NumWBN was set to 2 in the site_variable_data table. The value for c_upstream was set to 0 in the file SW1.SSF as shown below.

```
"C_upstream",1,"FLOAT",0,"mg/L",
3,0,0,0
```

4.3.8 SDP_08

4.3.8.1 Description and Rationale

If the number of air points is greater than 0 (NumAir > 0), then the basic process will be followed and applied to the site, regional, and national data tables as described previously to populate the Air SSF according to the AR.DIC dictionary file. However, if the source is also a tank, the SHight must be collected from the National Variable Distribution Table. The SDP will use the aerated tank index (ATIndex) from the Site Layout SSF to find the corresponding SHight value.

4.3.8.2 Input Data

The same input data used in case SDP_01 were used.

4.3.8.3 Expected Results

It is expected that the SDP will find the value of ATIndex in the Site Layout SSF. The SDP will then find the SHight value corresponding to the index in the National_Distribution_Data table and populate the value for SHight in the Air SSF. The database entries were checked. The ATIndex in the Site Layout SSF was 231. The SHight with this index in the National_Distribution_Data table is 3.857111691. This value should be written to the Air SSF.

4.3.8.4 Conducting the Test

The SDP will not be executed again for this test case. The Air SSF created in test case SDP_01 will be examined in greater detail. Check the Site Layout SSF for the aerated tank WMU (slAT1632106.SSF) for the value of ATIndex. This ATIndex will be used as the index for SHight in the National_Distribution_Data table. Open up the National_Distribution_Data table and search for the value of SHight that corresponds to the ATIndex. Then check the Air SSF (arAT1632106.SSF) for the value that is populated.

4.3.8.5 Results

The value of ATIndex in the Site Layout SSF (slAT1632106.SSF) was 231 as expected. The entry from the Site Layout SSF is listed below.

```
"ATIndex",0,"INTEGER",0,"",
231,
```

The value of SHight in the Air SSF (arAT1632106.SSF) was 3.857111691 as expected. The entry form the Air SSF is listed below.

```
"SHight",0,"FLOAT",0,"m",
3.857111691,
```

4.3.9 SDP_09

4.3.9.1 Description and Rationale

The SDP should populate the SSF for data groups as specified by parameter values in the Site Layout Data Group. The specific rules are listed below. The requirement numbers will be referenced in the expected results and results sections. (Note: the requirement numbers used below do not correspond to the requirement numbers listed in Table 4.1.)

1) If the number of watershed subbasins is greater than 0 (NumWSSub > 0), then the basic process will be followed and applied to the site, regional, and national data tables as described above to populate the Watershed SSF according to the WS.DIC dictionary file.

2) If the number of waterbody networks is greater than 0 (NumWBN > 0), then the basic process will be followed and applied to the site, regional, and national data tables as described above to populate the Aquatic Foodweb SSF according to the AF.DIC dictionary file.

3) If the number of farms or human receptors is greater than 0 (NumFarm > 0 or NumHumRcp > 0), then the basic process will be followed and applied to the site, regional, and national data tables as described above to populate the Farm Foodchain SSF according to the FF.DIC dictionary file.

4) If the number of farms or human receptors is greater than 0 (NumFarm > 0 or NumHumRcp > 0), then the basic process will be followed and applied to the site, regional, and national data

tables as described above to populate the Human Receptor and Human Exposure SSF according to the HR.DIC and HE.DIC dictionary files.

5) If the number of habitat regions is greater than 0 (NumHab > 0), then the basic process will be followed and applied to the site, regional, and national data tables as described above to populate the Terrestrial Foodweb SSF according to the TF.DIC dictionary file.

6) If the number of habitat regions is greater than 0 (NumHab > 0), then the basic process will be followed and applied to the site, regional, and national data tables as described above to populate the Ecological Risk and Ecological Exposure SSF according to the ER.DIC and EE.DIC dictionary files.

The results from test SDP_01 involving site 1632106 and a LAU will be checked. The Site Layout Data Group section of the site_variable_data table will be checked for the Num* parameters and then the SSF directory will be checked for the presence of the associated SSF.

4.3.9.2 Input Data

The same input data used in case SDP_01 were used.

4.3.9.3 Expected Results

It is expected that the SDP will generate a data group SSF for any of the above "Num" parametrs that has a value greater than 0.

4.3.9.4 Conducting the Test

The SDP will not be executed again for this test case. The Site_Variable_Data table was searched for the Num* variables, and the presence of the associated SSF was checked.

4.3.9.5 Results

The results are listed by number, which corresponds to the requirements listed in Section 4.3.9.1 above.

1) The parameter NumWSSub was set to 10. The WSLA1632106.SSF was located in the SSF directory.

2) The parameter NumWBN was set to 2. The AFLA1632106.SSF was located in the SSF directory.

3) The parameters NumFarm and NumHumRcp were set to 3 and 222, respectively. The FFLA1632106.SSF was located in the SSF directory.

4) The parameters NumFarm and NumHumRcp were set to 3 and 222, respectively. The HRLA1632106.SSF and HELA1632106.SSF were located in the SSF directory.

5) The parameter NumHab was set to 6. The TFLA1632106.SSF was located in the SSF directory.

6) The parameter NumHab was set to 6. The ERLA1632106.SSF and EELA1632106.SSF were located in the SSF directory.

4.3.10 SDP_10

4.3.10.1 Description and Rationale

The SDP creates SSF as directed by information in the Site Layout Data Group. Therefore, SSF should not be created if they are not required for the simulation. In this case, the database SDP_TestDB.mdb was copied, and several modifications were made to the Site Layout Data Group so that the site conceptual model does not include a vadose zone. This case will check to see if the Vadose Zone SSF is created.

4.3.10.2 Input Data

In the database SPD_TestDB2.mdb, one parameter was changed in the site-based database. The value for parameter NUMVAD was changed to 0 for the site SI1632106. This change instructs the SDP that the Vadose Zone SSF (VZ.SSF) should not be created.

4.3.10.3 Expected Results

It is expected that no Vadose Zone SSF will be created.

4.3.10.4 Conducting the Test

Make a copy of the database SDP_TestDB.mdb and save it as SDP_TestDB2.mdb. Edit the Site_Variable_Distribution table such that the central tendency value for the parameter NUMVAD for site SI1632106 is set to 0. Save the database. Before executing the SDP, delete all SSF present in the SSF directory that were created from previous runs. Be careful not to delete header files and dictionary files. Bring up the SUI and enter the data listed in the input section for site "1632106." Instructions for operating the SUI are located in Appendix A. After the data have been entered, click on the "Start" button to execute the SDP. After the run is complete, check the SSF directory for the presence of the VZ.SSF.

4.3.10.5 Results

The VZ.SSF was not created in the SSF directory.

4.3.11 SDP_11

4.3.11.1 Description and Rationale

The SDP accesses information in the site variable distribution, regional, and national databases to obtain the data required for simulations. Each record or entry in these databases has 23 fields associated with it. It is important that the SDP be able to determine if the input for each field is appropriate and to generate error messages if the input is incorrect. This case will evaluate whether the SDP checks each field for appropriate data. For certain fields, an error message should be generated if incorrect data have been entered, and for other parameters no checking is done.

4.3.11.2 Input Data

For this case, use SDP_TestDB4.mdb, which is a copy of SDP_TestDB.mdb that has been modified. The parameter, Real1, which is in the Vadose Zone Data Group and is located in the Site_Variable_Distribution table, will be used for testing. As shown below, most of the values associated with the parameter "Real1" are modified so that they are incorrect or unallowable, and thus error messages should be generated for each one. Table 4.5 shows the entries that were made along with the allowable ranges or appropriate entries that should be entered.

Table 4.5 Fields with Values, Entries, and Allowable Ranges

Field	Value Entered	Required or Allowable Entry	Allowable Minimum	Allowable Maximum
RowID	200000	any number	--	--
Setting_ID	Site2	WP0223504	--	--
Data_Group_Name	vad	vadose zone	--	--
Variable_Name	Float	Real1	--	--
Units	minutes	days	--	--
Index_1	5	any number	--	--
Index_2	1	0	--	--
Index_3	1	0	--	--
Index_4	1	0	--	--
Index_5	1	0	--	--
Index_6	1	0	--	--
Data_Type	Real	Float	--	--
Reference	0	0	--	--
Distribution	Const	Normal	--	--
Central_Tendancy	101		0	100
Variance	500	any number	--	--
Maximum	10	100	--	100
Minimum	100	0	0	--
User_Defined_Dist_Index	--	--	--	--
String_Value	--	--	--	--
Logical_Value	--	--	--	--
Weight	--	--	--	--
AutoFilled	--	--	--	--

When setting up the run using the SUI, use site 0223504, the WP waste management unit, waste level 1, the chemical 2,3,7,8-Tetrachlorodibenzo, minimum storage level, one realization, and the seed value of 11031.

4.3.11.3 Expected Results

The SDP should find all of the errors that exist, halt execution for each of them, and write a descriptive error message to the error.all file. The error message should also appear in the status window of the SUI.

4.3.11.4 Conducting the Test

Enter the input data listed in Section 4.3.12.2 using the SUI and save the file as HD_SDP_test4.ssf. Then run the SDP. As each run is halted because of an error, the specific error that is found will be corrected, and the test will be re-run. Another error should be found, and the run will be halted. Again the specific error will be corrected, and the test will be re-run. This process will be repeated until all errors associated with the parameter “Real1” are corrected.

The first error that will be found is that the parameter “Real1” could not be found in the database. When that error occurs, change the Setting ID to WP0223504 and the data group name to vadose zone. After that, the error messages will correspond to invalid data entries for the parameter “Real1.”

4.3.11.5 Results

The SDP halted execution and produced error messages as expected. Once all data entry errors were corrected, the SDP ran to completion successfully and the parameter “Real1” was found in the Vadose Zone SSF file (vzWP0223504.SSF).

4.3.12 SDP_12

4.3.12.1 Description and Rationale

The SDP should allow the user to enter in a user-defined distribution for parameters. In this case, the parameter AquPH has been entered as a user-defined distribution. A check will be made to verify that the parameter value chosen lies within the allowable distribution range specified.

4.3.12.2 Input Data

For this case, use SDP_TestDB3.mdb, which is a copy of SDP_TestDB.mdb that has been modified. The entries for the parameter AquPH in the User_Defined_Distribution_Data table were changed to the values shown in Table 4.6.

Table 4.6 Changed Values for the User-Defined Distribution Table

User_Defined_Dist_Index	Value	CDF
AquPh	3.0	0
AquPh	3.01	0.01
AquPh	3.02	0.05
AquPh	3.03	0.1
AquPh	3.04	0.25
AquPh	3.05	0.5
AquPh	3.06	0.75
AquPh	3.07	0.9
AquPh	3.08	0.95
AquPh	3.09	0.99
AquPh	3.1	1

When setting up the run using the SUI, use site 0223504, the WP waste management unit, waste level 1, the chemical 2,3,7,8-Tetrachlorodibenzo, minimum storage level, one realization, and the seed value of 11031.

4.3.12.3 Expected Results

The SDP will populate the Site Layout SSF with a parameter value for AquPH that lies within the allowable distribution range specified (3.0 to 3.1).

4.3.12.4 Conducting the Test

Enter the input data listed in Section 4.3.12.2 using the SUI and save the file as HD_SDP_test3.ssf. Then run the SDP. The SDP should execute without error. After the successful run is completed, check the Site Layout SSF for the parameter value of AquPH.

4.3.12.5 Results

The SDP ran without error, and the value for the parameter AquPH found in the Site Layout SSF was between 3.0 and 3.1. The result found in the Site Layout SSF is listed below. (Note: the complete Site Layout SSF is very large and is not shown below.)

slWP0223504.SSF

```
"AquPh",0,"FLOAT",0,"pH units",
3.087505726,
```

4.3.13 SDP_13

4.3.13.1 Description and Rationale

The SDP should conduct Site Layout Data Group verification checks on parameters in the input databases. This is done in part by using each data group dictionary file to determine which parameters to search for. Parameters in each data-group dictionary file will be searched for and must be found. Extraneous data-group parameters located in the databases should be ignored. In this case, an extra parameter will be placed in the database, but not in the corresponding data group dictionary file. The SDP should ignore the parameter (that is, it should not appear in the data group SSF). The SDP will also perform other checks to ensure that database data are consitent. The parameters NumAqu, NumVad, and NumWBN indicate the number of aquifers, vadose zones, and waterbody networks that are associated with a site. For instance, if the Site Layout Data Group specifies that NumAqu is 2, then there should be data for two aqifers for the site in the database. In this case, the number of each of these parameters will be increased by one without adding the additional associated data. The SDP should catch all of these errors, terminate the run on each error, and write the error messaage to the error file.

4.3.13.2 Input Data

For this case, use SDP_TestDB3.mdb, which is a copy of SDP_TestDB.mdb that has been modified. A parameter named “FakeData” was added to the Site_Variable_Distribution_Data table. It was listed in Setting ID WP0223504 and the Vadose Zone Data Group. No corresponding entry was made to the vadose zone dictionary file.

When setting up the run using the SUI, use site 0223504, the WP waste management unit, waste level 1, the chemical 2,3,7,8-Tetrachlorodibenzo, minimum storage level, one realization, and the seed value of 11031.

4.3.13.3 Expected Results

It is expected that the SDP run will terminate when each of the three Num parameter errors are encountered. Each error should halt the run with an illegal operation error. When the invalid database entry is fixed, the SDP will be re-run and will halt on the next Num parameter error. Again the invalid database entry will be fixed, and the SDP will be re-run. This process will repeat until all Num parameters have been fixed, and the SDP completes the run successfully. At this point, the Vadose Zone SSF will also be checked to ensure that the added data group parameter “FakeData” was not populated.

4.3.13.4 Conducting the Test

Open up the Site_Variable_Distribution_Data table in the SDP_TestDB3.mdb and change the values for the central tendencies for the following parameters as shown in Table 4.6.

Table 4.7 Central Tendency Changes for Site Layout Verification Checks

Setting_ID	Data_Group_Name	Variable_Name	Old Central_Tendency	New Central_Tendency
WP0223504	Site Layout	NumAqu	1	2
WP0223504	Site Layout	NumVad	1	2
WP0223504	Site Layout	NumWBN	1	2

Enter the input data listed in Section 4.3.13.2 using the SUI and save the file as HD_SDP_test3.ssf. Then run the SDP. The SDP execution should halt four times, once for each error. After each error is detected, read the error.all file in the GRF directory to determine which Num error was caught, then go back into the database and change the parameter central tendency back to its original value. Then re-run the SDP and repeat the process until the SDP runs successfully. After the successful run is completed, check the Vadose Zone SSF for the added parameter.

4.3.13.5 Results

NumWBN was the first error caught. An illegal operation error halted the run and was written to the screen as expected. The following error message was found in the error.all file in the GRF directory. (Note: only the relevant section of the error.all file is listed below). The error message indicates that data for the second waterbody reach has not been defined.

```
"Error reading data group [slWP0223504.ssf], parameter
[WBNNumRch(2,0,0,0,0,0)], unit []
     Parameter value has not been defined",
```

NumAqu was the second error caught. An illegal operation error halted the run and was written to the screen. The following error message was found in the error.all file in the GRF directory. (Note: only the relevant section of the error.all file is listed below). The error message indicates that data for the second aquifer have not been defined.

```
"Error reading data group [slWP0223504.ssf], parameter
[AquDir(2,0,0,0,0,0)], unit [degrees]
     Parameter value has not been defined",
```

NumVad was the third error caught. An illegal operation error halted the run and was written to the screen. The following error message was found in the error.all file in the GRF directory. (Note: only the relevant section of the error.all file is listed below). The error message indicates that data for the second vadose zone have not been defined.

```
"Error reading data group [slWP0223504.ssf], parameter
[VadId(2,0,0,0,0,0)], unit []
      Parameter value has not been defined",
```

After the successful completion of the SDP run, the Vadose Zone SSF was checked for the presence of the parameter "FakeData." The complete contents of the Vadose Zone SSF are listed below.

vzWP0223504.SSF

```
1,
"vzWP0223504.ssf","data group",
3,
"DISPR",0,"FLOAT",0,"m",
1.1376,
"POM",0,"FLOAT",0,"g/g",
3.8,
"RHOB",0,"FLOAT",0,"g/cm3",
1.4575,
```

4.3.14 SDP_14

4.3.14.1 Description and Rationale

The SDP should allow and account for cross-correlated variables. To do this, the SDP relies on the Stat DLL. The Stat DLL was tested separately to ensure that it is operating correctly. In this test case, a check will be made to verify that the correct information is being passed to the Stat DLL to correlate parameters correctly. A special debug version of the SDP will be used for this test case only. The modification made was that the SDP will echo the data being passed to the Stat DLL for each call to the error.all file, which is written to the GRF directory. In this case, two parameters in the Vadose Zone Data Group will be correlated by a particular coefficient.

4.3.14.2 Input Data

For this case, use SDP_TestDB4.mdb, which is a copy of SDP_TestDB.mdb that has been modified. In the Site_Variable_Distribution_Data table, only the entries corresponding to Setting ID WP0223504 were kept. All other entries were deleted.

When setting up the run using the SUI, use site 0223504, the WP waste management unit, waste level 1, the chemical 2,3,7,8-Tetrachlorodibenzo, minimum storage level, one realization, and the seed value of 11031.

4.3.14.3 Expected Results

It is expected that the SDP will echo the distribution and correlation data used in the call to the Stat DLL to the error.all file for the parameters of interest. In this case, the parameters of interest are "RealCor1" and "RealCor2." Both are part of the Vadose Zone Data Group. An entry was made in the Cross_Correlation_Data table to correlate the two parameter values by a coefficient of 0.911.

4.3.14.4 Conducting the Test

Before running this test case, rename the SDPBeta2.exe in your HWIR directory to SDPBeta2_orig.exe. Then rename the executable SDPBeta2_stat.exe in the same directory to SDPBeta2.exe. This will switch in the special debug version that will echo the Stat DLL call information to the error.all file. Then bring up the SUI and pick HD_SDP_test4.SSF. All settings should be set correctly. Execute the SDP and then open up the error.all file, which will be located in the GRF directory. Using your editor, search for 0.911 to locate the section of interest. It should look similar to the section listed below in the results section. After you have made the check, close down the file and the SUI. Then rename the SDPBeta2.exe to SDPBeta2_stat.exe and also rename the SDPBeta2_orig.exe to SDPBeta2.exe. The debug version of the SDP should not be used for other test cases. It writes out unnecessary information to the error.all file.

4.3.14.5 Results

The following results were extracted from the error.all file created by the debug version of the SDP. The information listed is an echo of the data used in the call to the Stat DLL for the Vadose Zone Data Group. As can be seen, there are three parameters in this data group that have distributions associated with them. The format for each parameter is as follows: distribution type, central tendency, variance, minimum, and maximum. The second and third parameters listed are the two parameters of interest for this case: RealCor1 and RealCor2. Below the parameter information is the parameter correlations for the data group. As can be seen, there is only one correlation, which is that between the second and third parameters in the above list. The final number on the line is the actual correlation coefficient between the two parameters. As shown, the correct correlation coefficient was used to correlate the two parameters.

Excerpt from error.all

```
"Sample:",
"NumDist:   3",
"Normal: 0.500E+02 0.500E+03 0.100E+02 0.100E+03",
"Normal: 0.500E+01 0.500E+01 0.000E+00 0.100E+02",
"Normal: 0.150E+02 0.500E+01 0.100E+02 0.200E+02",
"NumCor:   1",
" Cor:            3           2  0.9110000",
```

5.0 Quality Assurance Program

The SDP was developed under a quality assurance program documented in Gelston et al. (1998). In that program, quality is defined as the ability of the software to meet client needs. Meeting client needs starts with a shared understanding of how the software must perform and continues throughout the software lifecycle of design, development, testing, and implementation through attention to details.

Figure 5.1 outlines the software development process used for the SDP, highlighting the quality check points. (Note: the SDP activities flow down the left side of the figure because it is software developed for the first time, as opposed to a modification to existing software.) The process shown is designed for compatibility with similar processes used by other government agencies. For example, this quality process compares favorably with that in the EPA Directive 2182, *System Design and Development Guidance* (EPA 1997). It also compares favorably with the Office of Civilian Radioactive Waste Management's *Quality Assurance Requirements and Description, Supplement I, Software* (OCRWM 1995). Activities roughly equivalent across these processes are shown in Table 5.1.

Development of the SDP included the implementation of a quality assurance checklist (see Figure 5.2). Understanding of this checklist by all team members resulted in the shared understanding of component requirements and design necessary to ensure quality. Completion of this checklist verified that all documentation was completed for transfer of the software to client use.

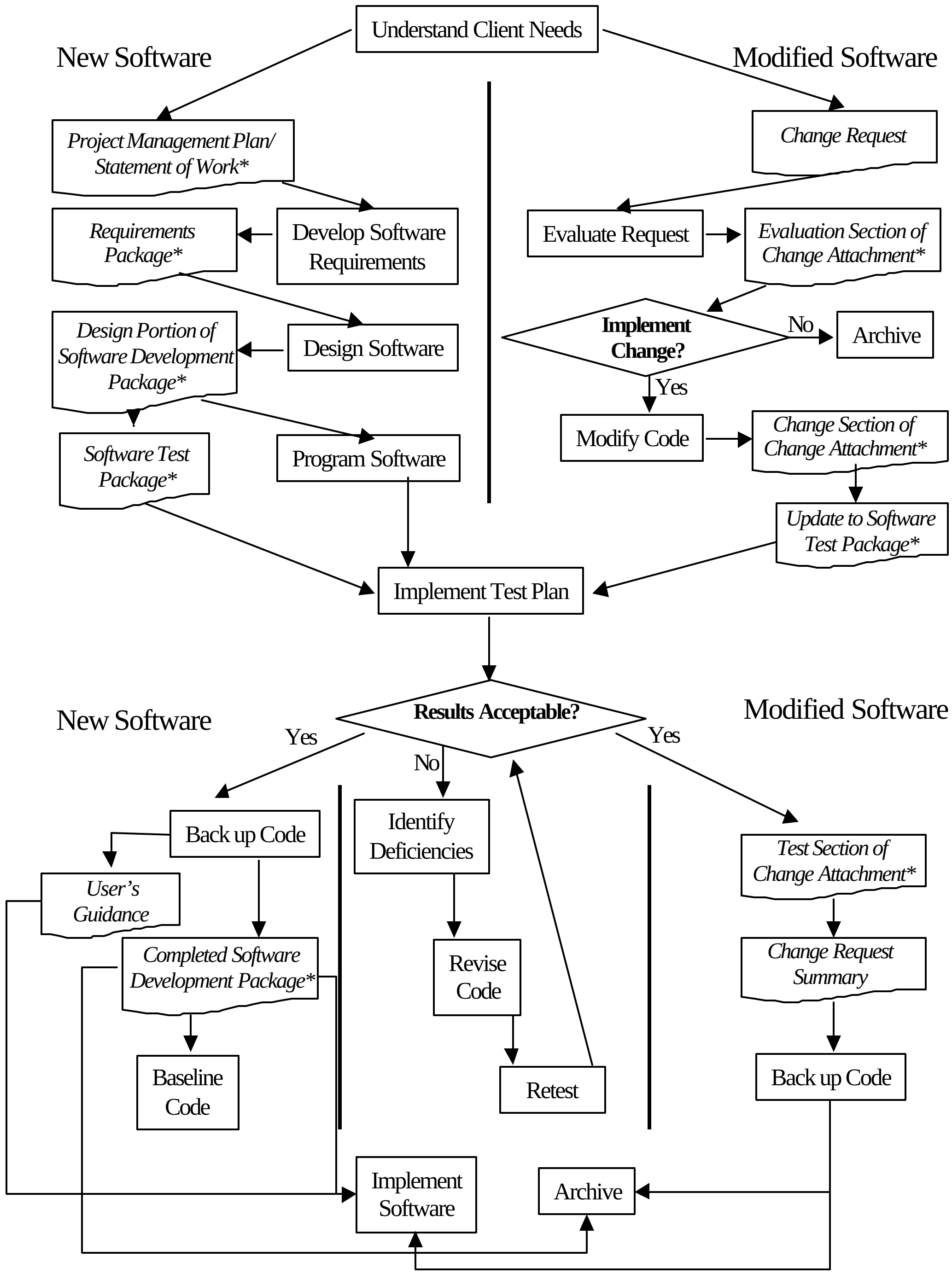

Figure 5.1 Ensuring Quality in the Environmental Software Development Process (* Indicates quality review stage; box with wavy bottom line and italics font indicates document versus activity)

Table 5.1 Relationship of PNNL Environmental Software Development Process to Quality Assurance Requirements (OCRWM 1995; EPA 1997)

OCRWM Quality Assurance Requirement[(a)]	EPA Essential Element of Information[(b)]	Environmental Software Process Equivalent (Section)
	4—System Implementation Plan	Project Management Plan or Statement of Work
I.2.5A Functional Requirements Information Documentation; I.2.5C Requirements and Design Documentation	5—System Detailed Requirements Document	Requirements Package
I.2.1 Software Life Cycles, Baselines (see Appendix C), and Controls	6—Software Management Plan	Project Management Plan or Statement of Work and Gelston et al. (1998)
I.2.2 Software Verification[(c)] and Software Validation; I.2.4 Software Validation[(d)]	7—Software Test and Acceptance Plan	Software Test Package
I.2.3 Software Verification; I.2.5C Requirements and Design Information Documentation	8—Software Design Document	Design Portion of Software Development Package
I.2.6A Configuration Identification		Completed Software Development Package
I.2.6B Configuration Control; I.2.6C Configuration Status; I.2.7 Defect Reporting and Resolution[(e)]	9—Software Maintenance Document	Modification Documentation
	10—Software Operations Document	User's Guidance and Training
I.2.5B User Information Documentation	11—Software User's Reference Guide	User's Guidance and Training
	12—System Integration Test Reports	Software Test Package

(a) Note that OCRWM requirement I.2.8, Control of the Use of Software, is the responsibility of the OCRWM-related client.

(b) Elements 1 through 3 are generally completed by clients in the EPA before contract initiation with the project team.

(c) Verification includes informal code testing by software engineers to ensure that code functions as required.

(d) Validation includes testing by those other than the software engineers who developed the code to provide an independent confirmation that software functions as required.

(e) Note that some changes requested by clients may not be made in the software unless funding has been allocated for such modifications.

A. General Requirements Analysis

--Documented in

_____Statement of Work (stored in project file; see Gene Whelan, Gariann Gelston, or current Integration Leader)

--Contains information on (all of the following)

_____problem description

_____deliverables

_____project team

_____capabilities to be used

_____restrictions

_____difficulties envisioned

_____compatibilities with existing software/hardware

_____scope of the project

B. Specific Requirements Analysis

--Documented in

_____requirements section of documentation (PNNL-11914, Volume 6, Section 2.0)

--Contains information on (all of the following)

_____purpose of the software

_____structure of the software

_____hardware and software requirements

_____input and output requirements

_____scientific basis

_____assumptions

_____limitations

_____post-October 31 requirements

C. Design Documentation

--Documented in

_____design portion of documentation (PNNL-11914, Volume 6, Section 3.0)

_____team task plans/Project Management Plan (stored in project file; see Gene Whelan, Gariann Gelston, or current Integration Leader)

--Contains information on (all of the following)

_____code type and description

_____development team members

_____specifications

_____logic diagrams

_____"help" descriptions

_____methods to ensure consistency in components

_____mathematical formulations

_____need for pre/post-processors

_____post-October 31 design elements

D. Development Documentation

--Documented in

_____Specifications Document (PNNL-11914, Volume 8)

_____Quality Assurance Archive (see Gariann Gelston or current Integration Leader)

--Contains information on (all of the following)

_____baseline hard copy of the source code

_____diskette copy

_____name of computer language(s) used

E. Testing Documentation

--Documented in

_____test plan that meets quality assurance requirements (PNNL11914, Volume 6, Section 4.0)

--Contains information on (all of the following)

_____description of software

_____testing scope

_____relationship between test cases and requirements

_____test activity description

_____hardware and software needed to implement plan

_____test case specifications

_____expected results

Figure 5.2 Quality Assurance Implementation Checklist for the Module Execution Manager

F. User's Guidance

--Documented in

_____hard copy printout of user's guidance for system (PNNL-11914, Volume 11)

--Contains information on (all of the following)

_____description of software

_____description of use of user interface

_____mathematical formulations

_____example problems

_____explanation of modules included

G. General Quality Assurance Documentation

--Documented in

_____Quality Assurance Program Document (PNNL-11880)

_____Quality Assurance Software-Specific Checklist (PNNL-11914, Volume 6, Section 5.0)

--Contains information on (all of the following)

_____purpose of quality assurance program

_____client-specified activities

_____activities required to ensure quality in software

H. Quality Assurance Archive

--Documented in

_____hard copy files (see Gariann Gelston or current Integration Leader)

_____back up disk files in multiple storage locations (see Gariann Gelston or current Integration Leader)

--Contains information on (all of the following)

_____all quality assurance documentation

_____client correspondence regarding software

_____modifications made to baselined software

_____disk copy back ups

_____reproducibility of code (check code for comments)

Completed by ___________________________________ Date _____________________

Approved by
System/Module Manager _________________________ Date _____________________

Figure 5.2 Quality Implementation Checklist (contd)

6.0 References

Documentation for the FRAMES-HWIR Technology Software System

Volume 1: Overview of the FRAMES-HWIR Technology Software System. 1998. PNNL-11914, Vol. 1, Pacific Northwest National Laboratory, Richland, Washington.

Volume 2: System User Interface Documentation. 1998. PNNL-11914, Vol. 2, Pacific Northwest National Laboratory, Richland, Washington.

Volume 3: Distribution Statistics Processor Documentation. 1998. TetraTech, Lafayette, California.

Volume 4: Site Definition Processor Documentation. 1998. PNNL-11914, Vol. 4, Pacific Northwest National Laboratory, Richland, Washington.

Volume 5: Computational Optimization Processor Documentation. 1998. TetraTech, Lafayette, California.

Volume 6: Multimedia Multipathway Simulation Processor Documentation. 1998. PNNL-11914, Vol. 6, Pacific Northwest National Laboratory, Richland, Washington.

Volume 7: Exit Level Processor Documentation. 1998. PNNL-11914, Vol. 7, Pacific Northwest National Laboratory, Richland, Washington.

Volume 8: Specifications. 1998. PNNL-11914, Vol. 8, Pacific Northwest National Laboratory, Richland, Washington.

Volume 9: Software Development and Testing Strategies. 1998. PNNL-11914, Vol. 9, Pacific Northwest National Laboratory, Richland, Washington.

Volume 10: Facilitating Dynamic Link Libraries. 1998. PNNL-11914, Vol. 10, Pacific Northwest National Laboratory, Richland, Washington.

Volume 11: User's Guidance. 1998. PNNL-11914, Vol. 11, Pacific Northwest National Laboratory, Richland, Washington.

Volume 12: Dictionary. 1998. PNNL-11914, Vol. 12, Pacific Northwest National Laboratory, Richland, Washington.

Volume 13: Chemical Properties Processor Documentation. 1998. PNNL-11914, Vol. 13, Pacific Northwest National Laboratory, Richland, Washington.

Volume 14: Site Layout Processor Documentation. 1998. PNNL-11914, Vol. 14, Pacific Northwest National Laboratory, Richland, Washington.

Volume 15: Risk Visualization Tool Documentation. 1998. PNNL-11914, Vol. 15, Pacific Northwest National Laboratory, Richland, Washington.

Quality Assurance Program Document

Gelston, G. M., R. E. Lundgren, J. P. McDonald, and B. L. Hoopes. 1998. *An Approach to Ensuring Quality in Environmental Software*. PNNL-11880, Pacific Northwest National Laboratory, Richland, Washington.

Additional References

Office of Civilian Radioactive Waste Management (OCRWM). 1995. *Quality Assurance Requirements and Description, Software*. U.S. Department of Energy, Washington, D.C.

U.S. Environmental Protection Agency (EPA). 1997. *System Design and Development Guidance*. EPA Directive Number 2182, Washington, D.C.

Appendix A
General Procedure for Test Case Implementation

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General Procedure for Test Case Implementation

The Site Definition Processor (SDP) can be executed via command line arguments or can be envoked through the use of the Hazardous Waste Identification Rule (HWIR) System User Interface (SUI). All testing was conducted using the SUI. The following instructions describe the general procedure for setting up an SDP run using the SUI. Specific input for each run is described in each test case section. These instructions assume that all HWIR components have been successfully installed on the user's system.

Bring up the SUI by clicking on SUI.EXE in the HWIR directory. The SUI window will appear on the screen. There are two main tabs that will require input for each run: the system configuration and system management tabs. The system status tab is the third main tab and is used to start the SDP execution and to view the execution status.

Click on the system configuration tab. On this tab, click on the databases tab to specify all database locations. For testing purposes, all data can be found in the file "SDP_TestDB.mdb," which should be loaded on the system. Type in the filespec for the "SDP_TestDB.mdb" or click on the button to the right of each window to find it. Each window must be populated.

To specify the directories and all directory paths, click on the directories tab. Table A.1 shows the directories and their locations that should be selected. Type in the filespec or click on the button to the right of each window to find it. Each window must be populated. Each of these directories should have been created and populated during the system install.

Table A.1 Directory Paths

Directory	Directory Path
Site Simulation File	\hwir\SSF
Global Results File	\hwir\GRF
Risk Summary Output	\hwir\RSOF
Protective Summary Output	\hwir\PSOF
Permanent Storage	\hwir\Permanent
Chemical Properties	\hwir\CPPData
Meteorological Data	\hwir\Metdata

To specify processors and their paths, click on the processors tab. Because this test plan only addresses the SDP, all other processors besides the SDP should be populated with a dummy module called "DummyProc.bat." The "DummyProc.bat" should be located in the main hwir directory. For the SDP, use "sdpBeta2.exe," which should be located in the main hwir directory. Type in the filespec or use the button on the right of each window to select the appropriate processors. All windows must be populated.

To specify the Multimedia Multipathway Simulation Processing (MMSP) modules and their paths, click on the MMSP modules tab. The MMSP will not be used in any of the SDP testing; however, because the SUI is being used, all MMSP modules must be specified. Similar to the processors that were not used, select the "DummyProc.bat" for all MMSP modules. Type in the filespec or use the button on the right of each window to select the appropriate processors. All windows must be populated.

Next click on the system management tab. On the selections tab, you will select the site, chemicals, source types, and waste levels for the simulation of interest. Specific entries will be listed for each test case. On the options tab, you will select the storage level, number of realizations, and the seed value to be used. Again, specific entries will be listed for each test case.

Next click on the system status tab. The start button on this tab will be used to fire off the SDP. A status of the run will be shown in the lower window. At any time you will be able to stop the run and reset the system. The output generated by a successful SDP run will be fully populated SSF files that will be located in the SSF directory. All of the information that has been entered may be saved to re-run the simulation again. To do this, use the "File" pull-down menu to select "Save As." Save the file in the SSF directory in the format HD*.SSF. The file name must start with the prefix HD and end with the extension .SSF. The information entered will be saved in a file called the header file.

Appendix B

Verification Testing for the Site Definition Processor

Appendix B
Verification Testing for the Site Definition Processor

B.1 Introduction

The purpose of the Site Definition Processor (SDP) is to gather data from the Site Variable Distribution Table, Regional Variable Distribution Table, and National Variable Distribution Table in a logical and organized manner and transfer that data to the appropriate site simulation files (SSF). The SDP primarily transfers data directly from the databases; however, certain parameter values are determined via statistical sampling or are computed by the SDP based on database entries. The following is a description of the process used by the SDP to transfer data to the SSF. Most of the data group SSFs are populated using the basic process; however, several of the data groups contain parameters that need to be addressed specially. The data groups that require special handling will be discussed in data group specific test cases.

B.1.1 Basic Process

The SDP uses a two-step process to search a database table for the data necessary to populate a specified data group SSF. In the first step, the SDP searches the table for all data group parameters that have the distribution type "constant" and populates the data group SSF with those values. The SDP uses the data group's dictionary file (*.DIC) to determine the parameters to search for. In the second step, the SDP selects appropriate records from the cross-correlation table, if they exist, samples from those records, and populates the data group SSF with those values. This two-step process is first applied to the Site Variable Distribution Table. If any parameters are missing, the process is applied to the Regional Variable Distribution Table. And finally, the process is applied to the National Variable Distribution Table to fill in the remaining parameter values. While some of the SSF categories have variable exceptions, this process is generally followed, and exceptions will be called out as the specific SSF population is discussed.

B.1.2 Purpose

The purpose of verification testing is to verify that the SDP is operating as expected. This appendix is organized in the following manner: 1) a requirement will be described, 2) a description of how the requirement was tested will be presented, 3) the expected results will be presented, and 4) the actual SDP results will be reported.

Two sites will be used for testing purposes. The sites and control information are listed below. As shown, all five waste management unit (WMU) types are covered. All test cases will refer back to the same input databases and the SSFs that are created after the execution of the SDP.

Site ID	WMU	Chemical	C_w	Seed Value
0223504	WP,LAU,LF	2,3,7,8,TCDD	3	11031
1632106	LAU,SI,AT	benzene	3	11031

The general procedure for all test cases is to check the databases for certain parameter values and then check the corresponding SSF to verify that the database values were transferred correctly. Certain parameters are transferred conditionally, depending on the modeling scenario. These conditionally populated parameters will be checked in detail. Also, as noted above, certain parameter values are determined via statistical sampling or are computed by the SDP based on database entries. These parameters will also be checked.

Data groups that follow the basic procedure exactly and do not require any additional logic to populate their SSF will be sufficiently examined in the first test case. Data groups that require additional logic will be examined in more detail in separate test cases.

B.2 Test Cases

B.2.1 Test Case 1

B.2.1.1 Requirement

The SDP will populate the SSF with data groups that may include header; site layout; landfill data; land application unit (LAU) data; waste pile data; aerated tank data; surface impoundment data; air data; vadose zone data; aquifer data; watershed data; surface water data; farm, terrestrial, and aquatic foodchain data; human and ecological exposure data; and human and ecological risk data, with all the data necessary to conduct the multimedia multipathway exposure and risk assessment. The SDP will search the site, regional, and national tables, in that order, to obtain the parameter values.

B.2.1.2 Test Description

In this test, the SSF directory will be checked to ensure that all appropriate SSFs are created during the runs. Also, a random sampling of three parameters in each data group SSF will be checked to ensure that the parameter values are being transferred correctly from the databases. An exhaustive check of the hundreds of parameters written to the SSF is not within the scope of this testing. Parameters that require special treatment (i.e., statistical or mathematical manipulation or those having a distribution type other than “constant”) will not be checked in this test case.

B.2.1.3 Expected Results

The following table shows the three parameters for each data group that should be transferred directly to the SSF. All parameters listed below have discrete values in the databases (i.e., all of these parameters had a distribution type of “constant”). When the “Site ID” is listed as “National Database” or “Regional Database,” this indicates that the parameter values were taken from these tables. This indicates that the values were missing from the site-based table, and thus the SDP should search the other tables for the missing data. The presence of these values in the SSF will indicate that the SDP performed the searches correctly.

Site ID	Data Group	Parameter	Units	Type	Indexes	Value
National Database	Landfill (LF)	mcW	volume percent	float	0,0,0,0,0,0	50
		deltDiv	unitless	integer	0,0,0,0,0,0	1
		RunID	unitless	string	0,0,0,0,0,0	Run KKMA
National Database	Aerated Tank (AT)	w_imp	rad/s	float	0,0,0,0,0,0	126
		n_imp	unitless	integer	508,0,0,0,0,0	1
		Q_wmu	m^3/s	float	231,0,0,0,0,0	0.00077
National Database	Waste Pile (WP)	RunID	unitless	string	0,0,0,0,0,0	Run KKMA
		thetawZ2d	volume fraction	float	0,0,0,0,0,0	0
		CutOffYr	year	integer	0,0,0,0,0,0	30
National Database	Land Application Unit (LAU)	zava	m	float	0,0,0,0,0,0	0
		deltDiv	unitless	integer	0,0,0,0,0,0	1
		asdm	mm	float	0,0,0,0,0,0	5
National Database	Surface Impoundment (SI)	EconLife	year	integer	0,0,0,0,0,0	50
		MWt_H2O	g/mol	integer	0,0,0,0,0,0	18
		d_imp	cm	float	0,0,0,0,0,0	61
National Database	Air (AR)	MASSFRAX-Option	unitless	logical	0,0,0,0,0,0	true
		AirSplineAngle	degrees	float	7,0,0,0,0,0	270
		WetDpStr	unitless	string	0,0,0,0,0,0	WETDPLT
AT1632106	Site Layout (SL)	AirLocY	m	float	68,0,0,0,0,0	1200.25
		HabRangeRec-Index	unitless	integer	8,1,0,0,0,0	3
		WBNDOC	mg/L	float	3,0,0,0,0,0	3.7
WP0223504	Vadose Zone (VZ)	POM	g/g	float	0,0,0,0,0,0	3.8
		RHOB	g/cm^3	float	0,0,0,0,0,0	1.4575
		Only two parameters are constants.				
national database	Saturated Zone (AQ)	ALATration	m	float	0,0,0,0,0,0	8
		ALAVration	m	float	0,0,0,0,0,0	160
		Only two parameters are constants.				

Site ID	Data Group	Parameter	Units	Type	Indexes	Value
regional database and WP0223504	Watershed (WS)	a_BF	m/d	float	0,0,0,0,0,0	0.00000311
		b_BF	unitless	float	0,0,0,0,0,0	1.17
		WCS	volume fraction	float	8,0,0,0,0,0	0.45
national database	Surface Water (SW)	rhoDBenthos	g/mL	float	1,0,0,0,0,0	1.1
		TrophicIndex	untiless	integer	0,0,0,0,0,0	3
		v_bury	mm/yr	float	3,0,0,0,0,0	10
national database	Farm Foodchain (FF)	Fw_exveg	untiless	float	0,0,0,0,0,0	0.6
		Rp_silage	unitless	float	0,0,0,0,0,0	0.44
		MAFroot	percent	float	0,0,0,0,0,0	87.32
national database	Terrestrial Foodweb (TF)	tp_exfruit	y	float	0,0,0,0,0,0	0.123
		rho_leaf	g/L FW	float	0,0,0,0,0,0	770
		VGag_forage	unitless	float	0,0,0,0,0,0	1
national database	Aquatic Foodweb (AF)	MaxPreyPref	unitless	float	5,5,1,0,0,0	-999
		MusWaterFrac	unitless	float	0,0,0,0,0,0	0.79
		c_fish	unitless	float	0,0,0,0,0,0	0.72
national database	Human Exposure (HE)	Fm_f	fraction	float	0,0,0,0,0,0	0.254
		Rshower	L/min	float	0,0,0,0,0,0	5.5
		fbp	fraction	float	0,0,0,0,0,0	0.65
national database	Ecological Exposure (EE)	MinPreyPref_ HabRange	unitless	float	6,17,13,0,0,0	0.13
		NumPrey	unitless	integer	0,0,0,0,0,0	20
		BodyWt_rec	kg	float	5,0,0,0,0,0	3.75
national database	Human Risk (HR)	LifeTime	unitless	float	0,0,0,0,0,0	76.5
		ExDur_NCar_ Block	unitless	integer	0,0,0,0,0,0	1
		RegPercentile	unitless	float	0,0,0,0,0,0	90
national database	Ecological Risk (ER)	EcoReg Percentile	unitless	float	0,0,0,0,0,0	95
		NumHabitat	unitless	integer	0,0,0,0,0,0	12
		HabitatIndex	unitless	integer	11,0,0,0,0,0	11

B.2.1.4 Results

The parameters listed in the previous section were searched for in the SSF. The SSFs are listed by data group. In the interest of conserving paper, only the records for the selected parameters are shown. The parameter values of interest are in bold and shadowed.

Landfill data group (LFLF0223504.ssf)

1. "mcW",0,"FLOAT",0,"volume percent",
   50,
2. "deltDiv",0,"INTEGER",0,"unitless",
   1,
3. "RunID",0,"STRING",0,"",
   "**Run KKMA**",

Aerated Tank data group (ATAT1632106.ssf)

1. "w_imp",0,"FLOAT",0,"rad/s",
   126,
2. "n_imp",0,"INTEGER",0,"unitless",
   1,
3. "Q_wmu",0,"FLOAT",0,"m3/s",
   0.0007736092098,

Waste Pile data group (WPWP0223504.ssf)

1. "RunID",0,"STRING",0,"",
   "**Run KKMA**",
2. "thetawZ2d",0,"FLOAT",0,"volume fraction",
   0,
3. "CutOffYr",0,"INTEGER",0,"year",
   30,

Land Application Unit data group (LALA1632106.ssf)

1. "zava",0,"FLOAT",0,"m",
   0,
2. "deltDiv",0,"INTEGER",0,"unitless",
   1,
3. "asdm",0,"FLOAT",0,"mm",
   5,

Surface Impoundment data group (SISI1632106.ssf)

1. "EconLife",0,"INTEGER",0,"year",
   50,
2. "Mwt_H2O",0,"FLOAT",0,"g/mol",

18,

3. "d_imp",0,"FLOAT",0,"cm",
   61,

Air data group (ArLA1632106.ssf)

1. "MASSFRAXOption",0,"LOGICAL",0,"",
   "**T**",
2. "AirSplineAngle",1,"FLOAT",0,"degrees",
   8,0,45,90,135,180,225,**270**,315,
3. "WetDpStr",0,"STRING",0,"",
   "**WETDPLT**",

Site Layout data group (SLAT1632106.ssf)

1. "AirLocY",1,"FLOAT",0,"m",

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   21,7,18,23,25,30,34,38,42,54,6,29,33,57,5,8,12,15,26,37,45,47,
   16,3,16,18,23,34,46,9,39,27,57,8,15,37,45,47,48,
   15,**3**,16,18,23,34,32,39,2,14,57,8,15,37,45,47,
3. "WBNDOC",1,"FLOAT",0,"mg/L",
   3,3.7,3.7,**3.7**,

Vadose Zone data group (VZWP0223504.ssf)

1. "POM",0,"FLOAT",0,"g/g",
   3.8,
2. "RHOB",0,"FLOAT",0,"g/cm3",
   1.4575,

Saturated Zone data group (AQ01.ssf from case WP0223504)

1. "ALATRatio",0,"FLOAT",0,"m",
   8,
2. "ALAVRatio",0,"FLOAT",0,"m",
   160,

Watershed data group (WSWP0223504.ssf)

1. "a_BF",0,"FLOAT",0,"m/d",
3.11e-006,
2. "b_BF",0,"FLOAT",0,"unitless",
1.17,
3. "WCS",1,"FLOAT",0,"volume fraction",
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Surface Water data group (SW1.ssf from case WP0223504)

1. "rhoDBenthos",1,"FLOAT",0,"g/mL",
3,**1.1**,1.1,1.1,
2. "TrophicIndex",1,"INTEGER",0,"",
3,3,4,6,
3. "v_bury",1,"FLOAT",0,"mm/yr",
3,10,10,**10**,

Farm Foodchain data group (FFLA1632106.ssf)

1. "Fw_exveg",0,"FLOAT",0,"unitless",
0.6,
2. "Rp_silage",0,"FLOAT",0,"unitless",
0.44,
3. "MAFroot",0,"FLOAT",0,"percent",
87.32,

Terrestrial Foodweb data group (TFLA1632106.ssf)

1. "tp_exfruit",0,"FLOAT",0,"y",
0.123,
2. "rho_leaf",0,"FLOAT",0,"g/L FW",
770,
3. "VGag_forage",0,"FLOAT",0,"unitless",
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Aquatic Foodweb data group (AFWP0223504.ssf)

1. "MaxPreyPref",3,"FLOAT",0,"unitless",
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Human Exposure data group (HEWP0223504.ssf)

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Ecological Exposure data group (EELA1632106.ssf)

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999,0.01,-999,-999,-999,
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999,-999,-999,

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999,-999,
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999,0.01,0.01,0.01,0,
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20,-999,0,0.5,-999,-999,0,-999,-999,-999,-999,-999,-999,-999,-999,-999,-
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57,
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999,0.01,-999,-999,0.02,
20,0.15,0.08,-999,-999,-999,-999,-999,-999,-999,-999,0.07,-999,0,-999,-999,-
999,0.01,-999,-999,-999,
20,0.6,0.01,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,0,-999,-999,-
999,0.01,-999,-999,-999,
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20,0.03,0.08,0,-999,-999,-999,-999,-999,-999,-999,0.05,0,0.13,-999,-999,-
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20,0,0.1,0.05,-999,-999,0.01,0.1,0.05,0.05,0,0,-999,0,-999,-999,-
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999,0.01,-999,-999,-999,
20,-999,0.1,-999,-999,-999,-999,0,-999,-999,0,0,-999,0,0.1,-999,-
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999,-999,-999,-999,-999,-999,
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20,-999,0.1,-999,-999,-999,-999,0,0,-999,0,0,-999,0,0.5,0,0,0.01,0.01,0.01,-
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999,0.01,0.01,0.01,0,
20,0.25,0.1,0,-999,-999,-999,-999,-999,-999,-999,0,0,-999,-999,-999,-
999,0.01,-999,-999,-999,
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999,0.01,-999,-999,0,
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999,0.01,0.01,0.01,0,
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999,0.01,0.01,0.01,-999,
20,-999,0.5,-999,-999,-999,-999,-999,-999,-999,-999,0,-999,0,-999,-999,-
999,0.01,-999,-999,-999,
20,-999,0.5,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,-999,0,-999,-
999,0.01,-999,-999,-999,
20,-999,-999,-999,-999,-999,-999,-999,-999,-999,0,0.1,0,0.5,0,-999,0,0.01,-
999,-999,-999,
2. "NumPrey",0,"INTEGER",0,"unitless",
20,
3. "BodyWt_rec",1,"FLOAT",0,"kg",
62,50.396842,0.1189153391,0.0773,0.1774732496,**3.75**,19.30859066,0.1470570683,12
8.874222,2.417022962,0.249,0.1516243278,2.996629957,0.009,0.4048645927,13.1288
9529,0.0196,0.3817513128,1.226135331,0.001915678448,0.006873863542,0.084243694
13,0.01773521089,2.229,0.0491,0.2260353955,1.091233068,1.799323202,0.040830302
78,0.7923896273,0.008789197916,0.047,0.1886469524,1.170158282,0.01060659515,0.
0208217222,0.9924225971,75.47001794,0.873,0.1912576396,0.2084946042,1.60138263
2,0.2389835129,0.02528596804,0.04156701674,5.691468746,0.113678197,4.532144522
,1.130926184,8.660254038,0.015,0.2015302847,5.295592583,0.1002456207,0.0425,0.
02095,0.1064424727,69.41716207,0,0,0,0,0,

Human Risk data group (HRLA1632106.ssf)

1. "LifeTime",0,"FLOAT",0,"unitless",
76.5,
2. "ExDur_NCar_Block",0,"INTEGER",0,"unitless",
1,
3. "RegPercentile",0,"FLOAT",0,"unitless",
90,

Ecological Risk data group (ERWP022304.ssf)

1. "EcoRegPercentile",0,"FLOAT",0,"unitless",
95,
2. "NumHabitat",0,"INTEGER",0,"unitless",
12,
3. "HabitatIndex",1,"INTEGER",0,"unitless",
12,1,2,3,4,5,6,7,8,9,10,**11**,12,

B.2.2 Test Case 2

B.2.2.1 Requirement

The SDP will use the Statistical Dynamic Link Library (Stat DLL) to obtain parameter values, based on distribution data, when discrete values are not available in the databases.

B.2.2.2 Test Description

Verification that the Stat DLL itself is operating correctly is beyond the scope of this test plan. The ability of the SDP to correctly utilize the Stat DLL, however, will be examined. Instead of performing specific tests, the source code for calling the Stat DLL has been included. The logic of the source code can be followed to check that it will make the correct calls to the Stat DLL.

The SDP reads the "Distribution_Type" field for each database parameter to determine if the parameter has a constant value or will require statistical modification. The distribution types available are "constant," "normal," "log normal," "exponential," "uniform," "integer uniform," "triangular," "empirical," "user-defined," "weibull," "gamma," "transform log normal," "transform Johnson SB," "transform Johnson SU," "Johnson SB," and "Johnson SU." The following is a key in the code to convert the actual distribution read into the variable name that is used in the code.

```
****************************************************************************************************

  if (strcmpi(s,"constant")==0) return DS_CONSTANT;
  if (strcmpi(s,"normal")==0) return DS_NORMAL;
  if (strcmpi(s,"logNormal")==0) return DS_LOGNORMAL;
  if (strcmpi(s,"exponential")==0) return DS_EXPONENT;
  if (strcmpi(s,"uniform")==0) return DS_UNIFORM;
  if (strcmpi(s,"intUniform")==0) return DS_INTUNIF;
```

```
 if (strcmpi(s,"triangular")==0) return DS_TRIANGLE;
 if (strcmpi(s,"empirical")==0) return DS_EMPIRICAL;
 if (strcmpi(s,"user-defined")==0) return DS_EMPIRICAL;
 if (strcmpi(s,"weibull")==0) return DS_WEIBULL;
 if (strcmpi(s,"gamma")==0) return DS_GAMMA;
 if (strcmpi(s,"TrnLogNormal")==0) return DS_TRNLOGNOR;
 if (strcmpi(s,"TrnJohnsonSB")==0) return DS_TRNJSB;
 if (strcmpi(s,"TrnJohnsonSU")==0) return DS_TRNJSU;
 if (strcmpi(s,"JohnsonSB")==0) return DS_JSB;
 if (strcmpi(s,"JohnsonSU")==0) return DS_UNKNOWN;
```

****

The actual source code that makes the call to the Stat DLL is listed below. As stated previously, the code logic can be followed to check that correct calls are being made to the Stat DLL.

```
    if ((stat==DS_NORMAL)
        || (stat==DS_LOGNORMAL) || (stat==DS_TRNJSB) || (stat==DS_TRNJSU)
        || (stat==DS_TRNLOGNOR) || (stat==DS_GAMMA) || (stat==DS_WEIBULL)
        || (stat==DS_JSB))
     {
     central = qry->Fields[FI_CT]->AsFloat;
     variance = qry->Fields[FI_VAR]->AsFloat;
     minimum = qry->Fields[FI_MIN]->AsFloat;
     maximum = qry->Fields[FI_MAX]->AsFloat;

     if (stat==DS_NORMAL)
       StatNormal(central, variance, minimum, maximum);
     else if (stat==DS_LOGNORMAL)
       StatLogNormal(central, variance, minimum, maximum);
     else if (stat==DS_TRNJSB)
       {
       StatSB(central, variance, minimum, maximum);
       }
     else if (stat==DS_TRNJSU)
       {
       StatSU(central, variance, minimum, maximum);
       }
     else if (stat==DS_TRNLOGNOR)
       StatTrnLogNormal(central, variance, minimum, maximum);
     else if (stat==DS_GAMMA)
       {
//     StatDebugOn();   // turn on statistics debugging
       alpha = pow(central / variance,2.0);
       beta = (central / alpha);
       StatGamma(alpha, beta, minimum, maximum);
       }
     else if (stat==DS_WEIBULL)
       {
       StatWeibull(central, variance, minimum, maximum);
       }
```

```
  else if (stat==DS_JSB)
    StatJohnsonSB(central, variance, minimum, maximum);
  }
else if (stat==DS_EXPONENT)
  {
  central = qry->Fields[FI_CT]->AsFloat;
  minimum = qry->Fields[FI_MIN]->AsFloat;
  maximum = qry->Fields[FI_MAX]->AsFloat;
  StatExponential(central, minimum, maximum);
  }
else if (stat==DS_UNIFORM || stat==DS_INTUNIF)
  {
  minimum = qry->Fields[FI_MIN]->AsFloat;
  maximum = qry->Fields[FI_MAX]->AsFloat;
  if (stat==DS_UNIFORM)
    StatUniform(minimum, maximum);
  else
    StatIntUniform(minimum,maximum);
  }
else if (stat==DS_EMPIRICAL)
  {
  astr = qry->Fields[FI_UD]->AsString;
  strcpy(dt,astr.c_str());
  minimum = qry->Fields[FI_MIN]->AsFloat;
  maximum = qry->Fields[FI_MAX]->AsFloat;
  numEmp = getUserDefined(dt, &minimum, &maximum, &empVal, &empProb);
  if (ErrorExists) return false;
  StatEmpirical(minimum, maximum, numEmp, empVal, empProb);
  if (numEmp>0)
    {
    delete[] empVal;
    delete[] empProb;
    }
  }
else if (stat==DS_TRIANGLE)
  {
  central = qry->Fields[FI_CT]->AsFloat;
  minimum = qry->Fields[FI_MIN]->AsFloat;
  maximum = qry->Fields[FI_MAX]->AsFloat;
  StatTriangular(central, minimum, maximum);
  }
```

B.2.2.3 Expected Results

It is expected that the SDP will follow the above logic to call the appropriate Stat DLL function, depending on the distribution type for the parameter.

B.2.2.4 Results

There are no results to be reported for this test case.

B.2.3 Test Case 3

B.2.3.1 Requirement

The SDP will modify variables for consistency and handle data exceptions in the site layout data group. The specific rules are listed below. The requirement numbers will be referenced in the expected results and results sections.

1) Set the human receptor pH (HumRcpPH) equal to the aquifer pH (AquPH).

2) When the number of selected air points in a waterbody network reach is 0 (WBNRchNumAir = 0), the waterbody network reach air fraction (WBNRchAirFrac) and waterbody network reach air index (WBNRchAirIndex) should be ignored.

3) When the number of wells in an aquifer is 0 (NumAquWell = 0), all aquifer-well parameters (AquWell*) should be ignored.

4) The SL.SSF can contain data for only one aquifer. If the number of aquifers is greater than 1 (NumAqu > 1) , then the SDP should pick an aquifer from the available aquifers and update that aquifer's data into the first aquifer data location. All data referring to the other aquifers should be ignored.

5) The SL.SSF can contain data for only one vadoze zone. If the number of vadose zones is greater than 1 (NumVad > 1) , then the SDP should pick a vadoze zone from the available vadose zones and update that vadose zone's data into the first vadose zone data location. All data referring to the other vadose zones should be ignored.

6) In order for the appropriate hydrogeologic variables to be selected, the processor must first get the soil type from the Site Variable Distribution Table. The soil type along with the source type will determine the site layout variables needed for the SSF. After getting the soil type (VadSoilType), the basic process described above can be run for the Site Variable Distribution Table.

The SDP will then retrieve the groundwater class (GWClass) and hydrogeologic region (HydrologicRegion) back from the site layout SSF for use in updating the hydrogeologic properties. An additional value, ground water class index (GWClassIndex), will be collected from the Regional Variable Distribution Table for that groundwater class (setting_id=GWClass). At this point, four records are expected to be sampled from the Regional Variable Distribution Table: aquifer saturated hydraulic conductivity (AquSATK), aquifer gradient (AquGRAD), aquifer thickness (AquThick), and vadose zone thickness (VadThick).

If one or more values are empty (value = -999), then an algorithm provided by EPA is applied 1 to 10 times to obtain the missing value. Input to this algorithm includes the corresponding data for these parameters, found in the cross-correlation table, for the specific groundwater class (setting_id = GWClass). If any of the four variables are still missing, the maximum value is then assigned. All four variables are then written to the site layout SSF.

B.2.3.2 Test Description

In this test, the database tables and the SLWP0223504.SSF will be examined to verify that the SDP followed the above logic.

B.2.3.3 Expected Results

It is expected that the SDP will follow the above logic and that the correct parameter values will be found in the SLWP0223504.SSF. The numbers listed below correspond to the requirement number listed in the requirement section above (Section B.2.3.1).

1) It is expected that human receptor pH (HumRcpPH) will be equal to the aquifer pH (AquPH) in the SLWP0223504.SSF.

2) It is expected that when the number of selected air points in a waterbody network reach is 0 (WBNRchNumAir=0), the waterbody network reach air fraction (WBNRchAirFrac) and waterbody network reach air index (WBNRchAirIndex) will be ignored. In other words, WBNRchAirFrac and WBNRchAirIndex should not appear in the SSF.

3) It is expected that when the number of wells in an aquifer is 0 (NumAquWell = 0), all aquifer-well parameters (AquWell*) will be ignored. In other words, all parameters beginning with AquWell should not appear in the SSF.

4) It is expected that if the number of aquifers is greater than 1 (NumAqu > 1), then the SDP will pick an aquifer from the available aquifers and update that aquifer's data into the first aquifer data location. All data referring to the other aquifers should be ignored.

5) It is expected that if the number of vadose zones is greater than 1 (NumVad > 1), then the SDP should pick a vadoze zone from the available vadose zones and update that vadose zone's data into the first vadose zone data location. All data referring to the other vadose zones should be ignored.

6) It is expected that the SDP will correctly populate the site layout SSF with values for the parameters aquifer saturated hydraulic conductivity (AquSATK), aquifer gradient (AquGRAD), aquifer thickness (AquThick), and vadose zone thickness (VadThick). The presence of these parameters in the site layout SSF either means that valid database entries were available or the EPA algorithm was called and applied successfully.

B.2.3.4 Results

As noted above, the results are listed by number. The number correlates back to the requirements and expected results sections above. All checks were made in SLWP0223504.ssf.

1) The aquifer and human receptor pH values were both set to the same value.

```
"AquPh",0,"FLOAT",0,"pH units",
8.762929432,
```

and

```
"HumRcpPh",0,"FLOAT",0,"pH units",
8.762929432,
```

2) The values for WBNRchNumAir were all zeroes as shown below, and the parameters WBNRchAirFrac and WBNRchAirIndex were not found.

```
"WBNRchNumAir",2,"INTEGER",0,"",
1,
8,0,0,0,0,0,0,0,0,
```

3) In this case, NumAquWell was equal to 125 as shown below; therefore, the AquWell parameters were populated.

```
"NumAquWell",0,"INTEGER",0,"",
125,
```

4) In this particular case, NumAqu was equal to 1.

5) In this particular case, NumVad was equal to 1.

6) The parameters aquifer saturated hydraulic conductivity (AquSATK), aquifer gradient (AquGRAD), aquifer thickness (AquThick), and vadose zone thickness (VadThick) were found and are listed below.

```
"AquSATK",1,"FLOAT",0,"m/yr",
1,31500,

"AquGrad",1,"FLOAT",0,"",
1,0.001,

"AquThick",1,"FLOAT",0,"m",
1,24.4,

"VadThick",1,"FLOAT",0,"m",
1,30.5,
```

B.2.4 Test Case 4

B.2.4.1 Requirement

In order to populate the source SSF, the SDP must first determine if the source type is an aerated tank. If the source type is not an aerated tank, then the basic process will be followed and applied to the site, regional, and national data tables as described previously to populate the source SSF according to the SI.DIC, WP.DIC, LF.DIC, and LA.DIC dictionary files.

1) If the source type is an aerated tank, then the maximum source area (MaxSrcArea) and the aerated tank index (ATIndex) are read from the site layout SSF. The site layout data group for this index (index_1=ATIndex) is then gathered from the national table. The tank source area (SrcArea) of the selected data group is then compared to the maximum source area (MaxSrcArea). If the tank source area is larger than the maximum source area (SrcArea > MaxSrcArea), then a resampling is done. This resampling continues until a tank source area is found that is not larger than the maximum source area. At this point, the data group associated with the successful source area is given an index of 0. The source area (SrcArea) can then be updated in the site layout SSF.

2) Each source local watershed subarea area (SrcLWSSubAreaArea) is also set equal to the source area (SrcArea).

3) Before completing the population of the source SSF, for all source types, the liquid or solid C_w must be updated based on the source type. The SDP makes a call to the CPP to obtain values necessary to update the liquid C_w (C_in) for aerated tank AT or surface impoundment (SI) and the solid C_w (CTPwaste) for waste pile (WP), landfill (LF), and LAU.

B.2.4.2 Test Description

The results involving site 1632106 and an aerated tank will be checked. The site layout SSF (SLAT1632106.SSF) will be checked for the values of MaxSrcArea and SrcArea for the first requirement. The values for each watershed subarea will be checked to verify that they are all equal to the SrcArea value to address the second requirement. The presence of the C_in will be checked in the aerated tank SSF (ATAT1632106.SSF) to address the third requirement.

B.2.4.3 Expected Results

The expected results are listed by number, which corresponds to the requirements listed in Section B.2.4.1.

1) It is expected that the value of SrcArea in SLAT1632106.SSF will be less than or equal to the value of MaxSrcArea in the same file.

2) In this case, there is only one local watershed subarea. It is expected that the area for the local watershed subarea is set equal to the SrcArea value.

3) It is expected that the parameter C_in will be populated in ATAT1632106.SSF.

B.2.4.4 Results

The results are listed by number, which corresponds to the requirements listed in Section B.2.4.1.

1) The values for SrcArea and MaxSrcArea were found in SLAT1632106.SSF and are listed below.

```
"MaxSrcArea",0,"FLOAT",0,"m^2",
16188,

"SrcArea",0,"FLOAT",0,"m^2",
10.14818302,
```

2) The values for SrcArea and SrcLWSSubAreaArea were found in SLAT1632106.SSF and are listed below.

(Note: SDP version 56 was used for verification. In checking the results for this particular requirement, an error was found in the ordering of the call arguments used to call the IODLL. The error was fixed, and a new version of the SDP was compiled. The below results were produced by the corrected SDP.)

```
"SrcArea",0,"FLOAT",0,"m^2",
10.14818302,

"SrcLWSSubAreaArea",2,"FLOAT",0,"m2",
1,
1,10.14818302,
```

3) The parameter C_in was found in ATAT1632106.SSF and is listed below.

"C_in",0,"FLOAT",0,"mg/L",
0.1,

B.2.5 Test Case 5

B.2.5.1 Requirement

If the number of vadose zones is greater than zero (NumVad > 0), then the basic process will be followed and applied to the site, regional, and national data tables as described above to populate the vadose zone SSF as directed by the VZ.DIC. However, an additional required parameter must be computed based on database information. The variable vadose zone thickness (VadThick) must be read from the site layout SSF and used to calculate the dispersivity. Dispersivity is then updated in the vadose zone SSF.

Equation for dispersivity:

Dispr = 0.02 + (0.022 x VadThick)

B.2.5.2 Test Description

The results involving site 0223504 and a waste pile will be checked. The site layout data group section of the site layout SSF (SLWP0223504.SSF) will be checked for the value of VadThick. The equation above will then be used to compute a value for dispersivity. The actual value of dispersivity that was written to the VZWP0223504.SSF will be checked.

B.2.5.3 Expected Results

The value for VadThick taken out of the file SLWP0223504.SSF was 50.8 m as shown below.

```
"VadThick",1,"FLOAT",0,"m",
1,50.8,
```

Dispersivity was computed to be 0.508 m as shown below.

Dispr = 0.01 + (0.022 x 50.8 m) = 1.1376 m

B.2.5.4 Results

The value for dispersivity that was found in the VZWP0223504.SSF is shown below.

```
"DISPR",0,"FLOAT",0,"m",
1.1376,
```

B.2.6 Test Case 6

B.2.6.1 Requirement

If the number of aquifer points is greater than 0 (NumAqu > 0), then the basic process will be followed and applied to the site, regional, and national data tables as described above to populate the aquifer SSF according to the AQ.DIC dictionary file. However, before completing the population of the aquifer SSF, the variables longitudinal dispersivity (AL), porosity (Por), and bulk density (BDens) must be calculated using EPA algorithms.

B.2.6.2 Test Description

The results involving site 1632106 and a LAU will be checked. Testing of the EPA algorithms will not be performed. The purpose of this test case is to verify that the SDP is correctly calling the EPA algorithms. The existence of the parameters AL, BDENS, and POR in the aquifer SSF will indicate that the algorithms were called. The aquifer SSF (AQ01.SSF) will be checked to see if values for AL, BDENS, and POR have been populated.

B.2.6.3 Expected Results

The site layout section of the site_variable_distribution_data table was checked for the value of NumAqu. The value of NumAqu was 1; therefore, it is expected that the SDP will make calls to the

EPA subroutines to obtain values for the parameters AL, BDENS, and POR. The SDP should then populate the aquifer SSF with those values.

B.2.6.4 Results

The following results were pulled out of the AQ01.SSF.

```
"AL",0,"FLOAT",0,"m",
67.69626174,

"BDENS",0,"FLOAT",0,"g/cm3",
1.36628892,

"POR",0,"FLOAT",0,"",
0.2227625536,
```

B.2.7 Test Case 7

B.2.7.1 Requirement

If the number of surface water points is greater than 0 (NumWBN > 0), then the basic process will be followed and applied to the site, regional, and national data tables as described above to populate the surface water SSF according to the SW.DIC dictionary file. However, before completing the population of the surface water SSF, the first index for concentration upstream (c_upstream) must be set equal to 1.

B.2.7.2 Test Description

The results involving site 1632106 and a LAU will be checked. The site layout data group section of the site_variable_data table will be checked for the parameter NumWBN, and then the surface water SSF (SW1.SSF) will be checked for the value of c_upstream.

B.2.7.3 Expected Results

If NumWBN is greater than 0, then the value of parameter c_upstream in the file SW1.SSF should equal 1.

B.2.7.4 Results

The value of NumWBN was set to 2 in the site_variable_data table. The value for c_upstream was set to 1 in the file SW1.SSF as shown below.

```
"C_upstream",1,"FLOAT",0,"mg/L",
1,0,
```

B.2.8 Test Case 8

B.2.8.1 Requirement

If the number of air points is greater than 0 (NumAir > 0), then the basic process will be followed and applied to the site, regional, and national data tables as described previously to populate the air SSF according to the AR.DIC dictionary file. However, if the source is also a tank, the source height (SHight) must be collected from the National Variable Distribution Table. This variable dimension must be augmented with the aerated tank index (ATIndex) before updating this value in the air SSF.

B.2.8.2 Test Description

We have no AR.SSF for the aerated tank case that was run. It was not possible to check the update to parameter SHight.

B.2.8.3 Expected Results

It is expected that the parameter SHight would be augmented by adding a dimension in order to keep track of ATIndex.

B.2.8.4 Results

No air SSF was available to verify this was done properly.

B.2.9 Test Case 9

B.2.9.1 Requirement

The SDP should populate SSF for data groups as specified by parameter values in the SL data group. The following logic should be followed:

1) If the number of watershed subbasins is greater than 0 (NumWSSub > 0), then the basic process will be followed and applied to the site, regional, and national data tables as described above to populate the watershed SSF according to the WS.DIC dictionary file.

2) If the number of waterbody networks is greater than 0 (NumWBN > 0), then the basic process will be followed and applied to the site, regional, and national data tables as described above to populate the aquatic foodweb SSF according to the AF.DIC dictionary file.

3) If the number of farms or human receptors is greater than 0 (NumFarm > 0 or NumHumRcp > 0), then the basic process will be followed and applied to the site, regional, and national data tables as described above to populate the farm foodchain SSF according to the FF.DIC dictionary file.

4) If the number of farms or human receptors is greater than 0 (NumFarm > 0 or NumHumRcp > 0), then the basic process will be followed and applied to the site, regional, and national data tables

as described above to populate the human receptor and human exposure SSF according to the HR.DIC and HE.DIC dictionary files.

5) If the number of habitat regions is greater than 0 (NumHab > 0), then the basic process will be followed and applied to the site, regional, and national data tables as described above to populate the terrestrial foodweb SSF according to the TF.DIC dictionary file.

6) If the number of habitat regions is greater than 0 (NumHab > 0), then the basic process will be followed and applied to the site, regional, and national data tables as described above to populate the ecological risk and ecological exposure SSF according to the ER.DIC and EE.DIC dictionary files.

B.2.9.2 Test Description

The results involving site 1632106 and a LAU will be checked. The site layout data group section of the site_variable_data table will be checked for the Num* parameters, and then the SSF directory will be checked for the presence of the associated SSF.

B.2.9.3 Expected Results

It is expected that the SDP will generate a data group SSF for any of the above "Num" parameters that has a value greater than zero.

B.2.9.4 Results

The Site_Variable_Data table was searched for the Num* variables, and the presence of the associated SSF was checked.

1) The parameter NumWSSub was set to 10. The WSLA1632106.SSF was located in the SSF directory.

2) The parameter NumWBN was set to 2. The AFLA1632106.SSF was located in the SSF directory.

3) The parameters NumFarm and NumHumRcp were set to 3 and 222 respectively. The FFLA1632106.SSF was located in the SSF directory.

4) The parameters NumFarm and NumHumRcp were set to 3 and 222 respectively. The HRLA1632106.SSF and HELA1632106.SSF were located in the SSF directory.

5) The parameter NumHab was set to 6. The TFLA1632106.SSF was located in the SSF directory.

6) The parameter NumHab was set to 6. The ERLA1632106.SSF and EELA1632106.SSF were located in the SSF directory.

B.2.10 Test Case 10

B.2.10.1 Requirement

The SDP will call the chemical properties processor (CPP) in order to populate the CP.SSF.

B.2.10.2 Test Description

The results involving site 1632106 and a surface impoundment will be checked. The SSF directory will be checked for the presence of the CPSR.SSF. The presence of the CPSR.SSF will indicate that the CPP was called and executed.

B.2.10.3 Expected Results

It is expected that the CPSR.SSF will be found in the SSF directory.

B.2.10.4 Results

The CPSR.SSF was found in the SSF directory.