

AIR2GIS (Air Model to GIS Risk-MAP) Version 1.0 Validation Report

Executive Summary

This validation report details the efforts U.S. Environmental Protection Agency (U.S. EPA) Region 6 made to ensure AIR2GIS (Air Model-to-GIS Risk-MAP) Version 1.0 operates according to its design. U.S. EPA developed AIR2GIS under the Regional Air Impact Modeling Initiative (RAIMI) to meet the functional need of preparing the ISCST3 air model plot files for import into Risk-MAP to support risk analysis for large and complex studies.

This validation effort tested the core capabilities of AIR2GIS:

1. Concatenate the air parameter values from each of the four ISCST3 air model plot files (one model run per phase) as required to support inputs for risk modeling within RAIMI applications.
2. Follow file naming conventions.
3. Offer a user interface on a Windows platform allowing for plot file selection by source and phase.
4. Support processing of up to 1,000 sources in a single batch run.

These core capabilities constitute the required functionality to meet project objectives. Validation did not include regression testing or error handling verification.

Testing validated the output AIR2GIS generated.

Functional Capabilities

The core capability of AIR2GIS provides the air modeler with a tool to prepare source-specific output files from the ISCST3 air model plot files. As each source may have up to four air model runs, one for each contaminant phase, consolidating the run results into a single file provides for logistically tracking and simplified integration of air model results into Risk Management Analysis Platform (Risk-MAP) to support further analysis.

The air model generates air parameter values at each grid node (approximately 7,500-8,000 nodes) with a discrete value for the one-hour average air concentration for use in acute risk assessment, and for the annual average air concentration, dry deposition and wet deposition for use in chronic risk assessment.

AIR2GIS addresses the four potential phases of the emitted constituents, including volatile vapor, particle, particle-bound and mercury vapor phases. For each contaminant phase modeled, ISCST3 outputs the air parameter values into two separate plot files, a one-hour and an annual, for each source modeled. AIR2GIS extracts the sixteen air parameter values from the eight air model plot files based on grid node location and merges them into a single air parameter value

file for each source. This file for each source, referred to as the 'A2G' file, is imported into Risk-MAP to support further analysis.

Validation Criteria

Validation efforts tested the following four functional elements:

1. Concatenate the air parameter values from each of the four ISCST3 air model plot files (one model run per phase) as required to support inputs for risk modeling within RAIMI applications;
2. Follow file naming conventions;
3. User interface on a Windows platform allowing for plot file selection by source and phase; and
4. Support processing of up to 1,000 sources in a single batch run.

Execution

The following sections describe the specific steps performed during the AIR2GIS validation.

Concatenate Air Parameter Values

Execute test case data set (includes ISCST3 modeling runs to represent all four phases) and compare results to a control to determine that AIR2GIS:

- Opened and read the appropriate air parameter data from the resulting 8 plot files, two for each phase.
- Read the annual and one-hour plot files from the 8 plot files for each source to extract the 16 air parameter values for concatenation into a single output file for each source.
- Properly formatted the single output files for each source and wrote the 16 associated air parameters for the four phases to a single line in the output file.
- Included all grid nodes in the output file, 'A2G.'

Follow Naming Conventions

AIR2GIS must read air model results from numerous sources and create a concatenated air parameter value file. The file naming convention is based on the unique source ID assigned to each source in the inventory. The air model runs are named for the unique source ID, with extensions identifying the file type. For example, the one-hour plot file for a vapor phase run has a filename of 'sourceID.vp'. The annual plot file name would be 'sourceID.vpa'. Similarly, the plot files for the particle phase model runs have extensions of '.pp1' and '.ppa', particle-bound runs have '.bp1' and 'bpa', and mercury vapor runs have extensions of '.hp1' and '.hpa'. Executed test case data set (includes ISCST3 modeling runs to represent all four phases) and compared results to a control to determine that:

- The plot files from the test case data set are read into the AIR2GIS program, and concatenated into a single output file named 'sourceID.a2g'.
- AIR2GIS is executed to demonstrate correct use of the convention for reading the air parameter values from the plot files and creating the 'A2G' file.

The 20-source validation test set was used to confirm the reading of plot files and creation of output files using the naming convention.

Windows-Based User Interface

AIR2GIS needs to execute on a Windows platform to accommodate multi-tasking of other applications during AIR2GIS execution, and to allow for the discontinuation by software developers of DOS-based applications and support. This test is validated by observation of AIR2GIS execution on a Windows platform.

Batch Process Sources

AIR2GIS needs to support large scale and complex RAIMI risk assessment applications with the capability to process up to 1,000 sources in a single batch run.

Validation Criteria Table			
Core Capability to be Tested	Test Description and Method of Comparison	Files	Comments
Concatenate Air Parameter Values	Test the extraction and assimilation of the one-hour and annual average air parameter values from the ISCST3 air model results for each of the four potential contaminant phases for each source. Compare AIR2GIS results to the control data set in a spreadsheet.	<ul style="list-style-type: none"> - Test data set (AIR2GIS) - Control data set (MS Excel) - Visual comparison 	This test used AIR2GIS to create a single file for input into the Risk-MAP NAIT by extracting the required air parameter values from the eight potential ISCST3 results files for each source, two averaging periods for each of the four potential phases. The eight plot files from ISCST3 were manually assimilated using a spreadsheet program to create the control data set to compare to the AIR2GIS output file. Twenty sources were tested.
Follow Naming Conventions	Test the capability of AIR2GIS to follow the file naming conventions (file extensions) established to identify the eight ISCST3 results files based on the two averaging periods and the four phases.	<ul style="list-style-type: none"> - Test data set (AIR2GIS) - Visual inspection 	This test used AIR2GIS to read test files following the file naming convention used in RAIMI applications. Successful opening and reading of the files by AIR2GIS demonstrated correct implementation.
Windows Based User Interface	Test the capability of AIR2GIS to run on a Windows-based platform.	<ul style="list-style-type: none"> - Test data set (AIR2GIS) - Visual Inspection 	This test executed AIR2GIS on a Windows-based platform. Successful execution on the test files demonstrated correct implementation.
Batch Process Sources	Test the capability of AIR2GIS to execute on multiple sources in a single execution of AIR2GIS.	<ul style="list-style-type: none"> - Test data set (AIR2GIS) - Visual Inspection 	This test used AIR2GIS to perform its functionality on multiple sources. The ISCST3 results files for 20 test sources were executed in a single batch run. Creation of the 20 AIR2GIS output files (.a2g) demonstrated successful implementation of this capability.

Conclusions and Considerations

Core Capability 1 - Concatenate Air Parameter Values. AIR2GIS was executed on the eight plot files from the 20 test sources. AIR2GIS successfully created a single file of all air parameter values for each source in the correct format for input into Risk-MAP. The AIR2GIS results for each of the twenty sources were visually compared to the corresponding results for the same sources in the control file created in a spreadsheet. The comparison included taking the quantitative difference between each control data value and the AIR2GIS test data values. All values were found to be identical in every file. Therefore, this core capability is successfully implemented in AIR2GIS for use in consolidating air model run results into a single file for each source for import into Risk-MAP for further risk analysis on large and complex assessments involved in RAIMI applications.

Core Capability 2 - Following Naming Conventions. AIR2GIS successfully opened and read the test files following the naming convention established for RAIMI applications. This core capability is successfully implemented in AIR2GIS.

Core Capability 3 - Batch Process Sources. AIR2GIS successfully consolidated air parameter values for the 20 test sources in a single batch run, creating 20 AIR2GIS output files (‘.A2G’) files. The design and development capacity of AIR2GIS exceeds the 20 source test case. In two RAIMI applications, AIR2GIS has successfully prepared the ‘.A2G’ output files for 273 and 1088 sources in a single batch runs.

Core Capability 4 - Windows Based User Interface. AIR2GIS successfully executes on multiple Windows-based platforms. Testing was completed on Windows 98, ME, 2000, NT, XP-Home and XP-Professional. AIR2GIS users should note that when executing a batch run with more than 20 sources, the user interface may have areas of the AIR2GIS window that appear to blank out. This blanking is due to infrequent updating of the AIR2GIS window to the monitor display during AIR2GIS execution. The user should not abort the execution, as AIR2GIS is continuing to perform its functions within the system, even though the interface may not be responding. Run times on large numbers of sources may be several minutes. If uncertain about continued processing by AIR2GIS, progress may be tracked by reviewing the creation of ‘.A2G’ files on the user’s computer drive.

AIR2GIS satisfies all design elements and correctly implements the four core capabilities to prepare the ISCST3 air model plot files for import into Risk-MAP to support risk analysis for large and complex studies.

