

## **ISCAPEX**

March 3, 2004

ISCAPEX runs as a stand-alone executable program to reformat ISCST3 results to the format required by APEX for “air quality” files, convert UTM coordinates used by ISCST3 into latitude and longitude coordinates required by APEX, and create the required “districts” input file for APEX.

Note that ISCAPEX can only process outputs from ISCST3 simulations that were run for an complete year starting on January 1 and ending on December 31. If longer simulation periods are desired, the user can perform multiple ISCST3 simulations (one for each year), run ISCAPEX for the outputs from each simulation, and then concatenate the resulting ISCAPEX “air quality” output files as needed. If shorter simulation periods are desired, the user can edit the ISCAPEX “air quality” output files as needed.

### **RUNNING ISCAPEX**

The following steps are required to run ISCAPEX:

- (1) Run ISCST3 and produce outputs in the “plot” format
- (2) Create “receptor” file
- (3) Start ISCAPEX and provide user-supplied inputs

### **Required Inputs**

This program requires two input files (i.e., an ISCST3 output file and a file with receptor information similar to the APEX districts file) as well as several user-supplied inputs during execution of ISCAPEX. Descriptions of these files and inputs follow.

#### ***ISCST3 Output file***

Run ISCST3 as normal, but with the following command in the output section:

OU POSTFILE 1 *SOURCE GROUP* PLOT *FILENAME.EXT*

where *SOURCE GROUP* refers to the source group from which the output concentrations are calculated and *FILENAME.EXT* refers to the user-selected name of the “plot” file being created.

This will create an output file with hourly concentration data for each ISCST3 receptor in the “plot” format (see example below). For more information on this command, refer to the ISCST3 User’s Guide.

The receptor locations included in your ISCST3 simulation should be the same as the location of the air quality “districts” to be used in the APEX simulation. If your ISCST3 simulation includes more than 500 receptors, it is suggested (but not required) that they be modeled in groups of 500 or less in

separate ISCST3 simulations to minimize the time required for the conversion from ISCST3 output to APEX input. The amount of time required to run the processor increases exponentially with increasing receptors, therefore smaller groups of receptors are suggested.

To include concentrations from all modeled sources, the source group will be “ALL.” To only include concentrations from select sources in the air quality file, adjust the source group accordingly. For more information on source groups, refer to the ISCST3 User’s Guide.

In some cases, the user may wish to scale emission rates used as inputs to ISCST3 to produce greater resolution in the output concentrations. Because ISCST3 output is in decimal notation out to 5 places, it is sometime difficult to distinguish between output concentrations at different receptors when source emission rates are relatively low. In these cases, the user can multiply all source emission rates by a single value (typically a multiple of 10) to produce output concentrations at a higher resolution. When this is done, the output concentrations are no longer in the ISCST3 standard output units of ug/m3. Therefore, the units must be converted back to ug/m3 for use in APEX. ISCAPEX allows for this by asking whether a conversion factor is needed, and then dividing the ISCST3 output by a user-supplied conversion factor (see “User-supplied Inputs” below).

### Example of ISCST3 output “plot” file

```
* ISCST3 (00101): Sample ISC Facility
* MODELING OPTIONS USED:
*   CONC          RURAL  FLAT          DEFAULT
*   POST/PLOT FILE OF CONCURRENT 1-HR VALUES FOR SOURCE GROUP: ALL
*   FOR A TOTAL OF 101 RECEPTORS.
*   FORMAT: (3(1X,F13.5),1X,F8.2,2X,A6,2X,A8,2X,I8.8,2X,A8)
*   X              Y          AVERAGE CONC  ZELEV      AVE      GRP      DATE
*   -----
380567.62500 4770410.00000      0.00000      0.00      1-HR  ALL      87010101
379355.43800 4770476.00000      0.00000      0.00      1-HR  ALL      87010101
370676.90600 4772697.00000      0.00000      0.00      1-HR  ALL      87010101
370560.50000 4771409.00000      0.00000      0.00      1-HR  ALL      87010101
371011.31300 4771342.00000      0.00000      0.00      1-HR  ALL      87010101
370508.00000 4770904.00000      0.00000      0.00      1-HR  ALL      87010101
370323.62500 4770419.50000      0.00000      0.00      1-HR  ALL      87010101
```

### *“Receptor” file*

Note that the “receptor” file required by ISCAPEX is identical to the “districts” file required by APEX except that (1) the coordinates are in UTM coordinates instead of latitude/longitude and (2) the start and end date included in the “districts” file are not included in the “receptor” file. For some simulations, the “sectors” locations and “districts” locations used for APEX will be the same (i.e., when the ISCST3 receptor locations are the same of the “sector” locations). In this case, the “receptors” file will be identical to the “sectors” file for APEX, except that the coordinates in the receptors are in UTM

coordinates. ISCAPEX will convert the coordinates in the “receptors” file into latitude/longitude and create a new “districts” file in the format required by APEX. This new “districts” file **MUST** be used in any APEX simulations that use the “air quality” file created by this processor.

To create a “receptor” file, complete the following steps:

- (1) Create a text file that contains a list of receptor IDs (typically census tract #). The IDs may be up to 25 characters (often a pound symbol, plus census tract number - i.e., #12345678912).
- (2) Using the receptor locations from the ISCST3 simulation, add the UTM coordinates for each receptor into the file with the receptor IDs. The UTM coordinates in the ISCST3 plot file and the receptor file MUST MATCH EXACTLY, otherwise the processor will not work. ISCST3 often changes the number of decimals for the coordinates, so it is important to make sure that the UTM coordinates in the “receptor” file match exactly with the UTM coordinates in the ISCST3 output file.

This file must be space delimited (i.e., include at least one space between values in a row), include only one receptor per line, and the data for each receptor should be organized in the order: receptor name, UTMX, UTMY. An example of the “receptor” file is provided below.

#### **Example of “Receptor” file**

```
#48201212100 380567.62500 4770410.00000
#48201212101 379355.43800 4770476.00000
#48201212102 370676.90600 4772697.00000
#48201212103 370560.50000 4771409.00000
#48201212104 371011.31300 4771342.00000
#48201212105 370508.00000 4770904.00000
```

#### ***User-supplied Inputs***

Several inputs must be provided manually for ISCAPEX to function. These are: input and output file names, output units conversion factor (if necessary), year of the simulation, and the UTM zone associated with the receptor coordinates used in the ISCST3 simulation. The order of entry is provided below.

- (1) Input the path and name of the ISCST3 output (plot) file  
(e.g. C:\Models\ISC\sample.plt)
- (2) Input the path and name of the receptor file  
(e.g., C:\Models\APEX\receptors.txt)
- (3) Input the conversion factor, if necessary

- (4) Input the year  
(e.g., 1987)
- (5) Input the UTM zone used  
(e.g., 16)
- (6) Input the path and name of the air quality file to be created  
(e.g., C:\Models\APEX\data\sample\_AQ.in)
- (7) Input the path and name of the districts file to be created  
(e.g., C:\Models\APEX\data\sample\_DF.in)

*File names:* You must enter names for the input files (i.e., the ISCST3 plot file and receptor file) and output files (i.e., APEX air quality and districts files names), including the file path (if the executable and files are not in the same folder) and extension for each file, when prompted. ISCST3 requires that file names (not including the file path) be no more than 8 characters plus a three character extension (e.g., ABCDEFGH.XYZ). Input and output files provided to ISCAPEX processor may be up to 200 characters, allowing for a path and file name. This allows the user to take the ISCST3 file name and add an extra identifier (e.g., if the ISCST3 output file name is SAMPLE.PLT, the APEX air quality input file created may be SAMPLE\_AQ.IN, and APEX districts file may be SAMPLE\_DF.TXT). If files with the same names and paths as the specified output files exist, they will be overwritten when the processor runs. If they do not exist, they will be created.

*Conversion Factor:* As described previously, ISCST3 concentrations may be scaled to show greater resolution in the output by multiplying all of the emission rate inputs by a single value. If this has not been done, enter “N” for no conversion. If the ISCST3 emission rate inputs have been scaled and a units conversion is necessary, enter “Y.” If “Y” is entered, ISCAPEX will then ask for a conversion factor by which to divide the ISCST3 outputs (this is equivalent to the factor by which ISCST3 emission rate inputs were multiplied). If emission rate inputs were divided by a value instead of multiplied, the ISCST3 outputs must be divided by the inverse of that value. For example, if ISCST3 emission rate inputs were multiplied by 100, the conversion factor should be 100. If emission rate inputs were divided by 100, the conversion factor should be 0.01.

*Year:* The year of the simulation must also be entered. This should be a four digit integer, such as 1987, and should match that used for the ISCST3 model.

*UTM Zone:* The UTM zone is a two-digit integer that corresponds to the longitudinal zone in the UTM grid system of the area being modeled. Note that the converter for UTM to latitude/longitude coordinates included in this processor is designed for use within the continental US. If your modeling region is in polar regions, the southern hemisphere, or other non-standard UTM grid areas, the conversion will not be accurate. Further, the conversion is set to output latitude/longitude coordinates according to the Geodetic Reference System 1980 (GRS80) ellipsoid.

## **Output Files from ISCAPEX**

This processor creates an air quality and a districts file to be used as inputs to the APEX model. For a description of these files, see the APEX User's Guide. While ISCST3 requires the use of UTM coordinates, APEX requires the use of latitude/longitude coordinates, which must match between files. This processor will convert UTM into latitude/longitude coordinates for use in the APEX air quality and districts input files.

## **ERROR CHECKING**

A few checks have been incorporated to let the user know how ISCAPEX is functioning and if the output are accurate. The processor will check to ensure the input files exist, and if not, then will ask again until a valid file name is entered.

After the user inputs the year of the simulation, a calculation will be performed to determine whether the data are for a leap year or not. If it is leap year, then the processor will write on the screen "This is a leap year," and likewise "This is not a leap year" if it is not.

ISCAPEX will verify that the UTM zone used is within the continental US (Zones 10-19). If the UTM zone entered is out of this range, then the message "Conversion from UTM to Lat/Long may not be correct" will appear on the screen.

The processor will count the number of receptors in the site file (i.e., the number of lines) and write this on the screen as "Number of receptors in receptor file = XX" (where XX is the number of receptors). It will then check the number of receptors reported in the ISCST3 output file (line 5, col. 26-30) and write on the screen "Number of receptors in ISC plot file = XX." If these are not equal, the processor will write "The number of receptors do not match - please check these files," and then echo the file paths/names that were entered for both the receptor file and the ISCST3 output (plot) file. ISCAPEX will then prompt the user to hit <Enter> and close.

Similarly, a verification will be performed to ensure that the user-input year matches the year in the ISCST3 output file. If the years do not match, the processor will write "The year entered (*input year*) does not match the year in the ISC file (*ISC year*)," then prompt the user to hit <Enter> and close.

As ISCAPEX goes through the receptors, it will write to the screen the number of receptor (e.g., 1,2,3...) and the latitude and longitude (converted from the UTM coordinates) of each receptor as it is processed. This is so the user can track how many receptors have been processed and check the coordinate conversion as ISCAPEX runs .