**CACIE Tool #38**– **CIE Transient Output Card Generator Tool**

**OC\_TR\_gen\_cie.f**

**Version** **1.0**

**QA**: **QA**

# Description and Purpose

The CIE Transient Output Card Generator tool creates the Output Control Card portion of a STOMP input file used for mass balance and transport production simulations. The Output Control Card details user selections for the contents of the STOMP-generated output file and one or more ***plot.xxx*** file(s), where ***xxx*** is the time step number for a simulation. The output file contains time-series of specified variable values at selected reference nodes. A ***plot.xxx*** file contains the variable values for all model nodes at a selected time. The tool is executed on Olive (Ubuntu  16.04.6 LT). Tool execution to create Output Control Cards should be limited to INTERA Vadose Zone (VZ) modelers.

For both simulations, the tool determines the reference nodes for a defined model domain. The reference nodes correspond to the center of the model domain and the center of each domain quadrant. If the model and/or quadrant centers are not located exactly at node centers, then the closest node center is chosen. The closest node center is determined by first evaluating i-index values, then j-index values. If a center location is equidistant (in i or j) from two node centers, then:

1) the lower i-index and j-index values are selected for the model center

2) the lower i-index value is selected for the western quadrants

3) the higher i-index value is selected for the eastern quadrants

4) the lower j-index value is selected for the southern quadrants

5) the higher j-index value is selected for the northern quadrants

Equations for Model and Domain Centers

**Equation 1** – Model Center along X-axis

**Equation 2** – Left Center along X-axis

**Equation 3** – Right Center along X-axis

**Equation 4** – Model Center along Y-axis

**Equation 5** – Lower Center along Y-axis

**Equation 6** – Upper Center along Y-axis

The reference nodes are assigned vertically to the bottom of the domain, layer 20 and at successive layers at intervals of 20. The final layer interval corresponds to the elevation of the uppermost active layer at a reference node location (e.g., 1, 20, 40, …, 200, 208).

Reference node variables include:

* rock/soil type
* integrated water mass
* solute aqueous concentration (for each constituent modeled)
* solute integrated mass (for each constituent modeled)
* aqueous saturation
* aqueous moisture content
* aqueous pressure
* aqueous hydraulic head
* XNC aqueous volumetric flux (node centered)
* YNC aqueous volumetric flux (node centered)
* ZNC aqueous volumetric flux (node centered)

The reference nodes and reference node variables are identical in the Output Control Card files for both the mass balance simulation and the transport production simulation.

In the mass balance simulation Output Control Card file, a single plot time of 3,070 years is specified. In the transport production simulation Output Control Card file, plot times are defined in a file external to the CIE Transient Output Card Generator tool (file name and location are provided as a command line argument).

Plot file output includes:

* rock/soil type
* solute aqueous concentration (for each constituent modeled)
* aqueous saturation
* aqueous moisture content
* aqueous pressure
* aqueous hydraulic head
* XNC aqueous volumetric flux (node centered)
* YNC aqueous volumetric flux (node centered)
* ZNC aqueous volumetric flux (node centered)
* no restart option

The plot time variables are identical in the Output Control Card files for both the mass balance simulation and the transport production simulation

# Functional Requirements

The following are the functional requirements of the Tool:

FR-1: Read the plot time file path/name as command line input.

FR-2: Read input.sij from ../build. This file is generated using the CAST tool.

FR-3: Calculate model grid and quadrant center coordinates based on model area domain extent coordinates.

FR-4: Read ***input.nij*** from../build. This file is generated using the CAST tool.

FR-5: Determine model grid and quadrant center i/j- index values corresponding to the model grid and quadrant center coordinates (FR-3): i-index left/center/right and j-index bottom/center/top.

FR-6: Read ***input.top*** from ../build. This file is generated using the CAST tool.

FR-7: Determine top active layer for grid and quadrant centers.

FR-8: Read Output Card plot times (file name and location from command line input).

FR-9: Write Output Control Card for the production transport simulations (See Section 1 Description and Purpose for specifics).

FR-10: Write Output Control Card for the mass balance transport simulations (See Section 1 Description and Purpose for specifics).

# Software Requirements Specifications

FORTRAN, linux Intel(R) Fortran Intel(R) 64 Compiler

Compiler Options: -o OutputFileName

Special Considerations: None

# Software Design Description

Flow:

The Tool performs the following steps:

1. Declare variables – Character and array variables are declared.
2. Assign input files.
3. Read command line argument – See description below.
4. Open the output files.
5. Read model node boundary coordinates – Read model node edge x and y values from ***input.sij***.
6. Calculate grid and quadrant center locations based on coordinates read in Step 5.
7. Read model node center coordinates – Read model node center x and y values from ***input.nij***.
8. Calculate grid and quadrant center i/j index values corresponding to the grid and quadrant center coordinates from Step 6 using rules defined in Section 1, Description and Purpose.
9. Read tops – Read the uppermost active model layer for each i,j column in the model from ***input.top***.
10. Find top active layer for grid and quadrant centers from Step 8.
11. Calculate number of output layers for grid and quadrant centers.
12. Read Output Card plot times.
13. Write Output Control Card for the production transport simulations.
14. Write Output Control Card for the mass balance transport simulations.

Arguments:

PlotTimes – Name and location of the file that contains the plot times to be used.

Input Files:

***input.sij*** (from ../build)

***input.nij*** (from ../build)

**input.top** (from ../build)

PlotTimes (name and location from command line argument; current location is in the ICF

Output Files:

***cie\_Output\_Control.dat*** – Output Control Card file for production simulations.

***cie\_Mass\_Balance\_Output\_Control.dat*** – Output Control Card file for mass balance simulations.

Tool Runner:

The following is the shell script configuration that will be passed as an argument to the Tool Runner for qualified runs:

{directory path to repository}/tools/cie-troccard/linux/OC\_TR\_gen\_cie\_linux-intel-64.exe {PlotTimes}

Code Review:

A code review was performed by Sara Lindberg on 8/26/2020. No impacts to other repository tools or library dependencies were identified for the Transient Output Card Generator tool.

# Requirements Traceability Matrix

The requirements traceability matrix for the CIE Transient Output Card Generator tool is presented in Table 1.

| Table 1  Requirements Traceability Matrix | | |
| --- | --- | --- |
| **Functional Requirement ID** | **Acceptance Test ID** | **Test Case** |
| QA Level | CACIE- OC\_TR\_gen\_cie-IT-1 | Installation Test |
| FR-2  FR-3  FR-4  FR-5 | CACIE-OC\_TR\_gen\_cie  AT-1 | Check that reference nodes for model center and quadrant centers are at the center coordinates, or as close as possible, considering that model and quadrant centers may not fall exactly on a node center. |
| FR-6  FR-7 | CACIE-OC\_TR\_gen\_cie  AT-1 | Check that the uppermost reference node at each i,j location is the top active node for that i,j location. |
| FR-1  FR-8 | CACIE-OC\_TR\_gen\_cie  AT-1 | Check that the plot times in ***cie\_Output\_Control.dat*** agree with the times listed in the ***Plot\_Times.txt*** file (name and location from command line argument). |
| FR-9 | CACIE-OC\_TR\_gen\_cie -AT-1 | For the production transport simulation Output Control Card file:  Check that the “Number of Reference Nodes” matches the number defined.  Check that the “Number of Reference Node Variables” matches the number defined.  Check that reference nodes are included for the model and quadrant centers for layer 1, the topmost active layer, and every layer number that is a multiple of 20 and less than the topmost active layer.  Check that the reference node variables are the expected parameters (See list in Section 1 Description and Purpose).  Check that number of plot times agrees with the number of times in the PlotTimes file (name and location from command line argument).  Check that the plot times match those in the Plot Times file (name and location from command line argument).  Check that the “Number of Plot File Variables” matches the number defined.  Check that the plot file variables are the expected parameters (See list in Section 1 Description and Purpose). |
| FR-10 | CACIE-OC\_TR\_gen\_cie  AT-1 | For the mass balance transport simulation Output Control Card file:  Check that the “Number of Reference Nodes” matches the number defined.  Check that the “Number of Reference Node Variables” matches the number defined.  Check that reference nodes are included for the model and quadrant centers for layer 1, the topmost active layer, and every layer number that is a multiple of 20 and less than the topmost active layer.  Check that the reference node variables are the expected parameters (See list in Section 1 Description and Purpose).  Check that there is a single plot file year at 3,070 years.  Check that the “Number of Plot File Variables” matches the number defined.  Check that the plot file variables are the expected parameters (See list in Section 1 Description and Purpose). |

# Installation Test Plan and Acceptance Test Plan Cases

The installation test plan for CIE Transient Output Card Generator is presented in Table 2 and the acceptance test plan case for CIE Transient Output Card Generator is presented in Table 3.

| Table 2  **CIE Transient Output Card Generator Installation Test Plan** | | | |
| --- | --- | --- | --- |
| **CIE Transient Output Card Generator Installation Testing**  **CACIE-CIE Transient Output Card Generator – IT-1** | | **Date:** | |
| **Tool Runner File Location for this test:** | | **Test Performed By:** | |
| **Testing Directory:** | | | |
| **Test Step** | **Test Instruction** | **Expected Result** | **Test Result  (Pass/Fail)** |
| Tools Code Repository Directory: | | | |
| Navigate to the testing directory | | | |
| 1 | Invoke Tool runner and test the installation of the tool as follows:  *./* *CACIE\_OC\_TR\_gen\_cie\_IT-1.sh* | | |
| 2 | Verify Tool Runner is invoked and executed. | Tool Runner log is generated and QA status documented |  |
| 3 | Verify tool is invoked and executed | cie\_Mass\_Balance\_Output\_Control.dat and cie\_Output\_Control.dat files are generated  Note: both files will be empty for installation test |  |

| Table 3  **CIE Transient Output Card Generator Acceptance Test Plan Case 1** | | | |
| --- | --- | --- | --- |
| **CIE Transient Output Card Generator Acceptance Testing**  **CACIE-CIE Transient Output Card Generator – AT-1** | | **Date:** | |
| **Tool Runner File Location for this test:**  \\olive\backups\CAVE\v4-4Test\afarms\_trOC-AT\trOCcards | | **Test Performed By:** | |
| **Testing Directory:** \\olive\backups\CAVE\v4-4Test\afarms\_trOC-AT\trOCcards | | | |
| **Test Step** | **Test Instruction** | **Expected Result** | **Test Result  (Pass/Fail)** |
| 1 | Ensure the following files are in \\olive\backups\CAVE\v4-4Test\afarms\_trOC-AT \build, as they are needed for the execution of the ***OC\_TR\_gen\_cie.f*** tool:   * ***input.sij*** * ***input.nij*** * ***input.top*** | The expected files are present in the \\olive\backups\CAVE\v4-4Test\afarms\_trOC-AT \build directory. |  |
| 2 | Navigate to the Testing Directory through a Linux terminal. Execute the shell script ***run\_cie\_xprt\_oc\_card.sh***. | The shell successfully executes. |  |
| 3 | Confirm the following files were generated by ***OC\_TR\_gen\_cie.f*** in \trOCcards\ subdirectory of the testing directory:   * ***cie\_Mass\_Balance\_Output\_Control.dat*** * ***cie\_Output\_Control.dat***   Other files generated in the same directory that are not a functional requirement are as follows:   * ***cie\_afarms\_trOCcards\_screen.log*** * ***trOCcards\_afarms.log*** | The files were generated in the testing directory. |  |
| 4 | Using a comparison program, such as DiffMerge, compare cie\_Mass\_Balance\_Output\_Control.dat against cie\_Output\_Control.dat. Confirm the only differences are: | | |
| 4.1 | **Line 3**  It will read“*Output Control Card for CIE transport mass balance simulation*” for the ***cie\_Mass\_Balance\_Output\_Control.dat***file and will read“*Output Control Card for CIE transport simulation*” for the ***cie\_Output\_Control.dat***. | The ***cie\_Mass\_Balance\_Output\_Control.dat*** file will contain the phrase “*mass balance*” and the ***cie\_Output\_Control.dat*** will not have the “*mass balance*” phrase. |  |
| 4.2 | In Windows Explorer navigate to the S:\PSC\!HANFORD\ICF\Prod\CIEPLYR\v1.0\data directory and open ***cie\_plot\_times.txt***.  **The *cie\_Output\_Control.dat* file**:   * Check that the Number of Plot Times entry is equal to the number of plot times listed. * Check that all the years from the ***cie\_plot\_times.txt*** file, with each year followed by “*, year,*” (for example, “*1943, year,”*) are included in the ***cie\_Output\_Control.dat*** file. | The section listing the output years of the ***cie\_Output\_Control.dat*** file will report “*42”* as the number of output times and includes each year from the ***cie\_plot\_times.txt*** file and “*, year,”*. |  |
| 4.3 | **The *cie\_Mass\_Balance\_Output\_Control.dat* file:**   * Check that the Number of Plot Times entry is equal to 1. * Check that the single plot time entry is: *3070, year,* | The Number of Plot File Times is 1 and the single plot time entry is:  *3070, year,* |  |
| If all the Test Steps above are reported as “*Pass*” then only one file from here to the end of the test will need to be checked, as all other items of the \*.dat files are the same.  Open the cie\_Output\_Control.dat file for all remaining test instructions. | | | |
| 5 | Test Step 5 will check the reference node profiles of the model domain. | | |
| 5.1 | Confirm the following sections are in the cie\_Output\_Control.dat file:   * Center domain * Center first quadrant (upper right hand) * Center second quadrant (upper left hand) * Center third quadrant (lower left hand) * Center fourth quadrant (lower right hand) | These five domain/quadrants are present. |  |
| 5.2 | For each Reference Node Profile section (Center domain, Center first quadrant, etc.) tally the number of reference node lines for each section. Example, the Center domain has 12 lines, from “*65, 74, 220*” down to “*65, 74, 1,*”   * Center Domain Number of Lines: [**INSERT VALUE**] * Center First Quadrant Number of Lines: [**INSERT VALUE**] * Center Second Quadrant Number of Lines: [**INSERT VALUE**] * Center Third Quadrant Number of Lines: [**INSERT VALUE**] * Center Fourth Quadrant Number of Lines: [**INSERT VALUE**]   The lines that follow each domain/quadrant heading have the following format: X, Y, Z, where X, Y, and Z are the I-, J-, and K- node index values, respectively, for the reference nodes. | The following sections have a total number of reference nodes:   * Center Domain: **12** * Center First Quadrant: **11** * Center Second Quadrant: **12** * Center Third Quadrant: **13** * Center Fourth Quadrant: **12** |  |
| 5.3 | Total the number of lines in each reference node from Test Step 5.2. Report that value here: [**INSERT VALUE**].  Confirm the total number of reference nodes from Test Step 5.2 matches the Number of Reference Nodes entry in the ***cie\_Output\_Control.dat*** file. | The Number of Reference Nodes entry in the ***cie\_Output\_Control.dat*** matches the total number of lines from Test Step 5.2. |  |
| 5.4 | Navigate to the testing directory and open ***calculations.xlsx*** file. Follow the directions within to calculate model and domain centers. The first line of the ***input.nij*** file contains two values: the number of X and Y nodes. The following lines list the i, j, x-center and y-center values for each node. Use these values to calculate the I- and J- node values for the domain and quadrant centers. The file ***input.sij*** will have a similar number of nodes from ***input.nij*** but increased by one, as well as ***input.sij*** has edge XYs for the nodes.. Use Section 1 of this document to understand the calculations.  Confirm the calculated reference nodes correspond to the reference nodes in the ***cie\_Output\_Control.dat*** file. | All five domain/quadrants are correctly calculated.  The Excel file containing the calculations is present in the testing directory. |  |
| 5.5 | In the cie\_Output\_Control.dat file, the first set of node index values underneath each reference node profile heading for the model and quadrant centers represents the uppermost node in that domain/quadrant.  Open input.top in the ../build/ directory of the testing directory. Using the uppermost node values above verify the K-node index value is present in the ***input.top*** file. | The first I-, J- and K- values of the Model and Quadrant Centers in cie\_Output\_Control.dat match the values present within input.top. |  |
| 5.6 | Confirm in the cie\_Output\_Control.dat file for each model and quadrant center reference node profile the K- representation starts at layer 1 (starts at the bottom row of each domain/quadrant), increments upward by 20 from layer 20 and the last layer is the topmost active layer.  For further details refer Section 1. | The Model and Quadrant Centers have correct K- value representation. |  |
| 6 | Confirm in the cie\_Output\_Control.dat file line 79 reads:   * 1, 1, year, m, 8, 8, 8, | Line 79 in the cie\_Output\_Control.dat file reads the same. |  |
| 7 | Confirm in the cie\_Output\_Control.dat file the Number of Reference Node Variables entry equals the number of reference node variables listed. | The number of reference node variables match. |  |
| 8 | Confirm in the ***cie\_Output\_Control.dat*** file the Reference Node Output Variables are the expected parameters, as described in Section 1 of this document. Check that units are correct. | The parameters match those listed in Section 1. |  |
| 9 | Confirm in the cie\_Output\_Control.dat file the Number of Plot File Variables entry matches the number of plot file variables listed. | The number of plot file variables match. |  |
| 10 | Confirm in the ***cie\_Output\_Control.dat*** file the plot file variables are the expected parameters described in Section 1 of this document. Check that units are correct.  Verify the last plot file variable reads “*No Restart, ,*” | The parameters match those listed in Section 1.  The last plot file variable reads “*No Restart, ,*”. |  |

# Acceptance Test Report

To complete the Acceptance Testing use Appendix A. The single test case is the A Farms model for testing the CIE Transient Output Card Generator tool, which generates two files:

* ***cie\_Mass\_Balance\_Output\_Control.dat***
* ***cie\_Output\_Control.dat***

Details of this test, when it was conducted, by whom, and if it Passed or Failed are in Table A-1 of Appendix A.

# User Guide

To run this code:

1. You need to have the inputs in the appropriate directory structure. Specified in Section 4: Software Design Description, under input files.
2. The /ModelName/build/ subdirectory must contain input.top, input.sij, and input.nij files.
3. From a Linux prompt in the ModelName/trOCcards/ directory execute the tool as specified in Section 4: Software Design Description.
4. Ensure the two output files were created in the /ModelName/trOCcards/ subdirectory.

# Tool Versions

This section details changes incorporated into each version of the CIE Transient Output Card Generator tool.

* 1.0 – Tool was developed.

# Appendix A

**Completed Acceptance Test Cases**

**Tool Runner Log**

###Executing Output Control Tool###

###Executing Fingerprint Tool###

INFO--09/01/2020 09:58:34 AM--Starting CA-CIE Tool Runner. Logging to "./trOCcards\_afarms.log"

INFO--09/01/2020 09:58:34 AM--Code Version: 78efcf372269bf04b6e725f6f84c87a1b2a8276e v5.3: /opt/tools/pylib/runner/runner.py<--1bcfd6779e9cbdb82673405873a8e5e81514ae27

INFO--09/01/2020 09:58:34 AM--Code Version: 78efcf372269bf04b6e725f6f84c87a1b2a8276e v5.3: /opt/tools/pylib/fingerprint/fingerprint.py<--e9692a4faec2ee264fe50417b6b6a516ba82b2f6

INFO--09/01/2020 09:58:34 AM--QA Status: QUALIFIED : /opt/tools/pylib/runner/runner.py

INFO--09/01/2020 09:58:34 AM--QA Status: QUALIFIED : /opt/tools/pylib/fingerprint/fingerprint.py

INFO--09/01/2020 09:58:34 AM--Invoking Command:"python3.6" with Arguments:"/opt/tools/pylib/fingerprint/fingerprint.py /home/pallena/CAVE/v4-4Test/afarms\_trOC-AT/build/input.nij --output ./trOCcards\_afarms.log --outputmode a"

INFO--09/01/2020 09:58:34 AM--Username:pallena Computer:olive Platform:Linux 4.4.0-38-generic #57~14.04.1-Ubuntu SMP Tue Sep 6 17:20:43 UTC 2016

Fingerprint generated at 2020-09-01 09:58:34.764173

/home/pallena/CAVE/v4-4Test/afarms\_trOC-AT/build/input.nij 96672cac2a69ac1998921f6392891f7a49255bff5e9eece78949dbd4bcb1e88e

###Finished Process###

###Executing Fingerprint Tool###

INFO--09/01/2020 09:58:34 AM--Starting CA-CIE Tool Runner. Logging to "./trOCcards\_afarms.log"

INFO--09/01/2020 09:58:34 AM--Code Version: 78efcf372269bf04b6e725f6f84c87a1b2a8276e v5.3: /opt/tools/pylib/runner/runner.py<--1bcfd6779e9cbdb82673405873a8e5e81514ae27

INFO--09/01/2020 09:58:34 AM--Code Version: 78efcf372269bf04b6e725f6f84c87a1b2a8276e v5.3: /opt/tools/pylib/fingerprint/fingerprint.py<--e9692a4faec2ee264fe50417b6b6a516ba82b2f6

INFO--09/01/2020 09:58:34 AM--QA Status: QUALIFIED : /opt/tools/pylib/runner/runner.py

INFO--09/01/2020 09:58:34 AM--QA Status: QUALIFIED : /opt/tools/pylib/fingerprint/fingerprint.py

INFO--09/01/2020 09:58:34 AM--Invoking Command:"python3.6" with Arguments:"/opt/tools/pylib/fingerprint/fingerprint.py /home/pallena/CAVE/v4-4Test/afarms\_trOC-AT/build/input.top --output ./trOCcards\_afarms.log --outputmode a"

INFO--09/01/2020 09:58:34 AM--Username:pallena Computer:olive Platform:Linux 4.4.0-38-generic #57~14.04.1-Ubuntu SMP Tue Sep 6 17:20:43 UTC 2016

Fingerprint generated at 2020-09-01 09:58:35.043742

/home/pallena/CAVE/v4-4Test/afarms\_trOC-AT/build/input.top ceb63d5fdaa7e67d9b27c4b1cc2a6d499ca10eb14bee8b3b847fbd68bd39ee6d

###Finished Process###

###Executing Fingerprint Tool###

INFO--09/01/2020 09:58:35 AM--Starting CA-CIE Tool Runner. Logging to "./trOCcards\_afarms.log"

INFO--09/01/2020 09:58:35 AM--Code Version: 78efcf372269bf04b6e725f6f84c87a1b2a8276e v5.3: /opt/tools/pylib/runner/runner.py<--1bcfd6779e9cbdb82673405873a8e5e81514ae27

INFO--09/01/2020 09:58:35 AM--Code Version: 78efcf372269bf04b6e725f6f84c87a1b2a8276e v5.3: /opt/tools/pylib/fingerprint/fingerprint.py<--e9692a4faec2ee264fe50417b6b6a516ba82b2f6

INFO--09/01/2020 09:58:35 AM--QA Status: QUALIFIED : /opt/tools/pylib/runner/runner.py

INFO--09/01/2020 09:58:35 AM--QA Status: QUALIFIED : /opt/tools/pylib/fingerprint/fingerprint.py

INFO--09/01/2020 09:58:35 AM--Invoking Command:"python3.6" with Arguments:"/opt/tools/pylib/fingerprint/fingerprint.py /opt/ICF/Prod/CIEPLYR/v1.0/data/cie\_plot\_times.txt --output ./trOCcards\_afarms.log --outputmode a"

INFO--09/01/2020 09:58:35 AM--Username:pallena Computer:olive Platform:Linux 4.4.0-38-generic #57~14.04.1-Ubuntu SMP Tue Sep 6 17:20:43 UTC 2016

Fingerprint generated at 2020-09-01 09:58:35.317904

/opt/ICF/Prod/CIEPLYR/v1.0/data/cie\_plot\_times.txt 0c441033fe8787b6048c09d9eeb999400c2121b249101a86a11ad4e1ae9661b1

###Finished Process###

###Executing Fingerprint Tool###

INFO--09/01/2020 09:58:35 AM--Starting CA-CIE Tool Runner. Logging to "./trOCcards\_afarms.log"

INFO--09/01/2020 09:58:35 AM--Code Version: 78efcf372269bf04b6e725f6f84c87a1b2a8276e v5.3: /opt/tools/pylib/runner/runner.py<--1bcfd6779e9cbdb82673405873a8e5e81514ae27

INFO--09/01/2020 09:58:35 AM--Code Version: 78efcf372269bf04b6e725f6f84c87a1b2a8276e v5.3: /opt/tools/pylib/fingerprint/fingerprint.py<--e9692a4faec2ee264fe50417b6b6a516ba82b2f6

INFO--09/01/2020 09:58:35 AM--QA Status: QUALIFIED : /opt/tools/pylib/runner/runner.py

INFO--09/01/2020 09:58:35 AM--QA Status: QUALIFIED : /opt/tools/pylib/fingerprint/fingerprint.py

INFO--09/01/2020 09:58:35 AM--Invoking Command:"python3.6" with Arguments:"/opt/tools/pylib/fingerprint/fingerprint.py /home/pallena/CAVE/v4-4Test/afarms\_trOC-AT/build/input.sij --output ./trOCcards\_afarms.log --outputmode a"

INFO--09/01/2020 09:58:35 AM--Username:pallena Computer:olive Platform:Linux 4.4.0-38-generic #57~14.04.1-Ubuntu SMP Tue Sep 6 17:20:43 UTC 2016

Fingerprint generated at 2020-09-01 09:58:35.588556

/home/pallena/CAVE/v4-4Test/afarms\_trOC-AT/build/input.sij dccc7e76f4905672aaf8ef8e54fe531886fb9082898f1b6cb8c7aebd552e242b

###Finished Process###

###Executing Output Control Tool for CIE###

INFO--09/01/2020 09:58:35 AM--Starting CA-CIE Tool Runner. Logging to "./trOCcards\_afarms.log"

INFO--09/01/2020 09:58:35 AM--Code Version: 78efcf372269bf04b6e725f6f84c87a1b2a8276e v5.3: /opt/tools/pylib/runner/runner.py<--1bcfd6779e9cbdb82673405873a8e5e81514ae27

INFO--09/01/2020 09:58:35 AM--Code Version: d3bc17a72974f474092bf14bc77ae74367793473 Local repo SHA-1 has does not correspond to a remote repo release version: ../../../CA-CIE-Tools-TestRepos/repo\_OC\_TR\_gen\_cie.f/tools/cie-troccard/linux/OC\_TR\_gen\_cie\_linux-intel-64.exe<--db07ec6118324605158f283be287146dae09a5be

INFO--09/01/2020 09:58:35 AM--QA Status: QUALIFIED : /opt/tools/pylib/runner/runner.py

INFO--09/01/2020 09:58:35 AM--QA Status: TEST : ../../../CA-CIE-Tools-TestRepos/repo\_OC\_TR\_gen\_cie.f/tools/cie-troccard/linux/OC\_TR\_gen\_cie\_linux-intel-64.exe

INFO--09/01/2020 09:58:35 AM--Invoking Command:"../../../CA-CIE-Tools-TestRepos/repo\_OC\_TR\_gen\_cie.f/tools/cie-troccard/linux/OC\_TR\_gen\_cie\_linux-intel-64.exe" with Arguments:"/opt/ICF/Prod/CIEPLYR/v1.0/data/cie\_plot\_times.txt"

INFO--09/01/2020 09:58:35 AM--Username:pallena Computer:olive Platform:Linux 4.4.0-38-generic #57~14.04.1-Ubuntu SMP Tue Sep 6 17:20:43 UTC 2016

###Finished Process###

###Executing Fingerprint Tool###

INFO--09/01/2020 09:58:35 AM--Starting CA-CIE Tool Runner. Logging to "./trOCcards\_afarms.log"

INFO--09/01/2020 09:58:35 AM--Code Version: 78efcf372269bf04b6e725f6f84c87a1b2a8276e v5.3: /opt/tools/pylib/runner/runner.py<--1bcfd6779e9cbdb82673405873a8e5e81514ae27

INFO--09/01/2020 09:58:35 AM--Code Version: 78efcf372269bf04b6e725f6f84c87a1b2a8276e v5.3: /opt/tools/pylib/fingerprint/fingerprint.py<--e9692a4faec2ee264fe50417b6b6a516ba82b2f6

INFO--09/01/2020 09:58:36 AM--QA Status: QUALIFIED : /opt/tools/pylib/runner/runner.py

INFO--09/01/2020 09:58:36 AM--QA Status: QUALIFIED : /opt/tools/pylib/fingerprint/fingerprint.py

INFO--09/01/2020 09:58:36 AM--Invoking Command:"python3.6" with Arguments:"/opt/tools/pylib/fingerprint/fingerprint.py /home/pallena/CAVE/v4-4Test/afarms\_trOC-AT/trOCcards/cie\_Output\_Control.dat --output ./trOCcards\_afarms.log --outputmode a"

INFO--09/01/2020 09:58:36 AM--Username:pallena Computer:olive Platform:Linux 4.4.0-38-generic #57~14.04.1-Ubuntu SMP Tue Sep 6 17:20:43 UTC 2016

Fingerprint generated at 2020-09-01 09:58:36.100633

/home/pallena/CAVE/v4-4Test/afarms\_trOC-AT/trOCcards/cie\_Output\_Control.dat a7aacd9f33a0022478cbfc847a9376cdcbf636c79a0a85f1447f460fd65b8977

###Finished Process###

###Executing Fingerprint Tool###

INFO--09/01/2020 09:58:36 AM--Starting CA-CIE Tool Runner. Logging to "./trOCcards\_afarms.log"

INFO--09/01/2020 09:58:36 AM--Code Version: 78efcf372269bf04b6e725f6f84c87a1b2a8276e v5.3: /opt/tools/pylib/runner/runner.py<--1bcfd6779e9cbdb82673405873a8e5e81514ae27

INFO--09/01/2020 09:58:36 AM--Code Version: 78efcf372269bf04b6e725f6f84c87a1b2a8276e v5.3: /opt/tools/pylib/fingerprint/fingerprint.py<--e9692a4faec2ee264fe50417b6b6a516ba82b2f6

INFO--09/01/2020 09:58:36 AM--QA Status: QUALIFIED : /opt/tools/pylib/runner/runner.py

INFO--09/01/2020 09:58:36 AM--QA Status: QUALIFIED : /opt/tools/pylib/fingerprint/fingerprint.py

INFO--09/01/2020 09:58:36 AM--Invoking Command:"python3.6" with Arguments:"/opt/tools/pylib/fingerprint/fingerprint.py /home/pallena/CAVE/v4-4Test/afarms\_trOC-AT/trOCcards/cie\_Mass\_Balance\_Output\_Control.dat --output ./trOCcards\_afarms.log --outputmode a"

INFO--09/01/2020 09:58:36 AM--Username:pallena Computer:olive Platform:Linux 4.4.0-38-generic #57~14.04.1-Ubuntu SMP Tue Sep 6 17:20:43 UTC 2016

Fingerprint generated at 2020-09-01 09:58:36.360764

/home/pallena/CAVE/v4-4Test/afarms\_trOC-AT/trOCcards/cie\_Mass\_Balance\_Output\_Control.dat 9feaf46f9fa542a3e6c4fe57e9124374f96c4d79e4e58c17229b9e74747bac56

###Finished Process###

###Finished Output Control Process###

| Table A-1  **CIE Transient Output Card Generator Acceptance Test Plan Case 1** | | | |
| --- | --- | --- | --- |
| **CIE Transient Output Card Generator Acceptance Testing**  **CACIE-CIE Transient Output Card Generator – AT-1** | | **Date: 09-01-2020** | |
| **Tool Runner File Location for this test:**  \\olive\backups\CAVE\v4-4Test\afarms\_trOC-AT\trOCcards | | **Test Performed By: Praveena Allena** | |
| **Testing Directory:** \\olive\backups\CAVE\v4-4Test\afarms\_trOC-AT\trOCcards | | | |
| **Test Step** | **Test Instruction** | **Expected Result** | **Test Result  (Pass/Fail)** |
| 1 | Ensure the following files are in \\olive\backups\CAVE\v4-4Test\afarms\_trOC-AT \build, as they are needed for the execution of the ***OC\_TR\_gen\_cie.f*** tool:   * ***input.sij*** * ***input.nij*** * ***input.top*** | The expected files are present in the \\olive\backups\CAVE\v4-4Test\afarms\_trOC-AT \build directory. | Pass |
| 2 | Navigate to the Testing Directory through a Linux terminal. Execute the shell script ***run\_cie\_xprt\_oc\_card.sh***. | The shell successfully executes. | Pass |
| 3 | Confirm the following files were generated by ***OC\_TR\_gen\_cie.f*** in \trOCcards\ subdirectory of the testing directory:   * ***cie\_Mass\_Balance\_Output\_Control.dat*** * ***cie\_Output\_Control.dat***   Other files generated in the same directory that are not a functional requirement are as follows:   * ***cie\_afarms\_trOCcards\_screen.log*** * ***trOCcards\_afarms.log*** | The files were generated in the testing directory. | Pass |
| 4 | Using a comparison program, such as DiffMerge, compare cie\_Mass\_Balance\_Output\_Control.dat against cie\_Output\_Control.dat. Confirm the only differences are: | | |
| 4.1 | **Line 3**  It will read“*Output Control Card for CIE transport mass balance simulation*” for the ***cie\_Mass\_Balance\_Output\_Control.dat***file and will read“*Output Control Card for CIE transport simulation*” for the ***cie\_Output\_Control.dat***. | The ***cie\_Mass\_Balance\_Output\_Control.dat*** file will contain the phrase “*mass balance*” and the ***cie\_Output\_Control.dat*** will not have the “*mass balance*” phrase. | Pass |
| 4.2 | In Windows Explorer navigate to the S:\PSC\!HANFORD\ICF\Prod\CIEPLYR\v1.0\data directory and open ***cie\_plot\_times.txt***.  **The *cie\_Output\_Control.dat* file**:   * Check that the Number of Plot Times entry is equal to the number of plot times listed. * Check that all the years from the ***cie\_plot\_times.txt*** file, with each year followed by “*, year,*” (for example, “*1943, year,”*) are included in the ***cie\_Output\_Control.dat*** file. | The section listing the output years of the ***cie\_Output\_Control.dat*** file will report “*42”* as the number of output times and includes each year from the ***cie\_plot\_times.txt*** file and “*, year,”*. | Pass |
| 4.3 | **The *cie\_Mass\_Balance\_Output\_Control.dat* file:**   * Check that the Number of Plot Times entry is equal to 1. * Check that the single plot time entry is: *3070, year,* | The Number of Plot File Times is 1 and the single plot time entry is:  *3070, year,* | Pass |
| If all the Test Steps above are reported as “*Pass*” then only one file from here to the end of the test will need to be checked, as all other items of the \*.dat files are the same.  Open the cie\_Output\_Control.dat file for all remaining test instructions. | | | |
| 5 | Test Step 5 will check the reference node profiles of the model domain. | | |
| 5.1 | Confirm the following sections are in the cie\_Output\_Control.dat file:   * Center domain * Center first quadrant (upper right hand) * Center second quadrant (upper left hand) * Center third quadrant (lower left hand) * Center fourth quadrant (lower right hand) | These five domain/quadrants are present. | Pass |
| 5.2 | For each Reference Node Profile section (Center domain, Center first quadrant, etc.) tally the number of reference node lines for each section. Example, the Center domain has 12 lines, from “*65, 74, 220*” down to “*65, 74, 1,*”   * Center Domain Number of Lines:   [12 lines starting from 65,74,220 …………ends at 65,74,1]   * Center First Quadrant Number of Lines: [11 lines starting from 93,105,191 ………. ends at 93,105,1] * Center Second Quadrant Number of Lines: [12 lines starting from 30,105,209 ………ends at 30,105,1] * Center Third Quadrant Number of Lines: [13 lines starting from 30,30,235 ………. ends at 30,30,1] * Center Fourth Quadrant Number of Lines: [12 lines starting from 93,30,220 ………. ends at 93,30,1]   The lines that follow each domain/quadrant heading have the following format: X, Y, Z, where X, Y, and Z are the I-, J-, and K- node index values, respectively, for the reference nodes. | The following sections have a total number of reference nodes:   * Center Domain: **12** * Center First Quadrant: **11** * Center Second Quadrant: **12** * Center Third Quadrant: **13** * Center Fourth Quadrant: **12** | Pass |
| 5.3 | Total the number of lines in each reference node from Test Step 5.2. Report that value here: [**60]**  Confirm the total number of reference nodes from Test Step 5.2 matches the Number of Reference Nodes entry in the ***cie\_Output\_Control.dat*** file. | The Number of Reference Nodes entry in the ***cie\_Output\_Control.dat*** matches the total number of lines from Test Step 5.2. | Pass |
| 5.4 | Navigate to the testing directory and open ***calculations.xlsx*** file. Follow the directions within to calculate model and domain centers. The first line of the ***input.nij*** file contains two values: the number of X and Y nodes. The following lines list the i, j, x-center and y-center values for each node. Use these values to calculate the I- and J- node values for the domain and quadrant centers. The file ***input.sij*** will have a similar number of nodes from ***input.nij*** but increased by one, as well as ***input.sij*** has edge XYs for the nodes.. Use Section 1 of this document to understand the calculations.  Confirm the calculated reference nodes correspond to the reference nodes in the ***cie\_Output\_Control.dat*** file. | All five domain/quadrants are correctly calculated.  The Excel file containing the calculations is present in the testing directory. | Pass |
| 5.5 | In the cie\_Output\_Control.dat file, the first set of node index values underneath each reference node profile heading for the model and quadrant centers represents the uppermost node in that domain/quadrant.  Open input.top in the ../build/ directory of the testing directory. Using the uppermost node values above verify the K-node index value is present in the ***input.top*** file. | The first I-, J- and K- values of the Model and Quadrant Centers in cie\_Output\_Control.dat match the values present within input.top. | Pass |
| 5.6 | Confirm in the cie\_Output\_Control.dat file for each model and quadrant center reference node profile the K- representation starts at layer 1 (starts at the bottom row of each domain/quadrant), increments upward by 20 from layer 20 and the last layer is the topmost active layer.  For further details refer Section 1. | The Model and Quadrant Centers have correct K- value representation. | Pass |
| 6 | Confirm in the cie\_Output\_Control.dat file line 79 reads:   * 1, 1, year, m, 8, 8, 8, | Line 79 in the cie\_Output\_Control.dat file reads the same. | Pass |
| 7 | Confirm in the cie\_Output\_Control.dat file the Number of Reference Node Variables entry equals the number of reference node variables listed. | The number of reference node variables match. | Pass |
| 8 | Confirm in the ***cie\_Output\_Control.dat*** file the Reference Node Output Variables are the expected parameters, as described in Section 1 of this document. Check that units are correct. | The parameters match those listed in Section 1. | Pass |
| 9 | Confirm in the cie\_Output\_Control.dat file the Number of Plot File Variables entry matches the number of plot file variables listed. | The number of plot file variables match. | Pass |
| 10 | Confirm in the ***cie\_Output\_Control.dat*** file the plot file variables are the expected parameters described in Section 1 of this document. Check that units are correct.  Verify the last plot file variable reads “*No Restart, ,*” | The parameters match those listed in Section 1.  The last plot file variable reads “*No Restart, ,*”. | Pass |

# Appendix B

**Completed Installation Test**

**Tool Runner Log**

INFO--09/09/2020 08:21:40 AM--Starting CA-CIE Tool Runner. Logging to "./trOCcards\_install\_test.log"

INFO--09/09/2020 08:21:40 AM--Code Version: 0a1106ab56e79ae27221b486af36bff51cf307ab v5.6: /opt/tools/pylib/runner/runner.py<--1bcfd6779e9cbdb82673405873a8e5e81514ae27

INFO--09/09/2020 08:21:40 AM--Code Version: 0a1106ab56e79ae27221b486af36bff51cf307ab v5.6: /opt/tools/tools/cie-troccard/linux/OC\_TR\_gen\_cie\_linux-intel-64.exe<--db07ec6118324605158f283be287146dae09a5be

INFO--09/09/2020 08:21:40 AM--QA Status: QUALIFIED : /opt/tools/pylib/runner/runner.py

INFO--09/09/2020 08:21:40 AM--QA Status: QUALIFIED : /opt/tools/tools/cie-troccard/linux/OC\_TR\_gen\_cie\_linux-intel-64.exe

INFO--09/09/2020 08:21:40 AM--Invoking Command:"/opt/tools/tools/cie-troccard/linux/OC\_TR\_gen\_cie\_linux-intel-64.exe" with Arguments:"infile3"

INFO--09/09/2020 08:21:40 AM--Username:slindberg Computer:olive Platform:Linux 4.4.0-38-generic #57~14.04.1-Ubuntu SMP Tue Sep 6 17:20:43 UTC 2016

| Table B-1  **CIE Transient Output Card Generator Installation Test Plan** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **CIE Transient Output Card Generator Installation Testing**  **CACIE-CIE Transient Output Card Generator – IT-1** | | | **Date: 09/09/2020** | | |
| **Tool Runner File Location for this test:**  **\\OLIVE\CAVE\CA-CIE-Tools-TestEnv\CA-CIE-Tools\_cie\_v5.X\_install\_tests\trOCcards\_cie** | | | **Test Performed By: Sara Lindberg** | | |
| **Testing Directory: \\OLIVE\CAVE\CA-CIE-Tools-TestEnv\CA-CIE-Tools\_cie\_v5.X\_install\_tests\trOCcards\_cie** | | | | | |
| **Test Step** | **Test Instruction** | | **Expected Result** | **Test Result  (Pass/Fail)** | |
| Tools Code Repository Directory: /opt/tools | | | | | |
| Navigate to the testing directory | | | | | |
| 1 | | Invoke Tool runner and test the installation of the tool as follows:  *./* *CACIE\_OC\_TR\_gen\_cie\_IT-1.sh* | | | |
| 2 | | Verify Tool Runner is invoked and executed. | Tool Runner log is generated and QA status documented | | *PASS* |
| 3 | | Verify tool is invoked and executed | cie\_Mass\_Balance\_Output\_Control.dat and cie\_Output\_Control.dat files are generated  Note: both files will be empty for installation test | | *PASS* |

**Appendix C**

**QA Checklist**

