**CACIE Tool #24** – **RTD STOMP Input File Generator Tool**

**xprt\_RTD\_input\_gen.f**

**Version** **1.0**

**QA**: **QA**

# Description and Purpose

The RTD STOMP Input File Generator Tool generates the 2018 – RTD year STOMP transport input file. This code reads and modifies the 1943-2018 STOMP input file created by the 2018 STOMP Input File Generator Tool.

The STOMP input file generated by this tool is ***input\_XPRT-#\_RTD***, where ***#*** is 1 or 2 (corresponding to the group of radionuclides modeled).

# Functional Requirements

The following are the functional requirements (FR) of the RTD STOMP Input File Generator Tool:

FR-1: Parse the following command line arguments: 1943-2018 STOMP input file location/name and simulation RTD year.

FR-2: Based on the name of the 1943-2018 STOMP input file, determine whether the simulation is for rads1 or rads2.

FR-3: Copy lines from the 1943-2018 STOMP input file except as noted in the following functional requirements FR-4 to FR-6. Input taken directly from the 1943-2018 STOMP input file includes the following STOMP cards:

* Simulation Title Card (Partial)
* Grid Card
* Inactive Nodes Card
* Rock Soil Zonation Card
* Mechanical Properties Card
* Hydraulic Properties Card
* Saturation Function Card
* X-Aqueous Relative Permeability Card
* Y-Aqueous Relative Permeability Card
* Z-Aqueous Relative Permeability Card
* Solute/Fluid Interaction Card
* Solute/Porous Media Interaction Card
* Initial Conditions Card
* Boundary Conditions Card
* Output Control Card (Partial)
* Surface Flux Card
* Source Card

FR-4: In the Simulation Title Card, replace the second Simulation Note Line (“*Rad# Transport Simulation (1943-2018),*”) with “*Rad# Transport Simulation (2018-YYYY [RTD Year]),*” where # is the radionuclide group as determined in FR-2 and YYYY is the RTD year.

FR-5: Replace the Solution Control Card as follows:

* Set the restart path depending on whether the simulation is for rads1 or rads2 (i.e., “*Restart File, ../xprt-1/restart,*” if rads1 or “*Restart File, ../xprt-2/restart,*” if rads2.
* Replace the rest of the Solution Control Card with:

Water w/ Patankar Vadose Transport Courant,1.0,

1,

2018,year,YYYY,year,1.0E-08,year,0.1,year,1.25,16,1.0E-6,

1000000,

0,

Where YYYY is the RTD year.

FR-6: Revise the Output Control Card:

* Copy the Output Control Card lines from the 1943-2018 STOMP input file down to the number of plot times.
* Write the number of plot times for the RTD STOMP input file. This value will be one more than the number of plot times in the 1943-2018 STOMP input file.
* Write the plot times, including a new value of 2018.00000001. All other plot times will be identical to those in the 1943-2018 STOMP input file.
* Copy the number of plot file variables and the plot file variable list from the 1943-2018 STOMP input file.

FR-7: Save the output file (i.e., the complete STOMP RTD transport input file, which includes all the required cards).

FR-8: The STOMP RTD transport input file produced by the tool should be formatted for STOMP execution.

# Software Requirements Specifications

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

Compiler Options: -o OutputFileName

Special Considerations: None

# Software Design Description

Flow:

The RTD STOMP Input File Generator Tool performs the following steps:

1. Declare variables – Character and array variables are declared.
2. Read command line arguments – See the list defined below.
3. Determine whether the simulation is for rads1 or rads2.
4. Open the output file.
5. Open the 1943-2018 STOMP input file created by the 2018 STOMP Input File Generator Tool – Portions of this file will be copied to the output file generated by the RTD STOMP Input File Generator Tool (see list in FR-3).
6. Write Simulation Title Card – All lines except the last line are from the 1943-2018 STOMP input file created by the 2018 STOMP Input File Generator Tool; the last line identifies the simulation (radionuclide group and model years).
7. Write Solution Control Card – See FR-5 for details.
8. Write the following cards, which are copied from the 1943-2018 STOMP input file created by the 2018 STOMP Input File Generator Tool:
   1. Grid Card
   2. Inactive Nodes Card
   3. Rock/Soil Zonation Card
   4. Mechanical Properties Card
   5. Hydraulic Properties Card
   6. Saturation Function Card
   7. X-Aqueous Relative Permeability Card
   8. Y-Aqueous Relative Permeability Card
   9. Z-Aqueous Relative Permeability Card
   10. Solute/Fluid Interaction Card
   11. Solute/Porous Media Interaction Card
   12. Initial Conditions Card
   13. Boundary Conditions Card
9. Determine if the simulation start year, 2018, is included in the Output Control plot times for the 1943-2018 STOMP input file. If 2018 is included in the Output Control plot times for the 1943-2018 STOMP input file, the number of plot times will be unchanged from the 1943-2018 STOMP input file. If 2018 is not included in the Output Control plot times for the 1943-2018 STOMP input file, the number of plot times will be one more than the 1943-2018 STOMP input file.
10. If the simulation start year is included in the Output Control plot times for the 1943-2018 STOMP input file, replace 2018 with 2018.00000001 so that STOMP will output a plot for that year. Otherwise, add a plot time of 2018.00000001.
11. Write Output Control Card:
    1. Copy the Output Control Card lines from the 1943-2018 STOMP input file down to the number of plot times.
    2. Write the number of plot times for the RTD STOMP input file.
    3. Write the plot times (including 2018.00000001).
    4. Copy the number of plot file variables and the plot file variable list from the 1943-2018 STOMP input file.
12. Write the Surface Flux Card and Source Card, which are copied from the 1943-2018 STOMP input file created by the 2018 STOMP Input File Generator Tool.

Arguments:

1943-2018 STOMP input file – Path to the 1943-2018 STOMP input file created by the 2018 STOMP Input File Generator Tool.

RTD year –RTD year for the model.

Input Files:

1943-2018 STOMP input file (path read as Command Line Argument 1) – 1943-2018 STOMP input file created by the 2018 STOMP Input File Generator Tool.

Output Files:

The output file generated by this tool is a STOMP input for transport modeling for 2018 through RTD year. There are two possible output file names depending on radionuclide group:

input\_XPRT-1\_RTD – Radionuclide Group = 1

input\_XPRT-2\_RTD – Radionuclide Group = 2

Execution:

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\ca-modinput\linux\xprt\_RTD\_input\_gen\_linux-intel-64.exe “$INPUT1 $INPUT2”

Each of the shell script variables (denoted by the “$”) will be set in the shell script with the corresponding variable input (“$INPUT1” for the input card and “$INPUT2” for the RTD year to apply).

Code Review:

A code review was performed by Jacob Fullerton on April 28, 2020. No impacts to other repository tools or library dependencies were identified for the RTD STOMP Input File Generator Tool.

# Requirements Traceability Matrix

The requirements traceability matrix for the RTD STOMP Input File Generator tool is presented in Table 1.

| Table 1  Requirements Traceability Matrix | | |
| --- | --- | --- |
| **Functional Requirement ID** | **Acceptance Test ID** | **Test Case** |
| QA Level | CACIE-xprt\_RTD\_input\_gen-IT-1 | Installation Test |
| FR-1 | CACIE-xprt\_RTD\_input\_gen-AT-1 | Check the screen output from this tool to see that the 1943-2018 STOMP input file location/name and RTD year were read correctly from the command line input. |
| FR-2 | CACIE-xprt\_RTD\_input\_gen-AT-1 and CACIE-xprt\_RTD\_input\_gen-AT-2 | Check the output file name to determine if the correct radionuclide group (“XPRT-1” for rads1 or “XPRT-2” for rads2) was selected. |
| FR-3 | CACIE-xprt\_RTD\_input\_gen-AT-1 | ~Grid Card, ~Inactive Nodes Card, ~Rock/Soil Zonation Card, ~Mechanical Properties Card, ~Hydraulic Properties Card, ~Saturation Function Card, ~X-Aqueous Relative Permeability Card, ~Y-Aqueous Relative Permeability Card, ~Z-Aqueous Relative Permeability Card, ~Solute/Fluid Interaction Card, ~Solute/Porous Media Interaction Card, ~Initial Conditions Card, ~Boundary Conditions Card, ~Surface Flux Card, ~Source Card:  Check that these Cards are identical to those in the 1943-2018 STOMP input file. |
| FR-4 | CACIE-xprt\_RTD\_input\_gen-AT-1 and CACIE-xprt\_RTD\_input\_gen-AT-2 | ~Simulation Title Card:   * Check that all lines except the last are identical to those in the 1943-2018 STOMP input file. * Check that the last line is “Rad# Transport Simulation (2018 – YYYY [RTD Year]),”, where # is 1 or 2 depending on the radionuclide group selected and YYYY is the RTD year. |
| FR-5 | CACIE-xprt\_RTD\_input\_gen-AT-1 and CACIE-xprt\_RTD\_input\_gen-AT-2 | ~Solution Control Card:  Check that the Solution Control Card matches the format described in Functional Requirement FR-5. |
| FR-6 | CACIE-xprt\_RTD\_input\_gen-AT-1 | ~Output Control Card:   * Check that the plot times include 2018.00000001. * Check that the number of plot times is correct. * Check that all other lines in the Output Control Card are identical to those in the 1943-2018 STOMP input file. |
| FR-7 | CACIE-xprt\_RTD\_input\_gen-AT-1 | Check that the following cards are included in the generated STOMP mass balance transport input file:   * Simulation Title Card * Solution Control Card * Grid Card * Inactive Nodes Card * Rock Soil Zonation Card * Mechanical Properties Card * Hydraulic Properties Card * Saturation Function Card * X-Aqueous Relative Permeability Card * Y-Aqueous Relative Permeability Card * Z-Aqueous Relative Permeability Card * Solute/Fluid Interaction Card * Solute/Porous Media Interaction Card * Initial Conditions Card * Boundary Conditions Card * Output Control Card * Surface Flux Card * Source Card |
| FR-8 | CACIE-xprt\_RTD\_input\_gen-AT-3 | Copy and Paste the generated input file as ***input*** in the same directory. Modify the Simulation Title Card in the ***input*** file to run STOMP for only one-time step. This test ensures the ***input*** file will pass the STOMP syntax check. |

# Installation Test Plan and Acceptance Test Plan Cases

The installation test plan for RTD STOMP Input File Generator is presented in Table 2 and the acceptance test plan cases for RTD STOMP Input File Generator are presented in Table 3, Table 4, and Table5.

| Table 2  **RTD STOMP Input File Generator Installation Test Plan** | | | |
| --- | --- | --- | --- |
| **RTD STOMP Input File Generator Installation Testing**  **CACIE-RTD STOMP Input File Generator – IT-1** | | **Date:** | |
| **Tool Runner File Location for this test:**  [**\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd\_xprt\_input\_gen\IT-1**](file:///\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd_xprt_input_gen\IT-1) | | **Test Performed By: [FIRST & LAST NAME]** | |
| **Testing Directory:** [**\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd\_xprt\_input\_gen**](file:///\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd_xprt_input_gen) | | | |
| **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 installation of the tool ***runner\_run\_IT-1\_RTD-Input-Gen.sh***:  Open a Linux terminal, navigate to the testing directory and type *./runner\_run\_IT-1\_RTD-Input-Gen.sh* | | |
| 2 | Verify Tool Runner is invoked and executed. | Verify that the following file has been created and has the appropriate output corresponding with a “Tool Runner” execution:  ***./IT-1/runner\_run\_IT-1\_RTD-Input-Gen.log*** |  |
| 3 | Verify tool is invoked and executed. | A new file should have been created: ***./IT-1/RTD\_Input\_Gen\_screen.log.log***  The following program error should be found: “forrtl: severe (29): file not found” |  |

| Table 3  **RTD STOMP Input File Generator Acceptance Test Plan Case 1** | | | |
| --- | --- | --- | --- |
| **RTD STOMP Input File Generator Acceptance Testing**  **CACIE-RTD STOMP Input File Generator – AT-1** | | **Date:** | |
| **Tool Runner File Location for this test:**  [**\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd\_xprt\_input\_gen\AT-1**](file:///\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd_xprt_input_gen\AT-1) | | **Test Performed By:** | |
| **Testing Directory:** [**\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd\_xprt\_input\_gen**](file:///\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd_xprt_input_gen) | | | |
| **Test Step** | **Test Instruction** | **Expected Result** | **Test Result  (Pass/Fail)** |
| 1 | Navigate to the testing directory | | |
| 2 | Invoke the ***runner\_run\_AT-1\_RTD-Input-Gen.sh*** by doing the following:  Open a Linux terminal, navigate to the testing directory and type: *./runner\_run\_AT-1\_RTD-Input-Gen.sh* | | |
| 3 | A new directory should have been created called “AT-1”. Navigate to that directory and open a file called ***RTD\_Input\_Gen\_screen.log*** in a text editor. Verify that in line 2 of the file you see “../xprt-1/input\_XPRT-1” and in line 6 you should see “Simulation RTD Year = 2030”  These 2 lines of text correspond with the two inputs specified in the shell script (feel free to verify the file names in $INPUT1 and $RTD\_YEAR of the shell script invoked in step 2 of this acceptance test). | If the text is present as described, this satisfies the following FRs:  FR-1 and FR-7 |  |
| 4 | The input file used has in its file name “XPRT-1” which is parsed by the code to recognize whether the input file corresponds with “Radionuclide Group 1” or “Radionuclide Group 2”. This input file has the number “1” in its name, which indicates to the script that this file corresponds with “Radionuclide Group 1”.  Open the ***RTD\_Input\_Gen\_screen.log*** in a text editor. Read in line 8 and verify that “Radionuclide Group 1” is written. | Verify that line 8 of ***RTD\_Input\_Gen\_screen.log.log*** has “Radionuclide Group 1” in the line. This partially satisfies the following FR:  FR-2  The other aspect of this test will be vetted in another test. |  |
| 5 | Using a diff merge or file comparison utility, open and compare the following files:   * ***input\_XPRT-1*** * ***input\_XPRT-1\_RTD***   Verify in the comparison that there are no differences (additional white space is negligible) in the following cards (look for the tilde “~” indicator for each card):   * Grid * Inactive Nodes * Rock/Soil Zonation * Mechanical Properties * Hydraulic Properties * Saturation Function * X-Aqueous Relative Permeability * Y-Aqueous Relative Permeability * Z-Aqueous Relative Permeability * Solute/Fluid Interaction * Solute/Porous Media Interaction * Initial Conditions * Boundary Conditions * Source Card * Surface Flux   Verify that there are differences between the two files for the following cards (expected differences will be enumerated in subsequent steps):   * Simulation Title * Solution Control * Output Control Card | Card differences between the input and output files should only be found in the cards indicated. This satisfies the following FR:  FR-3 |  |
| 6 | Open the ***input\_XPRT-1\_RTD*** file in a preferred text editor. Verify that the “Simulation Title Card” has the following line of text: “Rad1 Transport Simulation (2018-2030 [RTD Year]),” | If the text is present in the card indicated, this partially satisfies the following FR:  FR-4  A subsequent test will verify the remaining aspect of this FR. |  |
| 7 | Open the ***./AT-1/input\_XPRT-1\_RTD*** and verify that line 21 has the following text:   * “Restart File, ../xprt-1/restart,”   Then verify that lines 22 through 26 have the following text (extra white spaces are negligible):   * Water w/ Patankar Vadose Transport Courant, 1.0, * 1, * 2018,year,2030,year,1.0E-08,year,0.1,year,1.25,16,1.0E-6, * 1000000, * 0, | If the “Solution Control Card” is written out in the ***input\_XPRT-1\_RTD*** as specified, this partially satisfies the following FR:  FR-5  A subsequent acceptance test will finish qualifying the functional requirement indicated |  |
| 8 | In either a text editor or file comparison utility, open the script output, ***./AT-1/input\_XPRT-1\_RTD***, and ***./xprt-1/input\_XPRT-1***. In both files, navigate to the “Output Control Card” and verify that:   * The two output control cards should be identical in their structure (white spaces are negligible) until the number of plot times is reported * The number of plot times will differ by “1” where the ***input\_XPRT-1\_RTD*** should have the same number of plot times as ***input\_XPRT-1*** plus one (e.g. if ***input\_XPRT-1*** has 10 plot times, then ***input\_XPRT-1\_RTD*** will have 11 plot times) * All plot times will be written verbatim (extra white spaces are negligible) except that there will be one more plot time written in the ***input\_XPRT-1\_RTD***. This extra plot time will be “2018.00000001” * The remainder of the “Output Control Card” should match between the two files (white spaces are negligible) | If the “Output Control Card” modifications are made as explained, this satisfies the following FR:  FR-6 |  |

| Table 4  **RTD STOMP Input File Generator Acceptance Test Plan Case 2** | | | |
| --- | --- | --- | --- |
| **RTD STOMP Input File Generator Acceptance Testing**  **CACIE-RTD STOMP Input File Generator – AT-2** | | **Date:** | |
| **Tool Runner File Location for this test:**  [**\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd\_xprt\_input\_gen\AT-2**](file:///\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd_xprt_input_gen\AT-2) | | **Test Performed By:** | |
| **Testing Directory:** [**\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd\_xprt\_input\_gen**](file:///\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd_xprt_input_gen) | | | |
| **Test Step** | **Test Instruction** | **Expected Result** | **Test Result  (Pass/Fail)** |
| 1 | Navigate to the testing directory | | |
| 2 | Invoke the ***runner\_run\_AT-2\_RTD-Input-Gen.sh*** by doing the following:  Open a Linux terminal, navigate to the testing directory and type: *./runner\_run\_AT-2\_RTD-Input-Gen.sh* | | |
| 3 | A new directory should have been created called “AT-2”. | | |
| 4 | The input file used has in its file name “XPRT-2” which is parsed by the code to recognize whether the input file corresponds with “Radionuclide Group 1” or “Radionuclide Group 2”. This input file has the number “2” in its name, which indicates to the script that this file corresponds with “Radionuclide Group 2”.  Open the ***RTD\_Input\_Gen\_screen.log*** in a text editor. Read in line 8 and verify that “Radionuclide Group 2” is written. | Verify that line 8 of ***RTD\_Input\_Gen\_screen.log.log*** has “Radionuclide Group 2” in the line. This test finishes verifying the following FR:  FR-2 |  |
| 5 | Open the ***input\_XPRT-2\_RTD*** file in a preferred text editor. Verify that the “Simulation Title Card” has the following line of text: “Rad2 Transport Simulation (2018-2031 [RTD Year]),” | If the text is present in the card indicated, this (with acceptance test 1) satisfies the following FR:  FR-4 |  |
| 6 | Open the ***./AT-2/input\_XPRT-2\_RTD*** and verify that line 21 has the following text:   * “Restart File, ../xprt-2/restart,”   Then verify that lines 22 through 26 have the following text:   * Water w/ Patankar Vadose Transport Courant,1.0, * 1, * 2018,year,2031,year,1.0E-08,year,0.1,year,1.25,16,1.0E-6, * 1000000, * 0, | If the “Solution Control Card” is written out in the ***input\_XPRT-2\_RTD*** file as specified, this (with acceptance test 1) satisfies the following FR:  FR-5 |  |

| Table 5  **RTD STOMP Input File Generator Acceptance Test Plan Case 3** | | | |
| --- | --- | --- | --- |
| **RTD STOMP Input File Generator Acceptance Testing**  **CACIE-RTD STOMP Input File Generator – AT-3** | | **Date:** | |
| **Tool Runner File Location for this test:**  [**\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd\_xprt\_input\_gen\AT-3**](file:///\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd_xprt_input_gen\AT-3) | | **Test Performed By:** | |
| **Testing Directory:** [**\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd\_xprt\_input\_gen**](file:///\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd_xprt_input_gen) | | | |
| **Test Step** | **Test Instruction** | **Expected Result** | **Test Result  (Pass/Fail)** |
| 1 | Navigate to the testing directory | | |
| 2 | Invoke the ***runner\_run\_AT-3\_RTD-Input-Gen.sh*** by doing the following:  Open a Linux terminal, navigate to the testing directory and type: *./runner\_run\_AT-3\_RTD-Input-Gen.sh* | | |
| 3 | A new directory should have been created called “AT-3”. | | |
| 4 | Navigate to the ***./AT-3*** directory and open the ***screenout*** file. Navigate through the file and verify that there are no error messages (search for the keyword “error” as a case-insensitive search). Verify that the following text is present in the ***screenout*** file:  113 2026685 2.01800E+03 8.00000E-09 [ 0/ 0/ 0/ 0/ 0/ 0/ 0/ 0/ 0] 1.0000000E+00 1.3233889E+10 0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00 3.1687181E-01 6.0744326E-02 -8.7102863E+04 1.9301252E+02 -4.0241227E-01 5.3871908E-02 -6.0014580E+00 | If the text is present in ***screenout*** as indicated and no errors are found, this satisfies the following FR:  FR-8 |  |

# Acceptance Test Report

To complete the Acceptance Testing use Appendix A. The three test cases are described as follows:

* Acceptance Test 1 is in Table A-1 of Appendix A. The test executes the RTD STOMP Input File Generator Tool and the outputs are compared against the input to validate several functional requirements.
* Acceptance Test 2 is in Table A-2 of Appendix A. The test executes the RTD STOMP Input File Generator Tool and the outputs are compared against the input to validate several functional requirements.
* Acceptance Test 3 is in Table A-3 of Appendix A. The test executes the RTD STOMP Input File Generator Tool and then executes a STOMP simulation using the newly created STOMP input file. Output from the STOMP program is evaluated for the associated functional requirement.

Details of these tests, when they were conducted, by whom, and if they Passed or Failed are in each table of Appendix A.

# User Guide

To run this tool a STOMP input file needs to be provided (to be modified by the tool). Refer to the software design and input description for additional information about the input file to be modified by the tool. Then, in a Linux terminal execute the following command:

$ ./<path/to/repository>/tools/ca-modinput/linux/xprt\_RTD\_input\_gen\_linux-intel-64.exe <path/to/STOMP/input/file>/input.file <YYYY>

The “YYYY” represents a year supplied by the user.

# Tool Versions

This section details changes incorporated into each version of the RTD STOMP Input File Generator tool.

* 1.0 – Tool was developed.

# 

# Appendix A

**Completed Acceptance Test Cases**

**Tool Runner Log**

Test directory verified

###Executing RTD Input Generator for: AT-1/../xprt-1/input\_XPRT-1 ###

INFO--04/28/2020 10:26:30 AM--Starting CA-CIE Tool Runner. Logging to ".././AT-1/runner\_run\_AT-1\_RTD-Input-Gen.log"

INFO--04/28/2020 10:26:30 AM--Code Version: 8c2f04ebbb2bba5650c21ba0bd59bc8684b76d4b v2.11: /opt/tools/pylib/runner/runner.py<--1bcfd6779e9cbdb82673405873a8e5e81514ae27

INFO--04/28/2020 10:26:31 AM--Code Version: a10efc061c39b7114119584a875c6d0af52c32e4 Local repo SHA-1 has does not correspond to a remote repo release version: /home/cfarrow/CAVE/CA-CIE-Tools-TestRepos/repo\_xprt\_RTD\_input\_gen.f/tools/ca-modinput/linux/xprt\_RTD\_input\_gen\_linux-intel-64.exe<--f45aee675624560326bae11da866db7ed04b8c55

INFO--04/28/2020 10:26:31 AM--QA Status: QUALIFIED : /opt/tools/pylib/runner/runner.py

INFO--04/28/2020 10:26:31 AM--QA Status: TEST : /home/cfarrow/CAVE/CA-CIE-Tools-TestRepos/repo\_xprt\_RTD\_input\_gen.f/tools/ca-modinput/linux/xprt\_RTD\_input\_gen\_linux-intel-64.exe

INFO--04/28/2020 10:26:31 AM--Invoking Command:"/home/cfarrow/CAVE/CA-CIE-Tools-TestRepos/repo\_xprt\_RTD\_input\_gen.f/tools/ca-modinput/linux/xprt\_RTD\_input\_gen\_linux-intel-64.exe" with Arguments:"../xprt-1/input\_XPRT-1 2030"

INFO--04/28/2020 10:26:31 AM--Username:cfarrow 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###

| Table A-1  **RTD STOMP Input File Generator Acceptance Test Plan Case 1** | | | |
| --- | --- | --- | --- |
| **RTD STOMP Input File Generator Acceptance Testing**  **CACIE-RTD STOMP Input File Generator – AT-1** | | **Date: 28 April, 2020** | |
| **Tool Runner File Location for this test:**  [**\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd\_xprt\_input\_gen\AT-1**](file:///\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd_xprt_input_gen\AT-1) | | **Test Performed By: Christopher Farrow** | |
| **Testing Directory:** [**\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd\_xprt\_input\_gen**](file:///\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd_xprt_input_gen) | | | |
| **Test Step** | **Test Instruction** | **Expected Result** | **Test Result  (Pass/Fail)** |
| 1 | Navigate to the testing directory | | |
| 2 | Invoke the ***runner\_run\_AT-1\_RTD-Input-Gen.sh*** by doing the following:  Open a Linux terminal, navigate to the testing directory and type: *./runner\_run\_AT-1\_RTD-Input-Gen.sh* | | |
| 3 | A new directory should have been created called “AT-1”. Navigate to that directory and open a file called ***RTD\_Input\_Gen\_screen.log*** in a text editor. Verify that in line 2 of the file you see “../xprt-1/input\_XPRT-1” and in line 6 you should see “Simulation RTD Year = 2030”  These 2 lines of text correspond with the two inputs specified in the shell script (feel free to verify the file names in $INPUT1 and $RTD\_YEAR of the shell script invoked in step 2 of this acceptance test). | If the text is present as described, this satisfies the following FRs:  FR-1 and FR-7 | PASS |
| 4 | The input file used has in its file name “XPRT-1” which is parsed by the code to recognize whether the input file corresponds with “Radionuclide Group 1” or “Radionuclide Group 2”. This input file has the number “1” in its name, which indicates to the script that this file corresponds with “Radionuclide Group 1”.  Open the ***RTD\_Input\_Gen\_screen.log*** in a text editor. Read in line 8 and verify that “Radionuclide Group 1” is written. | Verify that line 8 of ***RTD\_Input\_Gen\_screen.log.log*** has “Radionuclide Group 1” in the line. This partially satisfies the following FR:  FR-2  The other aspect of this test will be vetted in another test. | PASS |
| 5 | Using a diff merge or file comparison utility, open and compare the following files:   * ***input\_XPRT-1*** * ***input\_XPRT-1\_RTD***   Verify in the comparison that there are no differences (additional white space is negligible) in the following cards (look for the tilde “~” indicator for each card):   * Grid * Inactive Nodes * Rock/Soil Zonation * Mechanical Properties * Hydraulic Properties * Saturation Function * X-Aqueous Relative Permeability * Y-Aqueous Relative Permeability * Z-Aqueous Relative Permeability * Solute/Fluid Interaction * Solute/Porous Media Interaction * Initial Conditions * Boundary Conditions * Source Card * Surface Flux   Verify that there are differences between the two files for the following cards (expected differences will be enumerated in subsequent steps):   * Simulation Title * Solution Control * Output Control Card | Card differences between the input and output files should only be found in the cards indicated. This satisfies the following FR:  FR-3 | PASS |
| 6 | Open the ***input\_XPRT-1\_RTD*** file in a preferred text editor. Verify that the “Simulation Title Card” has the following line of text: “Rad1 Transport Simulation (2018-2030 [RTD Year]),” | If the text is present in the card indicated, this partially satisfies the following FR:  FR-4  A subsequent test will verify the remaining aspect of this FR. | PASS |
| 7 | Open the ***./AT-1/input\_XPRT-1\_RTD*** and verify that line 21 has the following text:   * “Restart File, ../xprt-1/restart,”   Then verify that lines 22 through 26 have the following text (extra white spaces are negligible):   * Water w/ Patankar Vadose Transport Courant, 1.0, * 1, * 2018,year,2030,year,1.0E-08,year,0.1,year,1.25,16,1.0E-6, * 1000000, * 0, | If the “Solution Control Card” is written out in the ***input\_XPRT-1\_RTD*** as specified, this partially satisfies the following FR:  FR-5  A subsequent acceptance test will finish qualifying the functional requirement indicated | PASS |
| 8 | In either a text editor or file comparison utility, open the script output, ***./AT-1/input\_XPRT-1\_RTD***, and ***./xprt-1/input\_XPRT-1***. In both files, navigate to the “Output Control Card” and verify that:   * The two output control cards should be identical in their structure (white spaces are negligible) until the number of plot times is reported * The number of plot times will differ by “1” where the ***input\_XPRT-1\_RTD*** should have the same number of plot times as ***input\_XPRT-1*** plus one (e.g. if ***input\_XPRT-1*** has 10 plot times, then ***input\_XPRT-1\_RTD*** will have 11 plot times) * All plot times will be written verbatim (extra white spaces are negligible) except that there will be one more plot time written in the ***input\_XPRT-1\_RTD***. This extra plot time will be “2018.00000001” * The remainder of the “Output Control Card” should match between the two files (white spaces are negligible) | If the “Output Control Card” modifications are made as explained, this satisfies the following FR:  FR-6 | PASS |

**Tool Runner Log**

Test directory verified

###Executing RTD Input Generator for: AT-2/../xprt-2/input\_XPRT-2 ###

INFO--04/28/2020 10:48:50 AM--Starting CA-CIE Tool Runner. Logging to ".././AT-2/runner\_run\_AT-2\_RTD-Input-Gen.log"

INFO--04/28/2020 10:48:50 AM--Code Version: 8c2f04ebbb2bba5650c21ba0bd59bc8684b76d4b v2.11: /opt/tools/pylib/runner/runner.py<--1bcfd6779e9cbdb82673405873a8e5e81514ae27

INFO--04/28/2020 10:48:50 AM--Code Version: a10efc061c39b7114119584a875c6d0af52c32e4 Local repo SHA-1 has does not correspond to a remote repo release version: /home/cfarrow/CAVE/CA-CIE-Tools-TestRepos/repo\_xprt\_RTD\_input\_gen.f/tools/ca-modinput/linux/xprt\_RTD\_input\_gen\_linux-intel-64.exe<--f45aee675624560326bae11da866db7ed04b8c55

INFO--04/28/2020 10:48:50 AM--QA Status: QUALIFIED : /opt/tools/pylib/runner/runner.py

INFO--04/28/2020 10:48:50 AM--QA Status: TEST : /home/cfarrow/CAVE/CA-CIE-Tools-TestRepos/repo\_xprt\_RTD\_input\_gen.f/tools/ca-modinput/linux/xprt\_RTD\_input\_gen\_linux-intel-64.exe

INFO--04/28/2020 10:48:50 AM--Invoking Command:"/home/cfarrow/CAVE/CA-CIE-Tools-TestRepos/repo\_xprt\_RTD\_input\_gen.f/tools/ca-modinput/linux/xprt\_RTD\_input\_gen\_linux-intel-64.exe" with Arguments:"../xprt-2/input\_XPRT-2 2031"

INFO--04/28/2020 10:48:50 AM--Username:cfarrow 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###

| Table A-2  **RTD STOMP Input File Generator Acceptance Test Plan Case 2** | | | |
| --- | --- | --- | --- |
| **RTD STOMP Input File Generator Acceptance Testing**  **CACIE-RTD STOMP Input File Generator – AT-2** | | **Date: 28-April-2020** | |
| **Tool Runner File Location for this test:**  [**\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd\_xprt\_input\_gen\AT-2**](file:///\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd_xprt_input_gen\AT-2) | | **Test Performed By: Christopher Farrow** | |
| **Testing Directory:** [**\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd\_xprt\_input\_gen**](file:///\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd_xprt_input_gen) | | | |
| **Test Step** | **Test Instruction** | **Expected Result** | **Test Result  (Pass/Fail)** |
| 1 | Navigate to the testing directory | | |
| 2 | Invoke the ***runner\_run\_AT-2\_RTD-Input-Gen.sh*** by doing the following:  Open a Linux terminal, navigate to the testing directory and type: *./runner\_run\_AT-2\_RTD-Input-Gen.sh* | | |
| 3 | A new directory should have been created called “AT-2”. | | |
| 4 | The input file used has in its file name “XPRT-2” which is parsed by the code to recognize whether the input file corresponds with “Radionuclide Group 1” or “Radionuclide Group 2”. This input file has the number “2” in its name, which indicates to the script that this file corresponds with “Radionuclide Group 2”.  Open the ***RTD\_Input\_Gen\_screen.log*** in a text editor. Read in line 8 and verify that “Radionuclide Group 2” is written. | Verify that line 8 of ***RTD\_Input\_Gen\_screen.log.log*** has “Radionuclide Group 2” in the line. This test finishes verifying the following FR:  FR-2 | PASS |
| 5 | Open the ***input\_XPRT-2\_RTD*** file in a preferred text editor. Verify that the “Simulation Title Card” has the following line of text: “Rad2 Transport Simulation (2018-2031 [RTD Year]),” | If the text is present in the card indicated, this (with acceptance test 1) satisfies the following FR:  FR-4 | PASS |
| 6 | Open the ***./AT-2/input\_XPRT-2\_RTD*** and verify that line 21 has the following text:   * “Restart File, ../xprt-2/restart,”   Then verify that lines 22 through 26 have the following text:   * Water w/ Patankar Vadose Transport Courant,1.0, * 1, * 2018,year,2031,year,1.0E-08,year,0.1,year,1.25,16,1.0E-6, * 1000000, * 0, | If the “Solution Control Card” is written out in the ***input\_XPRT-2\_RTD*** file as specified, this (with acceptance test 1) satisfies the following FR:  FR-5 | PASS |

**Tool Runner Log**

Test directory verified

###Executing RTD Input Generator for: AT-3/../xprt-1/input\_XPRT-1 ###

INFO--04/28/2020 10:52:27 AM--Starting CA-CIE Tool Runner. Logging to ".././AT-3/runner\_run\_AT-3\_RTD-Input-Gen.log"

INFO--04/28/2020 10:52:27 AM--Code Version: 8c2f04ebbb2bba5650c21ba0bd59bc8684b76d4b v2.11: /opt/tools/pylib/runner/runner.py<--1bcfd6779e9cbdb82673405873a8e5e81514ae27

INFO--04/28/2020 10:52:27 AM--Code Version: a10efc061c39b7114119584a875c6d0af52c32e4 Local repo SHA-1 has does not correspond to a remote repo release version: /home/cfarrow/CAVE/CA-CIE-Tools-TestRepos/repo\_xprt\_RTD\_input\_gen.f/tools/ca-modinput/linux/xprt\_RTD\_input\_gen\_linux-intel-64.exe<--f45aee675624560326bae11da866db7ed04b8c55

INFO--04/28/2020 10:52:27 AM--QA Status: QUALIFIED : /opt/tools/pylib/runner/runner.py

INFO--04/28/2020 10:52:27 AM--QA Status: TEST : /home/cfarrow/CAVE/CA-CIE-Tools-TestRepos/repo\_xprt\_RTD\_input\_gen.f/tools/ca-modinput/linux/xprt\_RTD\_input\_gen\_linux-intel-64.exe

INFO--04/28/2020 10:52:27 AM--Invoking Command:"/home/cfarrow/CAVE/CA-CIE-Tools-TestRepos/repo\_xprt\_RTD\_input\_gen.f/tools/ca-modinput/linux/xprt\_RTD\_input\_gen\_linux-intel-64.exe" with Arguments:"../xprt-1/input\_XPRT-1 2030"

INFO--04/28/2020 10:52:27 AM--Username:cfarrow 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###

###Copy RTD input file to 'input'

###Modify the number of time steps to be '1'###

###Copy the input.zone and input.bot from data\_files into the test directory###

Copied ./data\_files/input.zone to: ./AT-3

Copied ./data\_files/input.bot to: ./AT-3

###Make the surface file directory###

Created the new directory 'srf' in the testing directory

###Finished all necessary preparations to execute the RTD STOMP input file###

###Execute the STOMP program using the RTD STOMP input file as input###

###STOMP execution complete###

###Delete Plot file to save space on disk###

Plot file(s) deleted

| Table A-3  **RTD STOMP Input File Generator Acceptance Test Plan Case 3** | | | |
| --- | --- | --- | --- |
| **RTD STOMP Input File Generator Acceptance Testing**  **CACIE-RTD STOMP Input File Generator – AT-3** | | **Date: 28-April-2020** | |
| **Tool Runner File Location for this test:**  [**\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd\_xprt\_input\_gen\AT-3**](file:///\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd_xprt_input_gen\AT-3) | | **Test Performed By: Christopher Farrow** | |
| **Testing Directory:** [**\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd\_xprt\_input\_gen**](file:///\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd_xprt_input_gen) | | | |
| **Test Step** | **Test Instruction** | **Expected Result** | **Test Result  (Pass/Fail)** |
| 1 | Navigate to the testing directory | | |
| 2 | Invoke the ***runner\_run\_AT-3\_RTD-Input-Gen.sh*** by doing the following:  Open a Linux terminal, navigate to the testing directory and type: *./runner\_run\_AT-3\_RTD-Input-Gen.sh* | | |
| 3 | A new directory should have been created called “AT-3”. | | |
| 4 | Navigate to the ***./AT-3*** directory and open the ***screenout*** file. Navigate through the file and verify that there are no error messages (search for the keyword “error” as a case-insensitive search). Verify that the following text is present in the ***screenout*** file:  113 2026685 2.01800E+03 8.00000E-09 [ 0/ 0/ 0/ 0/ 0/ 0/ 0/ 0/ 0] 1.0000000E+00 1.3233889E+10 0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00 3.1687181E-01 6.0744326E-02 -8.7102863E+04 1.9301252E+02 -4.0241227E-01 5.3871908E-02 -6.0014580E+00 | If the text is present in ***screenout*** as indicated and no errors are found, this satisfies the following FR:  FR-8 | PASS |

# Appendix B

# Completed Installation Test

**Tool Runner Log**

Test directory verified

###Executing RTD Input Generator for: IT-1/not\_a\_file ###

INFO--04/29/2020 08:25:30 AM--Starting CA-CIE Tool Runner. Logging to ".././IT-1/runner\_run\_IT-1\_RTD-Input-Gen.log"

INFO--04/29/2020 08:25:30 AM--Code Version: 9fc677a264d164fa9287e1d8e34a8b9df48e2642 v2.12: /opt/tools/pylib/runner/runner.py<--1bcfd6779e9cbdb82673405873a8e5e81514ae27

INFO--04/29/2020 08:25:30 AM--Code Version: 9fc677a264d164fa9287e1d8e34a8b9df48e2642 v2.12: /opt/tools/tools/ca-modinput/linux/xprt\_RTD\_input\_gen\_linux-intel-64.exe<--f45aee675624560326bae11da866db7ed04b8c55

INFO--04/29/2020 08:25:30 AM--QA Status: QUALIFIED : /opt/tools/pylib/runner/runner.py

INFO--04/29/2020 08:25:30 AM--QA Status: QUALIFIED : /opt/tools/tools/ca-modinput/linux/xprt\_RTD\_input\_gen\_linux-intel-64.exe

INFO--04/29/2020 08:25:30 AM--Invoking Command:"/opt/tools/tools/ca-modinput/linux/xprt\_RTD\_input\_gen\_linux-intel-64.exe" with Arguments:"not\_a\_file 2030"

INFO--04/29/2020 08:25:30 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

###Finished Process###

| Table B-1  **RTD STOMP Input File Generator Installation Test Plan** | | | |
| --- | --- | --- | --- |
| **RTD STOMP Input File Generator Installation Testing**  **CACIE-RTD STOMP Input File Generator – IT-1** | | **Date: 04/29/2020** | |
| **Tool Runner File Location for this test:**  [**\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd\_xprt\_input\_gen\IT-1**](file:///\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd_xprt_input_gen\IT-1) | | **Test Performed By: Sara Lindberg** | |
| **Testing Directory:** [**\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd\_xprt\_input\_gen**](file:///\\olive\backups\CAVE\CA-CIE-Tools-TestEnv\rtd_xprt_input_gen) | | | |
| **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 installation of the tool ***runner\_run\_IT-1\_RTD-Input-Gen.sh***:  Open a Linux terminal, navigate to the testing directory and type *./runner\_run\_IT-1\_RTD-Input-Gen.sh* | | |
| 2 | Verify Tool Runner is invoked and executed. | Verify that the following file has been created and has the appropriate output corresponding with a “Tool Runner” execution:  ***./IT-1/runner\_run\_IT-1\_RTD-Input-Gen.log*** | Pass |
| 3 | Verify tool is invoked and executed. | A new file should have been created: ***./IT-1/RTD\_Input\_Gen\_screen.log.log***  The following program error should be found: “forrtl: severe (29): file not found” | Pass |

**Appendix C**

**QA Checklist**

