Getting Started with SCALE 5.1 / ORIGEN-ARP 5.1
for Windows XP and Vista
Revised August 2007

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1. Introduction

This document is the README file for the Windows version of SCALE 5.1, RSICC code package CCC-732, which includes ORIGEN-ARP 5.1. You can find additional information and technical support at the following websites. The initial release of SCALE 5.1 for Windows in November 2006 was developed for Windows XP and was not fully compatible with the new Windows Vista operating system. In August 2007, the Windows version was updated to provide compatibility with Windows Vista. No other changes were made to the package. Note that administrator privileges are required to install under Windows.

http://www.ornl.gov/sci/scale   (SCALE Web site)
http://rsicc.ornl.gov (RSICC Web site)
http://rsicc.ornl.gov/rsiccnew/CFDOCS/scale5enotebook.cfm (SCALE 5 Notebook)
In the SCALE 5 Notebook, further information regarding the installation of SCALE 5.1 will be posted to page 129 http://rsicc.ornl.gov/rsic-cgi-bin/enote.pl?nb=c725&action=view&page=129

2. Computer Hardware Requirements

The computer requirements for the Windows version of SCALE are listed below.

SCALE 5.1 on Windows PC:
- Pentium 4 or later
- 512 MB RAM minimum (1 to 2 GB recommended)
- 5 GB of hard disk space - note that very complex problems may require large amounts of memory (1 GB or more) and scratch disk space (up to 2 GB)
- Windows XP or Windows Vista

ORIGEN-ARP 5.1 on Windows PC:
- Pentium 4 or later
- 512 MB RAM minimum
- 1 GB of hard disk space
- Windows XP or Windows Vista

SCALE 5.1 on MacOS:

- Intel-based Mac (Mac OS 10.4.8 or later) booted into Windows XP under Apple BootCamp
- 1.5 to 2 GB of memory recommended for running under Parallels Desktop

Note that calculations are fast, I/O operations (especially point data processing) can be slow. Best mode of operation would be to use Parallels Desktop for GUI-type applications (GeeWiz, ORIGEN-ARP, KENO3D, etc.) and save created input files in a shared directory to run with Mac OS executables (see ReadMe file for Unix/Linux).

This Windows version contains all modules, data libraries, and miscellaneous utilities in SCALE 5.1. It includes Fortran source and executable files created with Version 7.1 of the Lahey F95

compiler on Windows XP Service Pack 2. This version is supported on Windows XP or Windows Vista. Earlier versions of Windows are not supported.

The latest news and software updates are posted on the SCALE website. From the SCALE home page, click on "Newsletter" for current and back issues of the *SCALE Newsletter*; click on "Download" for software updates, new utilities, verification & validation input files, and other files. The SCALE 5 electronic notebook on the website contains a great deal of helpful information including answers to many FAQs.

If you encounter problems, please read all this information and determine where the first problem occurred before contacting ORNL for help. Inquiries for technical assistance may be directed to the SCALE staff at scalehelp@ornl.gov. To aid in identifying the problem, try to include as much detail as possible, including input/output files and error messages. Be sure to specify your computer, operating system and compiler versions.

The programs WinZip 10.0 and WinZip Self-Extractor 3.0 (WinZip International, LLC) were used to create the self-extracting compressed files included in this package.

3. Installation of SCALE

To begin installation, insert the Windows Install Disk DVD into your DVD-ROM drive, and the SCALE 5.1 registration screen should automatically appear on the screen within one minute. If it does not, go to the DVD-ROM drive and run InstallScale5.1.exe.

Administrator privileges are required to install SCALE 5.1. This version may be installed on a computer with previous versions of SCALE. The previous versions do NOT have to be uninstalled.

Installation of SCALE 5.1 requires registration via the Internet. Registration must be performed prior to installation. If the installation computer does not have Internet access, the registration may be done from another computer. The online registration URL is https://public.ornl.gov/scale/index.cfm. A link to this website is provided on the initial registration screen via the "Click here to register now" button. During the registration process, the user must provide their RSICC pass number and password and the computer name on which SCALE is being installed. The computer name is displayed on the initial installation screen next to the red arrow.

WARNING!!!

Please close all applications prior to running the SCALE installer.

It is necessary to register as a SCALE user prior to installing SCALE on each computer.

➡ Computer Name: kjspc2

Registration Key:

RSICC Pass Number: 0

How to Register as a SCALE User

1. Connect to the SCALE website at http://public.ornl.gov/scale

➡ 2. You will need the computer name shown above.

3. You will need your RSICC pass number.

4. After you register you will be provided the "Registration Key" for this computer.

Click here to register now at http://public.ornl.gov/scale

Hint: You may cut and paste computer name from the edit box above, and
you may cut and paste the registration key from the scale order website.

Help   OK   Cancel

Once the registration key and RSICC pass number have been successfully entered, the installation screen will appear.

The installation program will prompt you for the hard disk drive where you want the programs installed. The computer name is automatically obtained from Windows. It will appear in your SCALE output to identify the computer on which the calculations were performed. The name is stored in **\scale5.1\data\machine.nam**.

Install SCALE 5.1

Name of this computer: KJSPC2

SCALE system location: C   to C:\scale5.1

Install SCALE 5.1 (Includes OrigenArp)

Install only ORIGEN-ARP 5.1

Set SCALE Paths (Assumes SCALE already installed)

Help   Cancel

The "Install SCALE 5.1" option installs the entire SCALE 5.1 code system, including all executable modules, data libraries, sample problems, and output files. The total disk space required to install all components is approximately 5 GB. **SCALE will be installed to \scale5.1 on the drive that you specify**. SCALE 5.1 is only supported on Windows XP (recommended), Windows Vista or later systems.

The "Install only ORIGEN-ARP 5.1" option installs only the portion of SCALE required to run ORIGEN-ARP 5.1, including executable modules, data libraries, sample problems, and output files. The total disk space required to install ORIGEN-ARP is approximately 1 GB. **ORIGEN-ARP will be installed to \scale5.1 on the drive that you specify.** This installation includes the SCALE Manual, OrigenArp/PlotOPUS, ORIGEN-ARP libraries, and PFE, as described below.

The third option "Set SCALE Paths" is no longer used.

SCALE 5.1 may be run from a network server or from a DVD. If you specify the SCALE system location as a mapped network drive where SCALE is already installed or a DVD drive that contains an installed version of SCALE, the installer will recognize this and prompt you for a drive on the local PC where you want to install the SCALE working directory. In this case, only the files needed to run SCALE (less than 1 MB) will be installed on the local PC.

4. Information for Foreign Language Windows Users

In foreign language versions of Windows, adding the SCALE5.1 folder to the Windows Start menu or the desktop may fail without error messages due to language specific folder names. Shortcuts are supposed to be created for the following items. The user may manually create shortcuts for these items. Note that the drive letter or the WINDOWS directory names may need to be changed.

Shortcut name	Target
GeeWiz	C:\scale5.1\GeeWiz\GeeWiz.exe
Getting Started	C:\scale5.1\GettingStarted.pdf
Keno3D	C:\scale5.1\keno3d\keno3d.exe
KENO V.a Primer	"C:\scale5.1\KENO V.a Primer\TM2005_135.pdf"
Javapeno	C:\scale5.1\cmds\JavaPeno\JavaPeno.jar
OrigenArp	C:\scale5.1\OrigenArp\OrigenArp.exe
PlotOPUS	C:\scale5.1\PlotOpus\PlotOPUS.exe
Run SCALE 5.1	C:\WINDOWS\SYSTEM32\cmd.exe /k C:\scale5.1\cmds\runscale.bat (Start in: C:\scale5.1\cmds)
SAS4 Espn	C:\scale5.1\Espn\Espn.exe
SCALE Manual	C:\scale5.1\scaleman\contents.PDF

SCALE Website	http://www.ornl.gov/sci/scale
SCALE Users Notebook	http://www.ornl.gov/sci/scale/notebook.htm
Uninstall SCALE5	C:\WINDOWS\system32\cmd.exe /c "C:\scale5.1\cmds\UninstallScale5.1.exe"

Subroutines **getmtm** in **\scale5.1\src\scalelib** and **getmtm_all** in the **qaupdate** program (**\scale5.1\src\misc\qaupdate**) perform searches for keywords contained in the output from the DOS "**dir**" command. For non-English versions of Windows, the file containing the keywords must be modified. This change is needed for the "PROGRAM VERIFICATION INFORMATION" table in the output to print correctly. These keywords are stored in **\scale5.1\data\language.dat**. The English defaults are shown below. If the **language.dat** file is not found, the English defaults are used. These keywords are case sensitive.

English Defaults	**Description**
"Volume in drive "	16-character keyword (must appear on line prior to other keywords)
"Volume Serial Number is "	24-character keyword (must appear on any line after the above keyword)
"Directory of "	16-character keyword (precedes the drive:\dir\subdir)
":\"	2-character keyword following drive letter in drive:\dir\subdir)
exe	4-character keyword (must be lowercase – between module name and size)
" is"	3-character keyword on same line as first keyword

Below is an example output from the DOS "**dir**" command that would be searched for keywords.

```
 Volume in drive C is DRIVE_C
 Volume Serial Number is 5C70-FAC3

 Directory of c:\scale5.1\bin

03/22/2004  06:01 PM         1,131,064 xsdrn.exe
              1 File(s)      1,131,064 bytes
              0 Dir(s)  23,047,335,936 bytes free
```

5. How to Run SCALE

The easiest way to run SCALE is to use one of the GUIs. GeeWiz can setup and run cases for many code sequences in SCALE:

♦ CSAS/KENO V.a or XSDRNPM
♦ CSAS6/KENO-VI
♦ SMORES
♦ TRITON/KENO V.a or TRITON6/KENO-VI
♦ TSUNAMI-1D and -3D

The OrigenArp GUI is designed for ORIGEN-ARP depletion/decay calculations and SAS4 ESPN is available for SAS4 shielding calculations. These GUIs assist you in setting up your input files and provide toolbar buttons to run SCALE and to view your output. Each of these GUIs can read most existing SCALE 4 input files.

For other SCALE modules or for users who choose not to use the GUIs, input files may be manually created in a text editor using the SCALE Manual as a guide. Input files can be "dragged and dropped" onto the "Run SCALE5.1" desktop shortcut.

Batch files to run SCALE are stored in **\scale5.1\cmds**. Users can run these programs by opening the "Run SCALE5.1" shortcut on the Start Menu. **Do NOT try to run SCALE from the standard MS-DOS "Command Prompt" icon.** SCALE can be run from any directory where your input and output files are stored. To run SCALE, there are two DOS commands that may be used, **scale5** and **batch5**. The syntax for the **scale5** command is:

```
scale5  inputfile  tempdrive  tempdir  scaledrive
```
where
inputfile = input file name (required)
tempdrive = temporary working directory drive (optional)
tempdir = temporary working directory (optional)
scaledrive = drive where SCALE 5.1 is installed (optional)

This command works with input file names with no extension (e.g., **case1**), or extensions of **.in**, **.inp**, or **.input** (e.g., **case1.in**, **case1.inp**, **case1.input**). Long file names are OK. Filenames with embedded blanks work (except for TSUNAMI-IP), but are not recommended. The output file will automatically be written with the **.out** extension (e.g., **case1.out**). There are three optional parameters, *tempdrive*, *tempdir*, and *scaledrive*, that allow the user to override the default values for the location of the temporary working directory or the SCALE 5.1 drive. These are normally not needed. The command to run **case1.inp** would simply be:

```
scale5 case1
```

The **scale5** command does not delete files from the temporary working directory at the conclusion of the job, so they remain there if needed for the next case. Only one case can be executed at any time using the **scale5** command. The **batch5** command, however, creates a new temporary working directory each time it is called, and by default removes it at the completion of the job. Thus, the

batch5 command can be used simultaneously in different windows to run multiple jobs at one time. Note that the **scale5** command only works for the user who originally installed SCALE 5.1. Any other user must use **batch5** (Note that they must run the third installation option "Set SCALE Paths" as explained previously under **Installation of SCALE**). The **batch5** command also has some additional options. The syntax for this command is:

> **batch5 [-m -r -t -p –u -x]** *inputfile tempdrive tempdir*
> where
> -m = print messages from KENO, XSDRN, MORSE to the screen (optional flag)
> -r = don't remove temporary working directory at end of job (optional flag)
> -t = use specified existing temporary working directory (optional flag)
> -p = print block letter banner pages in output (optional flag)
> -u = UNIX carriage return output format (optional flag)
> -x = return XSDRN output files (optional flag)
> *inputfile* = input file name (required)
> *tempdrive* = temporary directory drive (optional, used with "-t" flag)
> *tempdir* = temporary directory (optional, used with "-t" flag, must be a subdirectory in
> > **\scale5.1**)

Unlike the SCALE5 command that prints messages from KENO, XSDRN, and MORSE for each generation, outer iteration, or batch to the screen during execution, the **batch5** command suppresses these messages by default. Specifying the "-m" option turns on the display of these messages.

The "-r" flag prevents the removal of the temporary working directory at the end of the job. The "-t" flag allows the use of an existing temporary working directory from a previous job where "-r" was specified. The optional input variables tempdrive and tempdir are required if "-t" is specified. The "-t" flag automatically activates the "-r" option to prevent the removal of the temporary directory at the end of the job.

The block letter banner pages that appeared in SCALE 4 output files are no longer printed by default. Specifying "-p" turns on the print of these banners. The "-u" flag causes the output to use UNIX carriage return format instead of PC format to allow easy file comparisons between output files from different computing platforms. The "-x" flag returns XSDRN output files in a subdirectory named "**inputfile.xsdrnfiles**" for plotting with Javapeño.

If you want to submit multiple files to run overnight or over a weekend, set up a .BAT file as follows:

```
call batch5 inputfile1
call batch5 inputfile2
  .     .       .
  .     .       .
call batch5 inputfilen
```

Then execute the .BAT file by typing its name. For example, if you store the commands in **overnite.bat**, then type "**overnite**" and the jobs will be executed sequentially.

6. Running and Verifying the SCALE Sample Problems

The sample problem input files are installed in **\scale5.1\smplprbs**. This directory also contains the **runsample.bat** file that will run all the sample problems. To run all SCALE 5.1 sample problems, open the "**Run SCALE 5.1**" shortcut, change to the **\scale5.1\smplprbs** directory and type "**runsample**." Note that **runsample.bat** accepts an optional parameter specifying the module for which you want to run sample problems. For example, if you want to run only the TRITON sample problems, you would enter the command "**runsample triton**." You can obtain a list of all optional keywords by entering "**runsample ?**" (ORIGEN-ARP users should use the command "**runsample origen-arp**.")

The sample problems ran in approximately 11 hours on a Pentium-4 3.0 GHz Windows XP computer. The ORNL output files for the sample problems are installed in **\scale5.1\output**. The sample problem output files were generated at ORNL on a Dell workstation with dual Intel Xeon 3.06 GHz CPUs using Windows XP Service Pack 2.

After running the sample problems, SCALE 5.1 users can compare the results to those provided in **\scale5.1\output** by running the **check_results** file from the \scale5.1\smplprbs folder. (ORIGEN-ARP users should use the command "**check_origen-arp**.") The **check_results** command calls the **make_results_table** command that extracts key data from the sample problem output files and writes them into tables. The tables are then compared to similar tables from the ORNL output files by **check_results**. The differences are written to the file **compare_output.txt**. This procedure significantly reduces the amount of data compared, and consequently, the time required for the installer to verify that the sample problem results are acceptable. The **check_results** file also attempts to display a 2-D color PNG file generated by the PICTURE module to confirm that PICTURE ran correctly. At the end of the messages generated by **check_results** in the DOS window, it prints the message

```
Attempting to display color PNG plot from PICTURE...
Close plot window to continue.
```

If the PNG file type is associated with a Windows program (such as Internet Explorer), it should be displayed automatically. When you close the window displaying the plot, the **check_results** file completes execution.

The differences for most of the non-Monte Carlo functional module sample problems should be fairly small, i.e., numerical round-off in the last one or two digits. For Monte Carlo results from KENO V.a, KENO-VI, and MORSE (this includes CSAS, CSAS6, TSUNAMI-3D, KMART, KMART6, SAS3, and SAS4), it is common for results to vary within 1 to 3 standard deviations.

Because the TSUNAMI-1D and -3D output files are very large, a special TSUNAMI-IP sample problem named **tsunami-3d_summary.input** is executed after the standard TSUNAMI-1D and -3D sample problems to generate a summary output file for comparison. This problem compares the sensitivity profiles generated by the standard TSUNAMI-1D and -3D sample problems on the test machine to the sensitivity profiles generated at ORNL by calculating the c_k index, which assesses the similarity of two systems based on normalized differences in the energy-dependent

sensitivity data for fission capture and scatter. The resulting c_k values should be near 1.0 (typically 1% or less). For comparisons of TSUNAMI-3D results for cases run on machines with the same operating system and compiler, the c_k indices may (but not necessarily) be 1.0, indicating an exact match.

NOTE: The **compare_output.txt** file should be examined very carefully. There must be corresponding lines from each output file that is being compared. In other words, if one or more sample problems fail to run, the extracted lines from the ORNL output files will be listed as differences in **compare_output.txt**.

7. How SCALE Works

When SCALE is executed, the user's input file is copied to a file named **sysin**. The driver calls each module requested and passes the input for each module as it is called via the file **input**. The output from the driver is written to file **print**. The functional modules write to **_out0000**, **_out0001**, **_out0002**, etc. The control modules write output files called **_prt0000**, **_prt0001**, **_prt0002**, etc. After each control module is finished, the driver collects the **_prt*** and **_out*** files into a unique **_tot000n** file, and removes the **_prt*** and **_out*** files.

After executing the problem, output files are collected and returned to the user's directory. If there is a problem with execution, sometimes the files are not returned. The user can manually go to the temporary directory and examine the files, **print**, **_out000n** and **_prt000n**, etc., to find the problem. The files beginning with "_" are numbered with an integer that increment each time another file is written.

The **datadir** and **bindir** files are used to point to the **\scale5.1\bin** and **\scale5.1\data** subdirectories without having to copy those files to the temporary working directory. All files written by the SCALE modules (e.g., working format cross sections, restart files, scratch files) are written to the temporary working directory. You may copy any of the files in the temporary working directory to another directory for later use (e.g., a KENO-V.a restart file.) You can insert DOS commands in your SCALE input file to copy or delete files or perform other operations. Specify "**=shell**" before or after the input for another SCALE module. The DOS commands written on the lines following "**=shell**" and before the "**end**" terminator will be executed from the temporary working directory. The original input file directory (aka the return directory) can be specified by the environmental variable **%RTNDIR%** and the temporary working directory by **%TMPDIR%**. For an example, view the sample problem input file **lava.inp** in **\scale5.1\smplprbs**. Note that these variables must be enclosed in quotes if there is a blank in the directory path name (e.g. **"%RTNDIR%"** if the input file directory is **c:\My Documents**).Once the SCALE job is completed and any desired files are copied, you may delete all files in **\scale5.1\tmpdir** to free disk space, if needed. Otherwise, the files may be used, overwritten, or deleted by the next SCALE job. Using the **batch5** command automatically allocates and removes a temporary working directory at the beginning and end of each job.

8. SCALE Manual

The SCALE Manual is a collection of Acrobat PDF files. The manual contains approximately 6,000 pages. Adobe Acrobat Reader is required for viewing and printing the manual. The SCALE Manual shortcut can be accessed from the SCALE 5.1 folder on the Windows Start menu. The shortcut will open the SCALE Manual table of contents.

The manual contains a searchable index that requires the search feature in Adobe Acrobat. You can download the latest version from Adobe. To activate the searchable index, open the SCALE manual. Select the search option from the Acrobat menu or toolbar. Click on "Use Advanced Search Options." The "Look in:" field should specify "In the index named SCALE5.1_Index.pdx." If not, click on "Select Index…" and select the SCALE 5.1 index (**SCALE5.1_Index.pdx** in the folder **\scale5.1\scaleman**). You can now search the entire SCALE Manual for words or phrases. Search will return a list of all sections of the SCALE Manual that contain the search specification. You may then select one of these files to view. Each occurrence of the word or phrase will be highlighted. You can then move to the next occurrence or the next file.

9. SCALE Graphical Interfaces and Visualization Tools for Windows

The Windows DVD of SCALE includes several graphical user interfaces (GUIs) as well as 2-D plotting and 3-D visualization tools that Unix/Linux users may want to install on a Windows PC to set up input files and/or plot and review results. These components are briefly described below. Shortcuts for these are installed on the Start Menu in the **scale5.1** folder.

GeeWiz User Interface

GeeWiz (Graphically Enhanced Editor Wizard for SCALE) is the graphical user interface (GUI) that serves as a "command center" for SCALE users. It assists users in setting up, running, and viewing results for CSAS/KENO V.a, CSAS6/KENO-VI, TSUNAMI-1D and -3D, TRITON/KENO V.a, TRITON6/KENO-VI, STARBUCS, and SMORES cases from an integrated user-friendly environment. It is integrated with KENO3D, Javapeño, and the KENO V.a HTML output.

Keno3D

Keno3D is the 3-D visualization software designed for interactively viewing KENO V.a and KENO-VI geometry models on Windows computers. It is built on the ACIS 3-D Toolkit from Spatial Technologies and a royalty fee is required. A limited capability (100 maximum bodies) 30-day evaluation version is distributed on the Windows DVD and may be installed at no charge. To obtain the full version, go to the SCALE website and click on "Order and Download KENO3D Full Version" to purchase by credit card for $100 and download. If you have already purchased the full version of KENO3D Version 5.0, you may request a free upgrade on the SCALE Download web page.

KENO V.a Primer with GeeWiz and KENO3D

The KENO V.a Primer is designed to teach new users how to use KENO V.a with the GeeWiz user interface in SCALE 5.1. It includes a section on the use of the KENO3D visualization tool to plot

models and overlay them with calculated results. The primer gives an overview of the basic requirements for KENO V.a input and allows the user to quickly run a simple criticality problem with KENO V.a. Each subsequent section provides a list of basic objectives that identifies the goal of the section and the individual SCALE/KENO V.a features that are covered in detail in the sample problems in that section. The document contains over 100 color figures illustrating the GeeWiz input screens, the KENO V.a geometry, and the sample KENO V.a models. The primer is written as a "getting started" manual for new KENO V.a users and complements the training provided in the SCALE workshops at ORNL.

OrigenArp/PlotOPUS

ORIGEN-ARP is a sequence in SCALE that serves as a fast and easy-to-use system to perform nuclear irradiation and decay calculations with the ORIGEN-S code using problem-dependent cross sections. ARP (Automatic Rapid Processing) uses an algorithm that allows the generation of cross-section libraries for the ORIGEN-S code by interpolation over pre-generated SAS2H cross-section libraries. The interpolations are carried out on the following variables: burnup, enrichment, and moderator density (optional). The OrigenArp GUI provides an easy-to-use Windows interface with menus, toolbars, and forms that allow the user to set up, run, and view results of ORIGEN-ARP calculations in an integrated user-friendly environment.

PlotOPUS is a Windows GUI designed to plot ORIGEN-S results that have been post-processed with the OPUS utility. Input for OPUS and viewing plots with PlotOPUS are handled automatically by the integrated OrigenArp GUI.

The ORIGEN-ARP libraries in SCALE 5.1 have been significantly expanded. All light water reactor (LWR) libraries and VVER libraries are based on TRITON/NEWT 2-D depletion models. All BWR libraries contain moderator density dependent cross sections. The available libraries include:
- BWR:
    - GE 7x7, 8x8 , 9x9, 10x10
    - ABB 8x8
    - ATRIUM-9 and ATRIUM-10
    - SVEA-64 and SVEA-100
- PWR
    - Siemens 14x14
    - Westinghouse CE 14x14 and 16x16
    - Westinghouse 14x14, 15x15, 17x17, 17x17 OFA
- CANDU reactor fuel (28- and 37-element bundle designs)
- MAGNOX graphite reactor fuel
- Advanced Gas Cooled (AGR) fuel
- VVER-440 flat enrichment (1.6% - 3.6%) and profiled enrichment (average 3.82%, 4.25%, 4.38%)
- VVER-1000
- MOX BWR 8×8-2, 9×9-1, 9×9-9, 10×10-9
- MOX PWR 14×14, 15×15, 16×16, 17×17, 18×18

Programmer's File Editor (PFE) 1.01

PFE is a powerful freeware text editor that can handle very large files and is useful for editing and printing SCALE input and output files. This is the same version that was distributed with SCALE 4.4a.

SAS4 ESPN GUI

ESPN (Easy Shielding Processor iNput) is the graphical user interface (GUI) that assists users in setting up, running, and viewing results from SAS4/MORSE 3-D Monte Carlo shielding cases.

10.   Javapeño

Javapeño (**Java P**lots, **E**specially **N**ice **O**utput) is an interactive 2-D and 3-D plotting package that is written in Java and operates on numerous computing platforms. Javapeño enables the plotting of data from TSUNAMI-A and TSUNAMI-B sensitivity data files, KENO V.a and KENO-VI data files generated with KMART and KMART6, XSDRNPM data files, and SMORES data files. New for SCALE 5.1, Javapeño includes a 3-D plotting engine and can plot data directly from binary AMPX master and working formatted cross-section data libraries and from binary COVERX formatted cross-section-covariance data libraries. Javapeño executes on any system with a Java Virtual Machine (JVM) version 1.5 or newer installed. Java3D components are required for 3-D plotting and Java Advanced Imaging components are required for image exporting. Current versions of the JVM for many operating are available from Sun Microsystems at http://java.com/en/download/manual.jsp. Implementations of JVM for other platforms may be available from the manufacturer.

Supported data file formats are:

* TSUNAMI Sensitivity Data (default extension .sdf)
    o TSUNAMI-1D data in TSUNAMI-A format
    o TSUNAMI-3D data in TSUNAMI-B format
* KENO V.a and KENO-VI Data (default extension .kmt)
    o KMART data files from KMART and KMART6
* XSDRNPM Data (default extension .idf)
    o Data generated in Input Dump File, Balance Table File, and Activity Data File
* SMORES Data (default extensions .plotd and .plote)
    o Effectiveness functions and density functions
* ICSBEP Sensitivity Data (no default extension)
    o International Handbook of Evaluated Criticality Safety Benchmark Evaluations sensitivity data
* General 2-D Plot Data (default extension .plt)
    o General 2-D data format
* Cross-Section-Covariance Data (no default extension)
    o Multigroup cross-section covariance data
* Cross-Section Data (no default extension)
    o Multigroup cross-section data

- General 3-D Plot Data (default extension .j3d)
  - General 3-D data format

Many new features have been added to Javapeño since its version 1.0 release. Below is a list highlighting the major (and some minor) new features:
1. 3-D plotting capability
2. Support for multigroup cross-section data
3. Support for multigroup cross-section-covariance data
4. Modern, floating window layout for Javapeño's application mode
5. Advanced 3-D plotting customization such as zooming, panning, rotating
6. Auto-rotate capability on 3-D plots
7. Simple mathematical operation capability for 2-D plots
8. Addition of a general 3-D plot data type
9. Printer Page Layout customization
10. Improved applet mode capabilities and layout

Javapeño 5.1 has the following system requirements:
1. Java Runtime Environment (JRE), Java Advanced Imaging (JAI), and Java 3D
2. 30MB of RAM free to run Javapeño.
3. Java 3D supported video card (to plot 3-D data).

For a more enjoyable Javapeño experience, the following system specifications are recommended for plotting 3-D data.
1. 512MB+ of free RAM
2. 1.4GHz+ processor

The required Java installation files are available on the SCALE installation DVD:
Java JRE1.6 (aka J2SE Runtime Environment 6.0): **jre-6u2-windows-i586-p.exe**
Java Advanced Imaging (JAI) 1.1.3: **jai-1_1_3-lib-windows-i586-jdk.exe**
Java 3D 1.5: **java3d-1_5_1-windows-i586.exe**

Or you may download Java JRE from http://java.sun.com/javase/downloads/index.jsp
The JAI and Java 3D files can be downloaded from:
http://download.java.net/media/jai/builds/release/1_1_3/jai-1_1_3-lib-windows-i586-jdk.exe
http://download.java.net/media/java3d/builds/release/1.5.1/java3d-1_5_1-windows-i586.exe

11.   Color 2-D Plot PNG and PS Files

KENO-V.a, KENO-VI, CSAS, CSAS6, and PICTURE can generate color PNG 2-D plot files. The files will be named "*inputfile*.plot*xxxx*.png", where "*inputfile*" is the input file name and "*xxxx*" is the plot number from 0000 to 9999 generated by *inputfile*. For more information about how to generate these plot files, please read the SCALE manual section for the appropriate SCALE module. The PNG files can be viewed by many different graphics viewers, such as IrfanView (http://www.irfanview.com), and by web browsers.

NEWT generates 2-D color PostScript (PS) files. These files can be viewed in Windows using Ghostscript and GSView (both must be installed). Both programs can be downloaded from http://www.cs.wisc.edu/~ghost/

12. KENO V.a HTML Output

A new feature in SCALE 5.1 is HTML output generated by KENO V.a. Javapeño 5.1 includes a full featured applet mode, which is used for interactive plots in the HTML output. All features included in the application mode can now be used in the applet mode. To accomplish this, the Javapeño applet had to be signed with a security certificate. Before running Javapeño in applet mode, the certificate must be accepted. If the following screen appears, click Run to accept the certificate. This should only happen once.

If the Javapeño plotting applet does not work when viewing the HTML output, try adjusting the settings in your web browser. The following settings are from Internet Explorer. Other browsers should have similar options.

In the Internet Explorer menu bar, click on Tools, then Internet Options. On the Advanced tab, scroll down to the Security heading. Check the box labeled "Allow active content to run in files on My Computer." See the figure below.
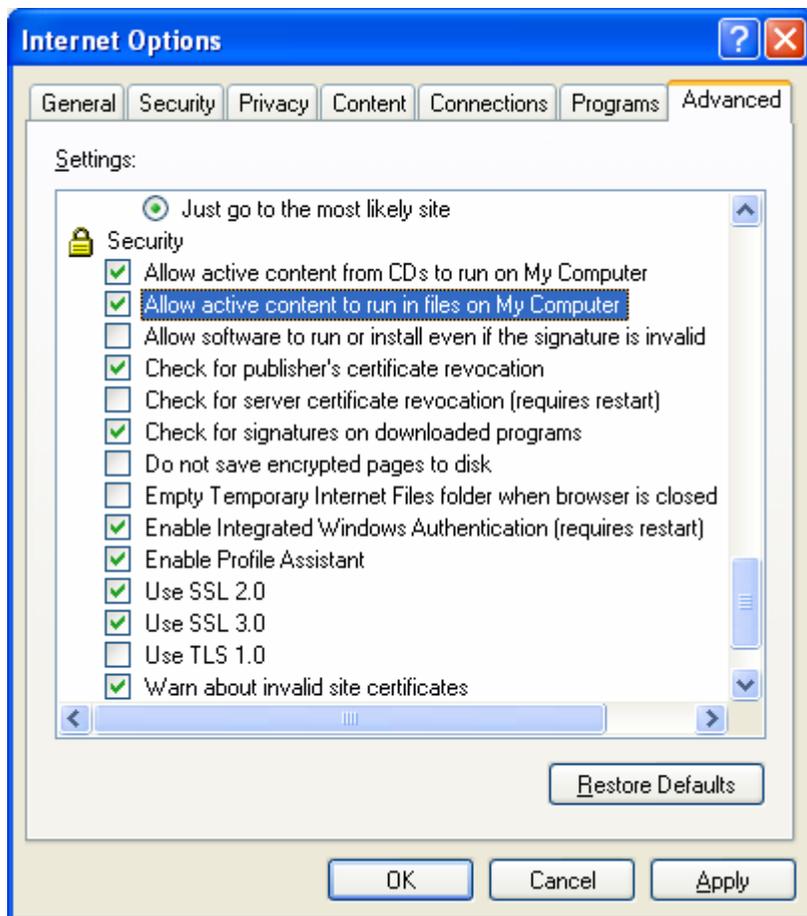
13.   Uninstalling SCALE

To uninstall SCALE, simply click on the "Uninstall Scale5" shortcut on the desktop or Start Menu. Note that SCALE can only be uninstalled by the user who installed it originally or by a system administrator on that computer.

14. Contents of This Distribution

Command Files to Execute SCALE

The following files are installed in **\scale5.1\cmds** to run SCALE. The .dll files (not listed) are used to check SCALE registration data and for uninstalling SCALE.

Commands	Function
scale5.bat	Executes SCALE
batch5.bat	Executes SCALE in batch mode (new TMPDIR); calls scale5.bat
append_file.bat	Called by COLLECT utility to append collected output files from each sequence or module to final output file
check_results.bat	Checks SCALE 5.1 sample problem results by comparing to ORNL results
check_origen-arp.bat	Checks ORIGEN-ARP 5.1 sample problem results by comparing to ORNL results
compare.bat	Called by check_results.bat to compare two files for differences
copy_file.bat	Copies a file. This allows use of the same command in =shell input on both Windows and Unix platforms.
copy_firstfile.bat	Called by COLLECT utility to copy collected output file from first sequence or module
copy_graphic.bat	Copies graphics files from \scale5.1\data\html_resources for HTML output
cpexec.bat	Used by SCALE driver to call executable programs.
extract_out.exe	Called by make_results_tables.bat to extract portion of output file between two keywords
get_scale_path.bat	Called by scale5.bat to get path where SCALE 5.1 is installed. This is the only command that is modified during installation.
GetAvailableMemory.exe	Called by javapeno.bat to find how much memory is available
iostatus.exe	Returns error message associated with I/O status number retuned by Lahey compiler when I/O error occurs
javapeno.bat	Executes Javapeño
make_results_tables.bat	Called by check_results.bat to make summary tables of results from sample problem output for comparison
make_results_tables_origen-arp.bat	Called by check_origen-arp.bat to make summary tables of results from sample problem output for comparison
makedirectory.bat	Called by SCALE HTML routine to make HTML output directory

makefilelist.bat	Called by COLLECT utility to create file list that contains individual module output files in order they are to be copied
maketotlist.bat	Called by COLLECT utility to create file list that contains all collected output files that are to be concatenated to make final output file
remove_outfiles.bat	Called by COLLECT utility to remove individual output files
rm.bat	Removes files (for compatibility with Unix)
run_all_dir.bat	Runs SCALE 5.1 for all *.inp and *.input cases in current directory
runscale.bat	Batch file called when "Run Scale5.1" shortcut is activated
scale5_drag_drop.bat	Batch file called by runscale.bat if input file is dragged and dropped onto "Run Scale5.1" shortcut; calls batch5.bat
scale5_return_calc.bat	Batch file called by scale5.bat to copy output files to return directory after SCALE execution is completed
updateqa.bat	Updates the SCALE QA Table
uslstats.exe	USLSTATS code that calculates upper subcritical limits

SCALE Fortran Source Files

The Fortran source files are installed in **\scale5.1\src**_module_ where _"module"_ is the SCALE module name (e.g., XSDRN). If you have the Lahey F95 compiler (version 7.0 or later) you can compile and link the SCALE modules using the included Makefiles. To make all subroutine libraries and modules, type "**make**" from the **\scale5.1\src** directory (be sure that the Lahey environmental variables are set). To make one module, type "**make**" from that module directory.

SCALE Modules and Executable Files

This distribution contains all the SCALE criticality, source term, reactor physics, shielding, and utility modules. These executables were compiled and linked with Version 7.1 of the Lahey F95 compiler on Windows XP Service Pack 2. The executables are installed in **\scale5.1\bin** and are native 32-bit Windows console applications. The table below lists the executable name(s) corresponding to each module and the section of the SCALE manual where it is documented.

Module	Executable	Documentation
AIM	aim.exe	M15
AJAX	ajax.exe	M15
ALPO	alpo.exe	M15
ARP	arp.exe	D1
ARPLIB	arplib.exe	D1
AWL	awl.exe	M15
BONAMI	bonami.exe	F1
BONAMIST	bonamist.exe	M18
C5TOC6	c5toc6.exe	M17
CADILLAC	cadillac.exe	M15

CAJUN	cajun.exe	M17
CENTRM	centrm.exe	F18
CENTRMST	centrmst.exe	M18
CHOPS	chops.exe	M7
COGNAC	cognac.exe	M15
COMPOZ	compoz.exe	M14
COUPLE	couple.exe	F6
CSAS	csas.exe	C4
CSAS6	csas6.exe	C6
CUTLET	cutlet.exe	M17
GENWGTS	genwgts.exe	M17
GWAS	gwas.exe	M17
ICE	ice.exe	F8
K5TOK6	k5tok6.exe	M17
KENO V.a	kenova.exe	F11
KENO-VI	kenovi.exe	F17
KMART	kmart.exe	M17
KMART6	kmart6.exe	M17
LAVA	lava.exe	M15
LEGEND	legend.exe	M13
LSULIB	lsulib.exe	M17
MAL	mal.exe	M15
MALOCS	malocs.exe	M15
MODIFY	modify.exe	C4
MORSE	morse.exe, morse123.exe, morse456.exe, morse7.exe, o0o006.exe, o0o106.exe	F9
NEWSIE	newsie.exe	M17
NEWT	newt.exe	F21
NITAWL	nitawl.exe	F2
NITAWLST	nitawlst.exe	M18
OPUS	opus.exe	F15
ORIGEN	origen.exe	F7
PALEALE	paleale.exe	M15
PERFUME	perfume.exe	M15
PICTURE	picture.exe, o0o016.exe	M13
PMC	pmc.exe	F19
PMCST	pmcst.exe	M18
PRISM	prism.exe	D1
QAD-CGGP	qadcggp.exe	S5
QADS	qads.exe	S5
RADE	rade.exe	M15
REORG	reorg.exe	M6
SAMS	sams.exe	F22

SAS1	sas1.exe	S1
SAS2	sas2.exe	S2
SAS3	sas3.exe	S3
SAS4	sas4.exe	S4
SCALE driver	scale.exe	M1
SHELL	shell.exe	M17
SMORES	smores.exe	C7
STARBUCS	starbucs.exe	C10
SWIF	swif.exe	C7
TOC	toc.exe	M17
TRITON	triton.exe	T1
TRITON6	triton6.exe	T1
TSUNAMI-1D	tsunami-1d.exe	C8
TSUNAMI-3D	tsunami-3d.exe	C9
TSUNAMI-IP	tsunami-ip.exe	M18
WAX	wax.exe	M15
WGT	wgt.exe	M17
WORKER	worker.exe	F20
XSDOSE	xsdose.exe	F4
XSDRN	xsdrn.exe	F3
XSECLIST	xseclist.exe	D1

In addition, the following files are also included in the \SCALE5.1\BIN directory.
aliases (used by SCALE driver to find modules known by different names)
collect_output.exe (collects individual module output files in proper order to produce output file)
qaupdate.exe (used to update QATABLE when executable modules are modified)
wpng.exe (freeware program to produce PNG files, called by LEGEND)

SCALE Data Libraries

After installing the system, the **\scale5.1\data** directory contains the SCALE Standard Composition Library, the AMPX master cross-section libraries, KENO biasing weights and albedos, ORIGEN-S binary libraries, the **aliases** file (contains aliases for module/sequence names), and the ASCII data libraries for QAD-CGGP. The **arplibs** directory contains the ORIGEN-ARP libraries. The **origen_data** directory contains the ORIGEN-S ASCII libraries. The **endf_b** directory contains the ENDF/B-V and ENDF/B-VI continuous energy cross-section libraries for CENTRM. There will also be a file **qatable** used to contain software quality assurance information.

The table below lists the data libraries included in this distribution. The ORIGEN-S libraries are described in Section M6 and may be converted from binary to ASCII and back using the REORG utility. The AMPX master format libraries are described in Section M4 and are distributed in binary format only. You may use the AIM module to convert these cross-section libraries to ASCII format and back to binary. The PERFUME module processes a cross-section library after it has been reconverted to binary format. You may use COMPOZ to convert the Standard Composition Library to ASCII format and back to binary. Examples of these conversions may be found in the **\scale5.1\work** folder.

Data Library Description	File or subdirectory name (in \SCALE5.1\DATA)	SCALE Manual
18GROUPGAMMA	xg18	M4
22N-18COUPLE	xn22g18	M4
238GROUPNDF5	xn238	M4
V6-238	v6-238	M4
27N-18COUPLE	xn27g18	M4
44GROUPNDF5	xn44	M4
HANSEN-ROACH	xn16	M4
CENTRM ENDF/B-V point cross-section data	endf_b/vers5	M4
CENTRM ENDF/B-VI point cross-section data	endf_b/vers6	M4
44-Group ENDF/B-V covariance data	44groupv5cov	M18
Recommended 44-Group ENDF/B-V covariance data	44groupv5rec	M18
44-Group ENDF/B-VI covariance data	44groupv6cov	M18
Recommended 44-Group ENDF/B-VI covariance data	44groupv6rec	M18
ARP library index	arpdata.txt	D1
KENO Albedos	albedos	F11
KENO Weights	weights	F11
ORIGEN-S alpha cross-section data	origen_data\origen.rev00.alphaxs.data	M6
ORIGEN-S alpha decay data	origen_data\origen.rev00.alphdec.data	M6
ORIGEN-S alpha yield data	origen_data\origen.rev00.alphyld.data	M6
ORIGEN-S alpha stopping coefficients	origen_data\origen.rev00.stcoeff.data	M6
ORIGEN-S card-image ENDF/B-VI decay data	origen_data\origen.rev04.end6dec.data	M6
ORIGEN-S card-image thermal LWR cross-section data	origen_data\origen.rev02.pwrlib.data	M6
ORIGEN-S master photon data for bremsstrahlung from negatrons slowing down in water	origen_data\origen.rev00.mpbrh2om.data	M6
ORIGEN-S master photon data for bremsstrahlung from positrons slowing down in water	origen_data\origen.rev00.mpbrh2op.data	M6
ORIGEN-S master photon data for bremsstrahlung from negatrons slowing down in UO2	origen_data\origen.rev00.mpbruo2m.data	M6

ORIGEN-S master photon data for bremsstrahlung from positrons slowing down in UO2	origen_data\origen.rev00.mpbruo2p.data	M6
ORIGEN-S master photon gamma ray spectra from spontaneous fission and (alpha,n) reactions	origen_data\origen.rev00.mpsfangm.data	M6
ORIGEN-S master photon decay X- and gamma-ray line data	origen_data\origen.rev02.mpdkxgam.data	M6
ORIGEN-S binary master photon lib w/ H2O bremsstrahlung	origen.rev02.maphh2ob	M6
ORIGEN-S binary master photon lib w/ no bremsstrahlung	origen.rev02.maphnobr	M6
ORIGEN-S binary master photon lib w/ UO2 bremsstrahlung	origen.rev02.maphuo2b	M6
ORIGEN-S PWR 33 GWD/MTU binary library	origen.rev02.pwr33gwd	M6
QAD-CGGP attenuation factors	attenuat	S5
QAD-CGGP buildup factors	buildup	S5
QADS dummy xsec library	qadxslib	S5
Parametric data for fissile solutions	soln_parameters	M7
Standard Composition Library	sclib	M8
Computer name for QA Verification Table	machine.nam	
Language keywords for QA Verification Table	language.dat	

The ASCII file **qatable** is required for execution on all computers. It is used by the control and functional modules to check the latest revision date and version for the modules. This is to help implement software quality assurance. In order to validate the **qatable** for use in a SQA procedure, the dates and versions are changed by **updateqa** to agree with the dates on which the executables were created. A portion of this file, illustrating the format, is listed below.

```
  scale    5.1
aim           aim            5.1.0  p22_sep_2006c:\scale5.1\bin
ajax          ajax           5.1.0  p22_sep_2006c:\scale5.1\bin
alpo          alpo           5.1.0  p22_sep_2006c:\scale5.1\bin
arp           arp            5.1.0  p22_sep_2006c:\scale5.1\bin
arplib        arplib         5.1.0  p22_sep_2006c:\scale5.1\bin
awl           awl            5.1.0  p22_sep_2006c:\scale5.1\bin
bonami        bonami         5.1.0  p22_sep_2006c:\scale5.1\bin
bonamist      bonamist       5.1.0  p28_sep_2006c:\scale5.1\bin
c5toc6        c5toc6         5.1.0  p22_sep_2006c:\scale5.1\bin
cadillac      cadillac       5.1.0  p22_sep_2006c:\scale5.1\bin
cajun         cajun          5.1.0  p22_sep_2006c:\scale5.1\bin
centrm        centrm         5.1.0  p22_sep_2006c:\scale5.1\bin
centrmst      centrmst       5.1.0  p05_sep_2006c:\scale5.1\bin
chops         chops          5.1.0  p22_sep_2006c:\scale5.1\bin
cognac        cognac         5.1.0  p22_sep_2006c:\scale5.1\bin
```

```
compoz        compoz        5.1.0  p22_sep_2006c:\scale5.1\bin
couple        couple        5.1.0  p22_sep_2006c:\scale5.1\bin
```

The name of the executable files begins in column 1, followed by the module name and version number. The "p" indicates that the particular module has production status. Other valid flags are "t" for test and "m" for migration. The revision date follows in dd_mmm_yyyy format. The last field is the pathname.

ORIGEN-ARP Libraries

The ARP libraries for ORIGEN-ARP are stored in the **\scale5.1\data\arplibs** folder and are listed in Sect. D1 of the SCALE Manual. Like other ORIGEN-S binary libraries, they may also be converted to and from ASCII using REORG as documented in Section M6 of the SCALE Manual.

15.   Reserved Unit Numbers in SCALE

While data can be read on logical units 1-99, some units are reserved as defaults for certain programs. When defining input, avoid using units 1-19, 21-28, and 79-99. SCALE expects to read SCALE libraries on units 21-28 and 79-88; it reads the Standard Composition Library on 89 and uses other units for temporary files. A list of unit numbers and their default assignments is included in the table below.

SCALE 5.1 Logical Unit Master List

Unit Number	Module	Type of File
1	BONAMI	Master library
	NITAWL	Master library
	SAMS	Master library
	WORKER	Master library
2	ICE	Macroscopic working library
	TRITON	Single mixture weighted 3-group library used by COUPLE
3	XSDRNPM	Cell-weighted working library
	ICE	Cell-weighted working library
	KENO V.a	Cell-weighted working library
	KENO VI	Cell-weighted working library
	NEWT	Cell-weighted working library
	SAMS	Cell-weighted working library
	SWIF	Binary interface data file
	TRITON	Spectrum-weighted three-group working library
4	NITAWL	Working library
	CENTRM	Working library
	ICE	Working library
	KENO V.a	Working library
	KENO VI	Working library

	XSDRNPM	Working library
	NEWT	Working library
	TRITON	Working library
	SWIF	Working library
	NITAWLST	Working Library
	WORKER	Working Library
	SAMS	Working Library
7	NEWT	Preprocessed (alias-expanded) input file
8	BONAMI	Random-access scratch file
	ICE	Random-access scratch file
	KENO V.a	Random-access scratch file
	KENO VI	Random-access scratch file
	XSDRNPM	Random-access scratch file
	TRITON	Random-access scratch file
	SWIF	Auxiliary output file
9	BONAMI	Random-access scratch file
	CENTRM	Random-access scratch file
	NITAWL	Random-access scratch file
	ICE	Random-access scratch file
	KENO V.a	Random-access scratch file
	KENO VI	Random-access scratch file
	XSDRNPM	Random-access scratch file
	CSAS	Random-access scratch file
	WORKER	Random-access scratch file
	TRITON	Random-access scratch file
10	ICE	Random-access scratch file
	KENO V.a	Random-access scratch file
	KENO VI	Random-access scratch file
	XSDRNPM	Random-access scratch file
	CSAS	Random-access scratch file
	TRITON	Random-access scratch file
	SENLIB	Implicit-sensitivity-data file
	SAMS	Implicit-sensitivity-data file
11	BONAMI	Master library
	CSAS	Master library
	SAS3	Master library
	SAS4	Master library
	NEWT	Master library
	ORIGENS	Scratch file
	NITAWLST	Implicit-sensitivity-data file
	SAMS	Implicit-sensitivity-data file

12	SAS4	XSDRN adjoint flux file
	SAS3	
	SAS2	Scratch file
	QADCGGP	
	SWIF	Plot data file
	BONAMIST	Implicit-sensitivity-data file
	SAMS	Implicit-sensitivity-data file
13	ORIGENS	FIDO edit of input
	SWIF	Collection of auxiliary output files
	MIPLIB	Working CENTRM point cross-section library
	CENTRM	Working CENTRM point cross-section library
	PMC	Working CENTRM point cross-section library
14	ICE	Monte Carlo library
	KENO V.a	Monte Carlo library
	KENO VI	Monte Carlo library
	TRITON	Direct-access scratch file
	SAS2	Scratch file
	SWIF	Plot data file
15	SAS2	Scratch file
	CENTRM	Pointwise flux file
	PMC	Pointwise flux file
	TRITON	ORIGENS library
	SWIF	Plot data file
16	KENO V.a	Scratch file
	KENO VI	Scratch file
	XSDRNPM	Angular flux file
	SAS3	Scratch file
	SAS4	Scratch file
	MORSE	Scratch file
	SMORES	Scratch file
	TRITON	Depletion/branch homogenized cross section library
17	XSDRNPM	Scalar flux file
	CENTRM	Scratch file
	PMC	Scratch file
	COUPLE	Scratch file
	MORSE	Scratch file
	SAS3	Scratch file
	SAS4	Scratch file
18	BONAMI	Scratch file
	CENTRM	Scratch file
	PMC	Scratch file
	NITAWL	Scratch file

	XSDRNPM	Scratch file
	COUPLE	Scratch file
	WORKER	Scratch file
19	BONAMI	Scratch file
	CENTRM	Scratch file
	PMC	Scratch file
	NITAWL	Scratch file
	COUPLE	Scratch file
	XSDRNPM	Scratch file
	WORKER	Scratch file
20	NITAWLST	Master sensitivity cross section file
	SAMS	Master sensitivity cross section file
	QADS	Scratch file
	QAD-CGGP	Scratch file
21	ORIGENS	33 GWD PWR library
23	ORIGENS	Master Photon Data - No Bremstrahlung
24	ORIGENS	Master Photon Data - H2O Bremstrahlung
26	ORIGENS	Master Photon Data - UO2 Bremstrahlung
27	ORIGENS	BCD library - decay data
	COUPLE	BCD library - decay data
28	ORIGENS	BCD library – cross-section data
	COUPLE	BCD library – cross-section data
29	COUPLE	Input binary library
30	ORIGENS	Input binary library
	NEWT	Spectrum-weighted working library
31	NEWT	Forward flux file
	XSDRNPM	Binary interface data file (forward soln – TSUNAMI-1D)
	SAMS	Binary interface data file (forward soln – TSUNAMI-1D)
32	COUPLE	Output binary library
	NEWT	Adjoint flux file
	XSDRNPM	Binary interface data file (adjoint soln – TSUNAMI-1D)
	SAMS	Binary interface data file (XSDRNPM adjoint soln – TSUNAMI-1D)
33	SAS2	Output ORIGENS Multiburnup library
	TRITON	Output ORIGENS Multiburnup library

34	XSDRNPM	Flux Guess File
35	KENO V.a	Binary interface data file (forward soln – TSUNAMI-3D)
	SAMS	Binary interface data file (forward soln – TSUNAMI-3D)
36	KENO V.a	Binary interface data file (adjoint soln – TSUNAMI-3D)
	SAMS	Binary interface data file (adjoint soln – TSUNAMI-3D)
42	PMC	Master cross-section library
53	SAS2	Scratch file
55	SAS2	Halt file for restart
60	SAS2	Scratch file
70	SCALE/MIPLIB	User-specified master cross-section library
71	SAS2	Binary output concentrations
	ORIGEN-S	Binary output concentrations
72	SAS2	BCD output concentrations
73	XSDRNPM	Input and derived data file
74	SAS2	Scratch file
75	XSDRNPM	Activity output file
76	XSDRNPM	Balance table output file
77	MIPLIB	Master point cross-section data file
	SAMS	Cross-section covariance data library
	TSUNAMI-IP	Cross-section covariance data library
79	KENO V.a	KENO V.a albedo file
	KENO VI	KENO VI albedo file
80	KENO V.a	KENO V.a weight file
	KENO VI	KENO VI weight file
81	CENTRM	Pointwise cross-section library
	PMC	Pointwise cross-section library
88	SCALE	Master Cross Section library
89	SCALE	Standard Composition library

90	CSAS	Random-access scratch file
	SAS3	Random-access scratch file
	SAS4	Random-access scratch file
	SAS2	Scratch file
91	SAS2	Scratch file
	NEWT	Alternate binary input file
	SAS4	Scratch file
	SMORES	Plot data file
92	SAS4	Scratch file
	SMORES	Collection of input files for restart
93	SMORES	Direct-access data file
	SAS4	PICTURE input file
94	SAS4	Scratch file
95	MORSE	Input file
	SAS4	MORSE input file
	KENOV.a	Binary restart file
	KENOVI	Binary restart file
96	MORSE	Input file (SAS4)
97	CENTRM	Pointwise thermal kernels
98	SAS4	Adjoint XSDRN input file
99	SCALE	Scratch

16. Reference Citation

The official citation for the SCALE 5.1 Manual as a reference in publications is:

SCALE: A Modular Code System for Performing Standardized Computer Analyses for Licensing Evaluations, ORNL/TM-2005/39, Version 5.1, Vols. I–III, November 2006. Available from Radiation Safety Information Computational Center at Oak Ridge National Laboratory as CCC-732.