Getting Started with SCALE 6 for Windows XP and Vista

Rev. 2
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1. Introduction

This document is the README file for the Windows version of SCALE 6, RSICC code package CCC-750, which includes ORIGEN-ARP 6. You can find additional information and technical support at the following websites. This version is compatible with Windows Vista and XP. Earlier versions of Windows are not supported. Note that administrator privileges are NOT 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/scale6enotebook.cfm (SCALE 6 Notebook)

2. Computer Hardware and Software Requirements

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

SCALE 6 on Windows PC:

- Pentium 4 or later
- 1 GB RAM minimum (4 GB recommended)
- 30 GB of hard disk space - note that very complex problems may require large amounts of memory (2 GB or more) and scratch disk space (up to 2 GB)
- Windows XP or Windows Vista

ORIGEN-ARP 6 on Windows PC:

- Pentium 4 or later
- 1 GB RAM minimum
- 2 GB of hard disk space
- Windows XP or Windows Vista

SCALE 6 on MacOS:

- Intel-based Mac (Mac OS 10.4.8 or later) booted into Windows XP under Apple BootCamp
- 4 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/Mac).

This Windows version contains all modules, data libraries, and miscellaneous utilities in SCALE 6. It includes Fortran source and executable files created with Version 10.1 of the Intel Visual Fortran 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 6 Notebook on the website contains a great deal of helpful information including answers to 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.

3. Installation of SCALE

It is strongly recommended that you reboot your PC prior to installation. This action may significantly speed up the installation. To begin installation, insert DVD #1 into your DVD-ROM drive, and the SCALE 6 installation menu (Figure 1 below) should automatically appear on the screen within one minute. If it does not, go to the DVD-ROM drive and run Autorun.exe.

This version may be installed on a computer with previous versions of SCALE. The previous versions do NOT have to be uninstalled.

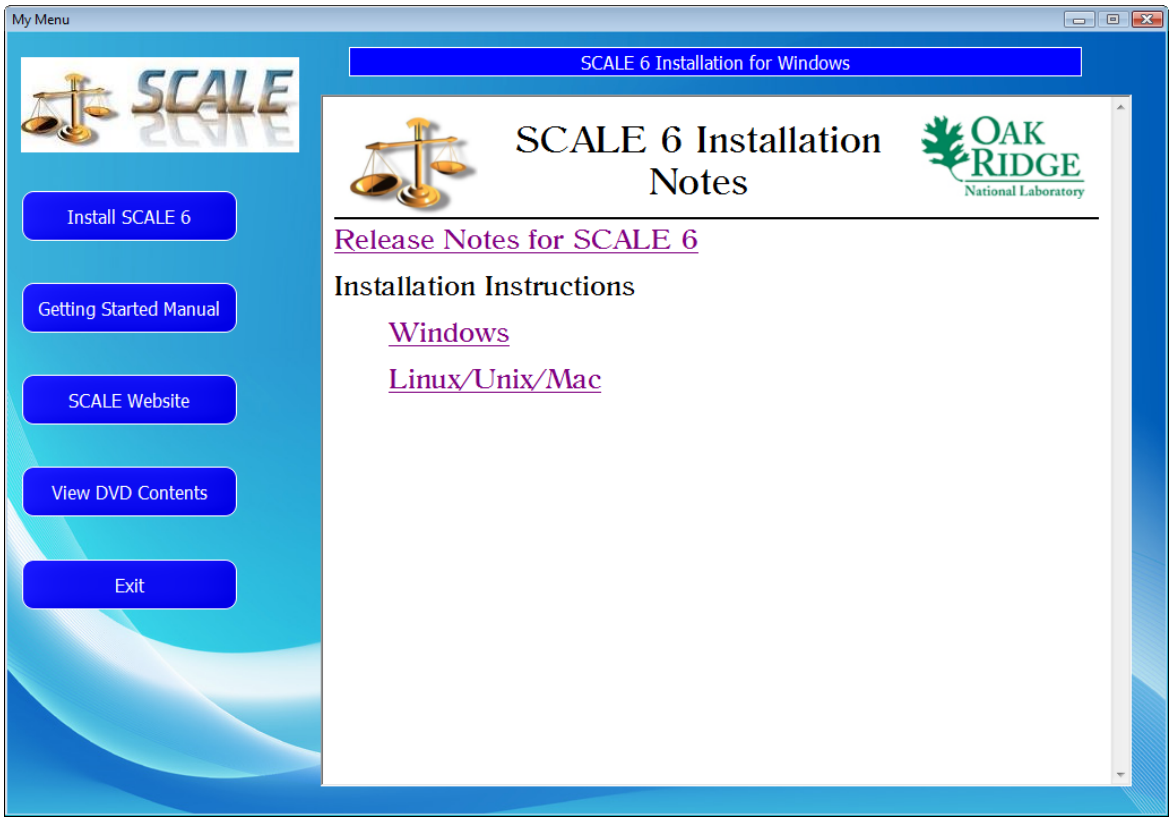


Figure 1. Installation Menu

The installation program will prompt you for the hard disk drive where you want the programs installed. The "Install SCALE 6" option installs the entire SCALE 6 code system, including all executable modules, data libraries, sample problems, and output files. The total disk space required to install all components is approximately 20 GB. **SCALE will be installed to \scale6 on the drive that you specify**. SCALE 6 is only supported on Windows XP or Windows Vista (recommended).

4. Windows Shortcuts for SCALE 6

Windows shortcuts (or links) are stored in the **\scale6\shortcuts** folder. The installation program should automatically copy this folder to the user's Windows desktop and name it "SCALE6." The shortcut names and targets are listed in the table below. The user will need to modify these if SCALE is installed to a drive other than C. The path for the \Windows\System32directory name may need to be changed too.

Shortcut name	**Target**
ChartPlot	C:\scale6\cmds\chartPlot.bat
GeeWiz	C:\scale6\GeeWiz\GeeWiz.exe
Getting Started	C:\scale6\GettingStarted-SCALE6.pdf
Javapeno	C:\scale6\cmds\javapeno.bat
Keno3D	C:\scale6\keno3d\keno3d.exe
KENO-V.a Primer	C:\scale6\primers\KENOVa_Primer.pdf
KENO-VI Primer	C:\scale6\primers\KENO-VI_Primer.pdf
MeshView	C:\scale6\cmds\meshview.bat
OrigenArp	C:\scale6\OrigenArp\OrigenArp.exe
PFE32	C:\pfe\pfe32.exe
PlotOPUS	C:\scale6\PlotOpus\PlotOPUS.exe
Run SCALE 6	C:\Windows\System32\cmd.exe /k C:\scale6\cmds\runscale.bat (Start in: C:\scale6\cmds)
SCALE Manual	C:\scale6\scaleman\contents.PDF
SCALE Users Notebook	http://www.ornl.gov/sci/scale/notebook.htm
SCALE Website	http://www.ornl.gov/sci/scale
TSUNAMI Primer	C:\scale6\primers\TSUNAMI_Primer.pdf
USLStats	C:\scale6\cmds\uslstats.bat
Vibe	C:\scale6\cmds\vibe.bat

5. Information for Foreign Language Windows Users

Subroutines **getmtm** in **\scale6\src\scalelib** and **getmtm_all** in the **qaupdate** program (**\scale6\src\misc\qaupdate**) perform searches for keywords contained in the output from the DOS "**dir**" command. If a SCALE job fails with an error in subroutine GETMTM, the default date format does not match that expected by SCALE. The problem can be corrected by selecting the proper date format in Windows.

Click on Start => Control Panel => Regional and Language Options

In Windows Vista: on the Formats tab, under "Current format" select **English (United States)**.
In Windows XP: on the Regional Options tab, select **English (United States)**.

If SCALE runs correctly, but the message "This is not a scale configuration controlled code" is shown in the Program Verification Information table in the SCALE output, please note the following information.

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 **\scale6\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. Note there is no impact on calculational results if these data are incorrect.

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:\scale6\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
```

6. 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:

- CSAS5/KENO V.a Monte Carlo criticality safety
- CSAS6/KENO-VI Monte Carlo criticality safety
- MAVRIC/Monaco Monte Carlo shielding
- SMORES 1-D optimization for criticality safety
- TRITON/KENO V.a or TRITON6/KENO-VI lattice physics depletion
- TSUNAMI-1D and -3D sensitivity/uncertainty
- XSDRNPM (CSAS1) 1-D discrete ordinates criticality safety

The OrigenArp GUI is designed for ORIGEN-ARP depletion/decay 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 input files. More information on the GUIs can be found in Sections 10 and 11 below.

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. Users can "drag and drop" SCALE input files onto the "Run SCALE6" desktop shortcut.

Batch files to run SCALE are stored in **\scale6\cmds**. Users can run these programs by opening the "Run SCALE6" 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, **scale6** and **batch6**. The syntax for the **scale6** command is:

`scale6` ***`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 6 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 6 drive. These are normally not needed. The command to run **case1.inp** would simply be:

```
scale6 case1
```

The **scale6** 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 **scale6** command. The **batch6** 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 **batch6** command can be used simultaneously in different windows to run multiple jobs at one time. Note that the **scale6** command only works for the user who originally installed SCALE 6. Any other user must use **batch6**. The **batch6** command also has some additional options. The syntax for this command is:

batch6 [-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 under **scale6**)

Unlike the **scale6** command that prints messages from KENO, XSDRN, and Monaco for each generation, outer iteration, or batch to the screen during execution, the **batch6** 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 batch6 inputfile1
call batch6 inputfile2
  .    .       .
  .    .       .
call batch6 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.

7. Running and Verifying the SCALE Sample Problems

The sample problem input files are installed in **\scale6\smplprbs**. To run all SCALE 6 sample problems, open the "**Run SCALE 6**" shortcut, change to the **\scale6\smplprbs** directory and type "**runsamples**." Note that the **runsamples** command 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 "**runsamples triton**." You can obtain a list of all optional keywords by entering "**runsamples ?**" (ORIGEN-ARP users should use the command "**runsamples origen-arp**.")

Runtimes for sample problems vary from approximately 8 to 24 hours depending on the speed of the machine. Note that by default not all sample problems are run with the **runsamples** command to reduce the time required to execute the sample problems. The default set is adequate to verify that the installation of SCALE 6 is successful. Other sample problems are provided as examples for users but are not run because of the long runtimes required. Note that it may take several days to run all sample problems. Note that continuous energy (CE) KENO sample problems 5 and 17 fail because sample problem 5 uses albedos and sample problem 17 is an adjoint calculation. These features are not available in CE mode with KENO. Users may run all sample problems by using the command "**runsamples all**" instead.

After running the sample problems, SCALE 6 users can compare the results to those provided in **\scale6\output** by running the **check_results** command from the \scale6\smplprbs folder. If you execute "**runsamples all**" then use the command "**check_results all**" to check results. 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** command 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...
```

If the PNG file type is associated with a Windows program (such as Internet Explorer), it should be displayed automatically.

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 Monaco (this includes CSAS, CSAS6, TSUNAMI-3D, KMART5, KMART6, and MAVRIC), 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**.

8. 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 **_out00000000**, **_out00000001**, **_out00000002**, etc. The control modules write output files called **_prt00000000**, **_prt00000001**, **_prt00000002**, etc. After each control module is finished, the driver collects the **_prt*** and **_out*** files into a unique **_tot0000000n** 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**, **_out0000000n** and **_prt0000000n**, 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 **\scale6\bin** and **\scale6\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 **sas1a.inp** in **\scale6\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 **\scale6\tmpdir** to free disk space, if needed. Otherwise, the files may be used, overwritten, or deleted by the next SCALE job. Using the **batch6** command automatically allocates and removes a temporary working directory at the beginning and end of each job.

9. 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 6 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 SCALE6_Index.pdx." If not, click on "Select Index…" and select the SCALE 6 index (**SCALE6_Index.pdx** in the folder **\scale6\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.

KENO V.a and KENO-VI Primers

The KENO V.a and KENO-VI Primers are designed to teach new users how to use KENO V.a or KENO-VI with the GeeWiz user interface in SCALE 6. Both primers include 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 input and allows the user to quickly run a simple criticality problem with KENO. Each subsequent section provides a list of basic objectives that identifies the goal of the section and the individual SCALE/KENO features that are covered in detail in the sample problems in that section. Each document contains over 100 color figures illustrating the GeeWiz input screens, the KENO geometry, and the sample KENO models. The primer is written as a "getting started" manual for new users and complements the training provided in SCALE workshops at ORNL.

TSUNAMI Primer

The TSUNAMI Primer is designed to teach new users how to use the TSUNAMI sensitivity/uncertainty tools in SCALE.

10. SCALE User Interfaces and Visualization Tools for Windows

The Windows version 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 in the **\scale6\shortcuts** 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/KENOV.a, CSAS6/KENO-VI, MAVRIC/Monaco, TSUNAMI-1D and -3D, TRITON/KENOV.a, TRITON6/KENO-VI, STARBUCS, and SMORES cases from an integrated user-friendly environment. It is integrated with KENO3D, Javapeño, and the KENO HTML output. An updated version of GeeWiz 6.0.2 should be downloaded from the SCALE 6 Download web page http://www.ornl.gov/sci/scale/scale6_updates.htm

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 previously purchased the full version of KENO3D Version 5.0 or later, you may copy your full version executable **keno3d.exe** file from **\scale5\keno3d** or **\scale5.1\keno3d** to **\scale6\keno3d**.

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 versions of OrigenArp and PlotOPUS in SCALE 6 are the same as those in Version 5.1. Users need to download an update from the SCALE 6 Download web page http://www.ornl.gov/sci/scale/scale6_updates.htm for OrigenArp and PlotOPUS to work with SCALE 6.**

All ORIGEN-ARP 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 an easy-to-use 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 previous versions of SCALE. A more powerful recommended text editor is EditPad Pro, which is available from http://www.editpadpro.com.

11. Java User Interfaces for Windows/Linux/Unix/Mac

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. 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 systems are available 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)
    - TSUNAMI-1D data in TSUNAMI-A format
    - TSUNAMI-3D data in TSUNAMI-B format
- KENO V.a and KENO-VI Data (default extension .kmt)
    - KMART data files from KMART and KMART6
- XSDRNPM Data (default extension .idf)

    - Data generated in Input Dump File, Balance Table File, and Activity Data File
- SMORES Data (default extensions .plotd and .plote)
    - Effectiveness functions and density functions
- ICSBEP Sensitivity Data (no default extension)
    - International Handbook of Evaluated Criticality Safety Benchmark Evaluations sensitivity data
- General 2-D Plot Data (default extension .plt)
    - General 2-D data format
- Cross-Section-Covariance Data (no default extension)
    - Multigroup cross-section covariance data
- Cross-Section Data (no default extension)
    - 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 has the following system requirements:

1. Java Runtime Environment (JRE), Java Advanced Imaging (JAI), and Java 3D
2. 512 MB of RAM free to run Javapeño.
3. Java 3D supported video card (to plot 3-D data).

The required Java installation files are available on the SCALE installation DVD:
Java JRE1.6 (aka J2SE Runtime Environment 6.0): **jre-6u11-windows-i586-p-s.exe**
Java Advanced Imaging (JAI) 1.1.3: **jai-1_1_3-lib-windows-i586-jdk.exe**
Java 3D 1.5: **j3d-1_5_2-windows-i586.exe**

ExSITE

Extensible SCALE Intelligent Text Editor (ExSITE) is the Java user interface that assists users in setting up, running, and viewing results from TSUNAMI-IP, TSAR, and TSURFER sensitivity/uncertainty utility modules.

MeshView

MeshView allows the user to display 3-D data using contour slices. Slices can be made through any of the three dimensions. Data can be shown using linear or logarithmic contours. Various geometry

data can be shown as edges with the data or as solid color regions without the data. For data sets with uncertainties, the uncertainties can also be shown using contour slices. As the mouse is moved around the image, a status bar below the image lists the location, cell indices, geometry index, data value, data uncertainty and the relative uncertainty for each cell. MeshView can be used to show Denovo scalar fluxes; Monaco mesh tallies, mesh importance maps and mesh-based sources; as well as other 3-D mesh-based data files.

ChartPlot

The ChartPlot interactive 2-D plotter allows the user to display data in a variety of ways in order to more fully investigate the data. Data can be shown on linear or logarithmic axes; with or without axis titles, a chart title or a legend. Each series of data in the chart can be shown as points with different markers; as lines of variable width; as both markers and lines; with or without error bars in either dimension; and in different colors. Linear least-squares fits can be made to subsets of series data. ChartPlot is used to display Monaco tally convergence data as well as lines of data through 3-D mesh-based data files using MeshView.

VIBE

VIBE (Validation, Interpretation and Bias Estimation) is a new interactive Java code developed for SCALE 6. VIBE will scan a file system and locate all available TSUNAMI sensitivity data files, which can include sensitivity data for the user's application as well as files from the ICSBEP Handbook. Because a sensitivity data file can contain millions of data points, VIBE will help the user consolidate these data by collapsing the data along one dimension (energy) and then allowing the user to sort and filter the data along other dimensions (nuclide, reaction, sensitivity values, etc). Once the data are parsed with VIBE, the user can select the benchmark most similar to the application based on sensitivity criteria. Lists of matching files can be stored in groups and passed to the SCALE 6 ExSITE input generator where further options for TSUNAMI-IP and TSURFER are set and the TSUNAMI-IP and TSURFER analysis is conducted. VIBE is also capable of querying the DICE database distributed with the ICSBEP Handbook to display the characteristic parameters of each benchmark (enrichment, EALF, H/X, etc.) along with the experimental and computed k_{eff} values and uncertainties in a tabular format. These data can be exported for further analysis, such as traditional trending analysis with USLSTATS for comparison with the TSUNAMI results.

USLSTATS

USLSTATS (Upper Subcritical Limit Statistics) is a new interactive Java version of the criticality safety validation tool for bias, bias uncertainty and upper subcritical limit trending analysis that was formerly written in Fortran. The SCALE 6 version of USLSTATS provides improved results over previous Fortran versions and provides a convenient interactive interface for input preparation, analysis and visualization of results.

12. 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.

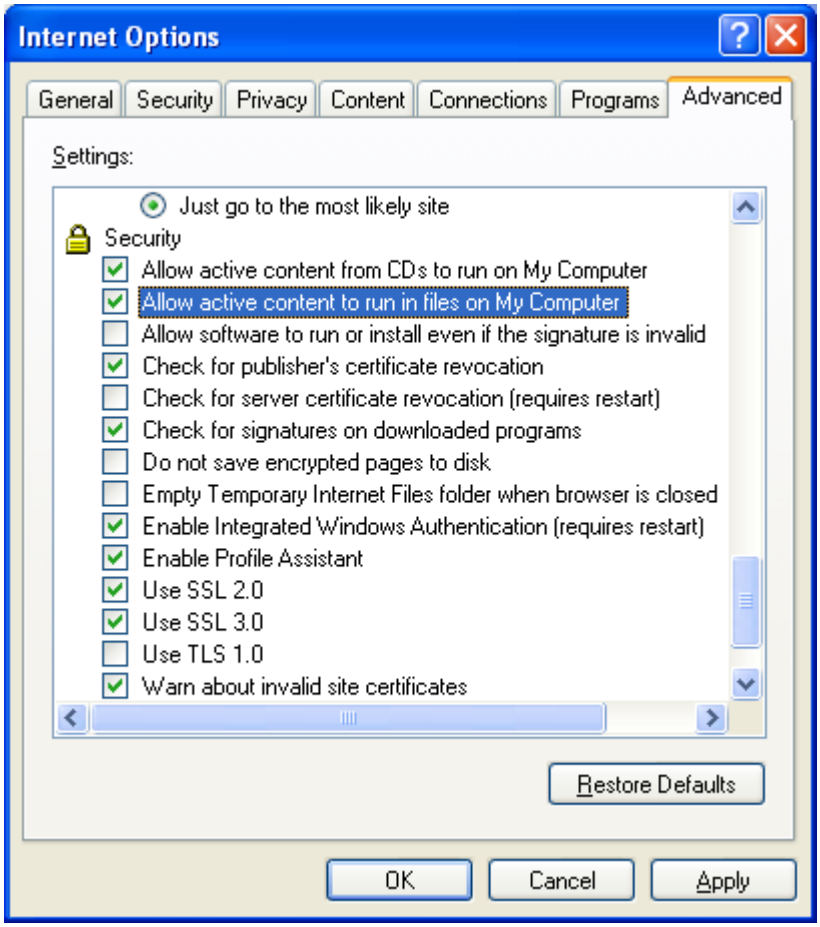
NEWT generates 2-D color PostScript (PS) files. These files can be viewed in Windows using Ghostscript and GSView (both must be installed). Both programs can be downloaded from http://www.cs.wisc.edu/~ghost/

13. HTML Output

HTML output is generated by several SCALE modules, including KENO V.a, KENO-VI, TSUNAMI-IP, TSAR, and TSURFER. Javapeño 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.



14. Uninstalling SCALE

To uninstall SCALE, simply delete the \scale6 folder. Note that SCALE can only be uninstalled by the user who installed it originally or by a system administrator on that computer.

15. Contents of This Distribution

Command Files to Execute SCALE

The following files are installed in **\scale6\cmds** to run SCALE.

Commands	**Function**
scale6.bat	Executes SCALE
batch6.bat	Executes SCALE in batch mode (new TMPDIR); calls scale6.bat
append_file.bat	Called by COLLECT utility to append collected output files from each sequence or module to final output file
chartPlot.bat	Executes Chart viewing option in Meshview
check_results.bat	Checks SCALE 6 sample problem results by comparing to ORNL results
check_origen-arp.bat	Checks ORIGEN-ARP 6 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 \scale6\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 scale6.bat to get path where SCALE 6 is installed. This is the only command that is modified during installation.
GetAvailableMemory.exe	Called by .bat files for Java GUIs to find how much memory is available
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
meshview.bat	Executes Meshview
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 6 for all *.inp and *.input cases in current directory
runscale.bat	Batch file called when “Run Scale6” shortcut is activated
scale6_drag_drop.bat	Batch file called by runscale.bat if input file is dragged and dropped onto “Run Scale6” shortcut; calls batch6.bat
scale6_return_calc.bat	Batch file called by scale6.bat to copy output files to return directory after SCALE execution is completed
updateqa.bat	Updates the SCALE QA Table
uslstats.bat	Executes USLStats
vibe.bat	Executes VIBE

SCALE Fortran Source Files

The Fortran source files are installed in **\scale6\src*module*** where “***module***” is the SCALE module name (e.g., XSDRN). If you have the Intel F90 compiler for Windows (version 9.0 or later) you can compile and link the SCALE modules using the included Makefiles. To make all subroutine libraries and modules, type “**makeall**” from the **\scale6\src**. To make one module, type “**nmake**” 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 10.1 of the Intel F95 compiler for Windows on Windows XP Service Pack 2. The executables are installed in **\scale6\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
CHOPS	chops.exe	M7
COGNAC	cognac.exe	M15
COMPOZ	compoz.exe	M14
COUPLE	couple.exe	F6
CRAWDAD	crawdad.exe	M17
CSAS5	csas5.exe	C4
CSAS6	csas6.exe	C6
GENWGTS	genwgts.exe	M17
GWAS	gwas.exe	M17
ICE	ice.exe	F8
K5TOK6	k5tok6.exe	M17
KENO_Dancoff	keno_dancoff.exe	M24
KENO V.a	kenova.exe	F11
KENO-VI	kenovi.exe	F17
KMART5	kmart5.exe	M17
KMART6	kmart6.exe	M17
LAVA	lava.exe	M15
LEGEND	legend.exe	M13
MAL	mal.exe	M15
MALOCS	malocs.exe	M15
MAVRIC	mavric.exe	S6
MCDancoff	mcdancoff.exe	M17
MODIFY	modify.exe	C5
Monaco	monaco.exe	F23
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	M13
PMC	pmc.exe	F19
PRISM	prism.exe	D1
QAD-CGGP	qadcggp.exe	S5
QADS	qads.exe	S5
RADE	rade.exe	M15
REORG	reorg.exe	M6
SAMS	sams5.exe, sams6.exe	F22
SAS1	sas1.exe	S1

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, triton6.exe	T1
TSAR	tsar.exe	M23
TSUNAMI-1D	tsunami-1d.exe	C8
TSUNAMI-3D	tsunami-3d_k5.exe, tsunami-3d_k6.exe	C9
TSUNAMI-IP	tsunami-ip.exe	M18
TSURFER	tsurfer.exe	M21
WAX	wax.exe	M15
WGT	wgt.exe	M17
WORKER	worker.exe	F20
Denovo	xkba.exe	S6
XSDOSE	xsdose.exe	F4
XSDRN	xsdrn.exe	F3
XSECLIST	xseclist.exe	D1

In addition, the following files are also included in the \SCALE6\BIN directory.
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 **\scale6\data** directory contains the SCALE Standard Composition Library, the AMPX master multigroup 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 2-D continuous energy cross-section data files for CENTRM stored in subdirectories according to ENDF version. There will also be a file **qatable** used to contain software quality assurance information. The ENDF/B-VI and ENDF/B-VII continuous energy data files for KENO and CENTRM are stored in the **ce_endf6** and **ce_endf7** directories, respectively.

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 **\scale6\work** folder.

Data Library Description	File or subdirectory name (in \scale6\data)	SCALE Manual
V5-238 (or 238GROUPNDF5)	xn238	M4
V6-238	v6-238	M4
V7-238	v7-238	M4
V5-44 (or 44GROUPNDF5)	xn44	M4
CENTRM ENDF/B-V scattering data	endf_b/vers5	M4
CENTRM ENDF/B-VI scattering data	endf_b/vers6	M4
CENTRM ENDF/B-VII scattering data	endf_b/vers7	M4
44-Group covariance data	44groupcov	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.rev03.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 fast reactor library for Advanced Burner Test Reactor	origen.rev00.abtrx	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.rev04.pwr33gwd	M6
QAD-CGGP attenuation factors	attenuat	S5
QAD-CGGP buildup factors	buildup	S5
Listing of ENDF/B-V continuous energy (CE) files	ce_v5_endf	M4
Listing of ENDF/B-VI CE files	ce_v6_endf	M4
Listing of ENDF/B-VII CE files	ce_v7_endf	M4
Fission photon yields and energy distributions for Monaco	fissionPhoton	F23
Energy group boundaries of the SCALE multigroup libraries	group.bounds	M4
ORIGEN-S list of cross-section library files and associated I/O numbers	origen_filenames	F7
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   6     QA Table WINDOWS version
aim               aim          6.0.8  p30_dec_2008c:\scale6\bin
ajax              ajax         6.0.9  p30_dec_2008c:\scale6\bin
alpo              alpo         6.0.8  p30_dec_2008c:\scale6\bin
arp               arp          6.0.9  p30_dec_2008c:\scale6\bin
arplib            arplib       6.0.8  p30_dec_2008c:\scale6\bin
```

```
awl                 awl          6.0.8  p30_dec_2008c:\scale6\bin
bonami              bonami       6.0.9  p30_dec_2008c:\scale6\bin
bonamist            bonamist     6.0.20 p09_jan_2009c:\scale6\bin
c5toc6              c5toc6       6.0.26 p07_jan_2009c:\scale6\bin
cadillac            cadillac     6.0.8  p30_dec_2008c:\scale6\bin
cajun               cajun        6.0.6  p30_dec_2008c:\scale6\bin
centrm              centrm       6.0.13 p30_dec_2008c:\scale6\bin
chops               chops        6.0.7  p30_dec_2008c:\scale6\bin
cognac              cognac       6.0.9  p30_dec_2008c:\scale6\bin
compoz              compoz       6.0.8  p30_dec_2008c:\scale6\bin
couple              couple       6.0.11 p30_dec_2008c:\scale6\bin
crawdad             crawdad      6.0.18 p30_dec_2008c:\scale6\bin
csas5               csas5        6.0.34 p07_jan_2009c:\scale6\bin
csas6               csas6        6.0.35 p07_jan_2009c:\scale6\bin
genwgts             genwgts      6.0.3  p30_dec_2008c:\scale6\bin
gwas                gwas         6.0.10 p30_dec_2008c:\scale6\bin
ice                 ice          6.0.10 p30_dec_2008c:\scale6\bin
k5tok6              k5tok6       6.0.17 p07_jan_2009c:\scale6\bin
```

The name of the executable files begins in column 1, followed by the module name in column 33, and the version number in column 65. 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 **\scale6\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.

16. Reserved Unit Numbers in SCALE

While data can be read on logical units 1-99, some units are reserved as defaults for certain programs. A list of unit numbers and their default assignments are included in Table 1. All distributed data libraries are kept in “big endian” order on all computers. As is obvious from the table below, a unit number being used in one module does not preclude it being used for something else in a different module.

Table 1. SCALE I/O 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	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	Working library
	Monaco	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	Random-access scratch file
	Monaco	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	Random-access scratch file
	Monaco	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	Random-access scratch file
	Monaco	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
	NEWT	Master library
	ORIGENS	Scratch file
	NITAWLST	Implicit-sensitivity-data file
	SAMS	Implicit-sensitivity-data file
12	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	Monte Carlo library
	Monaco	Monte Carlo library
	TRITON	Direct-access scratch file
	SWIF	Plot data file
15	CENTRM	Pointwise flux file
	PMC	Pointwise flux file
	TRITON	ORIGENS library
	SWIF	Plot data file
16	KENO	Scratch file
	XSDRNPM	Angular flux 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
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	TRITON	Output ORIGENS Multiburnup library
34	XSDRNPM	Flux Guess File
35	KENO	Binary interface data file (forward soln – TSUNAMI-3D)
	SAMS	Binary interface data file (forward soln – TSUNAMI-3D)

36	KENO	Binary interface data file (adjoint soln – TSUNAMI-3D)
	SAMS	Binary interface data file (adjoint soln – TSUNAMI-3D)
42	PMC	Master cross-section library
70	SCALE/MIPLIB	User-specified master cross-section library
71	ORIGEN-S	Binary output concentrations
73	XSDRNPM	Input and derived data 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	KENO albedo file
80	KENO	KENO 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
91	NEWT	Alternate binary input file
	SMORES	Plot data file
92	SMORES	Collection of input files for restart
93	SMORES	Direct-access data file
95	KENO	Binary restart file
97	CENTRM	Pointwise thermal kernels
99	SCALE	Scratch

17. Reference Citation

The official citation for the SCALE 6 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 6, Vols. I–III, January 2009. Available from Radiation Safety Information Computational Center at Oak Ridge National Laboratory as CCC-750.