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HotSpot Software Configuration Management Plan

H. Walker, S. G. Homann

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Hoyt Walker and Steve Homann

National Atmospheric Release Advisory Center
Lawrence Livermore National Laboratory

Revision History

Document Version	Revision Date	Revision Description
0.0	March 4, 2009	Initial version

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1 Introduction

Purpose of the plan

This Software Configuration Management Plan (SCMP) describes the software configuration management procedures used to ensure that the HotSpot dispersion model meets the requirements of its user base, which includes:

- Users of the PC version of HotSpot for consequence assessment, hazard assessment and safety analysis calculations
- Users of the NARAC Web and iClient software tools, which allow users to run HotSpot for consequence assessment modeling

These users and sponsors of the HotSpot software and the organizations they represent constitute the intended audience for this document. This plan is intended to meet Critical Recommendations 1 and 3 from the Software Evaluation of Hotspot and DOE Safety Software Toolbox Recommendation[1] for inclusion of HotSpot in the Department of Energy (DOE) Safety Software Toolbox[2]. HotSpot software is maintained for the Department of Energy Office of Emergency Operations by the National Atmospheric Release Advisory Center (NARAC) at Lawrence Livermore National Laboratory (LLNL). An overview of HotSpot and NARAC are provided below.

Scope of the plan

Overview of the software project

HotSpot

The HotSpot Health Physics codes were created to provide emergency response personnel and emergency planners with a fast, field-portable set of software tools for evaluating incidents involving radioactive material. HotSpot uses a Gaussian plume model to calculate the air concentration and dose from radiological releases to the atmosphere. The software is used for consequence assessment, hazard assessment and safety analysis of facilities handling nuclear material. HotSpot provides a fast and usually conservative means for estimation the radiation effects associated with the short-term (less than several hours) atmospheric release of radioactive materials. The use of HotSpot is fully described in the HotSpot User's Guide[6].

NARAC

The National Atmospheric Release Advisory Center (NARAC) provides tools and services that predict and map the spread of hazardous material accidentally or intentionally released into the atmosphere. Located at the Lawrence Livermore National Laboratory, NARAC is a national support and resource center for planning, preparedness, real-time emergency response, and detailed assessments

of threats and/or incidents involving a wide variety of hazards, including nuclear, radiological, chemical, biological or natural emissions. NARAC products provide information on affected areas, potential casualties, health effects, and protective action guides to assist decision makers.[3,4]

NARAC is a distributed system, providing modeling and geographical information tools for deployment to an end user's computer system, as well as real-time access to global meteorological and geographical databases. The core of the capability is a suite of models ranging from simple, fast running Gaussian models to advanced three-dimensional model predictions run at the national center. These models and their supporting systems must be extensively verified and validated in order to insure that they have been implemented properly, produce realistic predictions, and are reliable in emergency conditions. NARAC's Software Quality Assurance (SQA) procedures are a component of this on-going verification and validation effort. As a consequence, the details of SQA in NARAC are evaluated, adapted and improved with the goal of improving NARAC's overall Quality Assurance within funding and other resource constraints.

HotSpot configuration management

The HotSpot configuration management process utilizes code management processes and procedures used for the larger NARAC software system. Therefore, the HotSpot Software Configuration Management Plan (SCMP) will make reference to selected NARAC Software Quality Assurance (SQA) procedures, tools, and activities. For a concise overview of SQA in NARAC with reference to HotSpot see Walker, et al. (2008)[5].

Many of the configuration management procedures in NARAC are driven by the same tool that is used to report and track problems. As a consequence and intentionally, the configuration management procedures and the problem reporting procedures used in NARAC are strongly coupled. For this reason, this document describes the problem reporting, evaluation and notification procedures as they are being applied to HotSpot.

Software configuration items managed by this plan

The items managed are:

- Source code
- Form description for the Graphical User Interface (GUI)
- Help code

Object modules and executables will be also subjected to version control.

Other software to be included in this plan

While this plan is focused on HotSpot, much of the configuration management is integrated with the tools used by the NARAC system. As a consequence, some

reference will be made to the NARAC System and its configuration management tools and procedures. However, this is not a SCMP for the NARAC System.

Relationship of hardware/system configuration management to this plan

The HotSpot codes have been developed for the Windows (95/98/00/NT/XP/Vista) operating systems (see HotSpot User's Guide[5]). Users of HotSpot typically download the software to their own Windows PC systems and are responsible for the hardware and system configuration of those systems. Use of HotSpot as an integrated component of the NARAC system is managed according to the hardware/system configuration procedures associated with the appropriate NARAC system components.

The NARAC is complex and can be viewed as three tiers (see Figure 1):

1. Central System – executes complex atmospheric models and manages large, global collections of meteorological and geographical data.
2. Enterprise System – securely exposes Central System capabilities to customers, provides flexible system product capabilities and runs relatively simple dispersion models such as HotSpot.
3. External User tier – provides browser, deployed application and Web service access to NARAC.

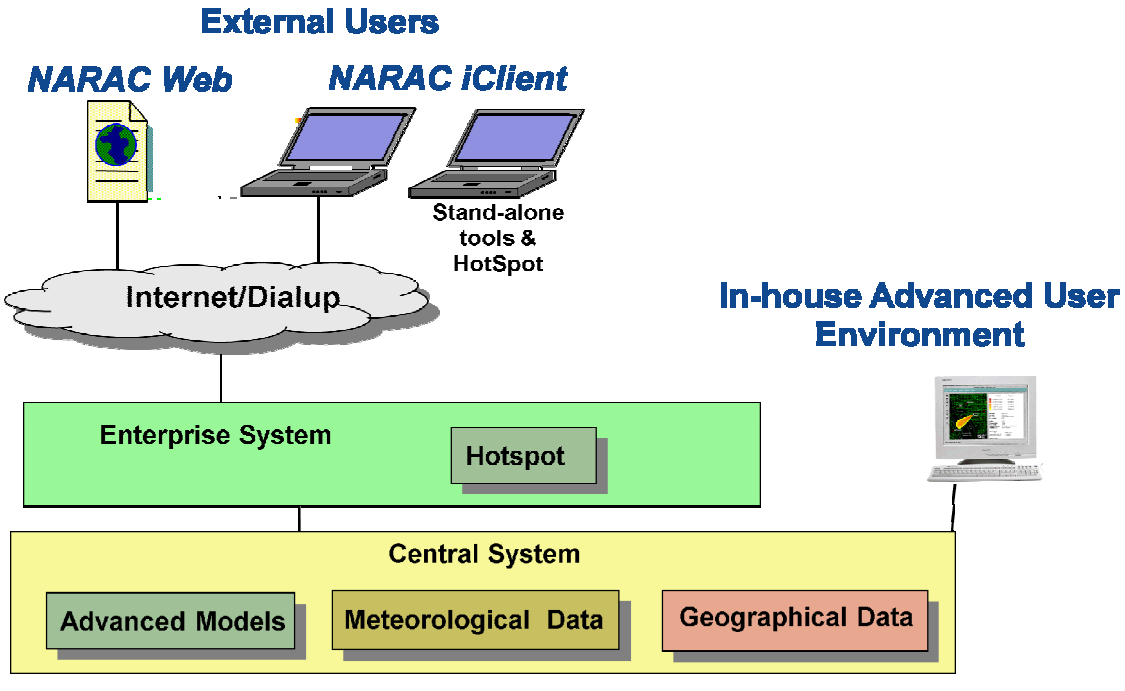


Figure 1. NARAC System

HotSpot is integrated in the NARAC Enterprise System and so the HotSpot configuration management procedures are related to those used by the Enterprise System development team. The HotSpot software is being managed with the configuration management tools of the Enterprise System.

References

1. DOE, U.S. Department of Energy, Office of Health, Safety and Security, 2007: *Software Evaluation of Hotspot and DOE Safety Software Toolbox Recommendation*, DOE/HS-0003.
2. DOE, U.S. Department of Energy, 2005: *Quality Assurance*, DOE O 414.1C.
3. http://narac.llnl.gov/
4. Nasstrom, J.S., G. Sugiyama, R.L. Baskett, S.C. Larsen, M.M. Bradley, 2006: The NARAC Modeling and Decision Support System for Radiological and Nuclear Emergency Preparedness and Response. *Int. J. Emergency Management*, **V. 4**, No. 3.
5. Walker, H., J.S. Nasstrom, S.G. Homann, 2008: NARAC Software Quality Assurance: Adapting Formalism to Meet Varying Needs, LLNL-CONF-236751.
6. Homann, S.G., 2009: *HotSpot Health Physics Codes, Version 2.07, User's Guide*, LLNL-TM-411345.

2 Software Configuration Management (SCM)

2.1 Organization

Responsibilities

Responsibility for final code development rests primarily with the HotSpot Primary Developer and a backup developer. These developers work within the NARAC/IMAAC Program at Lawrence Livermore National Laboratory. This Program manages HotSpot and other NARAC software maintenance, development, and quality assurance. The NARAC/IMAAC Program can be viewed as four teams that interact continuously to meet the programs current operational requirements and improve the ability of the models and system software to meet future requirements:

1. Program Management Team – Program Leaders that provide oversight of the work to ensure quality and alignment with sponsor work authorization and budgets; Team Leaders that supervise different components of the overall Program: Operations, System Development and Model Development.
2. Operations Team – scientists and technicians who test and apply software tools, help defined operational requirements for software, and provide scientific guidance, support and training to external users.

3. Model Development – scientists who maintain and improve current atmospheric transport and fate models, development new models and acquire and study external models for addition to the NARAC System.
4. System Development – software developers and information technologists who integrate internal and external models and data with the necessary system software, control mechanisms, network support and hardware to meet the requirements of sponsors, external customers and Operations.

SCM roles and responsibilities are discussed further below.

Problem Resolution Responsibilities

Problems with the HotSpot software will be resolved at different levels within the organization depending on the severity and impact of the problem, and the resources required to correct the problem. The HotSpot developer will correct minor problems that are reported with the HotSpot software. More complex problems, that are not quickly solved or require additional resources, will be resolved by the developer consulting with Team Leaders, and, if needed, Program Leaders. Problems requiring solutions that are beyond the scope of current sponsor work authorization and budget will be referred to sponsors for resolution. Problem reporting and tracking is described further below.

2.2 SCM responsibilities

The SCM responsibilities are currently shared between the primary developer and other members of the NARAC system team. The following roles are defined:

- Enterprise System Team Lead – lead software developer for the Enterprise System
- Software Librarian – manages software and updates for the NARAC System including the problem reporting system
- Enterprise System Coordinator – Operations team member who coordinates Enterprise System development task identification and prioritization

Responsibilities are assigned as follows:

Configuration identification:
Primary developer, Enterprise System Team Lead

Configuration control:
Primary developer, Software Librarian, Enterprise System Coordinator

Configuration status accounting:
Primary developer, Software Librarian

Configuration Evaluation and Reviews:
Primary developer, Enterprise System Team Lead, Enterprise System Coordinator

Interface control:
Primary developer, Enterprise System Team Lead

Subcontractor/vendor control:
Primary developer, Enterprise System Team Lead

Reviews are performed as needed by the Enterprise System Team Lead, the Enterprise System Coordinator and NARAC Management.

Each of the positions described above in the context of configuration management also have responsibilities for the evaluation and prioritization of reported problems and the scheduling of problem resolution tasks with respect to each other and with respect to on-going and new development tasks identified by the Operations Team, Program Management and sponsors.

2.3 Applicable policies, directives, and procedures

HotSpot and NARAC respond primarily to policies, directives and procedures defined by the Department of Energy, particularly those identified as priorities by the sponsoring offices in these agencies and the user community.

2.4 Management of the SCM process

NARAC Program Management is responsible for the overall SCM process and for ensuring compliance with this plan. Formal and informal reviews will be used to determine compliance. The evaluation of costs and risks is done continuously as part of normal NARAC interactions with sponsors and user community. These same management responsibilities also apply to the problem reporting and evaluation system.

3 SCM activities

3.1 Configuration identification

The HotSpot software will be stored in the Enterprise System version control system which is built on SVN (see http://subversion.tigris.org/). This includes source code and derived items, such as executables, that would normally be built from the source files during a software build. Each stored item is identified by name. The SVN capability will be used to track the version of each item as it is updated.

This use of version control for HotSpot is tuned to the current development environment and practices of the HotSpot development process and the relatively modest complexity of the HotSpot development environment.

3.1.1 Identifying configuration items

The normal SVN version management and change tracking will be used. A description of the items maintained in version control follows.

HotSpot Installation files:

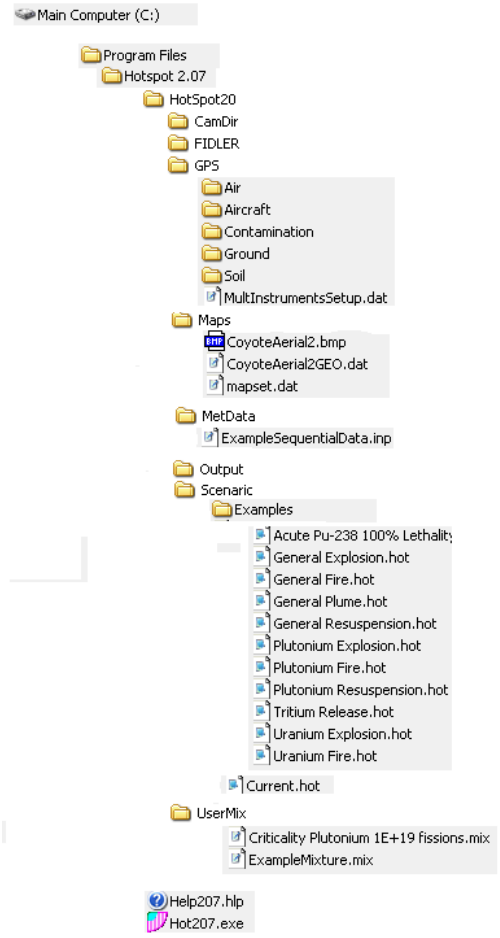
The following files needed to install HotSpot on a user's computer system:

1. Hot207.cab Cabinet file containing all of the required runtime files
2. Setup.lst Setup configuration file
3. Setup.exe Executable files that extracts runtime files from Hot207.cab

The default installation location for HotSpot is the "HotSpot 2.07" folder located in the "Program Files" folder on the main drive. The version number (2.07) will be updated with each new version of HotSpot released.

HotSpot folders and files:

The following folders and files to be installed on a user's computer:



HotSpot 20 - Main folder containing all HotSpot sub folders and files

CamDir - Folder for interfacing to the Canberra Albuquerque, Inc. Environmental Continuous Air Monitor (ECAM). Contains ECAM alpha/beta air measurement data.

FIDLER - Contains all calibration files for Field Instrument for the Detection of Low Energy Radiation (FIDLER) calibration and Lung Screening measurement data

GPS - Contains files supporting Hotpot Global Positioning Satellite exercise mode.

Maps - Location of .bmp maps and associated geo position data for each map. An example map and geo file for Coyote Hills (Albuquerque, NM) are loaded when HotSpot is initially run.
MetData - Contains Site-specific meteorological data for HotSpot Percentile Dose Option. An example file is loaded when HotSpot is initially run.
Output - Contains HotSpot output files, Tables, plots, etc.
Scenario - Contains Example release files and user-created files.
UserMix - Contains user-created radionuclide mixtures and two example mixtures, "Criticality Plutonium 1E+19 fissions.mx" and "ExampleMixture.mix."

Help207.hlp - HotSpot Help and Documentation program.

Hot207.exe - HotSpot executable program.

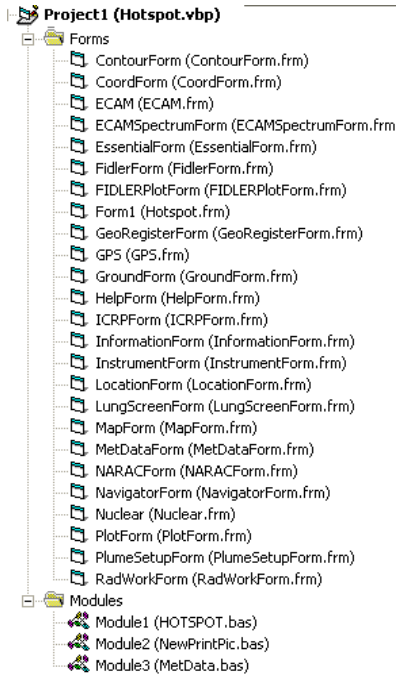
HotSpot 2.07 Source Code Files

HotSpot Help Files

HotSpot.hlp – Final executable help file created by Macromedia RoboHelp X5
HotSpot.doc – Microsoft Word document used to interact with RoboHelp to edit and create HotSpot.hlp file

Microsoft Visual Basic 6.0 Project Files

The HotSpot Project consists of 25 forms and 3 modules. Each form contains local variables, objects, and GUI for a specific HotSpot capability. The modules contain global variables, and a general printer interface.



Form Descriptions:
ContourForm.frm - Display of Dose and Deposition contour plots.

CoordForm.frm – Input of HotSpot supported coordinates, e.g., Latititude/longitude UTM, MGRS, etc.).
ECAM.frm – Interface to Canberra Albuquerque, Inc. Environmental Continuous Air Monitor (ECAM).
ECAMSpectrumForm.frm – Store and display ECAM alpa spectrum (0 – 10 MeV).
EssentialForm.frm – Generate ".plm" plume contour file format (x,y and Latitude/longitude).
FidlerForm.frm – FIDLER Calibration and Lung Screening
FIDLERPlotForm**.frm** – Display FIDLER calibration data for QC check.
Form1 (HotSpot.frm) – Main HotSpot GUI and program code
GeoRegisterForm.frm – Geo-position a ".bmp" map image for plotting HotSpot contours and generating real-time GPS instrument simulation.
GPS.frm – Interface to GPS instrumentation
GroundForm.frm – Store and manage selection and display of Federal Guidance Report 11 (FGR-11) ground shine and submersion dose conversion factors.
HelpForm.frm – Display HotSpot Help
HotSpot.bas - Global variables for all HotSpot forms.
ICRPForm.frm - Store and manage selection and display of Federal Guidance Report 12 (FGR-12), FGR-13 (ICRP-60+), and Acute inhalation dose conversion factors.
InformationForm.frm – Display general HotSpot information, Version number, etc.
InstrumentForm.frm – Manage and display radiation instrument files for exercise mode.
LocationForm.frm – Input of source term release point coordinates.
LungScreenForm.frm – Manage and display Lung screening results.
MapForm.frm – Manage and display HotSpot geo-position maps.
MetData.bas – Global variables for Percentile Dose Module.
MetDataForm.frm – Percentile Dose data evaluation and display of results.
NARACForm.frm – Manage NARAC plume file creation and storage.
NavigatorForm.frm – Interactive navigation of plume contour display with mouse for output dose, deposition, and concentration date to screen.
Nuclear.frm – Nuclear Explosion Special program.
PlotForm.frm- Manage and display contour plots.
PlumeSetupForm.frm - Input display options for contour plots, e.g., line width and color.
RadWorkForm.frm – Workplaces for Radionuclides evaluation and display.

Each item is identified by name and the SVN capability will be used to track the version of each item as it is updated.

3.1.2 Naming configuration items

HotSpot Releases will be named beginning with the current release. Depending on the nature of the release the Release number will be incremented. A subsequent release consisting of only bug fixes would be 2.07.01, while a release that included some additional functionality added to the current framework would be 2.08. Incrementing the major revision number from 2 to 3 is reserved for major changes in the framework and its supporting tools.

3.1.3 Acquiring configuration items

The configuration items are transferred from the primary developer to the Enterprise System Team Lead and Software Librarian using ftp between local LLNL systems. The SVN repository is backed up regularly according to NARAC standard procedures.

3.2 Configuration Control

HotSpot change and requirements tracking have been integrated into the NARAC change and requirements tracking system, which is based on Bugzilla (see http://www.bugzilla.org/). NARAC has adapted the Bugzilla tool to handle many requirements tracking and configuration management processes as well as trouble reporting, which is the core capability of the tool. Bugzilla is used for all changes to the software system that are targeted for eventual inclusion in a production system. These tracked changes include defects identified by external users, the Operations Team and software developers. In addition, enhancements to existing capabilities and new capabilities are also tracked with this system. Large development tasks can be broken down into smaller entries that are more actionable and to manage phased implementations. The parent-child relationships associated with such large tasks are explicitly tracked in the Bugzilla-based system.

To support these configuration management, problem reporting and requirements tracking activities, the basic Bugzilla capability has been extended to support prioritization of all tasks by the appropriate authority, assignment of tasks to developers, the recording of new information about the task for issues taking extended time periods or multiple developers to resolve, the recording of testing and installation instructions, tracking the movement of the change towards the production environment or the transfer back to the developer if testing fails. Successful deployment to the production environment and availability of approved packages for external user download is also recorded as part of the final resolution of the problem correction or development task. A variety of reports can easily be generated to assist in prioritizing tasks, managing the collection of a group of changes into a release, determining the testing status of a release and its readiness for deployment to production systems.

The Bugzilla system has been extended to manage HotSpot changes as a separate major category and current change requests have been added to the system.

3.2.1 Requesting changes

Changes and new requirements from sponsors and the NARAC/HotSpot User Group are added to the Bugzilla system for prioritizing and tracking. External change requests are received by e-mail to the primary developer and to narac@llnl.gov (as indicated on the HotSpot web page at LLNL). Change requests are entered into the Bugzilla system and subsequently tracked by the normal NARAC procedures.

3.2.2 Evaluating changes

Proposed changes are evaluated by the primary developer, the Enterprise System Coordinator, the Enterprise System Team Lead, NARAC physics model developers,

NARAC management, sponsors and the user group, depending on the nature and scope of the proposed change.

3.2.3 Approving or disapproving changes

The primary developer and the Enterprise System Coordinator will prioritize and resolve which changes are to be approved, with NARAC Management team oversight to ensure consistency with sponsor work authorization and budgets. The Enterprise System Coordinator will review changes with NARAC Management. The Enterprise System Team Lead will assign the task to the appropriate developer.

3.2.4 Implementing changes

The software change is worked on by the developer in a private environment. After initial unit and integration testing by the developer, the change will be installed in a test environment and test and installation instructions entered into the Bugzilla (with specific test code and data installed in the test environment as appropriate) and the Bugzilla entry for the change is flagged as installed and ready for testing. The packaging of changes into a HotSpot release package is negotiated between the primary developer, the Enterprise System Coordinator and the Enterprise System Team Lead with NARAC Management oversight.

3.3 Configuration status accounting

All configuration status accounting is based in the Bugzilla system and managed by the Software Librarian although a wide variety of reports are easily generated via the Bugzilla interface so that all NARAC staff can track those aspects of the configuration management and problem reporting that are important to their work. The existing NARAC Enterprise System status accounting procedures will apply.

3.4 Configuration evaluation and reviews

The configuration of the HotSpot SVN package will be review by the primary developer and the Enterprise System Team Leader as development work completes in preparation for the release of a new version.

3.5 Interface control

The interface between HotSpot and NARAC will be reviewed by the primary development and Enterprise System Team Lead whenever changes to that interface are being considered. Evaluation of the costs and tasks associated with such a change and the coordination of the effort once it is appropriated will be negotiated between the primary developer, the Enterprise System Team Lead and the Enterprise System Coordinator with Management oversight as appropriate. Changes to the interface will be managed according to Enterprise System conventions.

3.6 Subcontractor/vendor control

At this time and for the foreseeable future no subcontractor work is involved. However, HotSpot is tied closely to Microsoft capabilities and relies on the SQA capabilities of that vendor to ensure the viability of the components used. Changes to the Microsoft support

of development environments will be evaluated by the primary developer and the Enterprise System Team Leader for any impacts on current or future development processes.

3.7 Release management and delivery

Current procedures for the independent release of the PC version of HotSpot will continue to be followed, using an LLNL Web site, after following DOE/LLNLcode review and release procedures. Release of HotSpot as part of the Enterprise System, will be managed as part of the normal Enterprise System release cycle.

4 SCM schedules

A new HotSpot CSM baseline is established as of February 2009. Review of the SCM plan will be evaluated during each HotSpot release, and any changes or improvements will be identified and instituted under the direction of the Software Quality Assurance Manager.

5 SCM resources

SCM resources are currently met by the existing NARAC personnel, software development environment, tools, equipment and techniques.

6 SCM plan maintenance

This plan will reviewed as discussed in section 4. The plan will be maintained by the primary developer and the Software Quality Assurance Manager.

7 Software storage

The software is maintained on the primary developers system and backed up according to that developer's procedures. In addition, the software is maintained in the Enterprise System version control system. This system, along with all other software and data associated with the NARAC System, is backed as part of NARAC and LLNL institutional backup procedures.

8 Disaster planning

As part of the NARAC System, HotSpot relies on the disaster planning of NARAC and LLNL. This includes a uninterrupted power system and the automatic start of generator power in the case of power loss.