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Implementation Plan and Initial Development of Nuclear Concrete Materials Database for Light Water Reactor Sustainability Program

September 30, 2010

Prepared by

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Light Water Reactor Sustainability Program

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EXECUTIVE SUMMARY

The FY10 activities for development of a nuclear concrete materials database to support the Light Water Reactor Sustainability Program are summarized. The database will be designed and constructed using the ORNL materials database infrastructure established for the Gen IV Materials Handbook to achieve cost reduction and development efficiency. In Phase I, a static database will be developed to manage searchable documents from the Structural Materials Handbook that contains information on nuclear concrete materials; and in Phase II, a dynamic database will be constructed to manage digitized nuclear concrete materials data to facilitate further electronic and mathematical processing of the data for analysis, modeling, and design applications.

In FY10, the following activities were completed: An implementation plan was made for the database development. Information sensitivity of the database was evaluated in compliance with the ORNL cyber security regulations; and based on the evaluation, access control requirements for the database were determined. Assessment was also made on the accessibility of the source information for the database, and procedures were developed for converting the source information into formats that are needed for database construction. Organization of the source information was reviewed, and according to the review results, database structure for the Phase I development was designed. The software and hardware components required for the database construction were also acquired. Up to the end of FY10, all the development activities were successfully completed on schedule as planned.

ACRONYMS

DOE	Department of Energy
GIF	Generation IV International Forum
IT	Information Technology
LWRS	Light Water Reactor Sustainability
MI	Materials Intelligence
NCMDB	Nuclear Concrete Materials Database
NRC	Nuclear Regulatory Commission
OCIO	Office of Chief Information Officer
OCR	Optical Character Recognition
ORNL	Oak Ridge National Laboratory
PDF	Portable Document Format
PMB	Project Management Board
SBMS	Standards Based Management System
SMH	Structural Materials Handbook
VHTR	Very High Temperature Reactor
XCAMS	External Computer Access Management System

1. INTRODUCTION

To support the Light Water Reactor Sustainability (LWRS) Program for life extension of the 104 domestic nuclear reactors, the properties data and related information of the concrete materials that were used in construction of these nuclear power plants must be efficiently managed and disseminated. In the early 1990s, these data and the related information were compiled in the Structural Materials Handbook (SMH) developed by the Oak Ridge National Laboratory (ORNL) under the sponsorship of the Nuclear Regulatory Commission's (NRC) Structural Aging Program [1]. The SMH was published in two forms: a four-volume hardcopy handbook in three-ring binders, and an electronic database composed of computer files stored in a standalone IBM-compatible personal computer. Due to the obsolescence of the computer hardware and software, retrieval of these computer files has now become very difficult, if not absolutely impossible. To achieve the data management and dissemination objective for the LWRS Program, development of an advanced Nuclear Concrete Materials Database (NCMDB) for web-based access of the nuclear concrete materials information is considered an effective approach. For long-term benefits, it has been decided that the NCMDB will be developed to manage and disseminate both the historical and the newly generated data for concrete materials used in design and construction of nuclear power plants.

In addition to web-based access, another three key attributes have been regarded necessary for the NCMDB development. First, because the LWRS Program is seeking life extension of the existing nuclear power plants to 80 years of operation, the NCMDB must be developed to stand the test of time, which means that the data managed in the NCMDB must remain accessible for decades to come despite the high obsolescence rate of computer hardware and software resulting from the rapid advancement in information technology (IT). Secondly, concrete materials are very pedigree- and constituent- dependent. For a given structural component, its concrete constituents and processing history greatly affect the final properties of the structure. Therefore, it is highly important that the NCMDB is developed with the capability to effectively manage not only all the needed detail information, but also the relations between data. For example, when one reviews the mechanical properties data, one should be able to conveniently track down the relevant background information on the concrete constituents, processing history, manufacturer, and so on, in the NCMDB. Very often, properties data can be interpreted and used with confidence only when such background information and its relations to the properties data are provided. Third, to maximize the benefits of the data and the related information, they should be managed in the NCMDB in digitized form that can be further electronically and mathematically processed. Nowadays, a lot of software applications are developed for data processing and analyses. Almost all such applications require digitized data. Managing digitized data in the NCMDB would allow researchers to take full advantage of the advanced analytical and processing software tools for their research and development (R&D), which would significantly facilitate efficiency and productivity.

Under the Gen IV Nuclear Energy Systems Program sponsored by the Department of Energy (DOE), the ORNL has developed a materials database dubbed "Gen IV Materials Handbook," which is recognized as a front-runner in best practice materials information management [2, 3]. The Gen IV Materials Handbook was first evaluated by DOE, and then by experts from the eight Signatories of the Generation IV International Forum (GIF) Very High Temperature Reactor (VHTR) Materials Project Management Board (PMB) representing Canada, the European Union, France, Japan, Korea, South Africa, Switzerland, and the United States. Because of its advanced features and functionalities for effective materials information management, the Handbook was unanimously accepted by the PMB as the shared database to support the international collaboration in Gen IV Nuclear Energy Systems development. The materials information management infrastructure established for the Gen IV Materials Handbook, including its hardware, software, access control system, network structure, database architecture, data management schema, and IT support system, provides an excellent

foundation for developing different materials databases to support various projects. All the desired key attributes discussed above can be effectively established in the NCMDB using this infrastructure. In 2008, it was used to successfully construct the Nuclear System Materials Handbook database. Currently, it is being used to develop a nuclear graphite materials database. Apparently, utilizing this infrastructure to develop the NCMDB would facilitate achieving great cost reduction and development efficiency for the LWRS Program.

2. DEVELOPMENT PLAN

Development of the NCMDB can be divided into two phases. In Phase I, an electronic document database will be designed and constructed to manage the historical data and related information of nuclear concrete materials compiled in the SMH. The major focus of Phase I development is to keep the characteristics of the original historical data and information documents that are familiar to scientists and engineers who have been working with these documents over the past two decades. The historical data and information will be uploaded as Portable Document Format (PDF) files into a well-organized database structure that provides certain rudimentary search capabilities. Users can conduct search operation to find the documents they need and conveniently print out or review the information on their computer screens. In Phase II, a digitized database will be designed and constructed to manage the historical as well as newly generated data and information. The major focus of Phase II development is to enable advanced data processing functionalities. Data and information will be stored in digitized forms in the database structure with powerful searching, reporting, tabulating, plotting, comparing, and many other desirable data processing and information management capabilities. The digitized database will not only securely store the data and information, but also register the relationships between the data and information to enable accurate traceability that is highly desired for pedigree and prediction researches.

The development activities and deadlines for Phase I are outlined in Table 1. Phase I was initiated in early FY10 and is expected to be completed in FY11 for evaluation and release of the NCMDB for operation.

Table 1: Phase I development plan for Nuclear Concrete Materials Database

Activity No.	Activity Description	Activity Notes	Time to Complete
1	Evaluate example data and requirements for database design consideration	Reports and datasheets of the concrete materials are needed.	1/31/2010
2	Access control mechanism review	Review available access mechanisms for access control implementation planning	2/15/2010
3	Budget and schedule planning	The database is to be constructed in the infrastructure of the Gen IV Materials Handbook System to save development cost and time	2/28/2010
4	Place order for database server machine		4/30/2010
5	Information sensitivity evaluation, security planning and approval	ORNL requires that database must have information sensitivity evaluation to determine adequate	4/30/2010

Activity No.	Activity Description	Activity Notes	Time to Complete
		cyber security (access control) planning and approval	
6	Collect and review historical nuclear concrete data and information documents	The document database structure must be designed based on the review to satisfy the data and information management needs.	6/30/2010
7	Design draft data management schema	Blueprint for the database construction	8/31/2010
8	FY10 progress report	Document the system design for future reference and report progress to sponsor	9/30/2010
9	Develop the database components	Construct the software parts needed for building the database structure	11/30/2010
10	Build the database structure	Construct the actual "containers" for storing the specific concrete data	1/31/2011
11	Prepare the data documents for uploading	Documents must be prepared in adequate formats for uploading into the database	3/31/2011
12	Upload documents into the database structure		4/30/2011
13	Develop access control system		5/15/2011
14	Testing of database functionalities	Revise the database as needed when suggested by testing	5/30/2011
15	Release database for business operation		5/31/2011
16	Progress report for completion of Phase I development	Document the construction for future reference and report progress to sponsor	6/30/2011

To achieve cost reduction and development efficiency, the NCMDB system has been planned to share the hardware and software components of the Gen IV Materials Handbook wherever possible. The first column of Table 2, Component Name, lists the major hardware components required for the database development. Based on the sharing plan, it is shown in columns 2 and 3 that NCMDB has been designed to require only one server machine along with its two SQL licenses and one Windows OS server. All the other needed components are provided by the Gen IV Materials Handbook for share, which has resulted in a 50% cost reduction.

All the databases developed in the materials information management infrastructure established for the Gen IV Materials Handbook are designed and constructed using the Material Information (MI) System as the base software. The MI System is provided as an "electronic LEGO set" for database developers to design and construct their own customized materials information management system to build databases. Another analogy that may be used is the ANSYS or ABAQUS provided for analysts to design and construct their own customized models to conduct finite element analysis. Cost for the MI System license is based on the number of user seats. At the present, a perpetual license for 250 user seats has already been purchased for the Gen IV Materials Handbook development and only a maintenance license fee is paid annually. Since there is no user for the

Table 2: Hardware component share in developing the NCMDB system

Component Name	Quantity for Gen IV Materials Handbook	Quantity for NCMDB
Hp DL 380 DB Server Machine	2	1
Hp DL 360 App Server Machine	1	0
SQL license 1 per Processor	2	2
Windows OS Server 2008	2	1
Backup Power Unit	1	0

NCMDB during its Phase I development, no cost for base software user seats has been planned into the NCMDB budget.

Phase II development activities are outlined in Table 3. At the present, no timetable has been set for Phase II activities. The timetable will be determined after the user evaluation and operation feedback for Phase I development are reviewed and the Phase II digitized database size, data digitization status, participating developers, and duration of the program are specified.

Table 3: Phase II development plan for Nuclear Concrete Materials Database

Activity No.	Activity Description	Activity Notes	Time to Complete
1	Design draft data management schema	Blueprint for the digitized database construction	TBD
2	Review, evaluate, and revise the draft data management schema	Determine adequacy of the draft design for the intended application	TBD
3	Develop the database components	Construct the software parts needed for building the database structure	TBD
4	Build the database structure	Construct the actual “containers” for storing the specific concrete data	TBD
5	Upload selected data for database components and structure testing	A small quantity of representative data is needed to test the construction and functionalities of the database	TBD
6	Test and evaluate the experimental version of the constructed database	It is much easier to identify and correct problems in small version than in a large database loaded with massive data.	TBD
7	Modify database structure and functionalities	To be done based on evaluation feedback	TBD
8	Develop automated massive data uploading software applications	Massive data uploading is conducted using specifically designed and constructed software applications instead of the conventional slow and error-prone manual input.	TBD
9	Prepare data for automated uploading	Automated uploading requires data to be prepared in spreadsheet with specified and/or consistent formats	TBD
10	Upload data		TBD
11	Test, error check, and modify as needed	Depending on the database schema design, Steps 7 ~ 11 may be itinerated	TBD

Activity No.	Activity Description	Activity Notes	Time to Complete
		with each cycle constructing a specific database section. Such piecewise development strategy to avoid large structure crash in operation has proven very effective.	
12	Prepare user manual	Database structure, functionalities, and typical operation examples must be understood by the users.	TBD
13	Release for business operation		TBD
14	Final report	In additional to the final report, periodic reports and/or monthly highlights may be submitted depending on the program requirements	TBD

3. EVALUATION OF THE SOURCE INFORMATION

3.1 Information Sensitivity

The ORNL cyber security policies require that web-based database projects must have the database contents assessed against the criteria provided by the Office of Chief Information Officer (OCIO). Results of the assessment determine the cyber security measures that must be implemented to the database. In compliance with the requirement, a system confidentiality, integrity, and availability determination was conducted on the major prospective source information for the NCMDB contents. The ORNL System/Application Determination Form, i.e. ORNL-919 (3-2010), was used to determine the category of risk associated with the information, application, and system. The results indicated that the system confidentiality, integrity, and availability all fell into the low risk category. Based on the results, no cyber security plan is required and the NCMDB can be hosted in the ORNL External Computer Access Management System (XCAMS). Details of the assessment for the NCMDB can be found in the ORNL-919 Form in Appendix A.

3.2 Accessibility Status

As previously mentioned, the major source information for the NCMDB is the SMH, which is provided in both three-ring binder hardcopy and a compilation of electronic files in a standalone IBM-compatible personal computer. To manage the SMH information in the web-based NCMDB, the original source must be electronically accessible so that the information can be processed for the NCMDB construction use. For Phase I development, the entire SMH must first be converted into PDF files, ideally searchable PDF files, which will not only enhance the traceability of the Phase I NCMDB, but also significantly facilitate the preparation of digitized NCMDB data for the Phase II development. There are two methods to obtain the searchable PDF files from the SMH:

1. Create the PDF files by scanning the hardcopy SMH along with or followed by an Optical Character Recognition (OCR) operation;

2. Retrieve the electronic files of the SMH from its standalone IBM-compatible personal computer and convert them into PDF files.

Success of the first method largely depends on the OCR operation. The contents in the PDF files scanned from the hardcopy are in the form of pictures whose texts must be converted into searchable letters and numbers through the OCR operation. A major concern for OCR is that when the original hardcopy documents are old and dirty, the OCR may misread some symbols to cause wrong conversion, e.g. the number "0" may be converted into "6," "8," "o," or vice versa; and the English letter "l," may be converted into Arabic number "1," or vice versa. Due to the large volume of SMH pages, checking for such potential errors after OCR operation would be a time prohibitive effort.

Feasibility of the second method depends on the accessibility of the SMH electronic files stored in the standalone IBM-compatible personal computer and the possibility of converting the accessed files from their original formats into the searchable PDF. Because this method eliminates the OCR concern for the first method, it is preferred. Therefore, efforts were made to investigate its feasibility, and if feasible, to develop a procedure for operation. The investigation indicated that the following software packages were used to develop the SMH electronic files:

Page layout and text: Macintosh – MacDraw II, MacDraw Pro, ClarisDraw

Graphs and data plots: PC – EnPlot

Each page of text was prepared using Macintosh software and stored as a separate file. Similarly, each EnPlot graph was prepared and stored as a separate file. Because it was not possible to copy the EnPlot graphs and paste them into Macintosh files at the time the SMH was developed, the hardcopy SMH pages with graphs and data plots were created using a two-step printing procedure: First, the EnPlot graph was printed on a piece of paper and the piece of paper with the graph was reinserted into the printer. Then Macintosh text was printed on the piece of paper with the graph. Since the hardcopy SMH pages were developed using this procedure, electronic counterparts of the hardcopy SMH pages do not exist for a direct conversion into PDF files.

Fortunately, although obsolete, the original standalone IBM-compatible personal computer along with its software used to develop the SMH electronic files was retrieved. The electronic files were successfully opened for review on the screen. After some trials and failure, procedures were developed for converting them into searchable PDF files. Details of the procedures are included in Appendix B, which will be used for the conversion operation in FY11 to construct the Phase I electronic document database.

3.3 Organization of the Source Information

To prepare for the design of the Phase I electronic document database, the structure and information organization of the SMH was reviewed. The SMH was composed of 4 volumes each containing information as follows:

Volume 1: Concrete materials performance data, including performance values of mechanical, thermal, physical, and other properties, which are long-term and environment-dependent information useful for structural assessments and structural margins evaluations.

Volume 2: Supporting data for the performance values in Volume 1, including test results and data used to develop the performance values.

Volume 3: Materials datasheets of baseline and background data, including general information, materials composition and constituent materials properties.

Volume 4: Appendices, including description of SMH organization, description of updating and revision control procedures, and description of the SMH electronic files.

Volume 1, Volume 2, and Volume 3 have the same structure for information organization despite the different data types contained. Each volume is composed of the following chapters:

Chapter 1: Portland Cement Concretes

Chapter 2: Metallic Reinformcements

Chapter 3: Prestressing Tendons

Chapter 4: Structural Steels

Chapter 5: Rubbers.

In each chapter, the information is organized by Material Code and Property Code. Each Material Code covers one specific material, whose properties data are provided under corresponding Property Codes.

The review of the SMH information organization suggests that it would be effective to keep the SMH structure in the NCMDB design for Phase I development since the Phase I database would manage searchable PDF files of the SMH. However, for Phase II development, the digitized SMH data should be reorganized to take full advantage of the powerful data management and processing functionalities established in the infrastructure.

4. NCMDB NETWORK CONFIGURATION

As described in Table 2, the NCMDB will be constructed using the materials database infrastructure established for the Gen IV Materials Handbook to achieve development efficiency and cost reduction. Because the system confidentiality, integrity, and availability of the NCMDB all fall into the low risk category, its database server machines can be located in the ORNL XCAMS for global access without the RSA SecurID system protection, as discussed in Section 3.1. Based on these conditions, the hardware network configuration as shown in Figure 1 is considered for the NCMDB development.

The NCMDB will be constructed on the Three-Tier Model to ensure that its accessibility will stand the test of time despite the high software obsolescence rate due to the rapid advancement in the IT industry. The Operation Server Machines in Figure 1 constitute the DB Tier containing the database contents that are fetched, stored, deleted or changed by the DB server through a few simple basic queries, such as SELECT, INSERT, UPDATE and DELETE. The simplicity of these operations minimizes the need for frequent software upgrade, therefore significantly reduces the obsolescence rate that is often experienced by sophisticated software applications. The required

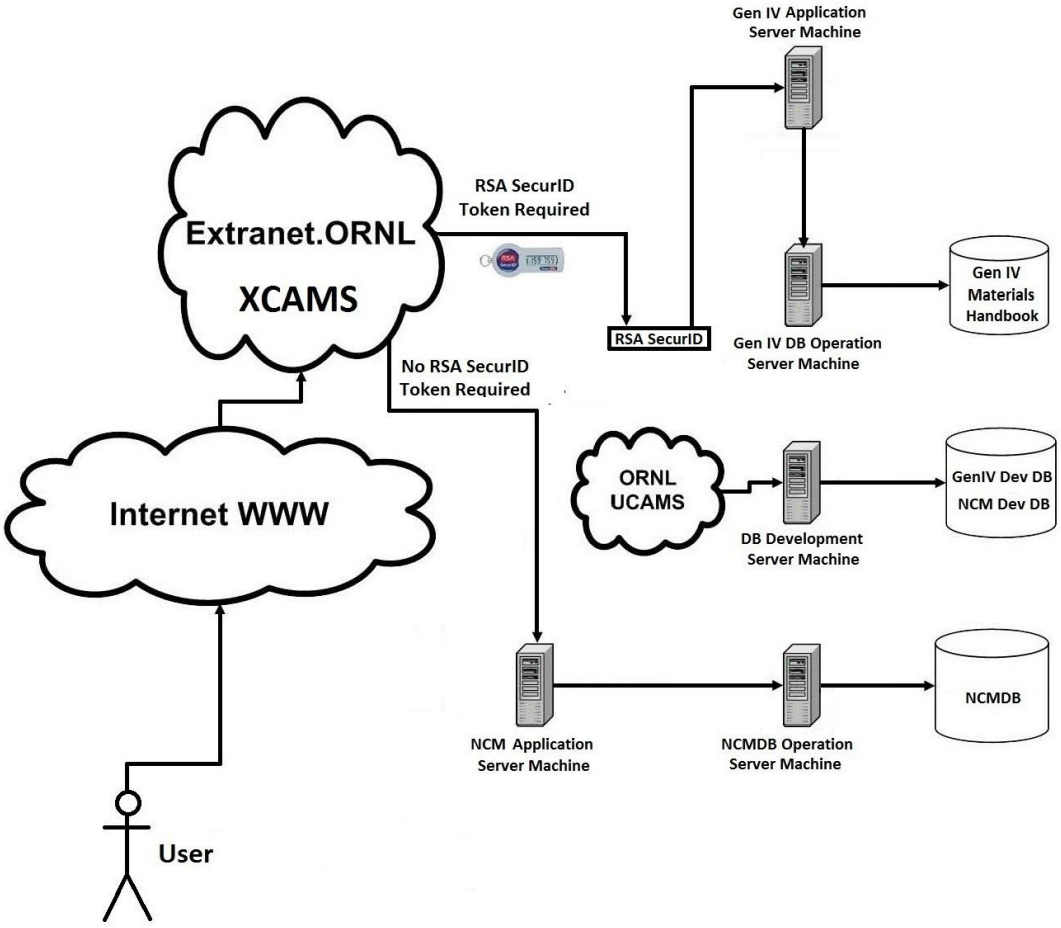

Figure 1: Hardware network configuration for the Nuclear Concrete Materials Database

sophisticated processing and presentation operations on the fetched data are carried out by the Application Servers and Presentation Servers that constitute the Application Tier and Presentation Tier, respectively, in other server machines. This allows the obsolete software in the Application Tier and Presentation Tier to be replaced piece by piece without affecting the data stored in the DB Tier.

As shown in Figure 1, the user reaching the XCAMS from the World Wide Web has two paths: (1) to access the NCMDB in the NCMDB Operation Server Machine, the user does not need the RSA SecurID authentication and can directly reach the NCM Application Server Machine to use the software and review or processing the data; and (2) to access the Gen IV Materials Handbook in the Gen IV DB Operation Server Machine, the user must pass the RSA SecurID authentication challenge before reaching the Gen IV Application Server Machine. Since only one NCMDB Operation server Machine was purchased in FY10 for the NCMDB development, a server machine retired from the Gen IV Materials Handbook system is used as the NCM Application Server Machine for the development. It can be replaced by a new server machine when the NCMDB is released for user access in the future.

5. PHASE I DATABASE STRUCTURAL DESIGN

The major objective for the NCMDB structure design in Phase I development is to establish an effective management schema for the SMH converted PDF documents so that they can be conveniently searched by users to retrieve desired information. In the materials information management infrastructure established for the Gen IV Materials Handbook, various "data containers" can be created to organize and manage information. Based on the analysis of the data organization of the SMH, the following hierarchy of "data containers" is considered for construction of the NCMDB:

Table

Folder

Subfolder

Record

Capital Heading

Heading

Each Table contains information for one family of material, corresponding to the Chapter of the SMH. The first level inside the Table is the Folder that contains information for one type of concrete, corresponding to the Group of the SMH. The second level is the Subfolder that contains information for one type of constituent material, corresponding to the Class of the SMH. The third level is the Record that contains information for one type of concrete mixture, ASTM specification etc, corresponding to the Identifier of the SMH. The fourth level is the Capital Heading that contains information for one material category, corresponding to the Thousands Property Code range of the SMH. The fifth level is the Heading that contains information for one material property, corresponding to Property Code and Code Description of the SMH.

Take SMH Volume 1 as an example, the hierarchy of the "data containers" and their corresponding "data contents" can be exhibited in Table 4. In this example, the "Table container" is labeled as "Vol. 1 Chapter 01 - Portland Cement Concretes," which is composed of the Volume number, the Chapter number, and the Chapter name of the SMH; the "Folder container" is labeled as "Insulating/PerformaceData," which is composed of the Group name and the data type of Volume 1. As previously discussed, SMH Volumes 1 contains the performance data and SMH Volume 2 contains the supporting data for Volume 1. Both volumes have the same structure of chapters. Therefore, the same Chapter name can be found in both Volumes, e.g. Chapter "Portland Cement Concretes" containing the performance data in Volume 1 and Chapter "Portland Cement Concretes" containing the supporting data in Volume 2. The data type after the slash symbol in the Folder label is designed to distinguish the identical Chapter names in different volumes to facilitate search operation. This technique is used for other "containers" when it is considered necessary, as shown in Table 4.

With the above discussion, the rest of the Table 4 should be easily understandable, therefore will not be further explained. The detail design of the management schema for the SMH converted PDF documents will be used as the blueprint for construction use, but will not be included in the present report due to its large size and the potential of revisions.

Table 4: Example of the hierarchy of "data containers" designed for NCMDB construction

Container	Container Label (example)	Notes
	Vol. 1 - Performance Values	Volume No. - Volume Name
Table	Vol. 1 Chapter 01 - Portland Cement Concretes	Volume No. & Chapter No. - Chapter Name
Folder	Insulating/PerformaceData	Group Name/Data Type of the Volume
Subfolder	Stone/PerformanceData	Class Name/Data Type of the Volume
Record	01BC001 - Abrams, Mix V/PerformanceData	Material Code - Common Material Name/Data Type of the Volume
Capital Heading	1000 GENERAL INFORMATION	Property Code Range 1000 - 1999
Heading	3762 Compressive Strength Ratio versus Temperature	Property Code & Code Description

6. PHASE I DATABASE CONTENT PREPARATION

Once the database structure is constructed using the design discussed above in FY11, the database contents will be uploaded to complete the Phase 1 development. In FY10, preparation work for the database contents has been successfully initiated. The SMH hardcopy has been reviewed and analyzed, and its electronic files along with the host standalone IBM-compatible personal computer have been retrieved. Despite the access difficulties resulting from its software obsolescence, those files were successfully opened for review and process. Procedures for converting the information into searchable PDF files were also developed. Due to the obsolete computer hardware and software that must be used and the significant volume of the SMH, converting the SMH information into PDF files can be a very time-consuming task. For the Gen IV Materials Handbook development, two intern technicians hired in FY10 have been particularly trained to prepare data for database uploading. To ensure that the conversion work can be completed on time, the task may be conducted by the interns in FY11 as needed.

7. FUTURE DEVELOPMENT

All planned development activities for FY10 as shown in Table 1 have been successfully completed on schedule, which has paved the path for future development. In FY11, the development will be continued to follow the timetable in Table 1. Because of the success in retrieving the electronic files of the SMH stored in the standalone IBM-compatible personal computer and the development of the procedures for converting the accessed files from their original formats into searchable PDF, the preparation of the documents for uploading, planned as Activity No. 11 in Table 1, would be conducted electronically following the procedure. This will not only facilitate the preparation quality, but also provide a technically sound foundation for the future digitized database development in Phase II.

8. REFERENCES

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2. "Development of Digital Materials Database for Design and Construction of New Power Plants", Proceedings of 2008 International Congress on Advances in Nuclear Power Plants (ICAPP'08), American Nuclear Society Annual Meeting, Paper 8019, June 8-12, 2008, Anaheim CA, USA, Weiju Ren.
3. "Gen IV Materials Handbook Functionalities and Operation", ORNL/TM-2009/285, U. S. Department of Energy Generation IV Nuclear Energy Systems Program, U. S. Department of Energy, December 2, 2009, Weiju Ren.

APPENDIX A

INFORMATION SENSITIVITY ASSESSMENT OF THE STRUCTURAL MATERIALS HANDBOOK

Management System: Information Technology Subject Area: Cyber Security Issue Date: 3/18/2010

ORNL System/Application Determination Form

Application/System Name: Concrete **Device Owner**: Tim Jerome

SYSTEM CONFIDENTIALITY/INTEGRITY/AVAILABILITY DETERMINATION

The information owner shall determine the category of risk associated with the information/application/system to ensure appropriate protection measures (see Table 1 for explanation):

	None	Low	Medium	High
Confidentiality		LOW		
Integrity	N/A	LOW		
Availability	N/A	LOW		

System will be a member of which ORNL Protection Zone (See NetReg for Protection Zone descriptions)?

Open Public (L/M/M) _____
Open Research (L/L/L) L/L/L
Controlled Research (M/L/L) _____
Infrastructure/Business (M/M/L) _____
Administrative (M/M/L) _____
Other as approved by Cyber Security _____ (isolated systems, standalone systems, etc.)

Yes to any of the following questions will require a cyber security plan (CSP):

1. Do any of the systems determinations for confidentiality, integrity or availability exceed those of the protection zone where your system resides? No
2. Are any of the designated protection measures (baselines and compensatory controls or security technical implementation requirements) in the protection zone where your system resides not fully implemented? (See the security planning controls template) No
3. Does your system have an exception to use controls outside of the official ORNL standards, policies and/or procedures? No
4. Does your system have a variance to ORNL SBMS requirements/guidance? No

Yes to any of the following questions require a system specific Security Technical Implementation Requirements document to document required controls; Yes to question 8 requires a system specific contingency plan:

5 Does the initial cost of your system or annual maintenance exceed $100,000?No
6 Is the primary function of the system/application to control access to ORNL resources/information (e.g. UCAMS, XCAMS, etc)? No
7 For work for others projects, are there any customer specific security requirements that exceed the cyber security control requirements for the specified protection zone? (See security planning controls template)No.
8 Is the system/application mission-essential to the ORNL mission, or does it support a mission-essential function of a mission-essential application? No
    a. Will the delay of execution of the application cause ORNL or other federal agency(s) to incur a legal obligation or financial penalty? No
    b. Will the delay of execution of the application cause ORNL or other federal agency(s) to miss federal or state reporting requirements? No

c. Do other applications that have already been declared as mission-essential rely on this application for execution? No

9 Will the failure of the system/application endanger personnel or have an environmental impact? No

10 Will the system/application produce or maintain legal records, or serve as the prime source of or maintain corporate or enterprise? No

Table 1

		None	Low	Medium	High
Confidentiality	The information requires protection from unauthorized disclosure	Cleared for public release	Process, store or transmit non-sensitive information	Process, store or transmit OUO/sensitive/PII/M/EC information	Process, store or transmit classified information
Integrity	The information must be protected from unauthorized, unanticipated, or unintentional modification.	Not applicable for integrity	Injury accrues to U.S. interests if the information is compromised; would cause only minor financial loss or require only administrative action for correction	Serious injury accrues to U.S. interests if the information is compromised; could cause significant financial loss or require legal action for correction	Extremely grave injury accrues to U.S. interests if the information is compromised; could cause loss of life, imprisonment, major financial loss, or require legal action for correction
Availability	The information technology resource (system or data) must be available on a timely basis to meet mission requirements or to avoid substantial losses	Not applicable for availability			

APPENDIX B

PROCEDURE FOR CONVERTING STRUCTURAL MATERIALS HANDBOOK FILES TO PORTABLE DOCUMENT FORMAT FILES

Procedure for Converting Structural Materials Handbook Files to Portable Document Format Files

Conversion Procedure

The following conversion procedure provides a method for converting the information reported on the hardcopy Structural Materials Handbook pages into PDF files that are electronically searchable. File conversion is accomplished using a Macintosh computer and results in PDF files that include both text and graphs. The page layout and text file conversion is performed using EazyDraw software. The graphs and data plots are recreated using the data reported on the Structural Materials Handbook pages and KaleidaGraph software.

Page Layout and Text Conversion Procedure

1. Open the original Structural Materials Handbook file created using either MacDraw II, MacDraw Pro, or ClarisDraw software.
2. Display the ***Graphic Details*** window – ***Tools: Graphic Details***
3. Use the ***Select All*** command to reposition all objects on page – ***Edit: Select All***
4. Use the ***Graphic Details*** window to set the top left position of the page to 1-in. by entering 1.0 for the top left ***Across*** and ***Down*** values (enter different values if the margins are not exactly 1-in.)
5. Use the ***Page Setup*** command to set left, right, top, and bottom margins to 1 in. and page size to 8.5 width and 11.00 height – ***File: Page Setup***
6. Close the ***Page Setup*** window by selecting the red radio button at the top left of the window.
7. Reposition the text blocks to fit inside block boundaries. Select the text block then use Ctrl and Arrow keys to incrementally move the text block up, down, left, or right.
8. Resize the text blocks to fit inside block boundaries while retaining the font size. First deselect the ***Snap to Major Grids*** – ***Format: Grid & Guides: Snap to Major Grid*** then select the text block and resize it by dragging and dropping the brown square at the center of the side or top.
9. Save the file in EazyDraw Graphic Format – ***File: Save As***
10. Convert the file to PDF – ***File: Export***
11. Close the file – ***File: Close***

Recreate Graph and Data Plot Procedure

1. Open the Kaleidagraph software and enter the computed values reported in Volume 1, Page 2. For time-dependent data, change heading ***A*** to **Time, days** and heading ***B*** to

Performance Curve then populate the Kaleidagraph spreadsheet beginning with 0.0 in the **Time, days** and **Performance Curve** columns.

2. Change the heading ***C*** to the data set identifier reported in Volume 2, Page 3, then populate the Kaleidagraph spreadsheet beginning with 0.0 in the **Time, days** and **Performance Curve** columns.
3. Repeat Step 2 as often as necessary to include all data sets reported in Volume 2, Page 3 under appropriately labeled column headings.
4. Use the ***Gallery*** to select graph type – ***Gallery, Linear, Line***
5. Use the ***Axis Options*** to set axis limits – ***Plot, Axis Options***
6. Edit the axis label text and font to Courier, non-bold, 10 pt.
7. Reposition and edit the legend to Courier, non-bold, 10 pt
8. Copy the graph – ***Edit: Copy Graph***
9. Save the graph – ***File: Save Graph As***
10. Close the file – ***File: Close***
11. Open the EazyDraw file, paste the graph, and then position the graph on page.
12. Save the file in EazyDraw Graphic Format – ***File: Save As***
13. Convert the file to PDF – ***File: Export***
14. Close the file – ***File: Close***

Create Combined PDF Files

1. Open Adobe Acrobat Professional.
2. Create a PDF file from multiple files by combining all Volume 1 PDF files for a particular material.
3. Create a PDF file from multiple files by combining all Volume 2 PDF files for a particular material.
4. Create a PDF file from multiple files by combining all Volume 3 PDF files for a particular material.

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