Document ID: PLN-2709
Revision ID: 6
Effective Date: 09/23/2024
INL/MIS-09-16368

Plan

Project No. 29412; 32134

Nuclear Data Management and Analysis System Plan

The INL is a
U.S. Department of Energy
National Laboratory
operated by
Battelle Energy Alliance

Idaho National Laboratory

NUCLEAR DATA MANAGEMENT AND ANALYSIS SYSTEM PLAN	Identifier: PLN-2709 Revision: 6 Effective Date: 09/23/2024	Page: i of **vi**

INL ART	Plan	DCR Number: 716932

Manual: NGNP

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REVISION LOG

Rev.	Date	Affected Pages	Revision Description
0	12/20/2007	All	New document
1	07/2320/09	All	Entire document revised
2	06/3020/10	All	Change definitions of data types, data disposition, and data categories. Add additional detail on the High Temperature Materials data stream. Change qualification process to reflect independent verification against requirements for intended use. Add additional flags for tracking the status of data qualification.
3	07/11/2011	11, 15, 34, 38	Remove the data qualification process from this document and replace with references to MCP-2691. Update Figure 1 to reflect current NDMAS 2.0 design concepts. Replace references to PLN-2247.
4	03/12/2015	All	Update title and references. Move section 5, “Data Collection Projects,” to a whitepaper document.
5	01/18/2016	All	Add Type E data to specifically cover QL-3 data collected at INL. Update the format of software management plan per LWP-20000-01. Update the data transmittal form. eCR: 637768
6	09/23/2024	All	Updated to include new processes and programs. Removed reference to LWP-20000-01 since it is not applicable to non-safety software.

SUMMARY

The United States Department of Energy Advanced Reactor Technologies Program was formed in Fiscal Year 2015 and encompasses the Next Generation Nuclear Plant Project and Very High Temperature Reactor (VHTR) Program as they were known previously. The VHTR Program was created to support design and licensing of the first VHTR nuclear plant. Data created for and used by the program must be qualified for use, stored in a readily accessible electronic form, categorized to assure the correct data are used, and controlled to prevent data corruption or inadvertent changes. The Nuclear Data Management and Analysis System was designed to support the data needs of the VHTR Program, at the time and now the Advanced Reactor Technologies Program.

Since its inception, use of the Nuclear Data Management and Analysis System has expanded to support additional projects and programs with similar requirements for control, analysis, and availability of large data sets.

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FIGURES

TABLES

ACRONYMS

ART	Advanced Reactor Technologies
ATR	Advanced Test Reactor
DRSC	Document Records Service Center
EDMS	Electronic Document Management System
GCR	Gas-Cooled Reactor
INL	Idaho National Laboratory
NDMAS	Nuclear Data Management and Analysis System
NQA	Nuclear Quality Assurance
NQSD	Non-qualified Supporting Data
QA	quality assurance
R&D	research and development
SQA	software quality assurance
SQL	Structured Query Language
TFS	Team Foundation Server
USHPRR	United States High-Performance Research Reactor

1. INTRODUCTION

Managing the data generated by large research and development (R&D) projects presents a significant challenge for retaining data integrity and availability. The Nuclear Data Management and Analysis System (NDMAS) stores data in a controlled and secure electronic environment, identifies the qualification status of data, provides data analysis and modeling products, and makes data available for use by project personnel. Data are identified to provide traceability and document qualification status. Identification and traceability are maintained throughout the lifetime of the data. Data reduction methods are described to permit independent reproducibility by another competent individual. NDMAS is web-based; therefore, program members can access the system and review the data, obtain analysis results including statistics and graphics, create slide presentations, and download data for advanced analysis.

Originally designed to support the Very High Temperature Reactor Technology Development Office, which is now part of the United States Department of Energy Advanced Reactor Technologies (ART) Gas-Cooled Reactor (GCR) Program, the use of NDMAS is expanding to include support for programs within and outside of the ART-GCR Program. The Very High Temperature Reactor concept has now evolved to more specifically a high temperature gas-cooled reactor concept for program purposes.

1.1 Purpose and Scope

This plan defines terminology, identifies responsibilities, describes elements of the process, and provides data generators and data users guidance on how to use the system. The plan describes how NDMAS identifies data with respect to qualification status, protects the integrity of the data, and provides access to the data for end users. The plan applies to all data accepted for entry into NDMAS.

2. PROGRAM DATA

R&D activities to support design and licensing of the high temperature gas-cooled reactor were the original focus of NDMAS and have contributed much of its current data. Additional projects, both in association with the ART Program and in support of other programs, are now using NDMAS. Data may come from existing sources, experiments conducted by the program; or experiments conducted by universities, other laboratories, or private companies. The process for entry of data into NDMAS is essentially the same for all customers.

2.1 Data Types

Collected data will be used for a variety of purposes. INL data is collected using requirements outlined in PDD-13000, "INL Quality Assurance Program Description" which implements NQA-1-2008/1a-2009 and 2017.. Data collected at universities or by other programs may be collected under other QA programs. The data transmitted to NDMAS must be labeled by the data generator to provide a basic understanding of its provenance. A classification system has been established in MCP-2691, “Data Qualification,” and is summarized in five data types as follows:

- *Type A*. Data collected within an NQA-1 QA program that must be collected to meet specific requirements for data use. Data collectors must verify that test requirements were met. Independent verification may be used to ensure that all other requirements were met. This category includes data collected to generate the licensing data such as gamma spectra analyzed to derive isotope activity, stress-strain data analyzed to derive a strength modulus, or a photomicrograph used to measure the thickness of an outer pyrolytic carbon layer. *Type A* data are qualified as directed in MCP-2691.

- *Type B.* Data collected within an NQA-1 QA program for which specific requirements cannot be defined or for which independent verification is not needed or desired. The Advanced Gas Reactor gross gamma data are a good example of *Type B* data. Some parameters may be monitored for information only. In some cases, it may not be possible to define the needed accuracy and precision requirements for a parameter because procedures or end use has not yet been established.
- *Type C*. Data collected by entities that do not follow an NQA-1 QA program that need to be qualified. For example, data gathered by international partners to the program may be gathered under an International Organization for Standardization 9001 QA program. These data could be qualified by showing that the International Organization for Standardization 9001 QA process was functionally equivalent to the NQA-1 process. *Type C* data are qualified as directed in MCP-2691.
- *Type D*. Data collected outside an NQA-1 QA program that are not examined but are used "as is." Examples of *Type D* data are existing data from the literature or data collected by a subcontractor that does not follow an NQA-1 QA program. ART Program researchers see a need to store the data in NDMAS, to potentially compare historical data to new data collected by the program. *Type D* data are archived, captured by NDMAS, and displayed to end users "as is."
- Applications of these data types for the NQA-1 program and qualification are displayed in Table 1.

Table 1. Properties of data types.

	Data Type			
	A	B	C	D
NQA-1 Program*	Yes	Yes	No	No
Qualification	Yes	No	Yes	No

* American Society of Mechanical Engineers NQA-1-2008, 1a 2009 Addenda, "Quality Assurance Requirements for Nuclear Facility Applications," is the currently accepted program.

2.2 Roles and Responsibilities

The following roles and responsibilities apply to data collection, qualification, and management within NDMAS.

2.2.1 Program Technical Personnel (Data Users and Data Collectors)

1. Identify data needs, methods to collect data, and requirements the data must meet for the intended use of the data.
2. Document the needs, methods, and requirements in data collection plans.
3. Identify data types and the disposition of data collected.
4. Collect data.
5. Prepare a data report for Type A data that can be reviewed to obtain independent verification that requirements for data use were met. Submit Type C data for qualification following the process defined in MCP-2691.

6. Submit data to the Document Records Service Center (DRSC) or NDMAS, depending on the identified disposition of the data, accompanied by Form 250.01, "Data Management and Analysis Transmittal."

2.2.2 NDMAS Personnel

1. Develop and maintain a controlled and secure electronic data storage environment compliant with relevant program quality assurance plans (ex. PLN-2690, "Idaho National Laboratory Advanced Reactor Technologies Quality Assurance Program Plan,") and PLN-4653, "INL Records Management Plan." Provide backup, security, and control of data and procedures to capture and maintain the data and the system.
2. Archive (in the data set native format) all data that are actively being used as backup support for data analysis and interpretation activities.
3. Capture programmatic data supplied from data streams in varying formats into the electronic data storage system and verifying that the data captured in the system are equivalent to the native data files.
4. Examine the incoming data for possible anomalies and problems that suggest data are not an accurate representation of the system or object being measured. Resolve anomalies and problems in the data with the technical project personnel. Maintain a record of resolutions and control the use of data that contain errors.
5. Store information about the data, such as analytical methods, QA programs, and experimental conditions, along with the data that allow users to determine if data are suitable for use.
6. Identify and communicate the qualification state of all data to end users.
7. Develop and maintain a data presentation and analysis environment for use by program members.
8. Perform data analyses such as correlation studies to monitor the ongoing quality of data streams, such as the irradiation data that are collected over a long period of time.
9. Conduct additional data analyses as needed for web displays and in response to user requests.
10. Provide access to qualified data through downloads.
11. Transfer data to the DRSC when the data are no longer actively being used by the program.

2.2.3 QA personnel are responsible for:

1. Review data collection plans and ensure that the appropriate requirements for the intended use of the data are identified.
2. Audit or perform surveillances on data collection activities as part of verifying that the requirements are met for *Type A* data.

2.3 Planning Considerations

During the planning and design phase of a data collection activity, the data collectors and data users must follow MCP-2691 to plan for data qualification and to facilitate the interface with NDMAS. NDMAS serves as a satellite file location for data collected and used by the project or program. In terms of data storage, management, and access, the performing organization determines the disposition of the data based, primarily, on the need for access to the data. Data disposition falls into the following three categories:

- *Records Service Center*. Data that are not likely to be needed again soon are sent to the DRSC.
- *Archive*. Native data files that may be needed as backup information, audit response, or investigation of anomalies, including the native data files from which data are captured into NDMAS, are archived to the NDMAS server or another location that meets NQA-1 requirements.
- *Capture and Display*. Data within NDMAS that are captured from various native formats into consistent electronic formats and made available to program participants for viewing on the web and downloading for use.

Note that the data's disposition depends on access, not qualification. For data that are captured and displayed by NDMAS, the native data are also archived to facilitate verification that the data capture process was performed correctly.

3. DATA QUALIFICATION

Data qualification is the act of reviewing, inspecting, testing, checking, or otherwise determining and documenting that data conform to requirements for a specific end use. A key aspect of qualification is that the reviewers are independent of the data generators. Qualification of data is done according to the respective program procedures. Qualification of data (ART and other programs) may be performed per MCP--2691. Qualification of United States High Performance Research Reactor (USHPRR) data is performed per MCP-3948. Data requirements for data from other programs are established by the data users for data streams during the planning process. Documentation of the requirements is maintained in the INL Electronic Document Management System (EDMS).

The review of the data for acceptance follows a formal review process as described in MCP-2691 or MCP-3948The formal review process generates a document trail of the verification review and approval that becomes a permanent record of the qualification decisions. The documentation may consist of FRM-1073, "Data Evaluation Report," Engineering Calculation and Analysis Reports, Technical Evaluations, etc., and is maintained in EDMS.

Time critical data can be captured into NDMAS and displayed on the web while data qualification is taking place. Such data will be identified with an appropriate data qualification state indicator (such as *In Process*) before being made available to data users.

4. DATA MANAGEMENT

NDMAS consists of a variety of data storage components appropriate for the specific data element and data disposition. These storage components consist of hierarchical folder structures, SAS® Libraries, and a Structured Query Language (SQL) database. The physical and data structure designs of NDMAS are discussed in this section.

4.1 Data Structure and Organization

Incoming data are organized into data streams. Data streams are subdivided into data packages. The design of the data storage structure is based on a hierarchy of:

Project

Data stream

Data package

Data element

Attribute element

Response element

One or more data streams may be generated for each project. A data stream is a particular workflow pathway along which related data flow into NDMAS. Data are received in batches, called data packages. The number of data packages ranges from one to dozens, depending on the data stream. Data packages are associated with a specific data stream and are aligned with some logical pattern or periodicity with which data are received into the system. For example, graphite characterization data for the Advanced Graphite Creep -1 (AGC--1) pre-irradiation examination were received in one data package, reactor operations and capsule conditions monitoring data have been received in biweekly data packages for the duration of the irradiation experiment (which may last up to 36 months), and portions of the fission product monitoring data will be received at the end of each reactor cycle. Now reactor operations and capsule conditions monitoring data are received hourly throughout the duration of the irradiation experiment.

The data element is the single variable value recorded that provides information about the system or object being measured. Data elements are divided into response elements and attribute elements. In general, response elements are numeric values that describe the response of the object or system. Examples include pressure, temperature, and elastic modulus. Attribute elements generally describe the object or system being measured, or provide category or spatial information about the object such as thermocouple composition, graphite grade, or capsule position.

5. NDMAS Process Flow

Figure 1 illustrates the general flow of data through the NDMAS process and the major data processing steps. Data are generated by the project or program researchers. Raw data files containing the experimental data are received by NDMAS and stored in the archive that resides on the NDMAS server. For *Capture and Display* data, the raw data files are read, and the data are transformed as necessary and then stored in SAS datasets or the SQL database (vault). Views and SAS datasets stored in the data mart are then used to structure the data into formats that can be used to distribute data to end users. Tools that support the delivery of data to users are Web reports, and Web pages. Reports can be automated with the use of JavaScript, SAS, or similar tools.

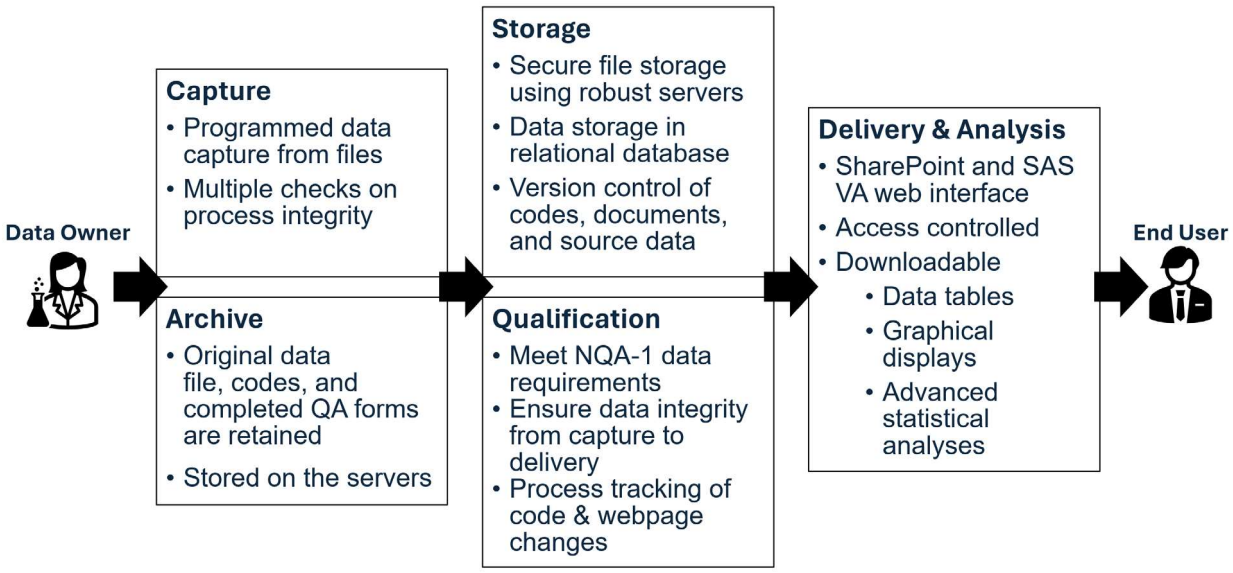

Figure 1. Major steps of data processing by NDMAS.

5.1 Data Input

The timing, frequency, and format of data generated by a program vary among data streams. Therefore, the process for passing data to NDMAS is adjusted for each stream as appropriate for that stream. Data are transmitted to NDMAS by e-mail, removable electronic media, paper, or by placing the data on a network-accessible server where the data can be accessed. Data streams generated by experiments have a wide variety of formats. Data in machine-readable format can be captured directly from the native file. Data that are not in machine-readable format require preprocessing or manual entry of data.

Examples of data package formats received include the following:

- Monitoring data from irradiation experiments collected from the Advanced Test Reactor (ATR) are placed on a network server in the form of delimited text files. They are uploaded from the network server to the NDMAS server when they are made available by ATR Operations. Data in these files are machine-readable.
- Data from graphite characterization activities are in the form of Excel spreadsheets placed on a network accessible server. The xls files are machine-readable.
- Fuel fabrication data are received as Portable Document Format files (PDFs) or hard-copy data packages that have been scanned to Portable Document Format files. Though the files are electronic, the data are not machine-readable and are entered manually.
- Gross gamma data are received daily in binary files. These binary files are machine readable.
- USHPRR miniplate experiment data are in the form of PDFs placed on a shared folder. Though the files are electronic, the data are not immediately machine-readable. Conversion with Adobe Acrobat Pro and Microsoft Excel reformat the data to be machine readable.

Data submitted to NDMAS for archive or display must be accompanied by Form 250.01. This form should be generated by the data submitter. Subsequent revisions can be discussed and executed by the NDMAS team before finalizing comments on what data should be input with the first signature. This form usually accompanies a single data package, but may cover an entire data stream under certain circumstances. Data streams that consist of many identical data packages submitted routinely over time, such as irradiation monitoring data, ATR operating conditions, and fission product monitoring, can be covered by one form for an entire experiment. For data streams that consist of a few data packages distributed over time, such as graphite characterization, fuel fabrication, or post-irradiation examination, each data package is accompanied by Form 250.01, which is stored in EDMS.

For planning purposes, in 2023 a new field was added that asks if the data is "Intended for qualification at time of transmittal." The time of transmittal is the "Transmission Start Date" and the "Transmission End Date," as applicable. If the data is not planned to be qualified at that time or in the near future (approximately a month from that time), the follow up question allows for the appropriate qualification state to be immediately input. The following options are listed below.

- "Non-qualified Supporting Data" is the term that the USHPRR program uses to indicate that the data is intended to be used as supporting data and will not be qualified.
- "Not-Examined" is the term the ART program uses to indicate that it does not go through a qualification review as according to MCP-2691.
- "In Process" indicates that the qualification state is not defined but may currently be under review. If no qualification state or marking is defined on the form, it by default will be marked as "In Process."

Since the primary purpose of FRM-250.01 is to document the transmittal of data from the data owner to NDMAS and the primary purpose of FRM-1073 is to justify and assign the qualification state of data, the qualification state defined in FRM-1073 will supersede the state defined in the "Other" field on FRM-250.01.

The second signature of the 250.01 forms is optional to confirm that the data has been captured as scoped in the Record Information Comments section of the form. This was created under initiation with the USHPRR program to meet their quality assurance requirements and is not required by NDMAS procedure for every program or experiment that submits data to NDMAS. Communication without documented signatures to confirm the data has been captured as scoped along with the change request process as documented in INL/MIS-12-26727 is sufficient for the NDMAS processes to satisfy NQA-1-2008/1a-2009. If other programs wish to utilize the second signature, that is allowable.

Note that historical data transmittal forms in EDMS include Forms 435.77 and 435.78.

5.1.1 Native Files

Native data files supplied by the data generators are archived to the NDMAS server or another location that meets NQA-1 requirements for records storage. This is true for the native files in either the *Archive* disposition category or the *Capture and Display* disposition category. No additional steps are taken with the files for data categorized as *Archive*. Archive data are stored in the native format provided by the project. No capture verification is performed on archived data beyond using the verify option with the operating system COPY or XCOPY command.

5.1.2 Data Changes

While changes to the native or raw data files are not desirable, there are instances when changes must be made to archive or capture the data into NDMAS. The data stream manager is able to make changes necessary for storage and capture of the raw data. Acceptable changes include altering the file name so it is compatible to be managed on Windows-based computers, or removing characters that prevent reading the files. Cases have occurred where the data in the electronic file were so poorly laid out, that the data were rearranged in the file to allow the data to be read by computer.

When data changes are required, the file a copy of the original file is made, and an appropriate version number is added to the file name. Both files are stored in the archive.

Generally, native files sent to NDMAS for archive will not be altered, and files for capture and display may be altered the minimum amount necessary consistent with the need to read the files.

5.2 Data Capture, Storage, and Display

Data files in the *Capture and Display* disposition category are captured and translated into a format that can be used to support NDMAS data analysis and display capabilities. Native data files are first captured to SAS data sets stored in SAS libraries on the NDMAS server. SAS data sets are retained at least until capture has been verified but may be retained longer. For some data streams, particularly those streams consisting of *Type B* data like gross gamma monitoring, the data are retained in these SAS datasets and made available in web displays generated from the SAS datasets. For most *Capture and Display* data, however, the captured data are pushed to the SQL database, also known as the vault, where the data are permanently stored in the format of an SQL relational database. Tests are run to verify the data captured and residing in either SAS data sets or the vault are the same as the data provided in the native data files or paper documents. Data in the vault can have individual data-element management of configuration control, qualification state, and associated metadata. Thus, most *Type A* and *Type C* data are stored in the vault because change control and qualification state tracking are required for these types of data.

5.2.1 Data Verification

For data captured by NDMAS, tests are applied to verify that native files are captured correctly. These tests are performed to address the requirement that data in NDMAS be equivalent to the original data collected by the program. The first step of verification is to capture data from native data files into SAS data sets. Most data are then pushed to the vault. The capture and push routines, in the form of SAS Projects, are saved for future auditing purposes to verify that transformations were performed correctly. Common transformations performed during data capture are:

- Create classification variables to identify the context for the physical data values
- Create a SAS date/time variable from various date and time formats
- Change the format of the original data into a standardized electronic format for merging with other data streams
- Transform measurement units so that all measurements conform to a standard set of units
- Optionally, label data records with descriptive metadata such as analyst, instrument, measurement conditions, and analytical method.

The captured data stored in the vault are compared to the native data to verify that the data capture process was performed successfully. Any errors in capturing the native data are fixed, either directly in the captured data or by modifying and rerunning the data capture routines. The results of the data capture tests are documented, usually within the Microsoft® Team Foundation Server (TFS) system change request.

5.2.2 Data Display

Staging and delivery cover the interpretation as well as presentation of the data on the Web. The staging area is where data analysis and display products are developed. Data feeding the displays in the staging area are stored in a data depot. Once the products are developed and stable, the associated data and metadata are moved from the depot to the mart for delivery to the customer. Web pages and reports are moved to production and are fed from the mart. The separation of the data mart and the data depot ensure the web pages will be stable. The products of data analysis include data tables, graphics, statistical analyses, and data documentation published to the Web. Data used to feed Web pages from the mart are pulled from the vault or from SAS datasets stored on the NDMAS server.

When data are no longer actively being used by the program, the data are transferred from NDMAS to the DRSC in accordance with PLN-4653. Data from other projects or programs are dispositioned per the data stream manager's instructions.

5.3 Testing and Modeling in Support of Data Qualification

The data generator takes responsibility for qualifying the data. The data generator prepares a data report for many of these data streams, such as an engineering calculation and analysis report, and submits the report for review. NDMAS provides testing and modeling of the collected data for other data streams to assist in the qualification of the data. Irradiation monitoring data streams from Advanced Gas Reactor and Advanced Graphite Creep experiments are the most common streams to follow this approach to data qualification. The NDMAS team performs tests or models the data to identify anomalies. Examples of anomaly tests include range tests, data integrity tests, statistical tests, comparison of models of system behavior to measured data, and correlation tests. Errors and anomalies identified during testing are recorded along with a pointer to the record in the vault that contains the error or anomaly. Anomalies are resolved with the technical staff. The data review committee process can be used to facilitate and document the resolution of the anomalies. This process is explained in more detail in MCP-3974 Section 4.7. The anomalies and resolutions are then included in a data report, such as a technical evaluation. The report is then reviewed by independent technical staff and QA staff, and the qualification state of the data determined. Data in the vault or SAS datasets are corrected or changed as needed in conformance with the agreed upon resolutions. The completed reports are maintained in EDMS.

5.4 Control of Data Use

During NDMAS processing of data from native data files to qualified data in the vault, the status of NDMAS testing is tracked with the use of a flag associated with each record in the vault. The NDMAS testing flag can take on the following values:

- *Raw*. No testing has been performed. Data that have just been uploaded into the vault. It is a short-lived state.
- *Capture Pass/Fail*. Tests have been performed on the data to determine if the data in the vault match the raw data provided by the generator. If data fail capture tests, the capture process is reviewed and modified until the captured data are correct. *Capture Fail* should be a fairly short-lived data state. For

some data streams, capture testing is all that is performed, and data from those streams retain the *Capture Pass* designation.

- *Accuracy Pass/Fail*. For data streams where NDMAS testing and modeling form an integral part of the data qualification process, additional tests are performed on the data to identify anomalies or errors in the data. When these tests are run, data anomalies are identified as *Accuracy Fail*. If review determines that an anomaly falls within the expected response of the system and the data are usable, the flag will be changed from *Accuracy Fail* to *Accuracy Pass*.

5.4.1 Data Qualification Flag

More important than the NDMAS internal testing flag, is the flag associated with the data to indicate qualification state. Type B and Type D data are not qualified, so this flag is set to Not Evaluated or Non-qualified Supporting Data (NQSD) for those data types. For time critical Type A and Type C data that are displayed on the web before final qualification states are determined, the flag is set to In Process so that data users understand that the data have not been through qualification. Once verification against requirements is complete, qualification states are assigned per MCP-2691 as Qualified, Trend, or Failed. Failed records are not displayed to users. Records in the Trend and Qualified states are displayed to users with the flags associated with the data to communicate the state of the data to the end user.

5.4.2 Data Collected Outside an Approved Quality Assurance Program

Some data of interest may come from sources outside of the INL. This may include data collected under non-NQA-1 QA programs, such as the International Organization for Standardization, 9001-2000 program, or without the benefit of a QA program, such as existing data from reports, journals, and/or data collected by universities. These data are categorized as either *Type C* or *Type D* data, depending on whether the data are to be qualified or used as is. *Type C* data are qualified in accordance with MCP-2691. *Type D* data are not qualified.

5.5 DATA ANALYSIS

Data analysis covers the interpretation of data and presentation of the data on the Web. The products of data analysis include Web pages, presentation materials, and statistical tests on programmatic data. NDMAS maintains a Web page through which users can view and download data as shown in Figure 2. Standard data reports and graphs (Figure 3) are also presented on Web pages. The amount of detail displayed can be adjusted by the user by drilling down into the data. Additional data reports and graphs can be prepared based on requests from the user community.

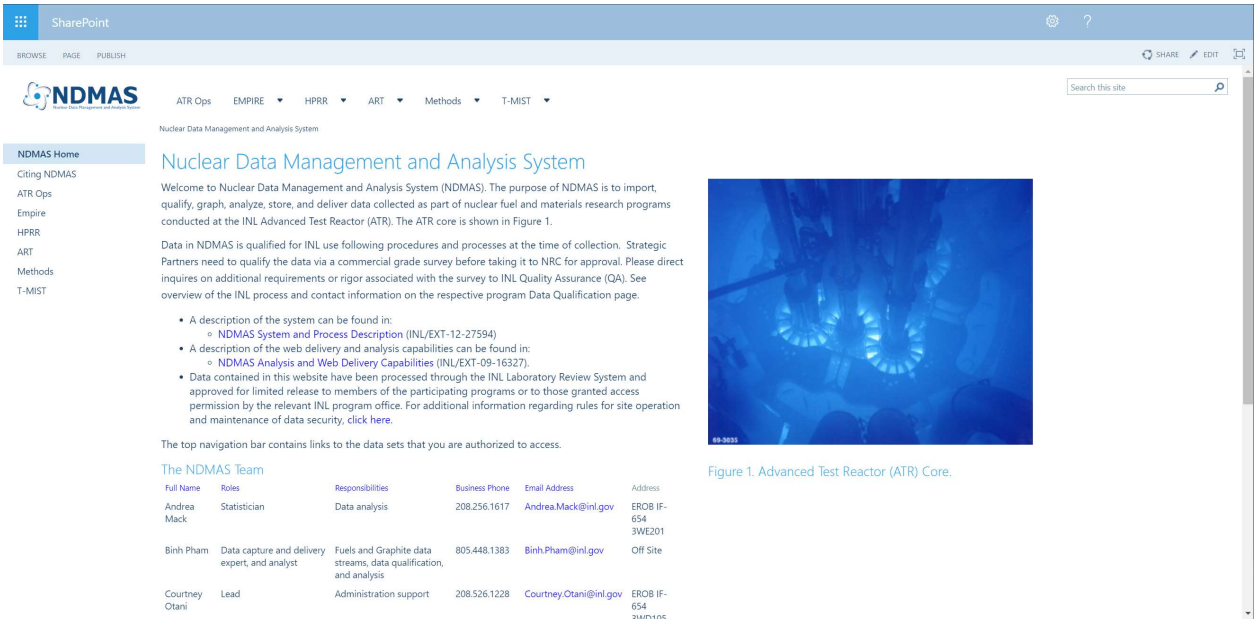

Figure 2. NDMAS website main screen.

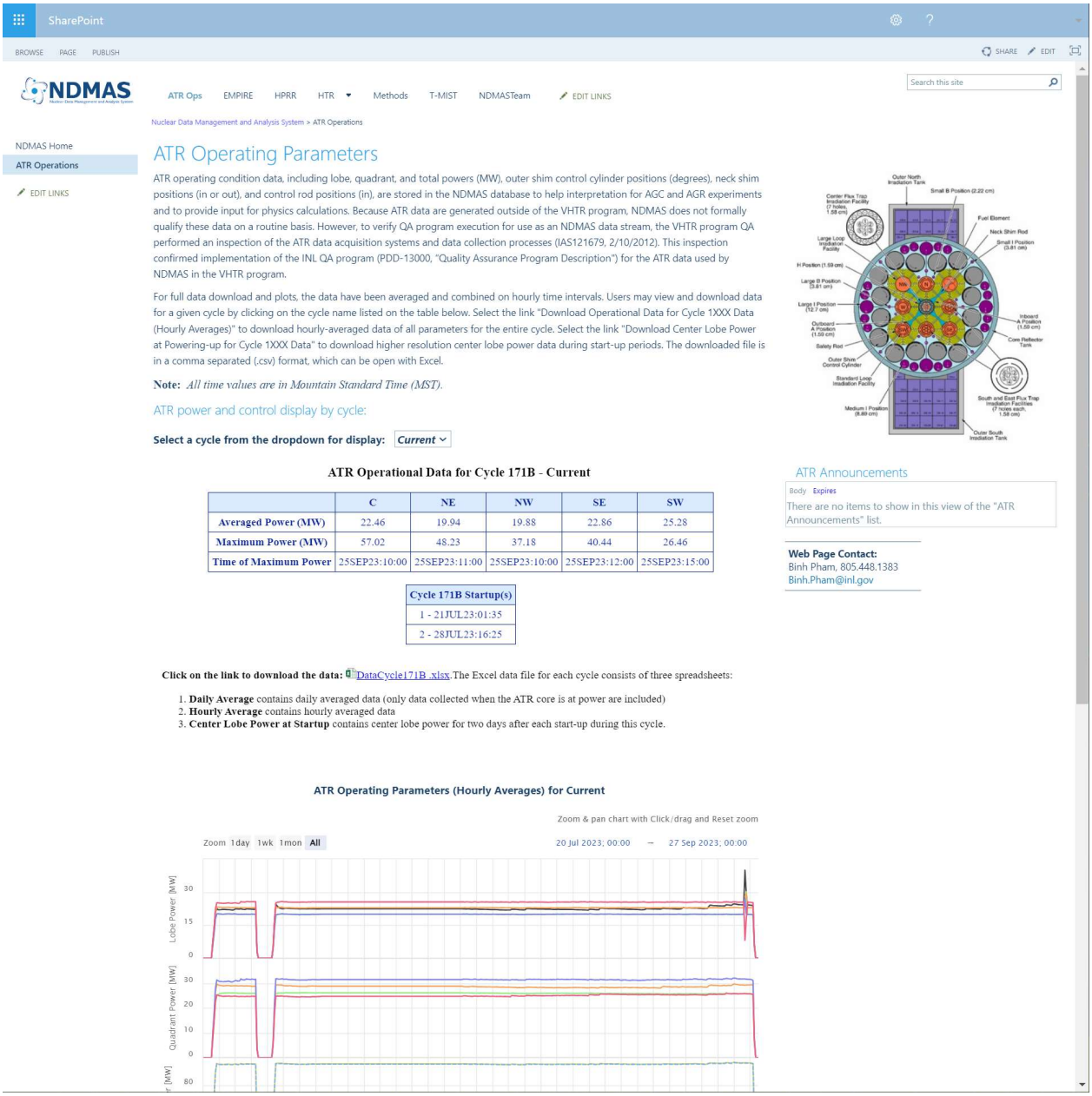

Figure 3. Example NDMAS web page.

For analysis of data using tools not available on the web page, data can be downloaded from the system to the user's computers. By downloading data from NDMAS, users get copies of the data for their analyses. Results of analyses can be captured into NDMAS if appropriate.

For representative datasets derived from a complete data spectrum produced during an experiment with extensive diagnostics, it will be necessary to produce and use masks that show the locations and dimensions of the region where measurements have been recorded. The masks may be generated based on

computer-aided design or computational fluid dynamics meshes. These masks will be displayed on web pages to guide the data user to the datasets most relevant to their applications.

6. DATA ANALYSIS AND MANAGEMENT SOFTWARE

The SAS Enterprise Business Intelligence server and SAS Viya 3.5 is used to manage and analyze data. Data storage is through an enterprise level SQL database. Content management is handled using SharePoint, a Microsoft product that promotes sharing and collaboration among team members. SAS Enterprise Business Intelligence has extensive capabilities, including portals/dashboards, report viewing, report building, advanced data exploration, Microsoft Office integration, guided analysis, and application development. As a result, users at all levels are able to quickly and easily obtain information to make decisions. Data access is controlled using role--based security.

SharePoint allows users to view reports and analysis results in a self-service manner while maintaining control of the underlying data and security. Large numbers of users can quickly open, view, and interact with previously created and secured reports to answer their programmatic and analytical questions. Report interaction enables multiple views of the data to support their data manipulation needs.

Analysis of NDMAS data is performed primarily with the extensive capabilities of SAS Enterprise Guide and SAS Studio. However, SAS JMP, SAS Enterprise Miner, and SAS Visual Analytics are SAS products that are part of the system and offer unique features for data analysis and Web display. Non-SAS software, such as MATLAB, is also employed for specific data analysis situations where appropriate.

7. SOFTWARE QUALITY ASSURANCE

NDMAS software quality assurance (SQA) requirements contained in KB0022103, “Research Software Quality and Lifecycle Management.” They are implemented through the Software Management Plan workflow processes built into the TFS System. The Software Management Plan follows Form 562.41, “Software Management Plan and Life Cycle Documentation for Research and Development Activities,” as prescribed in KB0022103. These processes will be reviewed and tasks identified for appropriate QA of all applicable portions of NDMAS. The processes under SQA control include the procured software (e.g., SAS Enterprise Business Intelligence), algorithms developed for statistical analyses and data management, and electronic data manipulation techniques used to capture, transfer, and store all related data.

As allowed by DOE 414.1D, “Quality Assurance,” and NQA-1-2008/1a-2009 Addenda, a graded approach must be applied to all SQA activities for NDMAS.

NDMAS uses “acquired software” as well as “custom developed software” in the system. In compliance with KB0022103, changes to existing software, acquisition of software, and development of new software will follow sound software engineering principles. Specifically:

- Acquired software must be identified, controlled, and then evaluated to determine its adequacy to support needed operations. Documentation must include capabilities and limitations for intended use, tests required to demonstrate the capabilities, and instructions for use. The SAS Suite vendor provides user instruction information on their web page at http://support.sas.com/documentation. SQA documentation must be maintained in accordance with KB0022103and LWP-1202, “Records Management.”
- Custom developed software must be developed, tested, and managed as required by KB0022103and documented on Form 562.41.

7.1 Configuration Management

The configuration of the NDMAS must be tracked and documented using the TFS system, which includes version control and revision history functionality. Configuration items shall be identified within the TFS and a baseline established using the item name or ID and version number or date/time.

Changes must be requested through the TFS system or by using the contact link found on NDMAS web pages. If approved, requested changes must be implemented and tested. Any needed documentation changes will be made, the change will be made operational, and the request will be closed.

7.2 Acceptance Testing

Prior to release for operational use, NDMAS was fully acceptance tested. Testing was documented in TFS or other documents as appropriate. Records are maintained by the software owner/project manager via TFS.

8. RECORDS MANAGEMENT

Records management is described in LWP-1202. Data generated by the projects are sent to NDMAS. When data are accepted, Form 250.01 is completed and sent to the DRSC records coordinator for entry into EDMS. When qualification states are assigned, Form 1073 is completed and sent to the DRSC records coordinator for entry into EDMS.

9. REPORTING

ART Program management has developed the reporting requirements of NDMAS. Management from other programs may use these reporting formats or request their own. Examples include weekly control charts, scatter plots, correlation matrices, and summary statistics for each parameter requiring qualification and validation. It could also include flags indicating parameters out-of-control or nearing out-of-control and possible explanations. User menus are available to allow users to create their own reports on demand.

10. ACCESS CONTROL

Access to data is controlled using role-based security in SAS and in SharePoint, which is a Microsoft product designed for team collaboration. Security groups will be developed in accordance with the nature of the data and any associated limitations set in governing documents such as Cooperative R&D Agreements. Access rights for individual users outside of the NDMAS team will be determined in consultation with the relevant program manager. Personally identifiable information (PII) collected is what is minimally required by INL Information Management procedures and is done in accordance with LWP-11202, “Controlled Unclassified Information Program.” Other information collected is used to ensure the user is placed in the appropriate security group. This information would be the program data of interest, their use case for the data, and if applicable, an INL point of contact. All international users, whether INL employees or external users, must have a security plan in place addressing NDMAS access prior to activation of their SharePoint and SAS accounts.

Citizenship will have to be declared by the requester. For U.S. citizens, an email, paper form, or electronic record are examples of acceptable declarations of citizenship. NDMAS personnel are not responsible for verifying the information provided by a requester.

Upon admittance of new users, the NDMAS lead will communicate expectations for use of NDMAS. Users should refrain from usage of the dataset(s) in a manner other than as communicated by the subject matter experts (SMEs). The contacts for these SMEs are available on their respective NDMAS pages and will be identified as information the user should be aware of and use when technical questions arise to ensure appropriate interpretation and use of the data. The NDMAS home page provides a subsite of information on expectations for citing usage of NDMAS data as well as a User Guide for assistance in navigation and use of the NDMAS websites.

11. REFERENCES

DOE Order 414.1D, “Quality Assurance,” U.S. Department of Energy.

Form 250.01, “Data Management and Analysis Transmittal.”

Form 562.41, “Software Management Plan and Life Cycle Documentation for Research and Development Activities.”

FRM-1073, “Data Evaluation Report.”

KB0022103, “Research Software Quality and Lifecycle Management.”

LWP-11202, “Controlled Unclassified Information Program.”

LWP-1202, “Records Management,”

MCP-2691, “Data Qualification,” Idaho National Laboratory.

MCP-3948, “US-HPRR Fuel Qualification Data Qualification”

MCP-3974, “NDMAS Team Foundation Server (TFS) Change Request Instructions”

NQA1-2008/1a-2009 Addenda, “Quality Assurance Requirements for Nuclear Facility Applications,” American Standards of Mechanical Engineers.

PLN-2690, Idaho National Laboratory Advanced Reactor Technologies Quality Assurance Program Plan.”

PLN-4653, “INL Records Management Plan.”