

 National Spent Nuclear Fuel Program	MANAGEMENT OF THE SPENT FUEL DATABASE	Doc. No.: NSNFP 19.02
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		DAR No.: NSNF-746

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Date: 3-18-08

I. PURPOSE AND SCOPE

This procedure describes the processes used to control the Spent Fuel Database (SFD) and distribution of data from the SFD. The SFD consists of application software and data files. The SFD provides centralized access to available data on the U.S. Department of Energy (DOE) spent nuclear fuel (SNF) inventory.

The SFD is intended for storage and retrieval of data for SNF scoping, planning, and programmatic decision-making by the National Spent Nuclear Fuel Program (NSNFP) and other recipients of the data. SFD Version 5.0.1 (L.A. Version) is the only authorized source of data to be used in support of NRC-licensed activities (NLA; see glossary) such as NSNFP inputs to the Yucca Mountain Project License Application, but SFD versions other than 5.0.1 may be used for non-NLA uses. SFD use for non-NLA purposes is not subject to this procedure.

This procedure establishes the NSNFP implementation of the requirements of QARD Supplement I for the SFD and does not apply to other NSNFP software. This procedure describes the processes used for the modification of SFD software and data subsequent to Version 5.0.1. This procedure also describes the processes used for preparation of queries used to respond to NLA data requests and for control on the distribution of electronic data for these NLA data requests.

II. SUMMARY

This procedure provides four controls on SFD, namely, controls on: 1) changing the SFD software; 2) collecting, updating, and checking data entries in the SFD; 3) developing and checking queries to provide responses from requesters for specific data residing in the SFD; and 4) providing electronically formatted data to requesters. SFD version updates are prompted by software changes, data changes, or both.

Section III.A provides the controls on changing SFD software. After proposed revisions are authorized, the appropriate documents are prepared or revised and the software is modified. Acceptance testing (see glossary) is performed to ensure the modified software performs as intended and the results documented. The new SFD version is then issued and distributed on CD to other users. The CDs distributed outside the NSNFP are provided for information only.

Section III.B provides the controls on updating SFD data. The fuel data are formally evaluated by NSNFP via an internal review package, and when authorized, the updated data are incorporated into a new version of the SFD. The data change authorization process includes an impact evaluation to compare these values to the values used for DOE SNF licensing for the Yucca Mountain repository. The new SFD version is then issued and distributed on CD to other users. The CDs distributed outside the NSNFP are provided for information only.

Section III.C provides controls on developing data queries for NLA-related data requests. After clarifying the details of the request, a new query or an existing query that has been modified will be used to provide the desired information in the desired format. The query results will be verified by comparison with results from a similar query using the SFD locator.

Section III.D provides control on the transmittal of electronic data that is produced via Section III.C. Electronic transmittal of data to be used for NLA purposes includes a requirement for use of "checksums" to verify data integrity.

Attachment A provides the criteria for development and review of the SFD documentation.

III. PROCEDURE

A. Software Change Control

- PSO Technical Staff 1. Identify changes to the software for the SFD when a new feature within the SFD is desired or a software defect is identified and discuss with the PSO Technical Lead. Software defects will be reported as described in NSNFP 19.02-3, SFD Software Defect Notification.
- PSO Technical Lead 2. Consider the request that the SFD software be modified to either correct a deficiency or add a new feature to the software. Decide whether the potential changes warrant implementation and direct PSO Technical Staff accordingly.
- PSO Technical Staff 3. Coordinate with the SFD software engineer to establish general work scope and cost estimates for the software and documentation changes.
4. Report to the PSO Technical Lead with a general estimate of the work scope and cost for the software and documentation changes.
- PSO Technical Lead 5. Determine if the changes should be implemented and direct the PSO Staff accordingly.
- PSO Technical Staff 6. Revise and issue the Functional and Operational Requirements as necessary consistent with Attachment A.
7. Prepare a software revision plan consistent with Attachment A of this document for each new software project and obtain review and approval in accordance with NSNFP 6.01.
8. Using a programmer that has been trained to the NSNFP procedures, modify the software in accordance with approved software revision plan. Software revisions shall be made to a developmental copy of the software controlled by the programmer. If new software (e.g., support software) is being procured for use in SFD as part of the revision, it shall be procured in accordance with NSNFP procedures.

9. Evaluate the ability of the revised software to perform its operations in accordance with the software revision plan. This evaluation should be performed both on a PSO Technical Staff computer and on a *clean platform* (see glossary). Configuration control of the software being tested may be accomplished by the programmer or a PSO Technical Staff member holding a CD copy of the software.
- a. If not satisfied that the new version provides the features or corrections desired, go back to Step III. A.7.
 - b. If satisfied, report to the PSO Technical Lead that the changes have been made and the software performs as required.
- PSO Technical Lead 10. Evaluate the new version of the SFD.
- a. If not satisfied with the new version, go back to Step III. A.7.
 - b. If satisfied with the revised software, authorize release of the SFD.
- PSO Technical Staff 11. Document the testing process, results, and conclusions in an engineering design file (EDF) consistent with Attachment A.
12. Assign a new version number to the SFD, maintain a file copy of the CD with the NSNFP DCC containing the new SFD version, and issue CDs to users with DOE approval as appropriate. Information obtained from the new version is for information only and not for use in NRC-licensed activities (NLA; see glossary). Since the SFD CDs are for information only, there are no restrictions on the distribution of the CDs beyond protection of official use only data.
13. Guidance shall be provided to users for software installation, use, and protection of official use only data, but the user is responsible for these activities.
14. Revise and re-issue the software design description as appropriate.
- PSO Technical Lead 15. When the software will no longer be used, inactivate its software documentation by canceling it in accordance with NSNFP procedure 6.01.

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B. Updating SFD Data

- PSO Technical Staff 1. Consider making updates to or reviews of the SFD data when one of the following conditions occurs.
- a. An error is discovered in the existing SFD data.
 - b. More complete data are found.
 - c. Updates in inventory are provided.
 - d. It is determined that a record should be reviewed for any reason such as fuel movements, potential generation of additional fuel, or a change in management plans.
2. Coordinate with DOE SNF Sites and other entities as appropriate to obtain available SNF data and changes thereto.
- a. When changes in inventory are known or suspected, request an updated SNF inventory from the SNF site point of contact, as appropriate.
 - b. As necessary, request clarifications to any data received. Where possible, obtain the data via formal letter, e-mail, or documented telephone conversation to allow referencing.
3. As needed, create an Excel spreadsheet to allow sorting and grouping of the data by physical or chemical characteristics, to facilitate aggregating and averaging of the data, or to facilitate review of proposed changes.
4. When directed by the PSO Technical Lead, prepare a SFD change package (Form 19.02-2 and any supporting documentation), and sign Form 19.02-2.
5. Perform independent review of change package and sign Form 19.02-2.
- PSO Technical Lead 6. Review SFD change package to determine if changes to the existing SFD data are appropriate and document the determination on Form 19.02-2.
- PSO Technical Staff 7. Open the appropriate SFD record in the edit mode and enter the updated data as authorized by approved Form 19.02-2.
8. Verify the changes with an independent review and sign Form 19.02-2.
 9. Evaluate the impact of the change, document, and sign Form 19.02-2.
 10. File the completed change package with the NSNFP DCC as a NSNFP non-quality related project file..

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11. After entering all completed change packages, assign a new version number to the SFD, maintain a file copy of the CD with the NSNFP DCC containing the new SFD version, and issue CDs to users with DOE approval as appropriate. Information obtained from the new version is for information only and not for use in NRC-licensed activities (NLA; see glossary). Since the SFD CDs are for information only, there are no restrictions on the distribution of the CDs beyond protection of official use only data.
12. Guidance shall be provided to users for software installation, use, and protection of official use only data, but the user is responsible for these activities.

C. Responding to Data Requests in Support of NRC Licensed Activities

- | | |
|---------------------|--|
| PSO Technical Staff | <ol style="list-style-type: none"> 1. Coordinate with the requester to determine the desired data fields to be included in the response. 2. If a request is made from an individual external to the PSO Technical Staff, request DOE Idaho Operations Office approval before proceeding with the query. 3. Create a new query or modify an existing query with the data fields as specified in the request and in the same order. Include in the query the value for MTHM whether or not the requester asked for these data. 4. Run the query, export the result to an Excel spreadsheet or other format as requested, and note the number of records involved and the total MTHM obtained in the SFD Query Verification, Form 19.02-1. 5. Run a similar query in the SFD locator. Include the same parameters as the query run from the raw data (e.g., location, management plans, irradiating reactor, SNF composition, storage configuration, standard canisters, SNM type, and grouping). 6. Note the number of records in the results and the value for total MTHM. If the values are not the same as obtained in the query (step III.C.4) run from the raw data, go back to Step III.C.3. |
| PSO Technical Staff | <ol style="list-style-type: none"> 7. Once the results are the same in both queries: <ol style="list-style-type: none"> a. Save the query used and assign it a unique name that indicates the data use and SFD version (i.e., source term Version 5.0.1) for future reference and retrieval. b. Attach a copy of the SQL (Structured Query Language) statement from the query to Form 19.02-1. c. Document the results of both queries on Form 19.02-1. |



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- d. Perform independent checks of mathematical formulas and results and document them on Form 19.02-1.
 - e. Transmit the Form 19.02-1 record copy to the NSNFP DCC for inclusion in the NSNFP nonquality-related project files.
8. Go to Section D, Control of Electronic Information, to transfer the response to the requester in electronic format.

D. Control of Electronic Information for NLA Uses

- PSO Technical Staff
1. To transfer data in electronic format, copy the results into Microsoft Excel.
 2. Add the "Checksum" feature to the Excel spreadsheet by entering an equation "=sum (then select numerical data by highlighting the two dimensional area with numerical data)."
 3. Copy the exact value into an adjacent cell by doing a "copy" and then "paste special" and select from the popup window "Values." The same value should appear in the cell.
 4. Set the decimal to three places to the right of the decimal.
 5. Subtract the second cell value from the first—the value should read 0.000.
 6. Furnish the Excel spreadsheet to the requester.
 7. Verify with the requester that the "Checksum" value equals 0.000.
 8. If the Checksum value does not equal 0.000, go back to Step III. D.2 and use another method of furnishing the spreadsheet.
 9. Finalize and file Form 19.02-1 with the NSNFP DCC.

IV. REFERENCES

None.

V. DEFINITIONS

Terms appearing in *italics* followed by the notation "see glossary" are defined in the NSNFP Documents Manual Introduction and Glossary.

VI. ATTACHMENTS

Attachment A – Development and Review Criteria for SFD Documentation.



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VII. QUALITY RECORDS

The following quality records generated as a result of this procedure require retention in accordance with the identified classification and NSNFP Procedure 17.01.

Lifetime

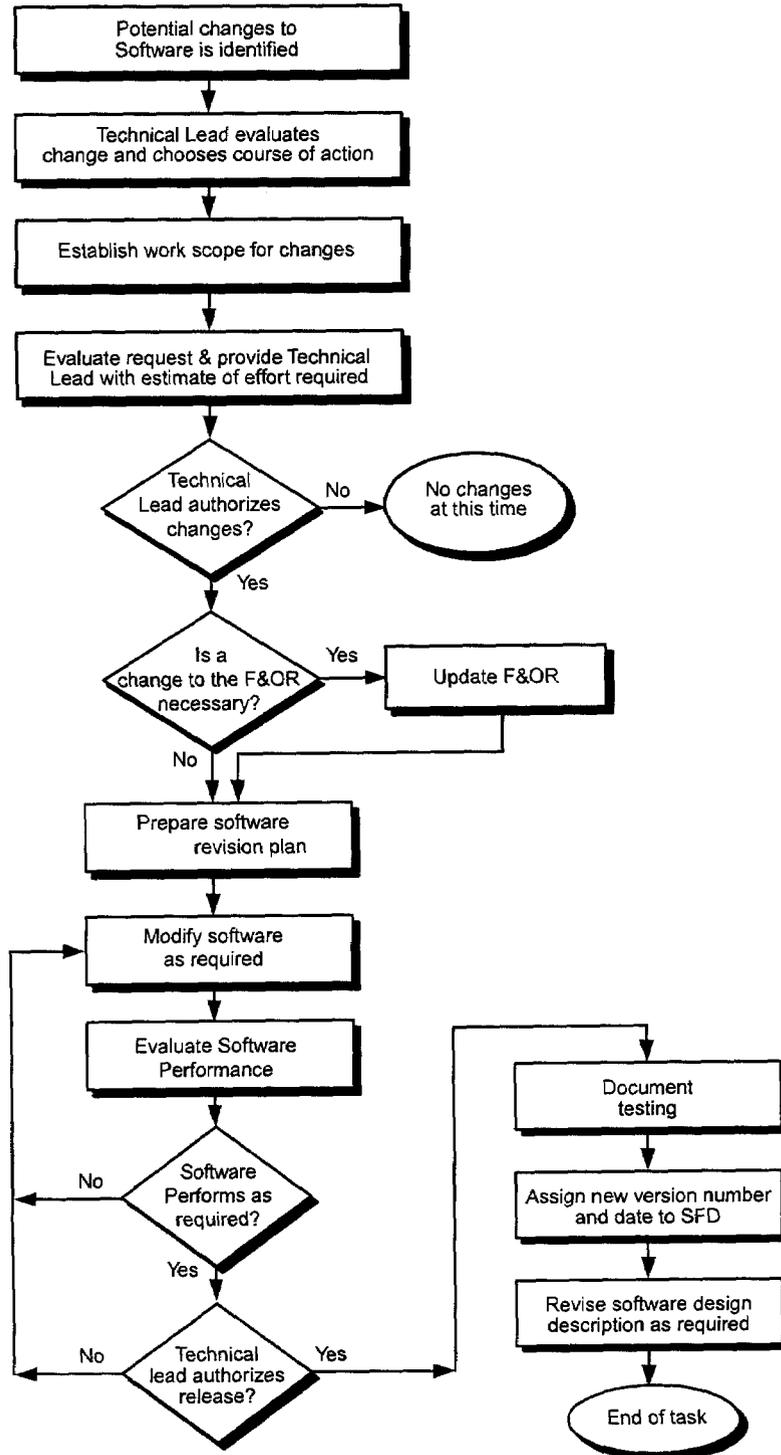
- A. Functional and Operational Requirements (F&ORs)
- B. Software Revision Plan
- C. Software Test Report
- D. Software Design Description (SDD)
- E. SFD Software Defect Notification Form (19.02-3)

Nonpermanent

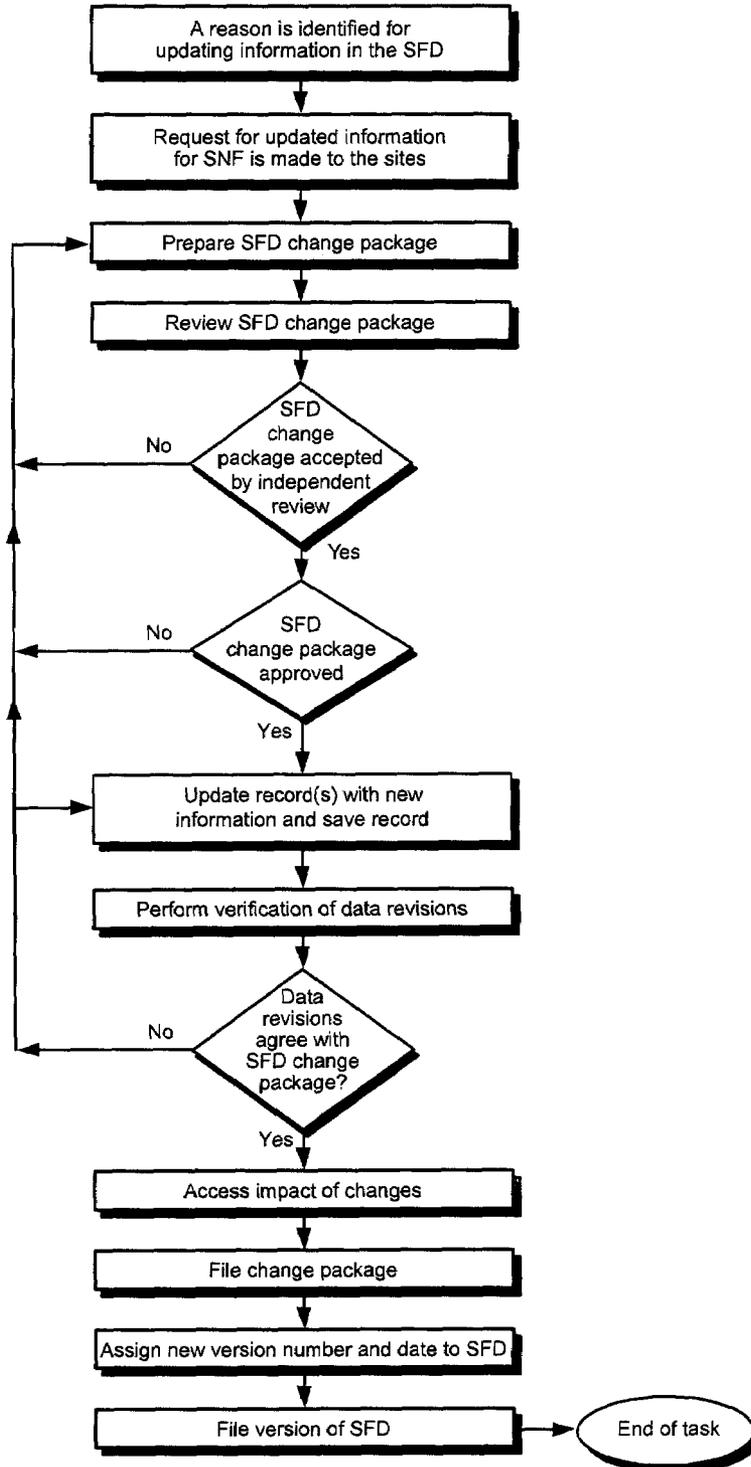
None.

VIII. PROCEDURE FLOW DIAGRAM

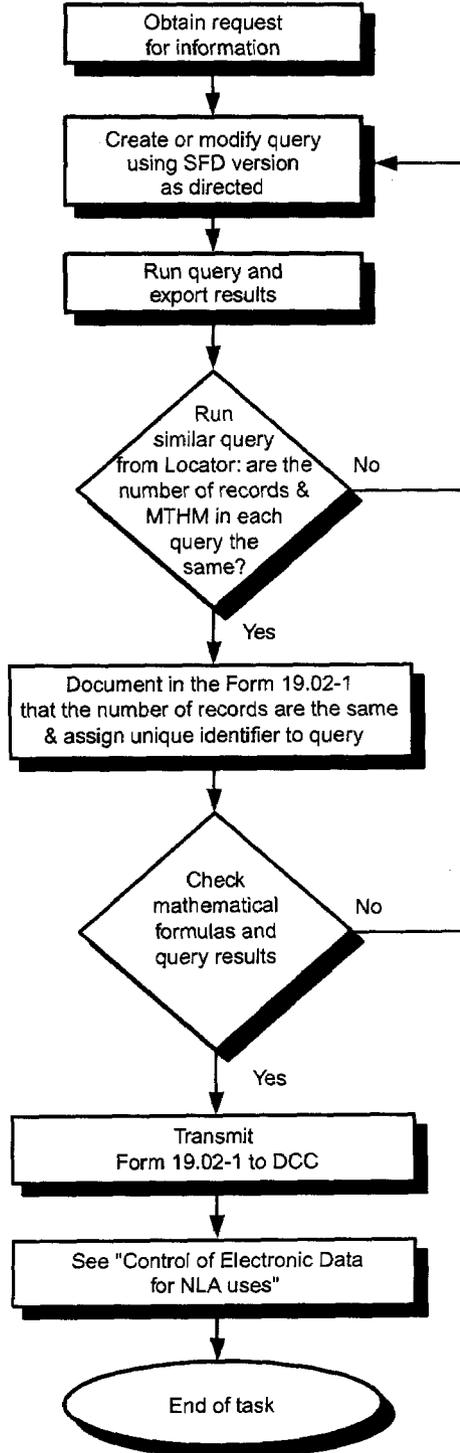
Software Change Control



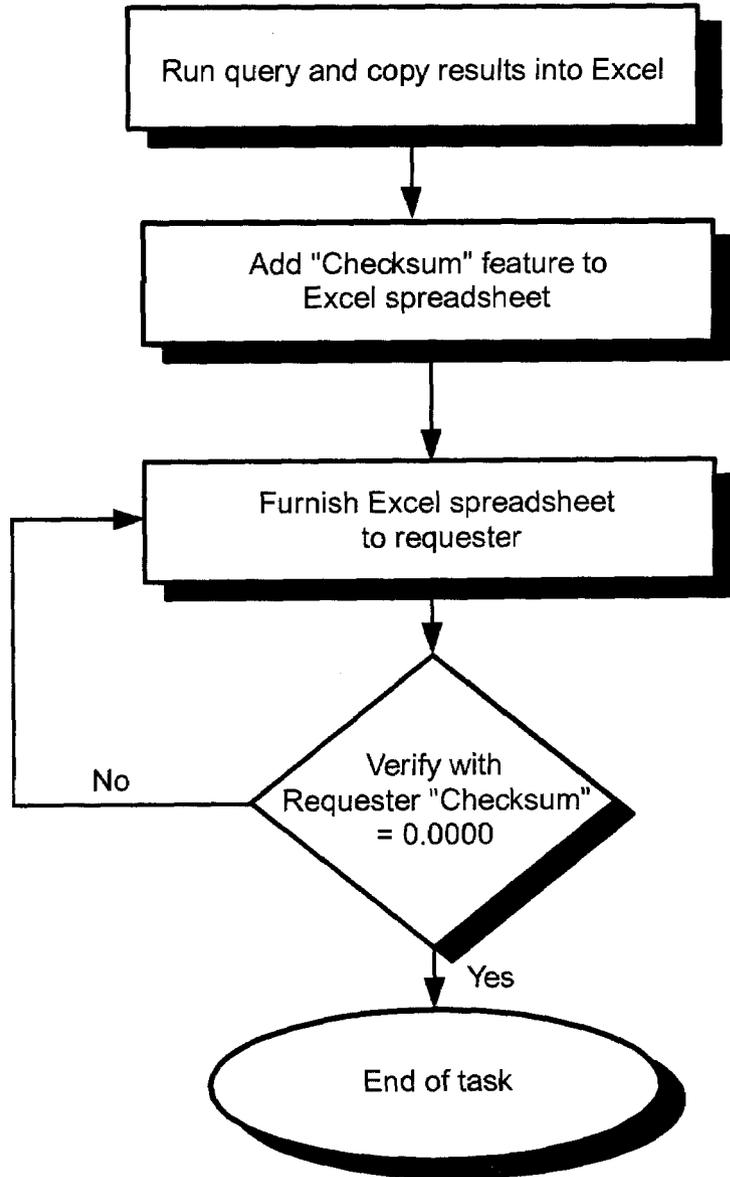
Updating the SFD Data



Responding to Data Requests in Support of NRC Licensed Activities



Control of Electronic Data for NLA Uses



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Attachment A

Development and Review Criteria for SFD Documentation

The development and review criteria are presented for documentation of the National Spent Nuclear Fuel Program (NSNFP) Spent Fuel Database (SFD). All documents associated with implementation of this procedure will be prepared, modified, and controlled consistent with NSNFP procedures. The documentation for future revisions of SFD will collectively consist of the following:

1. **The Functional and Operational Requirements (F&ORs)** will cumulatively document the overall requirements of the software and may or may not need to be revised for each future revision of SFD.
2. **A Software Revision Plan** will document the requirements for the changes being made to the software and define the associated testing requirements. A software revision plan is required for each future revision of SFD.
3. **A Software Test Report** will document the results of the testing defined in the Software Revision Plan. A software test report is required for each future revision of SFD.
4. **The Software Design Description (SDD)** will document the software design and may do so via a data dictionary and entity-relationship diagram. The SDD may or may not need to be revised for each future revision of SFD.

The SFD software is in a maintenance phase of its lifecycle and revisions involve feature refinement rather than large-scale development of capabilities. Because of the developer's familiarity with the software and the software is in the maintenance phase, SFD revisions expected to be performed via a rapid prototyping process. The rapid prototyping process integrates the design, implementation, and testing processes for quicker and more efficient completion. The developer will prepare a prototype of the software for review and testing by management and users. Because of the rapid prototyping approach used, the software revision plan(s) and revisions to the F&OR document will only provide general direction. The detailed design that results from the design, implementation, and testing activities of the rapid prototyping process will be subsequently recorded in the SDD.

1. **Planning and Requirements**

The planning and requirement associated with SFD revisions shall be documented in a software revision plan. The overall SFD requirements associated shall be documented in the F&OR document. The following sections identify the requirements for the software revision plan and the F&OR document.



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Purpose, Scope, and Applicability (Qualified Software Reviewer¹)

The software revision plan identifies the purpose, scope, and applicability of the revisions, and the applicable Work Breakdown Structure number. The F&OR document identifies the purpose, scope, and applicability of the entire software, and the applicable Work Breakdown Structure number.

Quality Assurance (NSNFP Quality Engineer)

Text similar to the following is included in the software revision plan and the F&OR document:

Quality assurance is maintained by compliance with NSFNP 19.02, Management of the Spent Fuel Database. NSFNP 19.02 prescribes processes and associated organizational responsibilities for development, verification, validation, and acceptance along with the associated responsibilities for achieving software quality. NSFNP 19.02 directs software design requirements, design specifications (including testing requirements), documentation of verifications following each of the software development phases, and validation at the completion of product development to be baselined in the software revision plan and the functional and operational requirements document, which, upon completion, become the software baseline documents. The software revision plan and the functional and operational requirements document are controlled in accordance with NSFNP 6.01.

The following are clearly identified in the software revision plan:

- The organizations responsible for development, verification, validation, and acceptance along with their respective responsibilities for achieving software quality
- Applicable standards, conventions, methodologies or other requirements, which may consist of the use of qualified programmers
- Any required reviews, control points, hold points, and associated criteria.

Requirements (Qualified Software Reviewer)

Requirements, which are specified within the subsections below, satisfy specified QA requirements and provide sufficient detail to enable successful design and/or acquisition of the software to achieve the planned objectives. Achievement of the specified requirements shall be capable of being verified, validated, and traceable.

Functional Requirements

The functions that the software must perform and any design constraints are clearly specified. Overall hardware and software requirements are specified in the F&OR documents. Software requirements for each revision cycle are specified in the software revision plan.

¹. Qualified in accordance with applicable NSNFP procedures and not associated with development of the software.

Performance Requirements and Other Attributes

Overall access control, both in terms of guest users and data entry/verification, is specified in the F&OR document. There are no SFD requirements for the time-related issues of software operation such as speed, recovery time, and response time.

Interfaces

Requirements to ensure successful interface with users and other hardware or software interfaces are clearly specified in the F&OR document. The primary interface requirements for SFD are the ability to display graphics and export data in standard formats.

Control Points

Because of the nature of the software, the only prescribed control points (see glossary) or hold points (see glossary) are those associated with testing and control prior to release of new versions, as provided in the software revision plan and Section III.A of the body of this procedure.

Testing (Qualified Software Reviewer)

The general approach to testing (e.g., feature-specific or overall software functionality) is described in the software revision plan for each revision cycle.

2. Design (Qualified Software Reviewer)

The design specification and documentation phase associated with SFD revisions are documented in the software revision plan. After each software revision, the SDD shall be reviewed to determine if revisions are needed. The following sections identify the design specification and design documentation requirements.

Design Specifications

The following are clearly specified in the software revision plan for software revisions:

- The major software functional and operational requirements including system functional and operation requirements are specified in the F&OR document, which will include security, hardware requirements and software requirements.
- The theoretical basis, mathematical model, control flow, data flow, control logic, and data structure employed for software revisions are specified in the software revision plan for new software changes. For simple calculations such as summations and averages, field names (e.g., total), screen labeling (e.g., record total), or the data dictionary description is a sufficient basis of the calculation.

Design Documentation

The design, in a manner that can be translated into code, shall be specified in the SDD including:

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- a. A data dictionary consisting of the database fields names, the displayed names, and the field formats (e.g., 4-place decimal).
- b. An entity-relationship diagram that shows the key database entities (tables and fields) and their relationships (e.g., primary key with a one-to-many relationship).

3. **Implementation** (Qualified Software Reviewer)

For NSNFP personnel, use of SFD data is controlled by Section C of the body of NSNFP 19.02. The only control on implementation for external users is that the CDs be labeled “For Information Only” and “Official Use Only.” In addition, it is not required but suggested that the CD transmittal provide:

- Explanation to external users that the SFD is for information only. All data used for NLA uses must be requested from the NSNFP and be based on Version 5.0.1.
- Notification that appropriate precautions should be taken for official use only data.
- Installation guide, either a printed copy or a text file on the CD.
- General installation and operating instructions, either a printed copy or a help file on the CD.
- Any hardware and software requirements.

4. **Testing** (Qualified Software Reviewer)

Test approaches and associated acceptance criteria are provided in the software revision plan. Following testing, a test report will:

- Include results of reviews and tests
- Describe the tests performed to detect unintended adverse effects introduced during the modification of the software, to verify that the modifications have not caused unintended adverse effects, and to verify that the revised software still meets specified requirements.
- Provide appropriate documentation (Technical Report or Engineering Design File according to NSNFP Procedure 3.04) of the successful completion of validation and installation tests.
- Identify the reviewers and their responsibilities.
- Document comments and their disposition.

Tests confirm implementation satisfies software design specifications.

- Tests and test documentation are organized in a manner that allows traceability to requirements.
- Software verification shall include review of the test results. Software verification shall be completed prior to approval of the computer program for use. Software verification shall consist of a comparison of the radionuclide inventories calculated with the revised software using the Version 5.0.1 dataset with the results using the Version 5.0.1 software and dataset.
- Testing shall demonstrate, as appropriate, that the software revisions to the computer program:
 - a. Properly handles abnormal conditions and events (e.g., unexpected operator entries) as well as failures.
 - b. Does not perform adverse unintended functions. Observations of unexpected or unintended results shall be dispositioned prior to test result approval.
 - c. Does not unexpectedly degrade the system either by itself or in combination with other functions or configuration items.