

Waiver #228 exists against this procedure. This waiver waives the requirement in Section 4.1.2 for a design authority to approve technical baseline calculations. This will be waived for non-nuclear facility designs as long as the designs are prepared by In-House Design Engineering and approved by a licensed professional engineer. Full text of the waiver can be viewed at <http://idmsweb/idms/livelink.exe/Open/170034761>.

		USQ #12-1323-S
ENGINEERING CALCULATIONS	Manual Document	Engineering TFC-ENG-DESIGN-C-10, REV B-3
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1.0 PURPOSE AND SCOPE

(7.1.2)

This procedure describes the process for preparing, processing, and revising Washington River Protection Solutions LLC (WRPS) engineering calculations. It also describes the process used by WRPS to accept calculations completed by outside contractors and suppliers. This process applies to all engineering, design, process, and nuclear safety calculations prepared as engineering deliverables or as a part of another deliverable.

Calculations may be embedded in a technical document or issued as a letter report. If the calculation is embedded in a technical document or issued as a letter report, it is especially important to ensure that relevant design inputs are clearly identified and that the document is reviewed for acceptability in the same manner as if it were issued as a separate calculation. Acceptance of the calculation is required prior to relying on the results of the calculation or using an item that the calculation supports. All calculations prepared to this procedure shall be determined by the Design Authority to be Technical Baseline Documents or not to be Technical Baseline Documents as defined in TFC-PLN-03. Final calculations should be released as "RPP-CALC-XXXXX." Scoping calculations and preliminary calculations may be released as "RPP-RPT-XXXXX." Calculations prepared for other projects that apply to the new design may be used instead of developing new calculations.

Calculations prepared solely using Microsoft Excel© spreadsheets shall follow TFC-ENG-DESIGN-C-32. If the calculation involves a combination of spreadsheet and hand calculations or other software, then the requirements of both this procedure and TFC-ENG-DESIGN-C-32 shall be met.

All calculations except as exempted below shall follow this procedure:

- Computations as defined in Section 5.0
- Calculations that are performed to check or verify another calculation, software, or spreadsheet
- Business, financial, or non-technical calculations.

All calculations performed to meet Technical Safety Requirements (TSRs) shall be prepared and released as required by this procedure.

2.0 IMPLEMENTATION

This procedure is effective on the date shown in the header. However calculations that have been prepared or are in process may continue according to the previous revision.

3.0 RESPONSIBILITIES

3.1 Engineering Discipline Lead

The following types of calculations shall be reviewed and approved by an Engineering Discipline Lead (EDL):

- All calculations affecting Safety Significant SSCs as stated in TFC-PLN-03 (7.1.3)
- All Electrical Distribution Studies as stated in TFC-ENG-STD-31.
- All electrical loads and calculations required by TFC-ENG-STD-06.

The following types of calculations should be reviewed and approved by an EDL:

- All calculations involving Finite Element Modeling.

3.2 Hoisting & Rigging (H&R) Engineer

The following types of calculations shall be reviewed and approved by an H&R Engineer:

- All calculations involving H&R equipment and activities as stated in TFC-CHARTER-31.

NOTE: Approval can be achieved by printing name, signing, and dating either the release document or Figure 4.

All other responsibilities are contained within Section 4.0.

4.0 PROCEDURE

See Figure 1 for process flow diagram.

4.1 Formal Engineering Calculations

This section describes the process for preparing, processing, and revising WRPS engineering calculations. It also describes the process used by WRPS to accept calculations completed by outside contractors and suppliers.

For the preparation of engineering calculations, proceed to the “preparation, checking, and approval” Section 4.1.1.

For the processing of engineering calculations, proceed to the “calculation release” Section 4.1.2.

For the acceptance of engineering calculations performed by outside contractors and suppliers, proceed to the “engineering calculations by subcontractors” Section 4.1.3.

For the revision of engineering calculations, proceed to the “revision of approved calculations” Section 4.1.4.

4.1.1 Preparation, Checking, and Approval

The requirements for preparation, checking, and approval of calculations that will be released in Hanford Document Control are contained within this section.

Responsible
Manager

1. Assign a qualified engineer or analyst, who is competent in the engineering discipline or subject matter, to prepare the calculation.

2. Assign a qualified checker, who is competent in the engineering discipline or subject matter, to check the calculation.

NOTE: The engineer/analyst, checker, and organizational manager must be different individuals; however, the organization manager may perform the role of checker provided the following criteria are met:

- The organizational manager does not:
 - Specify a singular design approach
 - Rule out certain design considerations
 - Does not establish the design inputs used in the design.
- The organizational manager is the only individual in the organization competent in the engineering discipline or subject matter to perform the checking.

Engineer/Analyst

3. Format the body of the calculation following the criteria given in Attachment A. Other sections may be added and the exact order of the sections is left to the engineer/analyst.

NOTE: Where calculations are prepared in support of documents that have their own procedural requirements and format, the document-specific format requirements take precedence over the format requirements of this procedure (e.g., waste compatibility assessments ([TFC-ENG-CHEM-P-13](#))).

4. If preparing a new calculation:
 - a. Assign a unique title and obtain a document number from Hanford Document Numbering System (HDNS).
 - b. To aid in retrievability, include key words that relate the calculation to the system, structure, component, area, project, or analogous terms.
5. If revising an existing calculation, use the next revision number/letter of the existing document number.
6. Prepare the calculation in a legible form suitable for reproduction, filing, and retrieval using the header shown in Figure 2, for each page.

NOTE: Documentation of electronically generated calculation sheets (such as MathCad©) shall use a format containing the same information as Figure 2.

7. Provide the page number in sequential order, the unique title, document number, and the revision number on each page of the calculation and on all attachment pages.
8. Ensure that the calculation is prepared or revised such a way that a technically qualified, independent person (e.g., checker) can repeat the calculation and come to the same conclusion without recourse to the engineer/analyst.
9. Ensure that the results of the calculation are assessed for impacts on requirements and that appropriate changes to requirements in the affected requirements documents (e.g., system/subsystem specifications and Operating Specification Documents) are initiated in accordance with [TFC-ENG-DESIGN-C-06](#).
10. Forward hard or electronic copy (check copy) of the calculation to the assigned checker, along with any documents that directly affect the calculation, such as drawings, codes, standards, and related analyses.

Checker

11. Verify that the calculation is:
 - Technically accurate
 - Suitable for the intended use
 - Compliant with this procedure (use Figure 3, as a checklist for key attributes).
12. When the design configuration depends on a calculation, ensure that the applicable design documents (e.g., drawings, ECNs, specifications) are consistent with the calculation.

NOTE 1: Verification of design calculations may be performed by alternate calculations.

NOTE 2: The alternate calculation is the check of the calculation and shall be attached to the calculation.

13. Review each page of the check copy of the calculation highlighting either on the hard copy or electronically any comments or changes required.
14. Return the marked check copy of the calculation to the engineer/analyst.

Engineer/Analyst

15. Resolve comments with the checker.
 - a. Make the agreed upon corrections.
 - b. If requested by the checker, make a copy of the corrected calculation for back checking.

16. For electronic calculations, once all comments have been resolved to the satisfaction of the checker, print a final copy of the calculation for signature.
- Engineer/Analyst and Checker 17. Print name and sign the Calculation Checklist (Figure 3) to signify that the resolution of review comments is complete and that the calculation complies with this procedure. Include the completed checklist at the beginning of the calculation.

NOTE 1: Additional organization-specific review checklists may also be included.

NOTE 2: For computer printout data (input or output files), Figure 2 shall be completed as the cover sheet of the computer printout. Signature or name on subsequent pages of computer printout is not required. Pages that contain textual information but not actual calculations do not need signature or name. For example, when the numerical calculations are contained in an appendix and the objectives and method are contained in the main body of the document, only the pages of the appendix containing the calculations have signatures or names.

NOTE 3: Where calculations are prepared in support of documents that have their own procedural preparation and review requirements, a document-specific review checklist may be substituted for the Calculation Checklist provided in [Figure 3](#). If no checklist is provided in the document-specific procedure, the checklist provided in this procedure shall be used.

17. Print the name of the engineer/analyst and checker and date on each page of the calculation.

NOTE: This is not required on attachment pages unless the attachment is a calculation.

- Responsible Manager 18. Review the Calculation Checklist (Figure 3) to ensure all items are checked either “Yes,” “No,” or “NA,” and that comments are provided for boxes checked “No” or “NA.”
19. Print name and sign the Calculation Checklist signifying that the engineer/analyst and checker are both qualified and the Calculation Checklist is completely and correctly filled out.

4.1.2 Calculation Release

Calculations performed to this procedure shall be retrievable and shall follow the criteria and steps from the “preparation, checking, and approval” Section 4.1.1 of this procedure. Calculations performed to this procedure can be released as either self releasing documents using the Calculation Cover Sheet (A-6005-860) or, in order to be readily retrievable with the document, as attachments to a:

- Technical Evaluation (A-6005-465, see TFC-ENG-FACSUP-C-02)

- Performance and Functional Requirements/Evaluation for Special Tools and Equipment (A-6003-129, see TFC-OPS-MAINT-C-01)
- Engineering Data Transmittal (BD-7400-172.2, see TFC-ENG-DESIGN-C-25)
- Engineering Change Notice (A-6003-563.1, see TFC-ENG-DESIGN-C-06).

Calculations submitted using the vendor processes procedure, TFC-BSM-IRM_DC-C-07, that are determined to require formal approval, or revision shall be released as described above.

To release calculations with the forms mentioned previously, the steps contained within the appropriate procedure shall be followed. For calculations prepared by outside contractors or suppliers, the requirements of the “engineering calculation by subcontractors” Section 4.1.3, shall be met.

The Responsible Engineer and Calculation Cover Sheet Checker may be different individuals than the Engineer/Analyst and Checker from the “preparation, checking, and approval” Section 4.1.1 of this procedure.

Originator/
Responsible
Engineer

1. Determine calculation release method. If necessary consult Responsible Manager on appropriateness of release method.
 - a. If the release method is the Calculation Cover Sheet, proceed to step 2.
 - b. If the release method is any other method than the Calculation Cover Sheet, proceed to the appropriate procedure.
2. Obtain a Calculation Cover Sheet (A-6005-860) number from the HDNS and obtain and complete the Calculation Cover Sheet using the form instructions.

NOTE 1: The Calculation Cover Sheet form instructions and Calculation Cover Sheet (A-6005-860) are obtained through Hanford Site Forms.

NOTE 2: The Calculation Cover Sheet is page 1 of the transmittal. The TOC Record of Revision (A-6003-835) is page 3 of the transmittal, when applicable (The Calculation Record of Revision (A-6003-835) is also obtained through Hanford Site Forms).

3. Submit the Calculation Cover Sheet to the Responsible Engineer.

NOTE 1: The Originator and Responsible Engineer may be the same individual.

NOTE 2: For calculations prepared by outside contractors or suppliers, the Responsible Engineer should be the project engineer for the project the calculations are supporting.

Responsible
Engineer

4. Evaluate for technical adequacy and completeness, approve, and date the Calculation Cover Sheet.

5. Submit the Calculation Cover Sheet to the Calculation Cover Sheet Checker.
- Calculation Cover Sheet Checker
6. Perform a peer check to ensure:
- The Calculation Cover Sheet is completely and correctly filled out
 - All related/impacted documents are listed and correctly referenced
 - The description and justification of issue/revision match the purpose of attached calculation
 - The Calculation Record of Revision is correctly filled out when applicable.
- NOTE: The calculation cover sheet checker shall be different than the cover sheet originator.
7. Resolve any comments with the Responsible Engineer and approve the Calculation Cover Sheet.
- Responsible Engineer
8. Obtain a USQ screening by Nuclear Safety and Licensing (NS&L) per TFC-ENG-SB-C-03.
- NOTE1: Responsible engineers may apply “N/A” for USQ in documents that meet the definition of routine maintenance in TFC-ENG-SB-C-03 or documents listed on RPP-27195.
- NOTE 2: All documents not meeting this condition must go through a qualified USQ Evaluator.
9. Determine if a Process Hazard Analysis (PrHA) needs to be conducted per TFC-ENG-DESIGN-C-35.
- Design Authority
10. Evaluate for technical adequacy and completeness and check “Yes” or “No” in the Technical Baseline box. Enter printed name, signature, and date to indicate approval of the Calculation Cover Sheet and calculation.
- NOTE: If the responsible engineer is also the applicable Design Authority, the Calculation Cover Sheet shall be signed in both required signature lines.
- Responsible Manager
11. Review the calculation for compliance with procedural requirements and ensure that it is suitable for its intended use. When finished, sign the Calculation Cover Sheet, signifying approval.

- Responsible Engineer
12. Submit native files to the Document Service Center per TFC-ENG-DESIGN-C-25. If native files cannot be submitted, provide a written explanation in the Calculation Cover Sheet.

NOTE: Native file refers to original MathCad®, Excel®, Word®, etc., files for easy retrieval and modification.
 13. Submit working files that will not be submitted to Document control, such as photos, notes, etc., to the electronic information file, “IDMS WRPS Shared Projects/Engineering Information Files.”
 14. After the Calculation Cover Sheet has all required signatures, submit the Calculation Cover Sheet (A-6005-860) containing the calculation to the Document Service Center in accordance with TFC-ENG-DESIGN-C-25. Include the Calculation Review Checklist (Figure 4) as necessary for calculations performed by subcontractors.

4.1.3 Engineering Calculations by Subcontractors

Calculations prepared by outside contractors or suppliers for WRPS (non-shared resource) are prepared according to the quality assurance requirements identified in the procurement specification or subcontract and these calculations must be accepted by WRPS. Therefore, acceptance by WRPS is in addition to the subcontractor’s quality assurance requirements.

- Responsible Manager
1. Determine if design verification is required.
 - a. If required, perform design verification in accordance with TFC-ENG-DESIGN-P-17 or if directed by management.
 - b. If design verification is not required, proceed to step 2.

NOTE: Upon completion of the Design Verification per TFC-ENG-DESIGN-17, calculations shall be released in accordance with the “Calculation Release” section of this procedure.
 2. Assign an engineer/analyst that is competent in the engineering discipline or subject matter as a designated reviewer to review the calculation.

NOTE: Multiple designated reviewers shall be assigned as required for multiple discipline reviews.
- Designated Reviewer
3. Perform a design review using criteria in the calculation review checklist in Figure 4.
 4. At completion of the design review, prepare Figure 4, and sign it as “Reviewer” indicating that the review was satisfactory.
- Responsible Manager
5. Review the calculation for suitability for its intended use and print name and sign Figure 4, signifying that the Designated Reviewer was qualified and that the calculation meets these requirements.

NOTE: The Designated Reviewer and Responsible Manager must be different individuals.

4.1.4 Revision of Approved Calculations

- | | |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Engineer/Analyst | 1. If an inadequacy or error is found in a calculation and the calculation is part of the design basis (referenced in a system design description that has been issued), notify the affected organizational manager and initiate a Problem Evaluation Request (PER) in accordance with TFC-ESHQ-Q C-C-01 . |
| | 2. If a revision is required such as update to the analysis, new data, resolve inadequacies or errors, or to close an engineering HOLD or To Be Determined (TBD) (see TFC-ENG-DESIGN-C-25), notify the affected Organizational Manager to revise calculation. |
| Responsible Manager | 3. Initiate calculation revision according to the “Preparation, Checking, and Approval” section of this procedure and update change documentation according to the “calculation release” Section 4.1.2. |

NOTE: For digital submissions, a full document release containing the updated revisions is preferred; however, page for page revisions are also acceptable.

4.2 Computer Software (7.1.1)

Custom software or commercial off-the-shelf software (COTS) must meet the requirements of [TFC-BSM-IRM_HS-C-01](#) prior to their use in engineering calculations.

4.2.1 Calculations Using MathCad©

Calculations that use MathCad© software must use the version available from HLAN. The calculation, including the portion generated by MathCad©, is prepared and checked by following the sections of this procedure that pertain to the category of the calculation. Unit values of variables shall be shown and correctly documented: whether using MathCad© preset unit values or manually inputting unit values.

4.2.2 Calculations Using Excel©

Calculations containing Excel© spreadsheets must use the version available from HLAN.

- | | |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Engineer/Analyst | 1. Prepare calculations performed solely using Excel© in accordance with TFC-BSM-IRM_HS-C-01. If the calculation involves a combination of spreadsheet and hand calculations or other software, it must meet the requirements of both this procedure and TFC-ENG-DESIGN-C-32. |
| Engineer/Analyst/
Checker | 2. Complete and document verification of spreadsheet portion of calculation in accordance with TFC-ENG-DESIGN-C-32. |

3. If the spreadsheet calculation requires documenting in accordance with this procedure, complete review process for the calculation as a whole using the sections of this procedure that pertain to the category of the calculation.

4.2.3 Calculations in Other Technical Documents

This section identifies how to handle calculations included in technical documents whose main purpose is not to perform the calculation itself. Such documents are prepared for many purposes, including interpretation of calculation results, use of calculation results to make programmatic decisions, to support design descriptions, to support operational decisions, to support the safety basis documents and decisions, or to support environmental permitting documents and decisions. It is especially important for authors and reviewers of technical documents to recognize when the document contains calculations and to ensure that the calculations meet the requirements of this procedure.

Calculations may be presented in text documents in one of three ways:

- Embedded in the main body of a document
- Included as an appendix to a document
- Prepared as separate document and included as a reference in the primary document.

The choice of how to present the calculation is based on consideration of the complexity of the calculation and the need for the reader to be able to view the calculation details within the primary document. The calculation may be stand alone, included as an appendix to a report, or embedded in a report.

5.0 DEFINITIONS

Alternate calculations. A method of verifying the correctness of original calculations or analyses by using alternate methods to perform an equivalent calculation. In performing an alternate calculation, the appropriateness of assumptions, input data, and computer hardware/software, if used, is also evaluated.

Competent. An engineer who is knowledgeable through education, experience and training of the engineering discipline, applicable regulations, standards, equipment, and systems in their area of expertise as assigned by management.

Computation. A computation is defined by the following:

- There are no assumptions
- A permanent record is not needed (i.e., it does not need to be referenced and can easily be reconstructed)
- Special engineering expertise is not needed
- Engineering expertise is used to evaluate the problem, and a formal calculation is not required.

Examples of computations include length of a zip cord, areas and volumes, simple thermal expansion, and simple unit conversions. There are no procedural requirements for simple computations.

6.0 RECORDS

The following records are generated during the performance of this procedure:

- Calculation packages, which include:
 - Calculation Cover Sheet
 - Calculation Checklist
 - Calculation Review Checklist.

The record custodian identified in the Company Level Records Inventory and Disposition Schedules (RIDS) is responsible for record retention in accordance with TFC-BSM-IRM_DC-C-02.

7.0 SOURCES

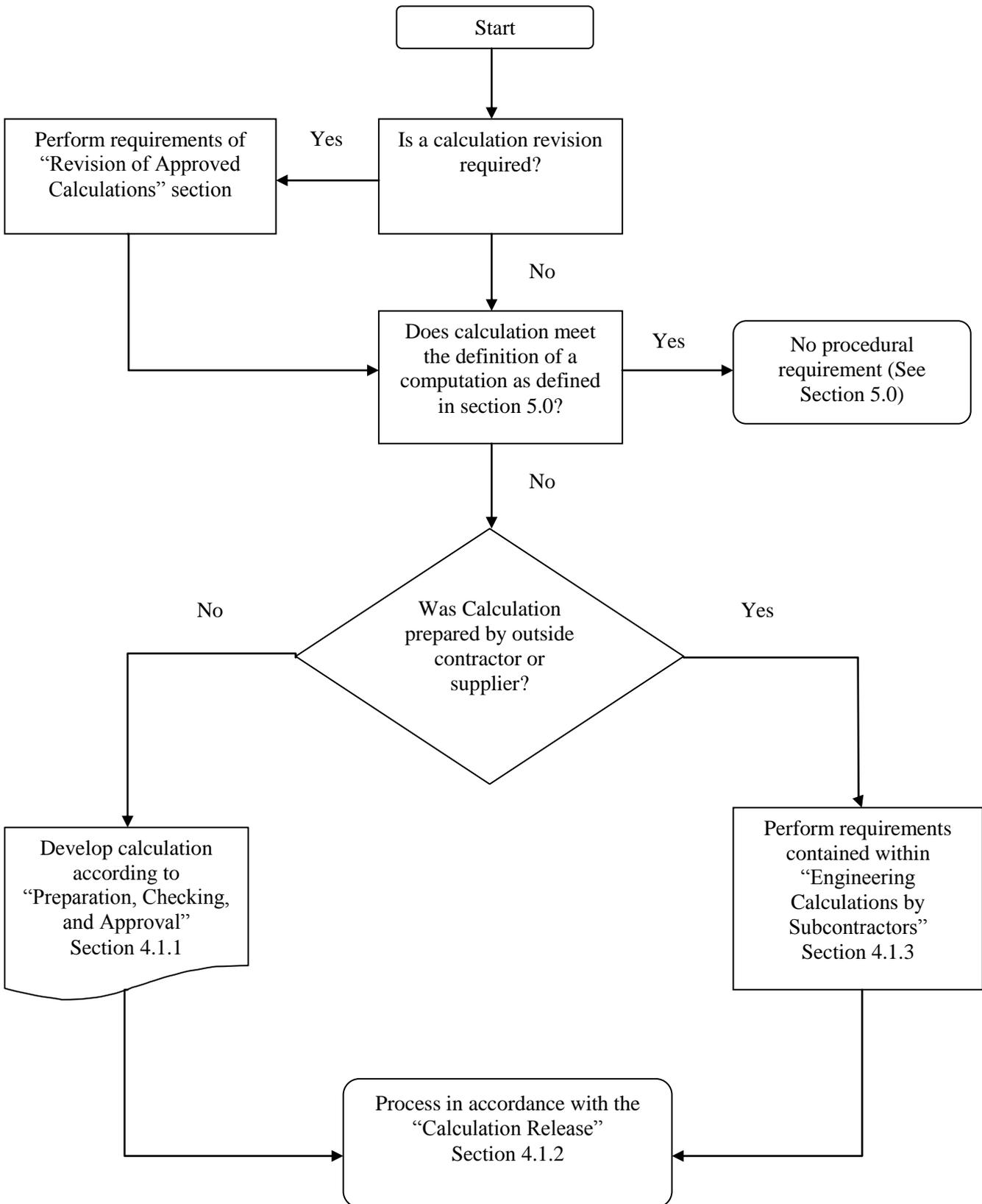
7.1 Requirements

1. TFC-BSM-IRM_HS-C-01, "Software Development, Implementation, and Management."
2. TFC-PLN-02, "Quality Assurance Program Description."
3. TFC-PLN-03, "Engineering Program Management Plan."

7.2 References

1. TFC-BSM-IRM_DC-C-02, "Records Management."
2. TFC-BSM-IRM_HS-C-01, "Software Development, Implementation, and Management."
3. TFC-ENG-CHEM-P-13, "Tank Waste Compatibility Assessments."
4. TFC-ENG-DESIGN-C-06, "Engineering Change Control."
5. TFC-ENG-DESIGN-C-25, "Technical Document Control."
6. TFC-ENG-DESIGN-C-32, "Spreadsheet Development and Verification."
7. TFC-ENG-DESIGN-P-17, "Design Verification."
8. TFC-ESHQ-Q_C-C-01, "Problem Evaluation Request."
9. TFC-ENG-FAC SUP-C-02, "Operability/Technical Evaluations."
10. TFC-OPS-MAINT-C-01, "Tank Operations Contractor Work Control."

Figure 1. Calculation Process.



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Figure 2. Calculation Page Header.

RPP-CALC-XXXXX
Page ____ of ____

Title: *Include a descriptive title for the calculation*

Engineer/Analyst: *Print* **Date:** _____

Checker: *Print* **Date:** _____

The header of each page of the calculation contains, as a minimum, the information shown above. Attachment A provides details on calculation format.

Figure 4. Calculation Review Checklist.

RPP-CALC-XXXXX

Page ____ of ____

Subject: _____

**The subject document has been reviewed by the undersigned.
The reviewer reviewed and verified the following items as applicable.**

Documents Reviewed: _____

Analysis Performed By: _____

- Design Input
- Basic Assumptions
- Approach/Design Methodology
- Consistency with item or document supported by the calculation
- Conclusion/Results Interpretation
- Impact on existing requirements
- _____

Reviewer (printed name, signature, and date) _____

Responsible Manager (printed name, signature and date) _____

ATTACHMENT A - CALCULATION FORMAT AND PREPARATION INSTRUCTIONS

Include the following sections in the body of the calculation that are marked “required.” Other sections may be added as needed and the exact order of the sections is optional.

1. Objective/Purpose (required)

Describe the objectives (including the required end products) of the analysis including a problem statement. Describe the analysis performed in the calculation. Identify the calculation’s design requirements and applicable National Codes and Standards.

2. Summary of Results and Conclusions (optional depending on calculation length or complexity)

For lengthy or complex calculations, summarize the results and conclusions contained in later sections, highlighting the key points.

3. Introduction/Background (optional)

Provide any background information needed to understand the calculation purpose.

4. Input Data (required)

Information that serves as input to the calculation must be referenced to the source.

Information used to produce a hand calculation or used as input for a computer code must be explicitly stated, or be included in an attachment that will stay with the calculation. (It is not intended that impractical attachments, such as voluminous databases, be included.) Extensive compilations of input data used in more complex calculations may be better contained in separate appendixes.

Data files used in computer codes, with associated release numbers or dates, shall be listed. Enough information shall be included in the report to allow a complete reconstruction of all the input cases. This may include publishing all input files used to reach the conclusion(s) in the calculation.

Data and information used as input to the calculation shall be referenced to the source. Copies of reference information should be made available to the checker and organizational manager to simplify the review and approval process.

Information or data used to produce a hand calculation or used as input to a computer code or spreadsheet shall be included in an attachment. In the case of voluminous data from databases registered in Hanford Information System Inventory (HISI); reference can be made to the specific query, specific spreadsheet, date of query, column and range of data used in the calculation.

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ATTACHMENT A - CALCULATION FORMAT AND PREPARATION INSTRUCTIONS (cont.)

Where spreadsheets are used in support of calculation preparation, document the sources of the input data in this section and complete verification that input data is correctly entered in accordance with TFC-ENG-DESIGN-C-32.

In documenting input data, preference should be given to providing the information in a numbered list format with a description of the type of input data used and the reference that it was taken from.

Assumptions resulting from engineering judgment should be clearly stated with the basis for that judgment.

5. Assumptions (required if assumptions are made)

Explicitly state or reference assumptions used in the analysis along with supporting data or information. Assumptions that are stated must be used within the calculation. At a minimum, list key assumptions that must be verified prior to relying on the calculation for operation (e.g., those providing a basis for selection of TSRs and safety structures, systems, and components). Engineering HOLD or To Be Determined (TBD) notations for missing information or unverified assumptions must be controlled in accordance with [TFC-ENG-DESIGN-C-25](#).

6. Method of Analysis (required)

The method needs to “stand alone” in quality and completeness so that a reasonably knowledgeable person would not have to seek the originator’s input on the methodology used in order to arrive at the same conclusions. Provide a brief description of the method of solution, numerical computations, and identification of the source or derivation of all equations that are not common usage. The method should use recognized national standards wherever possible with clear derivation of or reference to equations and any limitations on their use. Provide diagrams, sketches, photographs, or drawings to clarify extent of the calculation and provide visual association with the actual configuration. Structural calculations, as a minimum, require a free body diagram that should include dimensions, forces, moments, and reactions; the free body diagram should be legible and should clearly represent the actual configuration.

If a formulation has been taken from an unpublished reference (such as an internal memo) or was developed by the engineer/analyst, the validity of the model or correlation must be demonstrated. The engineer/analyst must ensure that the uncertainties thus introduced will not impact the conclusions of the document. The actual numerical calculations may be included in this section where practical. Complex calculations or spreadsheets not readily contained within the body of the calculation are better contained in separate appendices.

Information necessary to reconstruct the analysis, including hand calculations, must be included.

Where repetitive use spreadsheets are used, their methodology should be documented in a published formal engineering calculation prepared in accordance with this procedure. Subsequent calculations performed with the repetitive use spreadsheet would then reference that calculation in this section for a full description of the method.

Where single use spreadsheets are used, their method should be described in this section or in a separate appendix.

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ATTACHMENT A - CALCULATION FORMAT AND PREPARATION INSTRUCTIONS (cont.)

7. Use of Computer Software (required if software is used)

Documentation of computer software application use shall include program name, version numbers, release dates, references to user manuals, and software verification documentation. Software verification documentation shall be included within the calculation as an attachment or as a reference. If the calculation uses software that has previously been documented and verified in an engineering calculation, that calculation may be referenced. The new calculation must contain documentation/justification that the previous verification is applicable.

If the calculation is performed by a MathCad© calculation worksheet, the numerical values of variables should be shown either on the same sheet as the variable in use or in a consolidated sheet at the end of the worksheet to facilitate checking and review. Angles should be presented in MathCad© as degrees (NOTE: MathCad© default is to calculate and present angles in radians).

If the calculation is performed solely by a spreadsheet (Excel©), the spreadsheet shall be developed, documented, and verified in accordance with TFC-ENG-DESIGN-C-32 only. If the calculation is supported by both a spreadsheet and hand calculations, the calculation shall be in accordance with both this procedure and TFC-ENG-DESIGN-C-32. The following information shall be included, as a minimum, in this section for each spreadsheet used in support of the calculation:

- Software and version used to create spreadsheet (e.g., Excel© 2003)
- File name and version of spreadsheet
- Spreadsheet Verification and Release Form Number, providing evidence of verification
- Software name and version of any add-in software.

8. Results (required)

Describe the results obtained. The number of significant figures reported shall be consistent with the quality of the data and with its purpose.

9. Conclusions (required)

Describe the degree to which the objectives and purpose have been met along with information on the appropriateness and completeness of the results for the intended purpose.

10. Recommendations (optional)

List the recommendation(s) including basis information. If recommendations are provided as the Design Basis for an SSC, the recommendations shall be provided on the design drawings or design media; or, a PER shall be written (Reference TFC-ENG-DESIGN-C-25).

11. References (required)

Examples of references include drawings, reports, change notices, manuals, publications, codes, and standards. Provide the title, author (or company), and revision number or publication date, if available. References that may not be retrievable in the future shall be added to the document as attachments. The engineer/analyst must be able to supply the reviewer with a copy of any document cited in the analysis.

ATTACHMENT A - CALCULATION FORMAT AND PREPARATION INSTRUCTIONS (cont.)**12. Attachments and Appendixes (optional)**

Include additional information such as computer software documentation (including spreadsheet printouts), calculation review checklist(s), spreadsheet verification form(s), detailed calculations not readily contained in the main body, extensive compilations of input data, inspection reports, and copies of references, memos, or pages of manuals.