UCOR BLUE SHEET COVER PAGE

Blue Sheet Review

ID Number:	BS-0073			
UCOR Level 1 Mgr:	Eric Abelquist			
Topical Area or Facility Name:	Engineering			
Blue Sheet Classification:	☑	Status 1: Document(s) adopted as is		
	☐	Status 2: Document(s) adopted with minor changes		
	☐	Status 3: Document(s) not adopted; major changes required		
	☐	Status 4: Document(s) superseded	Superseding Doc #:	
	☐	Status 5: Document(s) retired		
Needed Updates/Revisions	See the latest revision of Management Directive DIR-UCOR-600 for a crosswalk of non-intent terminology changes (e.g., company name and logo, organization titles).			

Unreviewed Safety Question (USQ) *(if applicable)*

USQ Review	☑	Excluded	Reason for Exclusion:	Non-intent changes do not require USQ screening
	☐	Required	Screening #:	

Approvals

Blue Sheet Reviewer:	Charles Curtis Print / Sign	CHARLES CURTIS (Affiliate) Digitally signed by CHARLES CURTIS (Affiliate) Date: 2022.03.24 13:00:18 -04'00' 3-24-22 Date
Level 1 Manager:	Eric Abelquist Print / Sign	ERIC ABELQUIST (Affiliate) Digitally signed by ERIC ABELQUIST (Affiliate) Date: 2022.03.29 15:19:49 -04'00' 3/29/2022 Date

Documents covered by this Blue Sheet *(or indicate attachment with information)*

Document #:	Document Title	Rev
PPD-DE-1035	Engineering Program Description	2
PROC-DE-0704	Project Calculations	5
PROC-DE-0705	Design Drawings	3
PROC-DE-1007	Specifications	5
PROC-DE-1008	Design Change Notices (DCNs) Engineering Instructions (EIs) and Equivalency Evaluations	10
PROC-DE-1010	Scopes of Work	2
PROC-DE-1016	Design Criteria	3
PROC-DE-1023	Preparation and Maintenance of Arc Flash (AF) Hazard Analysis for AC and DC Electrical Systems	6
PROC-DE-1027	UCOR Structural Inspections	2
PROC-DE-1031	Welding Procedure	2
PROC-DE-1034	Performing Code Welds	0
PROC-DE-1039	Hydrostatic and Initial Service Leak Test	3

UCOR
United Cleanup Oak Ridge LLC

OWNER: Chief of Staff	**DIR-UCOR-600**	**REVISION: 0**
SUBJECT MATTER AREA: Contract Transition	**PREPARER: Samantha Dolynchuk**	**Page 1 of 3**
DIRECTIVE	**CONCURRENCE/DATE:** LINDA RAULSTON (Affiliate) Digitally signed by LINDA RAULSTON (Affiliate) Date: 2022.05.11 09:19:37 -04'00'	
TITLE: **TRANSITION OF UCOR PERFORANCE DOCUMENTS**	**APPROVED BY/DATE:** SAMANTHA DOLYNCHUK (Affiliate) Digitally signed by SAMANTHA DOLYNCHUK (Affiliate) Date: 2022.05.10 09:08:12 -04'00'	
USQD ☒ **UCD** ☐ **CAT X** ☐ **EXEMPT** ☐	**EFFECTIVE DATE:**	**5/23/22**
USQD/UCD/CAT X No: USQD-MS-DIRUCOR600-1807	**REQUIRED REVIEW DATE:**	**5/23/25**

PURPOSE

This directive formalizes the adoption of UCOR LLC, an Amentum-led partnership with Jacobs, performance documents by United Cleanup Oak Ridge LLC (UCOR). It also serves as an authorizing change mechanism for documents that require administrative, non-intent changes to reflect the new contractual relationship between new UCOR and the U.S. Department of Energy Oak Ridge Office of Environmental Management (DOE OREM) eliminating the need for individual change records for each document. The following statement will be added to the Performance Document Database (Forms and Procedures (ettp.gov)) to notify document users that performance documents have been blue sheeted and accepted:

All performance documents have been accepted per Management Directive DIR-UCOR-600.

The Blue Sheeting process, including this Management Directive, will be briefed at key meetings including the President's Accident Prevention Council (PAPC), Executive Plan of the Week, Chief Operating Officer's Morning Operations Calls, and an Expanded Staff Meeting that will be held on May 11, 2022. This Management Directive will be flowed down to the entire UCOR workforce during the Safety Start that will be held on May 23, 2022. Additionally, this Management Directive will be assigned as required reading for the entire UCOR workforce.

SCOPE

This directive applies to all performance documents controlled by the UCOR Performance Documents Group. This directive also applies to the UCOR nuclear facilities' safety basis documents controlled by Nuclear and Criticality Safety, Security documents controlled by Security and Emergency Services, and any UCOR-numbered documents that were submitted as Transition Deliverables.

DIRECTIVE

This directive is effective at the start of Task Order 2, Contract Implementation. Existing documents will be updated to reflect the elements herein within one year of the start of Task Order 1 Transition (February 28, 2023). Procedures and documents are to be considered suitable and useable for the safe accomplishment of assigned work until that time.

While the technical content of a performance document remains accurate, references within a given document may not immediately match newly assigned UCOR titles, UCOR logo's, company names, or other contractually-

related information. This directive provides direction for using incumbent UCOR terminology compared to new UCOR terminology in order to allow employees to achieve verbatim compliance without work stoppage.

INTERPRETATIONS

The crosswalk in Attachment A lists the previous UCOR organization structure with the new UCOR organizational equivalent. Document users encountering an incumbent UCOR organization name shall interpret it as if the organizational names in Attachment A have been updated in the document.

Some performance documents refer to forms that contain UCOR LLC, an Amentum-led partnership with Jacobs, or URS | CH2M Oak Ridge LLC. These forms are acceptable for continued use until changes can be made by the form owners, and incumbent UCOR references shall be interpreted as if they refer to United Cleanup Oak Ridge LLC or UCOR.

Some performance documents may refer to other performance documents by number and title. Some of these references may be affected by the contract transition or a previous organizational restructuring. These cases shall be interpreted by their current number and title.

CHANGE PROCESS

Performance documents requiring administrative changes only (i.e., those identified in Interpretations) will be processed under a blanket administrative change and authorized by this directive as change authorization.

Changes to documents other than the administrative changes listed in Attachment A will be performed in accordance with *Performance Document Process* (PROC-OS-1107).

Changes to safety basis documents controlled by Nuclear and Criticality Safety will be changed in accordance with *Safety Documentation for Hazard Category 2 & 3 Nuclear Facilities* (PROC-NS-1002) and *Safety Documentation for Less than Hazard Category 3 Nuclear and Non-Nuclear Facilities* (PROC-NS-1009).

POINTS OF CONTACT

Contact the appropriate functional or line manager for guidance related to the content of a procedure or document or the information on Attachment A. For questions related specifically to the performance document process, contact the Information, Technical Editing & Records Manager.

REVISION LOG			
Revision	Effective Date	Description of Changes	Pages Affected
0	5/23/22	Initial release.	All

Attachment A

Crosswalk of Organizational Terminology for UCOR Transition

UCOR TRANSITION REPLACEMENT TERMINOLOGY TABLE	
UCOR (current) Organization Terminology	**New UCOR Organization Terminology**
UCOR an Amentum-led partnership with Jacobs	United Cleanup Oak Ridge LLC
URS | CH2M Oak Ridge LLC	United Cleanup Oak Ridge LLC
East TN Technology Park (ETTP) contract	Oak Ridge Reservation Cleanup contract (ORRCC)
Contract number: DE-SC-0004645	Contract number: 89303322DEM000067
Oak Ridge Reservation (ORR) Environmental Cleanup	ORRCC Site Integration & Cleanup
President and Project Manager	President and Chief Executive Officer (CEO)
Environmental Services	Environmental Services & Regulatory Management
Heritage Center Enterprise	Heritage Center Area Project
Field Characterization	Characterization Services
D&D Waste Integration	Waste Integration
Waste Management Enterprise	Waste Disposition
Nuclear Operations	ORNL Waste Operations
Waste Disposition and TRU Operations	ORNL TRU Operations
Shipping and Receiving	Shipping & Receiving/Logistics
Technical Services	Technical, Engineering, & Nuclear Safety
Nuclear Services	Technical Programs
Nuclear Safety	Nuclear and Criticality Safety
Mercury Projects	Mercury Projects & Technology Development
End State & Federal Land Reuse	Chief Program & Sustainability Office
Reindustrialization and Closure	Beneficial Reuse and End State Management
Diversity & Workforce Development Program	Equity, Environmental & Regulatory Programs
Project Services and Support	Project Integration & Business Services
Project Integration	Project Integration & Business Services
Project Mgmt and Integration Services	Enterprise Project Management

UCOR
an Amentum-led partnership with Jacobs

PERFORMANCE DOCUMENT COVER PAGE

NOTE: If the following document is printed, this cover page must be attached to the front and the required information filled in below.

Date Printed: _____

Dates Rev. No. Checked:

Document Number: _____ **Revision Number:** _____

Title: _____

Person Checking Revision Number: _____

The attached document was printed from the online Performance Document System. The user must check that the hard copy revision number matches the revision number of the controlled document in the online Performance Document System. For future use, confirm the revision number's accuracy online and record dates that the revision number was checked.

Section Below Completed by the Performance Document Group Only

Document Type: ☒ Administrative ☐ Technical Emergency
☐ Standard Practice ☐ Alarm Response

Required Review Date: 7/12/24 Date Required Review Completed: _____

Document Status: ☐ Maintain As Is ☐ Revise ☐ Delete

If "Maintain As Is," Next Required Review Date: _____

If "Revise" or "Delete," Due Date: _____

UCOR
an Amentum-led partnership with Jacobs

OWNER: Engineering	**PROC-DE-0704**	**REVISION: 5**
SUBJECT MATTER AREA: Calculations	**PREPARER: K. Oldfield**	**Page 1 of 16**
PROCEDURE TYPE: Administrative ☒ **Emergency** ☐ **Alarm Response** ☐	**CONCURRENCE/DATE: A. J. Reed 6/28/21 [Approval Signature on File]**	
TITLE: PROJECT CALCULATIONS	**APPROVED BY/DATE: Kraig Oldfield 6/28/21 [Approval Signature on File]**	
USQD ☒ **UCD** ☐ **CAT X** ☐ **EXEMPT** ☐	**EFFECTIVE DATE: 7/12/21**	
USQD/UCD/CAT X No: PSW-MS-PROCDE0704-1885	**REQUIRED REVIEW DATE: 7/12/24**	
Exhibit L Mandatory Contractor Procedure: No ☐ **Yes** ☒	**If an Interim Procedure, Expiration Date:**	

This document is approved for public release per review by:
Leesa Laymance 6/23/21
ETTP Classification & Information Control Office — Date

REVISION LOG

Revision	Effective Date	Description of Changes	Pages Affected
5	7/12/21	Intent change. Updated Appendix B to remove outdated software examples (IF-2021-0477).	16
4	2/20/20	Intent change. Total re-write. Includes new form, Form-3473, Calculation Checking and Verification Checklist.	All
3	6/20/16	Intent change. Revised Section B on alternate calculations and section G on computer calculations to align with NQA-1 requirements. This revision addresses corrective action PD-P2-01 from issue IF-2016-0416 and corrective actions 1 and 2 from management assessment MA-EN-16-003. Added clarifications to assumptions in Section A.	4, 5, 9, 11
2	11/9/15	Intent change. Added Nuclear Safety Review prior to calculation approval.	4, 5
1	3/2/15	Intent change due to triennial review. Updated procedure references, organization changes, clarified other details.	All
0	12/5/11	Initial release of this document number. This document replaces BJC-DE-0704 (Rev. 0), *Project Calculations*, and resolves I/CATS Action 36417.	All

PURPOSE

This procedure provides the method and format for preparing, checking, approving, revising, filing, and retaining project calculations.

SCOPE

This procedure applies to the generation of calculations by UCOR LLC (an Amentum-led partnership with Jacobs) and subcontractors for use by UCOR when so requested in the subcontract requirements. This procedure does not apply to calculations performed per other approved procedures (e.g., lift plans).

A calculation in this procedure is considered to be any type of technically required mathematical computation in which the results are used in a design, study, report, evaluation, or work activity that is performed or used by personnel working on UCOR projects.

Projects or specific subject matter areas may have further instructions on specific tasks contained in or implied by this procedure (e.g., PROC-NS-1005, *Nuclear Criticality Safety Evaluations and Calculations*, for calculations and/or validation of Nuclear Criticality Safety software).

Subcontractors should contact their Subcontract Coordinator/Subcontract Technical Representative for assistance in understanding or complying with this procedure.

OTHER DOCUMENTS NEEDED

- PROC-DE-1008, *Design Change Notices (DCNs), Engineering Instructions (EIs) and Equivalency Evaluations (EEs)*
- PROC-DE-1018, *Evaluation and Approval Process for Dedicating Commercial Grade Items and Services*
- PROC-IT-6008, *Application Lifecycle Management*
- PROC-OS-1004, *Document Numbering and Issuance*
- Form-136, Engineering Document Cover Page
- Form-3473, Calculation Checking & Verification Checklist

WHAT TO DO

A. Performing Simple Calculation

NOTE 1: Simple calculations are those that provide support to operations and are often provided via email correspondence.

NOTE 2: For Simple calculations, a calculation cover page does not exist. Written or email concurrence satisfies the requirements.

Originator

1. Simple calculation shall NOT be utilized for the following:

- In support of design per PROC-DE-1018, *Evaluation and Approval Process for Dedicating Commercial Grade Items and Services*.
- To determine the operability of Safety Class (SC)/Safety System (SS) structures, systems, and components (SSCs).
- When potential release to the environment is possible.
- To meet regulatory requirement/s.
- In situations where a formal record is needed to be maintained.

Originator

2. Formulas shall be established, standard, and recognizable.

3. Prepare the calculation in a manner that produces a legible, reproducible document of sufficient contrast.

4. Ensure calculations are orderly, complete, and are sufficiently detailed to permit verification if necessary.

5. Ensure the calculation includes, at a minimum, the following:

- A concise statement of the purpose for the calculation.
- All input data including source and source revision number/effective date, as applicable.
- Assumptions individually listed.
- Equations clearly stated.
- Identification of the units used.
- Clear results and conclusions.

6. Transmit the calculation to a peer checker who has sufficient qualifications to have originated the calculation.

NOTE: The Calculation Checking & Verification Checklist, Form-3473, is available to be used for checking purposes, but is not required for simple calculations.

Checker

7. Review the calculation for appropriate assumptions, inputs, method, completeness, and accuracy.

8. Return the calculation to the Originator with any comments.

Originator

9. Resolve any comments and transmit the calculation to the Project Engineer for approval.

Project Engineer

10. Review the calculation for completeness and ensure the criteria for a Simple Calculation is met.

11. Resolve any comments with the Originator.

NOTE: Simple calculations are informal and not required to be transmitted to the Document Management Center (DMC) as an official record.

Project Engineer

12. Indicate approval of the calculation and return to the Originator.

B. Embedded Calculations

NOTE: Calculations are often developed in support of Documented Safety Analysis, Fire Hazards Analysis and the Design Change Notice (DCN) or Engineering Instruction (EI) process. In certain instances, the calculation may be performed as part of the mother document and not as a Formal Calculation.

Originator

1. Calculations may be embedded in mother documents if the following criteria are met:

- Does NOT affect an SC/SS SSC.
- Not being used to support a Special Administrative Control or programmatic administrative control.
- Not used to meet regulatory requirement(s).
- Formulas are standard and recognizable.
- Does NOT contain unverified assumptions.

2. Prepare the calculation in a manner that produces a legible, reproducible document of sufficient contrast.

3. Ensure calculations are orderly, complete, and are sufficiently detailed to permit verification if necessary.

4. Ensure the calculation includes, at a minimum, the following:

- A concise statement of the purpose for the calculation.
- All input data including source and source revision number/effective date, as applicable.
- Assumptions individually listed and clearly stated with a basis.
- Numerical calculations shall include the identification of the units used.
- Concise statements addressing the calculation results, recommendations, limitations, and conclusions.

NOTE: After checking the calculation, approval of the mother document also approves the calculation. The calculation does not require separate approval.

Originator

5. Go to Section D, Calculation Checking.

C. Formal Calculation Preparation by UCOR Personnel

NOTE 1: Formal calculations are engineering calculations that are issued and controlled as stand-alone documents.

NOTE 2: Formal calculations are statused as either a Preliminary Calculation or a Committed Calculation.

NOTE 3: A Preliminary Calculation is a calculation that has open items.

NOTE 4: A Committed Calculation is a calculation that forms the basis for final safety analysis, drawings, specifications or other design or Safety Basis documents that are used to construct, modify, or operate a facility.

NOTE 5: The Vault software program is being implemented to electronically track calculations. Desktop Instruction for Vault are available to approved users. E-mail Helpline@orcc.doe.gov with questions regarding access and usage.

Project Engineer or designee

1. Assign an originator competent in the subject matter of the calculation.

Originator

2. Obtain a calculation number using the Document Number Request System.

3. Determine the calculation type: preliminary or committed (see Attachment A for definitions).

- For Preliminary Calculations, the revision identifier shall be an alpha character, with the initial issue being "Revision A."
- For Committed Calculations, the revision identifier shall be a numeric character, with the initial issue being "Revision 0."

4. Prepare the calculation(s) using Form-136, Engineering Document Cover Page.

a. Prepare the calculation in a manner that produces a legible, reproducible document of sufficient contrast.

b. Erase or line out errors completely and initial and date. The use of white-out or correction tape is not permitted.

c. Designate each page (including intentionally left blank pages) with the calculation number, revision number, and page number. In addition, attachments and addendums may be numbered separately.

5. Ensure calculations are orderly, complete, and are sufficiently detailed to permit verification if necessary.

Originator

6. Ensure the calculation includes, at a minimum, the following:

- A table of contents for complex calculations.
- A concise statement of the purpose for the calculation.
- A description of the methodology used to develop the calculation.
- All input data including source and source revision number/effective date, as applicable.
- Individually listed and clearly stated assumptions with a basis (note if the assumption is unverified).
- A list of references with their exact title and revision or version number, including process knowledge, drawings, codes, standards, and computer program used.
- Algorithms and code generated by the user in development of the calculation when computer software is used.
- Numerical calculations shall include the identification of the units used.
- Concise statements addressing the calculation results, recommendations, limitations, and conclusions.
- Reference to verification of computer programs as required by Section J of this procedure.

D. Calculation Checking

NOTE 1: Checking is required to be performed by someone besides the originator who is also qualified to have originated the calculation.

NOTE 2: This section is not applicable to Simple Calculations.

Originator

1. Submit calculation(s) to the Project Engineer to identify a checker.

Project Engineer or designee

2. Assign an individual (someone besides the originator) to be the checker for the calculation who has sufficient qualifications to have originated the calculation.

NOTE 1: Form-3473 is available to be used for checking purposes but is not required for all calculations.

NOTE 2: Form-3473 is required for all calculations that affect the safety basis.

Checker

3. Check the calculation by reviewing the following:

a. Technical accuracy, completeness, and procedural compliance, including logic of the calculation, adequate explanation of assumptions, and clarity of the conclusion. This includes:

- Performing mathematical checks.
- Reviewing correct use of technical inputs and quality requirements.
- Checking for appropriate methodology, computer programs, etc.
- Reviewing the reasonableness of the output with regards to the approach and methodology used.
- Performing an administrative check of the calculation, including page numbers, required content, etc.

b. **IF** the results from a referenced calculation are used as an input to a Committed Calculation, **THEN:**

- Ensure the referenced calculation is Committed, **OR**
- The Open Items from the referenced Preliminary Calculation do not affect the Committed Calculation being prepared.

4. Perform a line-by-line check of the calculation annotating each line as evidence of completeness of review.

5. **IF** using an alternate calculation method for comparison of results to the original calculation, **THEN:**

a. Attach alternate calculations used for checking to the original calculation.

b. In either documentation method, the alternate calculation shall be checked per Section D of this procedure.

c. Number each page independently of the calculation being checked, both the originator and checker sign the alternate calculation cover page and note on the cover page the original calculation being checked.

d. Verify the computer program is appropriate and has been authorized for use on the project.

6. **IF** multiple checkers are used on a calculation, **THEN**
the checkers shall identify which portions of the calculation they checked, e.g., initial individual calculation pages or identify on cover page.

Checker

7. Check computer calculations to ensure the computer programs meet the requirements of Section J.

NOTE: For calculations developed as part of a DCN or EI, checker signatures are performed as required per PROC-DE-1008, *Design Change Notices (DCNs), Engineering Instructions (EIs) and Equivalency Evaluations (EEs)*.

Checker

8. Sign the calculation cover page.

9. Return calculation to the originator with any comments.

Originator

10. Resolve the checker's comments.

E. Calculation Verification

NOTE 1: Calculation Verification is required for all calculations that support the Safety Basis.

NOTE 2: The Project Engineer can request Calculation Verification for any calculation.

NOTE 3: The methods for Calculation Verification consist of Verification By Testing, Verification by Alternate Calculations, and Verification by Document Review.

NOTE 4: Calculation Verification is generally performed by the Checker, however, the Project Engineer may assign an independent verifier if necessary.

1. Perform a verification of the calculation via one of the three methods described below.

Verifier

a. Performing Verification by Testing:

i. Develop an appropriate test of the calculation.

ii. Execute the test and evaluate the results to verify the calculation.

iii. Document the test and results as documentation of acceptable verification.

NOTE: Alternate calculations are calculations that are performed with alternate methods to verify correctness of the original calculation.

Verifier

b. Performing Verification by Alternate Calculation:

i. Perform an alternate calculation as an attachment to the original calculation.

ii. Request the alternate calculation be checked in accordance with Section D.

iii. Ensure the alternate calculation is signed by the preparer and the checker.

Verifier

c. Performing Verification by Document Review:

i. Complete the Calculation Verification Checklist section of Form-3473 for verification by document review.

ii. Attach Form-3473 to the calculation as documentation of an acceptable verification.

F. Calculation Approval

Originator / Subcontractor

1. Submit checked calculation(s) to the Project Engineer and to the Deployed Nuclear Safety Manager or designee.

NOTE 1: Nuclear Safety review of a calculation is not required with written waiver from the Chief Engineer or for Simple Calculations.

NOTE 2: For calculations performed as part of the DCN or EI process, Nuclear Safety is required to perform an Unreviewed Safety Question Determination (USQD)/Unreviewed Change Determination (UCD) Screen and concurrence with the Work Package that implements the DCN/EI.

NOTE 3: It is preferred that technical review and approval of calculations be tracked in Vault and electronic signatures be used. If inked signatures are used, then all signatures should be inked and a .pdf version of the approved calculation attached in Vault.

Project Engineer or designee

2. Review the calculation(s) to determine calculation completeness and conformance with design practice and procedure requirements.

3. Return calculation to the originator with any comments.

Deployed Nuclear Safety Manager or USQD preparer/ reviewer

4. Review Formal Calculation(s) for impact on the applicable facility Safety Basis documents.

5. Return any calculation review comments to the originator for disposition.

Originator / Subcontractor

6. Resolve the comments and return the calculation back through the checker and review cycle, as required.

NOTE 1: Nuclear Safety review and signature is not required for Simple Calculations.

NOTE 2: Nuclear Safety review and signature is performed as part of the Work Package approval process that implements the DCN/EI.

Deployed Nuclear Safety Manager or USQD preparer/ reviewer

7. For Formal Calculations, sign the “Nuclear Safety Review” block on Form-136.

Project Engineer or designee

8. Approve the calculation(s) and initial or sign and date the "Approver" block on Form-136.

9. Ensure Form-136 contains required signatures and printed names.

G. Management of Approved Formal Calculations

Project Engineer or designee

1. Issue the calculation in the Vault software program. Automatic notification will be sent to the DMC.

H. Calculation Preparation by Subcontractor

NOTE 1: The subcontractor may use either their calculation numbering syntax or may use a calculation number obtained in accordance with PROC-OS-1004, *Document Numbering and Issuance*.

NOTE 2: Typed or printed name of originator and checker is acceptable on Form-136, Engineering Document Cover Page, if signature or initials are included on the subcontractor's calculation cover page.

Subcontractor

1. Assign an originator and checker qualified to perform the calculation.

2. Prepare calculation following either the subcontractor's calculation procedure or this procedure.

3. Place the calculation number, revision, and page number on each page of the calculation.

4. Place approval signatures and printed name for the originator and checker on either Form-136 or a subcontractor cover page.

Subcontractor Approver

5. Approve calculation attesting to calculation completeness, accuracy, and conformance with design practice and procedure requirements, and that the calculation is adequate for submittal to UCOR.

UCOR Project Engineer or designee

6. Obtain a calculation number in accordance with PROC-OS-1004 and include on Form-136.

7. Attach Form-136 on top of subcontractor calculation cover page, when received.

8. Review, approve, and submit according to Sections C and D of this procedure noting that subcontractor approvals are on the subcontractor's cover page.

I. Revisions

NOTE 1: Revisions are prepared, checked, reviewed, and approved in the same manner as a new calculation with the addition of the steps included in this section of the procedure.

NOTE 2: The revision must be identified in one of the following ways:

- Revision bars or other graphical indication of changes in the calculation.
- An addendum with the changes and a description of changed content.
- The numbers of the pages that changed, a description of what changed, and replacement pages, to be included in the total package, for the pages that changed.

NOTE 3: Simple Calculations are not permitted to be revised.

Originator

1. Request the latest revision of the original calculation from the DMC.

2. Identify revisions to completed calculations as follows:

a. Draft calculations shall be given "letter" revision designators. Committed calculations shall be given "numeric" designators. When a draft calculation is converted to a committed calculation, the revision letter shall be changed to a number, starting with "0".

b. When graphically indicating changes, the change indicators from previous revisions shall be removed. Revised portions shall be identified (e.g., revision bars for text) adjacent to the revised portions. The letter or number designator for this revision shall be noted adjacent to the calculation number provided on each calculation page.

c. All calculation pages affected by the revision shall be identified in the Record of Revisions.

d. **IF** the original calculation cover page is not available to revise, **THEN** replace the previous revision signatures and dates with typed information.

e. Minor changes may be made on the original calculation pages by lining out, initialing, and dating the portion being revised. The revision bars (see Step I.2.b) shall be used. The use of white-out or correction tape is not permitted. The information from preceding revisions, except the revision bars, shall not be erased.

f. When a revision is made, the checker, reviewer, and approver are required to follow all the steps in this procedure for the revised portions of the calculation.

J. Computer Use in Calculations

NOTE: Software verification and validation is performed in accordance with PROC-IT-6008, *Application Lifecycle Management*.

Originator

1. **IF** using computer software for the calculation, **THEN** include the following in the calculation package:

- Inputs and outputs.
- Algorithms and code revealing functions/formulae created by the Originator or Checker.
- Identification of software packages by name.
- Documentation as to whether each software package used is either registered in the Official Application Database or has been determined to be exempt based on the criteria given in PROC-IT-6008, Attachment B, and Attachment B of this procedure.
- Version/release for all software packages employed.
- DOE serial number, type of computer, and operating system used.
- Options used, if the program permits multiple options. If default options are used, a justification should be stated.
- Basis supporting application of the computer program to the specific physical problem.

2. **WHEN** a front-end validation program is used, **THEN** include a statement confirming that this method was employed and was successful.

3. **WHEN** test problems are used, **THEN** include a description of the problems, the results obtained, and a statement regarding their acceptability.

4. **WHEN** a spreadsheet is used to perform calculations, **THEN** check the equations for computations performed within the spreadsheet.

RECORDS

All approved calculations and revisions will be managed in accordance with the requirements of PROC-OS-1001, *Records Management, Including Document Control*.

SOURCE DOCUMENTS

- None.

Attachment A
Definitions/Acronyms
Page 1 of 2

Alternate Calculation – A calculation prepared independent of the parent calculation by alternate methods to verify correctness of the parent calculation. An alternate calculation is prepared during the checking process, typically by the parent calculation checker.

Approver – Reviews the calculation to determine calculation completeness, accuracy, and conformance with design practices and procedure requirements. Once satisfied with the calculation, approves it for the company. Typically, the approver is the Project Engineer; however, the Project Engineer may designate someone else to perform the review prior to their approval.

Checker/Verifier – An individual different from the originator who is qualified to have originated the calculation who performs a check of the calculation for technical accuracy. This may be performed by a review of the original calculation or by performing an alternate calculation.

Committed Calculations – Calculations that form the basis of drawings, specifications, or other design documents used to procure, construct, or operate a facility, or provide the design basis for change to an existing facility. Committed Calculations have verifiable assumptions and inputs.

DMC – Document Management Center

Embedded Calculations – Formal calculations embedded within a mother document (e.g., Design Change Notice, Engineering Instruction, Documented Safety Analysis, or Fire Hazards Analysis).

Formal Calculation – Calculations that use physical and/or chemical relationships and/or inputs that are chosen based on judgements of authors. Calculations are not based solely on observable properties.

Open Items – Are those items that affect the results of a calculation and require resolution prior to the calculation becoming Committed. Open Items are only pertinent to inputs and assumptions. Programmatic activities that are required to complete a task that a calculation is supporting do not constitute an open item.

Originator – An individual qualified based on education, training, and/or experience within a particular discipline to perform original analysis, computations, and draw conclusions concerning an engineering problem.

Preliminary Calculations – Calculations which contain inputs and/or assumptions that are not verifiable at the time of calculation preparation (open items). A Preliminary calculation undergoes revision as open items are closed. A Preliminary calculation eventually becomes a Committed calculation prior to use.

Preliminary calculations may form the basis for preliminary design work of other engineering groups or for issue of drawings or specifications for construction or procurement when only preliminary data are available (e.g., data supplied on similar equipment manufactured for other projects, designer's or supplier's knowledge of similar systems). Such calculations must be revised to assume the status of "committed calculations" when confirmed data are available.

Design and analysis work performed based on preliminary calculations must be reviewed and revised as necessary if the results of committed calculations differ from the preliminary results.

Attachment A
Definitions/Acronyms
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Project Engineer – A person appointed by the UCOR Engineering Manager to be responsible for the technical aspects of a project or operations and for providing review and approval authority for their project or operations. The UCOR Engineering Manager and/or Project Engineer Designee (for example, a subject matter expert or other technically qualified person) may serve the Project Engineer role for approval of calculations.

Simple Calculation – Calculations that include finite, observable inputs and produce simple results of fact (e.g., area, volume, distance, unit conversion). Simple Calculations are intended to enable using arithmetical operations that are routine and do not utilize complex relationships or author selected values.

Superseded Calculations – Calculations voided by general revision, change of criteria, or any other reason.

Attachment B
Guidance of Computer Use
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If an engineering calculation employs software for which there exists documented approval (as applicable) in the Official Application Database including an accurately completed and approved copy of the applicable forms required by Attachment D of PROC-IT-6008, *Application Lifecycle Management*, then the calculation must also meet all requirements for checking described herein.

CAUTION REGARDING SOFTWARE USE IN ENGINEERING CALCULATIONS

Users of software should adhere to the principles of numerical analysis and be especially wary of:

a. round-off errors that arise because it is impossible to represent all base-10 real numbers exactly;

b. numbers that closely approach zero, infinity, or use very large absolute value of an exponent;

c. truncation errors that are committed when an iterative method is terminated or a mathematical procedure is approximated, and the approximate solution differs from the exact solution;

d. discretization error that arises because the solution of the discrete problem does not coincide with the solution of the continuous problem;

e. boundary condition input error that results in large error in output;

f. inappropriate method for elimination of singularities created in FEM models;

g. ill-conditioning error so that a small error in the data will grow to be a large error in results due to numeric instability;

h. sampling error for describing systems whose outputs are inherently stochastic. A stochastic variable is a variable that varies randomly to some extent, and whose behavior can be analyzed and described statistically but not predicted precisely;

i. insufficient sampling (number of model runs) for Monte-Carlo based simulations to support the level of statistical confidence stated for the results;

j. finite element mesh is too course (increasing piecewise approximation error) or too fine (resulting in excessive execution time to be of practical use);

k. mesh refinement technique results in excess time to convergence;

l. iterative solver errors arise from permitting iteration with binary repeaters (such as iteration by decimal number 0.1) or choice of iterative quantity resulting in instability that might not be detected because proprietary methods do not provide iteration stopping criteria;

m. using weight for mass and other units confusion;

n. using constant values or means for variable parameters;

o. noisy data errors arise from exceedance of the maximum rate through the channel that collected the electronic data;

p. wrong definition of material or unrealistic assumption of material homogeneity;

q. inadequate constraints lead to singularity;

r. misapplication of algorithms or dividing by very small quantities;

s. storage precision size is inadequate for mesh refinement resolution near boundaries;

t. stack overflow or underflow resulting from lack of arbitrary precision storage capability of the software employed.

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Guidance on Computer Use
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SOFTWARE SUBJECT TO SOFTWARE QUALITY ASSURANCE (SQA)

All software used in UCOR-issued Engineering Calculations is subject to the SQA process except as exempted above. Many of the calculations performed by UCOR support Safety Management Programs for Category 2 or 3 Nuclear Facilities and fall into the Category B-C per PROC-IT-6008. Safety Management Programs (SMPs) are described in detail in DSA-MS-SMP-0017/R5, "Safety Management Program Descriptions for URS | CH2M Oak Ridge LLC." UCOR Engineering Calculations often support an SMP that provides adequate protection of workers or the public from nuclear facility hazards (note that this does not mean "nuclear" hazards per se and also refers to "nuclear facility" hazards which may be chemical, electrical, mechanical, etc. in nature—nuclear "facility" hazards are not limited to neutron-induced hazards). SMP supporting software is Category B-C software at a minimum.