

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

QUALITY ASSURANCE AUDIT PLAN

FOR AUDIT YM-ARP-95-16

OF

**THE CIVILIAN RADIOACTIVE WASTE MANAGEMENT SYSTEM
MANAGEMENT AND OPERATING CONTRACTOR**

LAS VEGAS, NEVADA

JULY 24 THROUGH 28, 1995

Prepared by: Stephen R. Maslar Date: 6/7/95
Stephen R. Maslar
Audit Team Leader
Yucca Mountain Quality Assurance Division

Approved by: Donald G. Horton Date: 6/8/95
Donald G. Horton
Director
Office of Quality Assurance

1.0 SCOPE

This performance based audit of the Civilian Radioactive Waste Management System Management and Operating (CRWMS/M&O) Contractor will be conducted by a team of auditors from Yucca Mountain Quality Assurance Division (YMQAD). The audit team will evaluate the effectiveness of Waste Package Design process, and the quality of the activities identified in Section 4.0 of this plan. The scope of the audit will not include Technical Data Management (Work Breakdown Structure [WBS] 1.2.5.3) since the Waste Package Design effort is presently in the conceptual design stage.

2.0 AUDIT SCHEDULE

Pre-audit Team/Observer Meeting	8:00 a.m., July 24, 1995 Las Vegas, Nevada
Pre-audit Conference	9:00 a.m., July 24, 1995 Las Vegas, Nevada
Audit Activities	10:00 a.m. to 4:00 p.m. July 24, 1995
	8:00 a.m. to 4:00 p.m. July 25 through 27, 1995
	8:00 a.m. to 11:30 a.m. July 28, 1995
Post-audit conference	1:00 p.m., July 28, 1995 Las Vegas, Nevada

An Audit Team/Observer meeting will be held at 4:00 p.m. daily to review audit progress. Beginning Tuesday, July 25, 1995, there will also be a daily Audit Team Leader (ATL) Observer/CRWMS/ M&O management meeting at 8:15 a.m. to communicate audit progress, to discuss potential deficiencies and establish needed liaison.

3.0 REQUIREMENTS TO BE AUDITED AND APPLICABLE REFERENCES

The requirements to be audited will be contained in programmatic and performance based checklists. These checklists will be developed from the latest available revision of CRWMS/ M&O's approved, issued and applicable QA Program procedures, study plans, technical procedures, project planning and control system project planning sheets, and the performance objectives established and agreed upon with CRWMS/M&O management.

The conduct of the audit will be in accordance with the documents (latest revision) listed below:

- Quality Assurance Procedure (QAP) 18.2, "Audit Program"
- AP 16.1Q, "Performance/Deficiency Reporting"
- AP 16.2Q, "Corrective Action and Stop Work"

4.0 ACTIVITIES TO BE AUDITED

A performance based audit evaluates products and activities to determine the degree to which they meet program requirements and management commitments and expectations. This evaluation of WBS 1.2.2.1 and WBS 1.2.2.2, Waste Package Design process effectiveness and product acceptability will be based upon flowchart elements:

- Design Input Control
- Design Process
- Design Analyses
- Design Verification
- Design Interface Control
- QA Controls for Waste Package Design Activities

The associated "Objectives," and "Measurement Criteria," for the evaluation can be found in Table 1, Audit Flowchart.

5.0 AUDIT TEAM MEMBERS

Stephen R. Maslar, YMQAD, Las Vegas, Nevada, ATL
John R. Matras, YMQAD, Las Vegas, Nevada, ATL in training
Marc J. Meyer, Headquarters Quality Assurance Division, Washington, D.C., Auditor

6.0 AUDIT CHECKLIST

The following checklist will be used during the audit:

YM-ARP-95-16, Performance Based Checklist

**OCRWM AUDIT YM-ARP-16
 PERFORMANCE BASED AUDIT FLOWCHART**

AUDIT SCOPE: M&O Waste Package Design Process
END PRODUCT: Waste Package Design Documents that meet the QARD requirements

FLOWCHART ELEMENT	OBJECTIVE	MEASUREMENT CRITERIA
Waste Package Design Input Control	Design Inputs are identified, documented, specified, and approved and that changes are controlled.	QAP 3.5, "Development of Technical Documents."
Waste Package Design Process	Design work is: prescribed and documented; design documents are adequate; appropriate standards are approved including changes; and design documents contain sufficient detail.	Technical Document Preparation Plan and QAP 3.5, "Development of Technical Documents." Use of trained and qualified personnel per QAP 2-1, "Indoctrination and Training."
Waste Package Design Analyses	Design analyses are planned, controlled, and documented.	QAP 3.9, "Design Analysis."
Waste Package Design Verification	Design verifications or reviews are documented and are performed.	QAP 3.1, "Technical Document and Milestones Review."
Waste Package Design Interface Control	Design interfaces are identified and coordinated; responsibilities are assigned, and transfer of information is controlled and documented.	QAP 3.12, "Transmittal of Design Input." QAP 17-1, "Record Source Responsibilities for Inclusionary Records."
Identifying QA Controls for Waste Package Design	Document the applicable controls for QA work	QAP 2.0, "Control of Activities."

TABLE 1

AUDIT FLOWCHART

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QUALITY ASSURANCE CHECKLIST

ORGANIZATION EVALUATED CRWMS M&O	<input checked="" type="checkbox"/> EXTERNAL <input type="checkbox"/> INTERNAL	<input checked="" type="checkbox"/> AUDIT <input type="checkbox"/> SURVEILLANCE	<p style="text-align: center;"><i>S. R. Maslar</i></p> PREPARED BY <u>Stephen R. Maslar</u> DATE <u>7/11/95</u>
DATES OF EVALUATION July 24-28, 1995			

CONTROLLING DOCUMENT (Title, Number, Revision)	ACTIVITY EVALUATED
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ITEM NO.	CHARACTERISTICS TO BE EVALUATED	REMARKS Record objective evidence reviewed, method of verification, personnel contacted	RESULTS
1-1	DESIGN INPUT CONTROL QAP-3-5, Revision 5, P01, "Development of Technical Documents" Have sources of input been identified in a manner that would permit retrieval from a library or an OCRWM records center? Would it be possible to determine where within a multi-volume source document or computerized database the cited information could be found?		
1-2	Is the status of input identified? Are preliminary assumptions requiring re-evaluation at a later date identified? Has unqualified data been identified as such?		

* INDICATE RESULTS: SATISFACTORY (SAT), UNSATISFACTORY (UNSAT), NOT APPLICABLE (N/A)

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ITEM NO.	CHARACTERISTICS TO BE EVALUATED	REMARKS Record objective evidence reviewed, method of verification, personnel contacted	RESULTS
1-3	Are cited sources of design input being retained as QA records? Are they readily available for use during technical document reviews and design verification?		
1-4	Where input is based on unqualified data or preliminary assumptions, has a plan of action been established for upgrading or replacing the input? If so, is it being implemented?		

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ITEM NO.	CHARACTERISTICS TO BE EVALUATED	REMARKS Record objective evidence reviewed, method of verification, personnel contacted	RESULTS
1-5	Where OCRWM documents have been cited as sources of input, is the specific data being used unqualified? If so, has it been identified as such by the user?		
1-6	How are personnel made aware of changes to referenced sources of design input, both OCRWM-generated design inputs and external design inputs? Does an on-line database exist that personnel can access in order to determine whether a cited OCRWM source of input has been revised?		

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ITEM NO.	CHARACTERISTICS TO BE EVALUATED	REMARKS Record objective evidence reviewed, method of verification, personnel contacted	* RESULTS
2-1	<p>DESIGN PROCESS QAP-3-5, Revision 5, P01, "Development of Technical Documents"</p> <p>Do TDPPs cover the full range of documents being prepared? Do they cover documents not subject to QARD requirements and documents (such as analyses) normally not covered by TDPPs?</p>		
2-2	<p>When a TDPP covers more than one document, are requirements for each document in sufficient detail and with sufficient clarity? Does the TDPP consider the need for corresponding differences in personnel qualifications (document preparers and reviewers), review criteria, etc?</p>		

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ITEM NO.	CHARACTERISTICS TO BE EVALUATED	REMARKS Record objective evidence reviewed, method of verification, personnel contacted	* RESULTS
2-3	Are design schedules and work scopes in TDPPs in agreement with each other? Is the sequence in which documents are being developed logical, orderly, and sensitive to the need for qualified and approved sources of design input?		
2-4	Are applicable industry codes and standards being referenced in design documents? Are personnel sufficiently familiar with reference codes and standards such that specific exceptions and amplifications are being included in design documents, when appropriate?		

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ITEM NO.	CHARACTERISTICS TO BE EVALUATED	REMARKS Record objective evidence reviewed, method of verification, personnel contacted	RESULTS
2-5	What has been the role of M&O management in planning and overseeing the design process? Has management identified the need for a readiness review, peer review, or other special review at any point in the waste package design process?		
2-6	Do personnel have enough time to research and create a quality document prior to its issuance for formal review? Based on interviews and informal comments, how much technical input is collected from interfacing organizations prior to versus during document reviews?		

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ITEM NO.	CHARACTERISTICS TO BE EVALUATED	REMARKS Record objective evidence reviewed, method of verification, personnel contacted	RESULTS
3-1	<p>DESIGN ANALYSES ANALYSIS OF DEGRADATION DUE TO WATER AND GASES IN MPC, ID BB0000000-01717-0200-00005, Revision 00</p> <p>Examine Multi-Purpose Canister (MPC) Subsystem Design Procurement Specification to confirm text in section 5.1.1.7.1.A and C.</p>		
3-2	<p>Does some requirement in a regulatory document dictate the specifications in the MPC Specification? If so, what document?</p>		

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ITEM NO.	CHARACTERISTICS TO BE EVALUATED	REMARKS Record objective evidence reviewed, method of verification, personnel contacted	RESULTS
3-3	Confirm the cited vapor pressure of water at 295K. This will involve the calculations used for the linear interpolation, including the formula used. (Para. 4.1.2)		
3-4	Confirm the interpolation for enthalpy of vaporization for water. (Para. 4.1.2)		

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ITEM NO.	CHARACTERISTICS TO BE EVALUATED	REMARKS Record objective evidence reviewed, method of verification, personnel contacted	RESULTS
3-5	Confirm some of the dimensions cited for the MPC (ref. 5.11). (Para. 4.1.2)		
3-6	Confirm some of the dimensions cited for the fuel (ref. 6.2). (Para. 4.1.2)		

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3-7	The volume of 4.555m ³ is here characterized as non-QA. What is the justification for using this value later, e.g., in section 7.1, pp. 12-13 and elsewhere. (Para. 4.3.1)		
3-8	The calculation of the upper limit on volume assumes that the interior of the canister is a right circular cylinder. Confirm this is the case by examining documentation for the design. (Para. 4.3.1)		

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3-9	Why was 152 kPa chosen, rather than, for example, 150 kPa? What is the justification for using a non-QA value? (Para. 4.3.2)		
3-10	Was PNL-6365 prepared under an accepted QA plan? (Para. 4.3.2)		

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3-11	What pressure is viewed as excessive? How was this determined? (Para. 4.3.2)		
3-12	Observe the extraction of the data for the mass ratio from the data base. Confirm the results listed in section 4.1.2. What is the QA status of the data? (Para. 6.1)		

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3-13	How much water may have become trapped inside fuel rods that have suffered pin-hole leaks? Might not this be sufficient to invalidate the test? (Para. 7.1)		
3-14	Why is dry air, as contrasted with exclusively water vapor, conservative? (Para. 7.3)		

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ITEM NO.	CHARACTERISTICS TO BE EVALUATED	REMARKS Record objective evidence reviewed, method of verification, personnel contacted	RESULTS
3-15	Why is the O ₂ in dry air added to that in water vapor as the sole component of the gas? The gas cannot simultaneously be both. (Para. 7.3)		
3-16	The estimation of the vapor pressure of the nitric acid-water azeotrope uses compositions that differ substantially from the actual composition of the azeotrope. Discuss magnitude of possible error. (Para. 7.4)		

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3-17	Whereas the maximum vapor pressures for water and nitric acid appear to be less than required for condensation of the azeotrope, vapor pressures can be very significantly lowered in small crevices and cracks. Essentially this is a capillary effect. Has this been taken into account? In other words, is it unreasonable that crevice corrosion could be initiated by condensation of the azeotrope into tiny cracks? (Para. 7.4)		

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ITEM NO.	CHARACTERISTICS TO BE EVALUATED	REMARKS Record objective evidence reviewed, method of verification, personnel contacted	RESULTS
4-1	<p>DESIGN ANALYSES REPORT ON PRELIMINARY SELECTION OF WASTE PACKAGE MATERIALS, DOCUMENT ID BB000000-01717-5705-00007, Revision 00</p> <p>This document appears to be largely a summary of conclusions drawn in other documents. What new decisions were drawn in this document?</p>		
4-2	<p>What criteria were used in making these decisions?</p>		
4-3	<p>Were these decisions made by the preparer alone, or did they result from group consultations?</p>		

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5-1	<p>DESIGN ANALYSES INITIAL WASTE PACKAGE PROBABILITY ANALYSIS: MULTI-PURPOSE CANISTER WITH DISPOSAL CONTAINER (TBV-060-WPD), DOCUMENT ID B00000000-01717-2200-00080, Revision 00 and UNCANISTERED FUEL (TBV 059-WPD), DOCUMENT ID B0000000Q-01717-2200-00079, Revision 00</p> <p>The text states that only two basic scenarios could lead to a criticality event. Does the document cited (NUREG-1327) provide the rationale for this conclusion? If not, where may it be found. (Para. 7.2 [pg 14 2nd Para. under event sequence])</p>		
5-2	<p>Could not a ceiling collapse also provide a new pathway from a conductive fracture to a waste package? (Para. 7.2 [pg. 15, 1st Para. under failure modes])</p>		

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5-3	These failure modes consider only infiltrating water. On the other hand water already present (in pores or hydrous minerals), or added as a component of cementitious materials, will be redistributed as a consequence of the thermal pulse. Will scenarios for these sources of water be considered? (Para. 7.2)		
5-4	What is the basis for the conservative estimate for leach rates for the boron absorber? (Para. 7.4.1)		

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5-5	Are equations 6 and 7 generally accepted by the engineering/scientific community? If not, what efforts have been or will be made to demonstrate their reliability? (Para. 7.4.3)		
5-6	Examine the calculations underlying the results shown in Fig. 7.7. (Para. 7.4.3 [pg. 29 top])		

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5-7	How has it been, or can it be, shown that the Weibull distribution provides reliable results when extrapolated to times far beyond the data base upon which it is based? (Para. 7.4.3 pg 29)		
5-8	The Weibull parameters for the Pdf for corrosion breach of the MPC shell appear to be based upon only two to five data points. This seems far too few to produce reliable predictions. These would, therefore, seem to require verification. How will this be done? (Para. 7.4.3.2, pg. 33)		

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ITEM NO.	CHARACTERISTICS TO BE EVALUATED	REMARKS Record objective evidence reviewed, method of verification, personnel contacted	RESULTS
5-9	The entire discussion appears to assume uniform corrosion of the baskets. Is this more conservative than non-uniform dissolution, and, if so, why? (Para. 7.4.3.3 pg. 34)		

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ITEM NO.	CHARACTERISTICS TO BE EVALUATED	REMARKS Record objective evidence reviewed, method of verification, personnel contacted	* RESULTS
6-1	ENSURE THAT DESIGN ANALYSES ARE PLANNED, CONTROLLED, AND DOCUMENTED QAP-3-9, Revision 5, "Design Analysis" Ensure that each design analysis has a unique document identifier. (Para. 5.1.3)		
6-2	Ensure that the design analysis is prepared per Attachment 1 of QAP-3-9.		
6-3	Ensure that the design analysis is legible and suitable for reproduction, filing, and retrieval. (Para. 5.1.3)		

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ITEM NO.	CHARACTERISTICS TO BE EVALUATED	REMARKS Record objective evidence reviewed, method of verification, personnel contacted	RESULTS
6-4	Ensure that the design analysis has a cover sheet per Attachment II of QAP-3-9.		
6-5	Ensure that the design analysis includes a revision record per Attachment IV of QAP-3-9.		
6-6	Ensure that each sheet of the design analysis is sequentially numbered. (Para. 5.1.3)		

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6-7	Ensure that attachments are properly identified. (Para. 5.1.3)		
6-8	Ensure that a design analysis review summary is included per Attachment VI of QAP-3-9.		

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6-9	Ensure that the lead design engineer determines the need for interdiscipline reviews. (Para. 5.3.1)		
6-10	If interdiscipline reviews are required, ensure that the following actions have been completed. (Para. 5.3) - Reviewer documented all comments. - Originator resolved comments. - Reviewer backchecked to insure all comments were resolved. - Signatures are contained on Attachment VI of QAP-3-9.		

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6-11	If interdiscipline reviews are not required, ensure that justification is provided in Block 13 - Attachment VI of QAP-3-9.		
6-12	Ensure that the department manager evaluated the design analysis for any required external reviews. (Para. 5.4.1)		

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ITEM NO.	CHARACTERISTICS TO BE EVALUATED	REMARKS Record objective evidence reviewed, method of verification, personnel contacted	RESULTS
6-13	If external reviews were required, then ensure that they were performed properly. (Para. 5.4.1)		
6-14	If external reviews were not required, ensure that justification is provided in Block 13 - Attachment VI of QAP-3-9.		

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6-15	Ensure that the lead design engineer concurred with the design analysis. (Para. 5.6)		
6-16	Ensure that all required signatures are contained on the design analysis cover sheet. (Attachment II to QAP-3-9)		
6-17	Ensure that all required signatures are contained on the design review summary sheet. (Attachment VI to QAP-3-9)		

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6-18	Ensure that the lead design engineer sends the final approved design analysis to: <ul style="list-style-type: none"> - DCC for distribution. (Para. 5.8.2) - Records Center. (Para. 5.8.2) 		
6-19	Ensure that design analysis revisions are properly made, reviewed, and approved. (Para. 5.9)		
6-20	Ensure that the following lifetime records exist: <ul style="list-style-type: none"> - Final design analysis - including cover sheet and revision record. - Design analysis review summary. (Para. 6.0) 		

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7-1	DESIGN VERIFICATION QAP-3-1, Revision 5, "Technical Document & Milestone Review" Are reviewers being given enough time to evaluate the technical adequacy of documents? Is allotted time commensurate with the document's importance, complexity, and length?		
7-2	Do reviewers have ready access to design inputs and other background information, and are they referring to these sources of information during reviews? Is a technical library or document center available with current copies of design documents?		

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7-3	Is management provided with a summary of major review comments and involved in resolving selected comments? Has management looked for a trend in review comments that would indicate a decline or improvement in the quality of design documents, procedures, or training?		
7-4	Is there a uniform understanding of review criteria? For example, what do reviewers think is required of them to answer the question, "Were the inputs correctly selected and incorporated?" and what do responsible managers expect from reviewers?		

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7-5	Are additional review criteria being developed when appropriate or are standard review criteria being relied upon almost exclusively? Are reviewers being instructed to ignore standard review criteria that are not applicable?		
7-6	How often are reviews performed by someone other than the assigned reviewer? Is this delegation with management's knowledge and concurrence, and do the actual reviewers have qualification comparable to the assigned reviewer?		

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7-7	Based on interviews and review comments, are reviews thorough and meaningful? Are comments being incorporated where appropriate?		

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8-1	ENSURE PROPER TRANSFER AND CONTROL OF DESIGN INPUT QAP-3-12, Revision 5, "Transmittal of Design Input" Ensure that requests for design input data are proper. (Para. 5.2)		
8-2	Ensure that transmittal of design input data to the requester is proper. (Para. 5.3A)		
8-3	Ensure that a design input data transmittal form is used for transmitting data. (Para. 5.3B)		

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8-4	Ensure that recipient acknowledges receipt of the design input data. (Para. 5.4.1)		
8-5	Ensure follow-up by responsible manager if receipt of data is not acknowledged. (Para. 5.4.2)		
8-6	Ensure that revisions to previously transmitted design input data are sent to recipients of the initial data. (Para. 5.5)		

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8-7	Ensure that appropriate lifetime QA records are maintained as follows: (Para. 6.1) - Design input data transmitted - Design input data		

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9-1	<p>QA CONTROLS FOR WASTE PACKAGE DESIGN ACTIVITIES QAP-2-0, Revision 2, "Control of Activities"</p> <p>Were Activity Evaluation Forms completed prior to beginning waste package activities? If not, what interim controls were implemented, and were they adequate?</p>		
9-2	<p>Does Part I of Activity Evaluation Forms adequately describe ongoing waste package design activities? Were all pertinent design products identified and was the level of detail sufficient to permit determining their relative importance and appropriate controls?</p>		

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9-3	Does the rationale provided in Parts II & III of Activity Evaluations Forms support designated controls? Has the M&O re-evaluated original rationale in response to CAR-HQ-94-015, and what were its conclusions?		
9-4	Are identified controls reasonable considering the importance and potential use of technical products resulting from waste package design activities? Are controls consistent with those recommended, if any, in classification analyses?		

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9-5	Are personnel aware of and implementing controls in Activity Evaluation Forms? Do controls in TDPPs agree with and support those in Activity Evaluation Forms?		
10-1	Verify that QA records generated to support milestones in waste package design are created, protected, authenticated, and submitted to the Records Processing Center. Per QAP 17.1.		

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11-1	Verify the personnel working on waste package design have been adequately trained to perform the work. Per QAP 2-1.		