CLASSIFICATION OFFICE INFORMATION REVIEW REQUEST

TITLE: Refurbishment and Reauthorization of the ATMX Railcar: Review of Safety Assessment

CHARGE NO.: R00039

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PRINCIPAL CONTACT FOR QUESTIONS: William Franz

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March 1, 2000

Mr. Bill Franz
Los Alamos Technical Associates, Inc.
C/o U. S. Department of Energy
1 Mound Road, Building 61
Miamisburg, OH 45343-3030

Reference: Purchase Order 2000-00566

Subject: Final Report, "Refurbishment and Reauthorization of the ATMX Railcar: Review of Safety Assessment," Revision 1

Dear Mr. Franz:

Attached are four copies of our report entitled, "Refurbishment and Reauthorization of the ATMX Railcar: Review of Safety Assessment," Revision 1. This report is submitted in accordance with our Statement of Work issued under Purchase Order 2000-00566.

We appreciate this opportunity to work with you on this project. If you have any questions or need any additional information, please call me at 505-880-3404.

Sincerely,

Frank Hand

Frank Hand
Principal Engineer

LATA

Refurbishment and Reauthorization of the ATMX Railcar: Review of Safety Assessment

Contract: DE-AC24-970H20044

Submitted to:

BWXT of Ohio, Inc.
1 Mound Road
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Submitted by:

Los Alamos Technical Associates, Inc.
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Revision 1, March 1, 2000

Signature Page

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Prepared by: ______________________ 3/1/00
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Contents

Refurbishment and Reauthorization of the ATMX Railcar: Review of Safety Assessment

1. Introduction

1.1 Purpose

Los Alamos Technical Associates, Inc. (LATA) was tasked by BWXT of Ohio to review the existing ATMX Railcar Containment System Safety Assessment (Ref 1). The Safety Assessment was issued in 1989 and has not been updated. LATA was to review the Safety Assessment and compare it to current references and to current methodologies to determine if its conclusions remain defensible.

1.2 Background

The 1989 report "presents a safety assessment of the ATMX-600 Series railcar system used for transporting transuranic (TRU) waste" (Ref 1). The 1989 report superseded the original 1974 ATMX safety analysis report and its 1977 and 1985 revisions. The objective of the 1989 report was "to demonstrate the level of compliance with U.S. Department of Transportation (DOT) requirements…" (Ref 1). The 1989 report was used as the technical basis to request and to obtain a DOT exemption that would allow the ATMX railcar system to be used.

The U.S. Department of Energy (DOE) has requested a renewal of this exemption. Once again, it is intended to use the 1989 report as the technical basis for the exemption. The 1989 report along with LATA's review of the report will form the technical basis for the exemption request.

1.3 Report Organization

The report is organized as follows. Section 2 describes the review methodology used and presents the five specific questions listed in the Statement of Work. Section 3 presents the results of the review. Section 4 presents the overall conclusions and recommendations.

2. Review Methodology

2.1 Scope of Review

LATA was instructed to review the ATMX Safety Assessment (Ref 1) and compare it to current references and current methodologies to determine if its conclusions remain defensible. In essence LATA was ask to review the Safety Assessment and determine if the information was (1) still timely or (2) out of date and needed to be revised. Specifically LATA was to determine, as stated in the Statement of Work,

1. Are the results of the Safety Assessment still sufficiently accurate to be used in an engineering assessment?

2. If comparison standards have changed, what is the material effect, if any, on the conclusions of the comparison?

3. If there are substantial questions of accuracy or validity of comparison, what action should be taken?

4. Are the fatigue and brittle fracture assessments still accurate? Particularly, is the critical crack size correct?

5. If cracks are observed during inspection, what repairs may be undertaken?

2.2 Methodology

The Safety Assessment scope was divided between four reviewers – a structural engineer, a metallurgist, a nuclear engineer, and a risk engineer. Each reviewer was responsible for his assigned sections and any other sections where applicable information was located.

The review of each section was conducted along the following general lines.

1. The section was reviewed for general content within the context of the overall Safety Assessment.

2. The references cited in each section were reviewed, as needed, to determine if the data, methods, or information were still valid or current.

3. The analysis and evaluation methods used were reviewed to determine if they (1) were still valid or (2) had been replaced by other techniques.

4. Computer codes were reviewed to determine if they were still valid. In many cases the computer codes which were used have been replaced with newer, enhanced, and more user friendly codes. However, review focus was to determine if (1) the analytical techniques used in the now out-of-date codes were still valid and (2) the computer results were sufficiently accurate that a new computer analysis is not required.

5. Where changes have occurred, these changes were evaluated to determine the impact on the overall analysis or evaluation conclusions. In many cases regulatory limits have changed but the ATMX analysis results are below both the old and new regulatory values such that there is no impact on the conclusions.

2.3 Review Documentation

Changes identified during the review process were documented using a "Requirement Change Evaluation Sheet." This form identifies (1) the specific item that is changed, (2) the location of this item by text section and page number, (3) the old and new numerical values, if applicable, and references for both the old and new values, (4) an assessment of the impact of the change, (5) the impact category (defined below), and (6) the reviewer.

Each change was evaluated and placed into one of four impact categories. The four categories are:

1. No impact or beneficial impact. This category is typically used when a regulatory limit has been "increased" and the actual ATMX values are "below" both the old and the new values. The regulatory changes, therefore, has no impact on the overall analysis result and no further action is required.

2. Adverse impact without significant material effect. This category is typically used when a regulatory limit has been "decreased" and the actual ATMX values are "below" both the old and new values. The regulatory change, therefore, has no impact on the overall result and no further action is required.

3. Adverse impact with significant material effect. This category is typically used when a regulatory limit has been "decreased" and the actual ATMX values are "above" the new value, changing the overall analysis result. Further action may be required.

4. Unknown impact or impact can not be determined. This category is typically used when a regulatory limit has been changed but the full impact can not be determined from the available information. In this case, a solution must be identified so the impact can be determined.

2.4 Documents Reviewed

The following documents were reviewed.

Mound-supplied documents:

1. ATMX Railcar Containment System Safety Assessment (Ref 1)
2. ATMX Railcar Containment System Safety Assessment: Engineering and Consequence Analysis (Ref 2)
3. Technical Manual, MD 10463, Waste Management Quality Plan (Ref 3)
4. Department of Transportation exemption DOT-E 5848 (Ref 4)
5. DOT Letter, Hedgepeth to Provencher, January 20, 2000 (Ref 5)

Other documents:

6. Technical references cited in the Safety Assessment
7. Various CFRs
8. Various NUREGs
9. Various ASTM standards

3. Review Results

3.1 General

LATA was to review the Safety Assessment and compare it to current references and to current methodologies to determine if its conclusions remain defensible. Also, LATA was to specifically answer the five questions stated in the Statement of Work. The results of this review are presented in this section. Changes identified during the review process were documented using a "Requirement Change Evaluation Sheet." These detail review comments are presented in Appendix A. The significant review comments are summarized in Section 3.2. The answers to the five questions are presented in Section 3.3.

3.2 Review Comments

LATA's review identified and evaluated 22 changes. The identified changes are listed in Table 1. These changes are grouped, according to the safety assessment section headings, and discussed in summary form below. The detailed review comments are presented in Appendix A. A two-digit sequence number is assigned to each identified change – the first number is the applicable safety assessment section; the second digit is simply a sequential number.

Table 1. Changes Identified in the Safety Assessment Review

Seq #	Topic	Item Description	Impact Category	Needed Action
31	Waste Characteristics	Waste acceptance criteria (WAC)	No impact	None
32	Waste Characteristics	Particulate limit	Unknown	Review new waste with high particulates procedures
33	Waste Characteristics	Hazardous materials	No impact	None
34	Waste Characteristics	Quality assurance program for waste packages	No impact	None
41	Accident Scenarios	Train accident rate	No impact	None
51	Structural Analysis	ANSYS finite element analysis code	No impact	None
52	Fatigue Evaluation	Member section properties	Unknown	Review underlying calculations and printouts
53	Brittle Fracture Analysis	KQ vs KId values	No impact	None
54	Brittle Fracture Analysis	Stress intensity factor KId value	No impact	None
55	Brittle Fracture Analysis	Critical crack depth determination	No impact	None
56	Brittle Fracture Analysis	Change in ASTM E 399 standard test method	No impact	None
71	Source Term	Pu/Am A2 values	No impact	None
72	Source Term	Escape fraction from impair railcar, Scenario 2	Adverse w/o significant effect	None
73	Source Term	Source Term comparison to NRC reactor risk analyses	No impact	None
81	Consequence Analysis	Economic consequences given in 1988 dollars	No impact	None
82	Consequence Analysis	Population based on 1980 census data	No impact	None
83	Consequence Analysis	GENII dispersion analysis computer code	No impact	None
84	Consequence Analysis	EPA Mean Contamination Level (MCL)	Unknown	Clarification is needed.
91	Criticality Analysis	Criticality evaluation reporting format	Unknown	Unknown
92	Criticality Analysis	Double contingency principle	Unknown	Unknown
93	Criticality Analysis	Peer review	Unknown	Unknown
94	Criticality Analysis	KENO code version	No impact	None

Waste Characteristics

Four changes were identified; all deal with the waste acceptance criteria. The safety assessment waste acceptance criteria is based on the WIPP waste acceptance criteria in effect in 1989. This document has been revised.

Item 31 – Waste acceptance criteria: The WIPP waste acceptance criteria has changed; the current version is Revision 7, dated 11-8-99. Since Mound intends to use the ATMX railcars to ship to sites other than WIPP, waste criteria for shipment in the ATMX railcars should be defined based on the safety assessment not the new and often changing WIPP waste acceptance criteria. It is recommended that (1) a set of waste acceptance criteria be established for the ATMX railcar that is based on all the applicable parameters used in the safety assessment and (2) these criteria be compared to the waste acceptance criteria for each receiving site to which Mound waste will be shipped. If any discrepancies are noted, further analysis may be required before shipments can be made.

Item 32 – Particulate limit: The WIPP waste acceptance criteria has changed; the particulate limit has been removed. This increase in particulates for new waste may impact the source term evaluation presented in Section 7 depending upon the methods used at Mound to solidify or stabilize new waste with high particulates.

Item 33 – Hazardous materials: The safety assessment does not specifically address hazardous materials in the waste packages. Hazardous material limits are identified in the new WIPP waste acceptance criteria. Since 1989 there has been an increased awareness of hazardous materials and the regulations controlling these materials have increased. Mound must comply with all hazard material regulations in the packaging and labeling of waste and in it shipment. Compliance with these hazardous material regulations will not impact the safety assessment conclusions.

Item 34 – Quality assurance program for waste packages: The quality assurance plan in effect in 1989 has been replaced. This change will not have a significant impact on the overall conclusions of the safety assessment because of the broad waste characteristics envelope used in the various accident scenarios.

Accident Scenarios

Item 41 – Train accident rate: The accident rate used is based on 1987 data. More current 1995 data indicates a slightly lower rate. Since this is an actual accident rate, year-to-year variations should be expected. This change does not impact the safety assessment conclusions.

Structural Analysis

Item 51 – ANSYS finite element analysis code: The version of the ANSYS code used in the structural analysis is out of date. Newer and improved codes are available. However, the underlying finite element principles have not changed and the overall understanding of the structural response will not change.

Fatigue Evaluation

Item 52 – Member section properties: Some of the calculated member properties shown in Figures 3, 4, and 5 are incorrect. If the member section property data in the figure were used in the analysis, then the structural analysis results are incorrect, the magnitude of the error is unknown at this time, and the fatigue analysis is incorrect. If the data in the figures were for illustration purposes only and incorrectly represent the value used in the analysis, then the "real values" used in the analysis are correct, the structural analysis results are correct, and the fatigue analysis is correct. From the data available for review, it is impossible to determine which condition is correct. However, any potential error in the structural analysis and resulting fatigue analysis would need to reduce the fatigue life to approximately 1% of the presently projected value in order to have a significant impact. Such a reduction appears most unlikely.

Brittle Fracture

The safety assessment brittle fracture evaluation presentation is somewhat confusing due to (1) inconsistent numerical values being used in the safety assessment and in its supporting analysis and (2) failure to always clearly identify which parameters values apply to the different steels used in the undercarriage and the superstructure.

Item 53 – K_Q versus K_{Id} values: The test data presented in Table 5.10 are labeled using the dynamic stress-intensity factor, K_{Id}. A review of the available data and comparison with other tabulated data from a parallel study (PE-N50132, part of Ref 2) of ATMX-600 railcar materials, suggests that the data of Table 5.10 should be labeled as K_Q values. The association of K_Q values with the dynamic stress-intensity factor, K_{Id} allows estimating the critical crack size for brittle fracture failures. The confusion between K_Q and K_{Id} labeling of the test results does not change the conclusions reached in the Section 5.3 of the safety assessment for undercarriage and superstructure steel materials.

Item 54 – Stress-intensity factor value: A stress-intensity factor value of 39 ksi $\sqrt{\text{in}}$. is adopted as representative of the fracture toughness test data over the range of testing temperatures from -40° to 74° F.

Item 55 - Critical crack depth determination: The safety assessment value of critical crack size as 0.32-in. is adopted for the undercarriage cast steel, determined for a maximum dynamic stress of 35 ksi and using the stress-intensity factor value of 39 ksi $\sqrt{\text{in}}$. A critical crack size of 0.32-in. may be conservatively adopted as best estimate for the A7 superstructure steel, based upon a qualified review of the limited test data presented in Reference PE-N50132 (part of Ref 2). Fracturing at weldments is not specifically addressed in the safety assessment and weld failure is viewed as becoming potentially more significant as the railcars age. The assessment reaffirms the need for an inspection and repair program for the railcars including weld inspection.

Item 56 – Change in ASTM E 399 standard test method: The ASTM E 399 standard test method used in the ATMX-600 series railcar materials mechanical properties test program in 1989 has been changed and updated. The current version is ASTM E 399-90(1997): Standard Test

Method for Plain-Strain Fracture Toughness of Metallic Materials. The changes in the standard do not have an effect on the validity of the fracture toughness data acquired under the now obsolete standard.

Source Term

Item 71 – Pu/Am A2 values: All of the A2 values used in the safety assessment for Pu and Am have changed. All of the Pu values increased which means the regulation is more relaxed. This has a beneficial impact on the safety assessment conclusions. Only the Am-241 value decreased, but because Am-241 content is negligible, it has no impact on the safety assessment conclusions.

Item 72 – Escape fraction from impaired railcar, Scenario 2: The escape fraction from an impaired railcar for Scenario 2 is given as both 0.9 and 0.1. There is no impact for these inconsistencies because (1) the actual airborne release quantities are still small and (2) Scenario 2 is not the controlling case.

Item 73 – Source term comparison to NRC reactor risk analyses: The NUREG-1150 approach and the safety assessment approach are similar. Both approaches have at least three barriers between the radioactive source and its release to the environment.

Consequence Analysis

Item 81 – Economic consequences given in 1989 dollars: The costs numbers presented are in 1989 dollars. These could be adjusted to 2000 dollars. However, the change in dollar amounts would not alter the safety assessment conclusions.

Item 82 – Population based on 1980 census data: The population information is based on 1980 census data. These figures could be updated but would not change the overall conclusions.

Item 83 – GENII dispersion analysis computer code: GENII 1.485 is the latest version. There are no significant changes in terms of physics between the earlier versions of GENII and GENII 1.485. The original analysis results are still valid.

Item 84 – EPA Mean Contamination Level (MCL): The MCL values reported in the safety assessment are significantly different than the value reported in 40 CFR parts 141&142. The impact is unclear based on the information provided in the safety assessment.

Criticality Analysis

Item 91 – Criticality evaluation reporting format: DOE-STD-3007-93 standardizes criticality evaluations throughout the DOE complex. Compliance with this standard is important; however, compliance would not change the criticality analysis conclusions.

Item 92 – Double contingency principle: The safety assessment did not discuss the double contingency principle, which is required by today's DOE guidelines. This is an important principle and should be addressed. However, compliance would not change the criticality analysis conclusions.

Item 93 – Peer review: An assurance to criticality evaluation is peer review. It is a DOE requirement. There is no indication that the safety assessment was peer reviewed. This is an important principle and should be addressed. However, compliance would not change the criticality analysis conclusions.

Item 94 – Keno code version: There are no significant physics modeling differences between the latest version of the KENO code and the version used in the safety assessment. The original analysis results are still valid.

3.3 Answers to the Five Questions

The answers to the five questions are given below.

Question 1: Are the results of the Safety Assessment still sufficiently accurate to be used in an engineering assessment?

Yes, but two cases require explanation. These cases are:

1. Item 52 – Fatigue Evaluation – Member section properties – which deals with the possible error in the area calculation for the members. A review of the supporting calculations may eliminate this potential error. However, any potential error in the area calculations would need to reduce the fatigue life to approximately 1% of the presently projected value in order to have a significant impact. Such a reduction appears most unlikely. Therefore, no fatigue life problem with the railcars is projected.

2. Item 84 – Consequence Analysis – EPA Mean Contamination Level (MCL) – which deals with the use of footnote C in calculating a MCL of 44 ρCi/l for Pu-238 and the lowering of the EPA standard from 40 ρCi/l to 15 ρCi/l. The methodology used for estimating a MCL for Pu-238 is rendered less important because the EPA standard has changed. The calculated concentration of Pu-238 of 18.3 ρCi/l exceeds the current EPA drinking water standard of 15 ρCi/l. However, the calculated dose to a theoretical individual as a result of the postulated accident does not change, and the overall conclusion of the consequence analysis remains valid.

Question 2: If comparison standards have changed, what is the material effect, if any, on the conclusions of the comparison?

Only two regulatory changes impact the safety assessment conclusions. These cases are:

1. Item 84 – Consequence Analysis – EPA Mean Contamination Level (MCL) discussed above.

2. Item 32 – Waste Characteristics – Particulate limit – where Mound may need to review how new waste with high particulate content is processed, should any be generated.

Question 3: If there are substantial questions of accuracy or validity of comparison, what action should be taken?

The needed actions are identified in Table 1. These actions are also discussed in Appendix A. There are only two cases where needed actions are required. These actions are for Item 52 – Fatigue Evaluation – Member section properties and Item 84 – Consequence Analysis – EPA Mean Contamination Level (MCL) and are discussed above.

In addition, there are five cases where recommended actions may be taken. These cases are:

1. Item 31 – Waste Characteristics – Waste acceptance criteria – where it is suggested that Mound develop an ATMX railcar waste acceptance criteria.

2. Item 32 – Waste Characteristics – Particulate limit – which is discussed above.

3. Item 91 – Criticality Analysis – Criticality evaluation reporting format – where it may be prudent for Mound to address this issue.

4. Item 92 – Criticality Analysis – Double contingency principle – where it may be prudent for Mound to address this issue.

5. Item 93 – Criticality Analysis – Peer review – where it may be prudent for Mound to address this issue.

Question 4: Are the fatigue and brittle assessments still accurate? Particularly, is the critical crack size correct?

Yes, both the fatigue and brittle fracture assessments are still accurate. The critical crack size is 0.32-in. as originally stated in the safety assessment.

Question 5: If cracks are observed during inspection, what repairs may be undertaken?

It is recommended that an inspection and repair program be part of the scheduled refurbishment of the ATMX railcars. Only the undercarriage and superstructure are addressed here. The inspection should include welds using the following guidance:

1. After receipt and disassembly, conduct a cursory visual inspection of the interior and exterior regions of the undercarriage and superstructure for identifiable or suspect defects and weld cracking.

2. Note, map, and otherwise document suspected defects, defects, cracked or broken welds, and defective areas as needed for later reevaluation after the railcar has been stripped and sandblasted for repainting.

Railcar weldments include intermittent and continuous welds throughout the outside and inside surfaces of the body of the car and its structural elements.

1. Visually inspect all weldments over the inside and outside surfaces and structural elements of the undercarriage and superstructure of the railcars.

2. Repair all visibly cracked and broken welds.

Weldment repair should include all visible cracks found in intermittent and continuous welds. Visible cracks in welds are to include crack sizes down to 0.062-in (1/16-in). The guidance on repair for intermittent welds will differ from that for continuous welds. [Note: The specification of a critical crack size of 0.32-in obtained from the safety analysis is used as reference only. This reference says that the railcar can be operated until free surface cracks in the frame (or superstructure) attain this critical size. The 0.32-in critical crack size is not intended to be used as an visual inspection requirement for the major refurbishment.]

<u>Intermittent welds</u>:

1. Visual cracks in intermittent welds should be tested for dye penetration to determine the extent of cracking.

2. Visual cracks in intermittent welds may be repaired by removing (1) the crack to past the crack root or (2) the entire weld and replacing the removed portion(s) by new weld material overlaying.

<u>Continuous welds</u>:

1. Visual cracks in continuous welds should be tested for dye penetration to determine the extent of cracking.

2. Repair continuous welds by removing the cracked weld material to beyond the crack root and replacing the removed portion(s) by new weld material overlaying.

4. Conclusions and Recommendations

LATA has reviewed the ATMX railcar safety assessment. Based on this review it is concluded that:

1. The overall results and conclusions presented in the ATMX safety assessment are still current and sufficiently accurate to be used in an engineering assessment. The issues addressed in Section 3.3 should be noted but do not change the overall conclusion.

2. The overall results and conclusions in the ATMX safety assessment are defensible and may form the basis for an exemption request to continue authorized used of the railcars.

Based on this review it is recommended that:

1. A set of waste acceptance criteria be developed for the ATMX railcar (see Item 31).

2. The new criticality requirements identified in Items 91, 92 and 93 be addressed by Mound.

3. The impact of particulate limit change be addressed for new waste (see Item 32).

4. A weld inspection and repair program be included in the scheduled refurbishment of the ATMX railcars.

5. References

1. Lombardi, E. F. and F. E. Adcock, *ATMX Railcar Containment System Safety Assessment*, RFE-8901, Rockwell International, Rocky Flats Plant, Golden, CO, March 1989.

2. Lombardi, E. F. et al., *ATMX Railcar Containment System Safety Assessment: Engineering and Consequence Analyses*, RFE-8902, Rockwell International, Rocky Flats Plant, Golden, CO, April 1989.

3. Technical Manual, *Waste Management Quality Plan*, MD 10463, Issue 3, November 1, 1999.

4. Department of Transportation, Exemption DOT-E 5948, Rev 9.

5. Hedgepeth, J. Suzanne, letter to Richard B. Provencher, January 20, 2000.

6. AAR Manual 1001, *Manual of Standards and Recommended Practices*, Section C, Part II, Vol. 1, Chapter VII – Fatigue Design of New Freight Cars, Revision 6/1/1988, American Association of Railroads, Washington, DC, 1999.

Appendix A

Requirement Change Evaluation Sheets

Requirement Change Evaluation Sheet

Seq #: 31 By: DJO Date: 2-11-00

SA Section: 3.4.2 Topic: Waste Characteristics

SA Page: 3.12 Subtopic: Waste criteria

Item Description: Waste acceptance criteria (WAC)

Old Value: WIPP WAC Old Ref: WIPP-DOE-069

New Value: WIPP WAC New Ref: WIPP-DOE-069- Revision 7, 11/8/99

Assessment: Recent changes in the WIPP Program have resulted in several changes to the Waste Acceptance Criteria (WAC) and the DOE Program that certifies each waste generator. These new criteria and certification requirements present a significant challenge to any waste generator intent on shipping to WIPP. Since Mound intends to use the ATMX railcars to ship to sites other than WIPP, waste criteria for shipment in the ATMX railcars should be defined based on the safety assessment, not the new and often changing WIPP WAC.

It is recommended that:

(1) A set of waste acceptance criteria be established for the ATMX railcar that is based on all the applicable parameters used in the safety assessment (RFE-8901).
(2) These criteria be compared to the WAC for each receiving site to which Mound waste will be shipped. If any discrepancies are noted, further analysis may be required before shipments can be made.

In establishing the ATMX criteria, care must be taken to separate those criteria dealing specifically with the waste drums and boxes from those dealing with the railcar itself. The development and use of these ATMX criteria will not impact the overall conclusions of the safety assessment because these ATMX criteria will reflect the actual criteria used in the safety assessment.

Classification: None or beneficial

NeededAction: Develop ATMX railcar waste acceptance criteria

Requirement Change Evaluation Sheet

Seq #: 32 | By: FRH | Date: 2-16-00

SA Section: 3.4.2 | Topic: Waste Characteristics

SA Page: 3.12 | Subtopic: Waste criteria

Item Description: Particulate limit

Old Value: <1 wt % | Old Ref: WIPP-DOE-069, 1989 (Ref 3.19)

New Value: no limit | New Ref: WIPP-DOE-069, Revision 7, 11-8-99

Assessment: The safety assessment waste criteria are based on the 1989 version of the WIPP WAC. These waste acceptance criteria have changed; the latest version is Revision 7, dated 11-8-99. One significant change in Revision 7 is the removal of the limit on allowable particulates. This increase in particulates for new waste may impact the source term evaluation presented in Section 7 depending upon the methods used at Mound to solidify or stabilize new waste with high particulates.

Classification: Unknown or can not be determined

NeededAction: Review new waste with high particulates procedures

Requirement Change Evaluation Sheet

Seq #: 33

By: DLL Date: 2-17-00

SA Section: 7 Topic: Source Term Analysis

SA Page: Subtopic: Hazardous materials

Item Description: Hazardous material limits

Old Value: Old Ref: None

New Value: New Ref: WIPP-DOE-069- Revision 7, 11/8/99

Assessment: The safety assessment does not specifically address hazardous materials in the waste packages. Hazardous material limits are identified in the new WIPP WAC. Since 1989 there has been an increased awareness of hazardous materials and the regulations controlling these materials have increased. Mound must comply with all hazard material regulations in the packaging and labeling of waste and in its shipment. Compliance with these hazardous material regulations will not impact the safety assessment conclusions.

Classification: None or beneficial

NeededAction: None

Requirement Change Evaluation Sheet

Seq #:	34	By:	FRH	Date:	2-15-00

SA Section: 3.4 Topic: Waste Characteristics

SA Page: 3.10 Subtopic: Quality assurance

Item Description: Quality assurance program for waste packages

Old Value: QA program Old Ref: 3.16, 3.17 & 3.18

New Value: QA program New Ref: Technical Manual, MD-10463, Issue 3, Waste Management Quality Plan, 11/22/99

Assessment: The Quality Assurance Program in place in 1989 is described in the Safety Assessment. This quality assurance program has changed. The new program is given in Technical Manual, MD-10463, Issue 3, Waste Management Quality Plan, dated 11-22-99. These quality assurance changes will impact waste characterization efforts associated with the individual waste packages and their handling. However, these changes will not have a significant impact on the overall conclusions of the safety assessment because of the broad waste characteristics envelope used in the various accident scenarios. Also, the intent of any quality assurance plan is to assure that the correct information is accurately gathered by properly trained and qualified personnel.

Classification: None or beneficial

NeededAction: None

Requirement Change Evaluation Sheet

Seq #: 41 By: FRH Date: 2-15-00

SA Section: 4.4.3 Topic: Accident Scenarios

SA Page: 4.18 Subtopic: Accident probability

Item Description: Train accident rate

Old Value: 4.55 x 10^-6 / mile Old Ref: 4.7

New Value: 3.91 x 10^-6 / mile New Ref: "Enhancing Rail Safety Now and into the 21st Century: The Federal Railroad Administration's Safety Programs and Initiatives," US DOT, Federal Railroad Administration, Report to Congress, Oct 1996

Assessment: The safety assessment used a national train accident rate of 4.55 per million train miles. This value is based on 1987 Federal Railroad Administration (FRA) data. More recent 1995 FRA data gives the rate as 3.91 per million train miles. Since this is an actual accident rate, the value should be expected to vary from year to year. This change in accident rate will neither significantly alter the accident probabilities calculated using the earlier value nor have a significant impact on the overall conclusions regarding accidents or accident scenarios.

Classification: None or beneficial

NeededAction: None

Requirement Change Evaluation Sheet

Seq #: 51

By: FRH Date: 2-9-00

SA Section: 5.1.2 Topic: Structural Analysis

SA Page: 5.9 Subtopic: Finite element analysis

Item Description: ANSYS finite element analysis code

Old Value: ANSYS Old Ref: 5.2

New Value: not specified New Ref: not specified

Assessment: The finite element code used in the structural analysis is the ANSYS code, version 4.3. This code is dated June 1987. Newer and improved codes (both Ansys and other codes) are available which could be used to perform this analysis involving both material and geometric nonlinearities. In addition, other codes specifically designed to solve the impact crushing problem exist. The use of these newer codes would simplify the analysis effort, improve the accuracy of the results, and yield a better understanding of the structural performance in the crushed zones. However, the underlying finite element principles have not changed, only the capabilities of the codes have changed. The overall understanding of the structural response, while known in greater detail, will not change.

Classification: None or beneficial

NeededAction: None

Requirement Change Evaluation Sheet

Seq #:	52			By:	FRH	Date:	2-11-00
SA Section:	Fatigue Analysis Rpt	Topic:	Fatigue Evaluation				
SA Page:	9	Subtopic:	Member section properties				
Item Description:	Member section properties						
Old Value:	Figs 3, 4 & 5	Old Ref:	SAIC Fatigue Analysis Report, part of RFE-8902				
New Value:		New Ref:					

Assessment:

Example element sections are shown in Figures 3, 4 & 5 on pages 9, 10 & 11, respectively. Calculated member properties are shown in each figure. The calculated areas were checked for all three element sections. The area given for Figure 3 checked; the areas given for Figures 4 and 5 did not agree. Several formatting inconsistencies are present in the three figures. The purpose of these figures and their data is unknown. Stoller Corporation performed the accident scenario structural analyses. SAIC performed the fatigue analysis. SAIC used member stress data in the fatigue analysis from another finite element structural analysis. It is not clear whether Stoller or SAIC performed this later analysis. Two possible conclusions may be drawn .

(1) If the member section property data in the figures were used in the analysis, then the structural analysis results are incorrect, the magnitude of the error is unknown at this time, and the fatigue analysis is incorrect.

(2) If the data in the figures were for illustration purposes only and incorrectly represent the value used in the analysis, then the "real values" used in the analysis are correct, the structural analysis results are correct, and the fatigue analysis is correct.

From the data in hand and available for review, it is impossible to determine which condition is correct. It is recommended that the underlying calculations and computer analysis printouts be checked to confirm what member section properties were actually used. Based on these findings, a final solution may be determined.

Even if case 1 is correct, the overall impact may not be severe. The projected fatigue life is 26,000,000 miles, well above the AAR limit of 1,000,000 miles. The actual car mileages are below 250,000 miles. Thus, any potential error in the structural analysis and resulting fatigue analysis would need to reduce the fatigue life to approximately 1% of the presently projected value. Such a reduction appears most unlikely.

Classification: Unknown or can not be determined

NeededAction: Review underlying calculations and printouts

Requirement Change Evaluation Sheet

Seq #: 53 By: SLS Date: 02-11-00

SA Section: 5.3 Topic: Brittle Fracture Analysis

SA Page: 5.59, 5.60 Subtopic: ATMX Fracture Data

Item Description: KQ vrs Kld values

Old Value: Table 5.10 Old Ref: 5.13, 5.14, 5.15

New Value: New Ref: PE-N50132, Raske, T. D., Apr 89

Assessment: Table 5.10 presents a summary of the results of a number of rapid-load fracture toughness tests conducted on metallurgical samples taken from the undercarriage and superstructure materials of an out-of-service ATMX railcar. The test data are labeled in the table using the stress-intensity factor, Kld.

In the text of Section 5.3.4, containing Table 5.10, the experimental data are identified as KQ [the ASTM E399 conditional stress-intensity factor] values. The discussion in the text becomes confusing regarding the representation of KQ data as Kld values with no explanation provided to clarify why Kld is used in Table 5.10 in place of KQ in representing the experimental data. Reference 5.13, from which the safety assessment data were obtained, was unavailable for this review and a check of the representation of the data could not be performed. KQ is correctly identified in the text, however, as representative of the dynamic fracture toughness behavior Kld.

The KQ test data presented in Table 3 of Report PE-N50132 (D. T. Raske, Packer Engineering, Inc., "Brittle Fracture Analysis of the ATMX-600 Series Railcar," Apr 1989) have a remarkable similarity to the data represented as Kld values in Table 5.10 at each of the test temperatures. Thus, the Table 5.10 data in the safety assessment are likely, more correctly identified as KQ values.

The association of KQ values with Kld allows estimating the critical crack size which is useful in providing guidance for evaluating the fracture resistance of ATMX railcar materials under postulated accident conditions and in establishing inspection requirements.

The confusion in KQ versus Kld designation in Table 5.10 does not change the conclusions reached in Section 5.3.

Classification: None or beneficial

NeededAction: None

Requirement Change Evaluation Sheet

Seq #: 54 | By: SLS | Date: 02-14-00

SA Section: 5.3 | Topic: Brttile Fracture Analysis

SA Page: 5.59, 5.60 | Subtopic: ATMX Test Results

Item Description: Stress-intensity factor value

Old Value: 39 ksi sqrt(in) | Old Ref: 5.13, 5.14

New Value: | New Ref:

Assessment: The safety assessment reports a stress-intensity factor value of 39 ksi sqrt(in) as representative of the test data from rapid-load fracture tests conducted on ATMX-600 series railcar metallurgical samples over a range in testing temperatures from a -40 to 74 F. The PE-N50132 report presents a nominal stress-intensity factor value of 40 ksi sqrt(in) for smaller set of test data obtained on other ATMX-600 series railcar metallurgical samples conducted over a range in testing temperatures from a -40 to 74 F. These values for Kld are essentially the same, owing to the uncertainties associated with the evaluation of a limited set of test data at each test temperatures, and the safety assessment stress intensity factor value of 39 ksi sqrt(in) is adopted as representative of the test data over the range of testing temperatures from -40 to 74 F.

Classification: None or beneficial

NeededAction: None

Requirement Change Evaluation Sheet

Seq #: 55 | By: SLS | Date: 02-15-00

SA Section: 5.3 | Topic: Brittle Fracture Analysis

SA Page: 5.61 | Subtopic: Critical Crack Size

Item Description: Critical crack depth determination

Old Value: 0.32-in | Old Ref: Safety Analysis report RFE-8901 Mar 1989

New Value: | New Ref:

Assessment: The critical crack depth for the ATMX-600 series railcar undercarriage material [AAR specification M-201 cast steel in the unannealed condition (Grade A)] is established in the safety assessment as 0.32-in for a maximum dynamic stress of 35 ksi. Report PE-N50132 (T. D. Raske, Packer Engineering, Inc. Apr 1989) reports a value of 0.33-in for the critical crack size for a maximum dynamic stress of 35 ksi.

The difference between the two values is due to the use of differing values of the stress intensity factor KId (determined from separate, limited sets of test data) in the equation expressing the relationship between allowable normal stress to failure and the allowable crack size. The safety assessment adopts a nominal KId value of 39 ksi sqrt(in) from test data and the PE-N50132 report establishes a nominal KId value of 40 ksi sqrt(in) from other test data; a result supporting the SA determined KId value but differing slightly. The 39 ksi sqrt(in) value is viewed as representative of test data over the range of testing temperatures from -40 to 74 F. The safety assessment value of critical crack size (0.32-in), determined using a KId value of 39 ksi sqrt(in) and maximum dynamic stress value of 35 ksi, is slightly more conservative than the PE-N50132 value and is adopted as representative best estimate for all the ATMX test data.

No critical crack size analysis appears to have been performed in the safety assessment for the ASTM specification (obsolete) A7 low carbon structural steel for the superstructure. An inference on brittle fracture behavior may be made by a comparison between the yield strengths of the undercarriage cast steel and the superstructure A7 material. The yield strengths of the cast steel (Y = 30 ksi) and A7 steel (Y = 33 ksi) are established in the safety assessment (References 5.3, 5.4, & 5.5, page 5.62) report. These yield data suggest that the A7 steel has a nominally equal or slightly greater potential resistance to failure. A qualified review of the A7 steel rapid-load fracture toughness test data, reported in PE-N50132, indicates a slightly greater potential to resist failure by the A7 steel test data at 0 F than the cast steel. With no other test data available for review, it appears that the A7 brittle failure behavior is conservatively similar, but slightly better than that of the undercarriage cast steel behavior for nominally the same temperature range. In light of the above discussion, it is reasonable to adopt 0.32-in as a conservative best estimate of the A7 steel brittle fracture behavior critical crack size.

Critical crack depth in weldments is not specifically addressed in the safety assessment and through-weld cracking is viewed as becoming potentially more significant as the railcars age, particularly along the superstructure outer and inner framing and at intermittent structural weldments located within the containment. 0.32-in cracks in welds would be readily detectable unaided visually and likely extend through the throat of some welds. Weldment inspection over the entire undercarriage and superstructure of the ATMX-600 series railcars is recommended.

The safety assessment reports the implementation of an inspection and repair program for the ATMX railcars' undercarriage and superstructure to detect and repair flaws. This assessment reaffirms the continuance of this inspection and repair program and should further include weld inspection, if not already an active part of this program, to assure the ongoing maintenance of the railcar integrity.

Classification: None or beneficial

NeededAction: None

Requirement Change Evaluation Sheet

Seq #: 56 By: SLS Date: 02-17-00

SA Section: 5.3 Topic: Brittle Fracture Analysis

SA Page: Subtopic: Fracture Toughness Testing Standard

Item Description: Standards update

Old Value: Old Ref: ASTM E 399

New Value: New Ref: ASTM 399 - 90 (1997)

Assessment: The ASTM standard E399 in effect at the time of the 1989 safety assessment was updated in 1990 and reapproved in 1997. The editorial changes and reorganization of material presented in the updated version (1990) of the standard do not have an effect on the validity of the fracture toughness data acquired using the now obsolete standard. No editorial changes were made in the 1997 reapproval.

Classification: None or beneficial

NeededAction: None

Requirement Change Evaluation Sheet

Seq #: 71 By: DLL Date: 2-8-00

SA Section: 3.2.1 Topic: Source Term

SA Page: 3.6 & 3.7 Subtopic: Release fraction

Item Description: Pu/Am A2 values

Old Value: See below Old Ref: 3.8

New Value: See below New Ref: 10CFR71, Appendix A (6/6/96)

Assessment: NRC regulations allow the release of a quantity not exceeding an A2 value of radioactivity from a containment system after being subjected to the prescribed accident conditions. Many of the A2 values cited in the safety assessment have changed. The A2 values used in the safety assessment (original value) and the currently specified NRC value (new value) are listed below.

ISOTOPES	Original Value	New Value
Pu-238	0.003	0.00541
Pu-239	0.002	0.00541
Pu-240	0.002	0.00541
Pu-241	0.1	0.270
Pu-242	0.003	0.00541
Am-241	0.008	0.00541

Generally, the "new values" are higher than the "original values" which means the regulation is more relaxed. Only the Am-241 value is lower, but because Am-241 content is neglectable, it has no impact on the outcome.

Using the "new values," the A2 value for the weapon grade Pu mixture (see Safety Assessment section 3.2.2) is now calculated to be 0.0311 which is higher than the original value of 0.012 calculated in the safety assessment using the "original values." Similar results may be obtained for the heat source Pu mixture. In the analyses which deal with weapon grade Pu and heat source Pu mixtures (with the same composition as given in the safety assessment), the new A2 values should have no adverse impact on the conclusions drawn from these analyses.

Classification: None or beneficial

NeededAction: None

Requirement Change Evaluation Sheet

Seq #: 72 By: DLL Date: 2-14-00

SA Section: 7.23 Topic: Source Term

SA Page: 7.16 Subtopic: Release fraction

Item Description: Escape fraction from impaired railcar, Scenario 2

Old Value: 0.9 Old Ref: SA Section #7 of RFE-8901

New Value: 0.1 New Ref: RFE-8902, "Source Term" section

Assessment: There are two discrepancies in the escape fraction from an impaired railcar in Scenario 2. The escape fraction is given as both 0.9 and 0.1.

First, Section 7.2.3 text (bottom page 7.16) gives the Scenario 2 escape fraction as 0.9 based on a discussion of the accident involving a JP-4 fire with "convective gas flow competing with aerosol deposition."

Second, Table 7.4 (page 7.17) summarizes the escape factors for the best estimate model. Table 7.4 lists the Scenario 2 escape fraction from railcar as 0.1 not 0.9.

Third, the Source Term Analysis in RFE-8902 also presents a table summary of escape factors (see Table 5.7). This Table 5.7 is identical to Table 7.4 of RFE-8901 and lists the Scenario 2 escape fraction from railcar as 0.1.

There is no impact for these inconsistencies because (1) the actual airborne release qualities are still small and (2) Scenario 2 is not the controlling case. Clarification may be needed, but revision may not be required.

Classification: Adverse w/o significant effect

NeededAction: None

Requirement Change Evaluation Sheet

Seq #: 73 | By: DLL | Date: 2-8-00

SA Section: 7 | Topic: Source Term Evaluation

SA Page: 7.1-7.22 | Subtopic: Risk analysis

Item Description: Source Term comparison to NRC reactor risk analyses

Old Value: See below | Old Ref: Ref 7.1, 7.2, 7.3

New Value: See below | New Ref: NUREG-1150

Assessment: NUREG-1150 represents the latest attempt by NRC to qualify the risk analysis of nuclear reactor safety. This comparison focuses on the general approach used in source term determination. NUREG-1150 assumes there are at least three barriers between the radioactive source and its release to the environment. The corresponding barriers identified in the ATMX safety assessment (safety assessment) and in the NUREG-1150 procedure (NUREG-1150) are listed below.

BARRIER	SAFETY ASSESSMENT	NUREG-1150
1	suspension factor	core release
2	waste package escape fraction	primary release
3	ATMX railcar escape fraction	containment release

In general, both approaches are very similar even through NUREG-1150 relied on expert opinion on risk to deduce the most likely accidents that contribute to a release. The safety assessment method is valid because it covers most of the possibilities involving suspension factors, accident scenarios, and experimental/empirical release comparisons. The differences in the two methods do not adversely impact the conclusions drawn in the ATMX safety assessment.

Classification: None or beneficial

NeededAction: None

Requirement Change Evaluation Sheet

Seq #: 81

By: DLL   Date: 2-15-00

SA Section: 8   Topic: Consequence Analysis

SA Page: 8.20   Subtopic: Economic consequences

Item Description: Economic consequences given in 1989 dollars

Old Value: Old Ref: 1980's value

New Value: New Ref: 2000's value

Assessment: The costs numbers are presented in 1989 dollars. These costs could be adjusted to 2000 dollars be applying an inflation factor and other economic adjustments over the time period related to accidents such as those described in the analysis. However, we suspect that the impact is minimal in terms of obtaining the exemption. The change in dollar amounts would not alter the safety assessment conclusions

Classification: None or beneficial

NeededAction: Adjust values based on today's worth.

Requirement Change Evaluation Sheet

Seq #: 82

By: DLL

Date: 2-15-00

SA Section: 8

Topic: Consequence Analysis

SA Page: 8.7

Subtopic: Population

Item Description: Population based on 1980 census data

Old Value: Table 8.2

Old Ref: 1980 Census

New Value:

New Ref: 1990 Census or 2000 Census

Assessment: The reported population data presented on Table 8.2 was based on the 1980 Census. Therefore, it is out of date. These population figures could be adjusted using more recent data. However, the impact should be minimal and would not change the conclusions based on the results in the consequence calculations.

Classification: None or beneficial

NeededAction: None

Requirement Change Evaluation Sheet

Seq #: 83 By: DLL Date: 2-9-00

SA Section: 8 Topic: Consequence Analysis

SA Page: 8.5 Subtopic: Dispersion analysis

Item Description: GENII dispersion analysis computer code

Old Value: GENII Old Ref: Ref 8.2

New Value: GENII 1.485 New Ref: RSIC code package CCC-601 MICRO

Assessment: The GENII computer code is used to calculate the atmospheric dispersion. The GENII code is dated 1988. GENII 1.485 is the latest version of GENII available to perform these atmospheric dispersion calculations. There are no significant changes between the earlier versions of GENII and GENII 1.485, except that in 3/95, alternate data were added (contributed by HEDL) which were intended to improve the treatment of decay chains for calculations of doses from contaminated soil allowed to decay for hundreds of years. Air transport calculations are largely unaffected by these changes because of the short decay time involved. Thus there is no impact to the assessment.

Also, since GENII is still accepted by the consequence community to date and the code is still available for use, no attempt is made to compare GENII to other dispersion codes such as CRAC2, PFPL, MACCS2 and RADTRAN4.

Classification: None or beneficial

NeededAction: None

Requirement Change Evaluation Sheet

Seq #: 84

By: DLL Date: 2-16-00

SA Section: 8 Topic: Consequence Analysis

SA Page: 8.9, 8.19 Subtopic: National Drinking Water Regulations

Item Description: EPA Mean Contamination Level (MCL)

Old Value: 40 & 44 pCi/l Old Ref: Pg 8.9, Table 8.5

New Value: 15 pCi/l New Ref: 40CFR parts 141&142, Appendix A to subpart O (8/19/98)

Assessment: The current EPA MCL value is 15 pCi/l for alphas emitters such as Pu-238. Values of 40 and 44 pCi/l are given in Table 8.5 of the safety assessment. It is unclear how the value of 44 pCi/l listed for Pu-238 in Table 8.5 was computed. In particularly, it is not clear how footnote C to Table 8.5 was used to derive the Pu-238 values. The calculated value for Pu-238 from Table 8.5 is 18.3 pCi/l and is above the current limit of 15 pCi/l. The impact of this overage is unclear until there is clarification of how the Pu-238 value was derived in Table 8.5.

Classification: Unknown or can not be determined

NeededAction: Clarify how the MCL value for Pu-238 was detemined.

Requirement Change Evaluation Sheet

Seq #: 91   By: DLL   Date: 2-15-00

SA Section: 9   Topic: Criticality Analysis

SA Page: Subtopic: Criticality evaluation reporting format

Item Description: Criticality evaluation reporting format

Old Value: Old Ref: RFE 8902, Section on Criticality evaluation report

New Value: New Ref: DOE-STD-3007-93

Assessment: Currently, all DOE contractors are required to follow the guidelines in DOE-STD-3007-93, "Guidelines for Preparing Criticality Safety Evaluations at Department of Energy Non-Reactor Facility". RFE 8902 provides a criticality evaluation report with different format and sections than that of DOE-STD-3007-93. These differences may have an impact if DOE is asked to use the up-to-date guidelines and methodology to evaluate criticality. Otherwise, there is no impact because the criticality analysis conclusions will not change.

Classification: Unknown or can not be determined

NeededAction: Unknown

Requirement Change Evaluation Sheet

Seq #: 92

By: DLL

Date: 2-15-00

SA Section: 9

Topic: Criticality Analysis

SA Page:

Subtopic: Double contingency principle

Item Description: Double contingency principle

Old Value:

Old Ref: RFE 8902

New Value:

New Ref: DOE-STD-3007-93, DOE G 421 1-1 (8/25/99), ANSI/ANS 8.1

Assessment: The analysis in REF 8902 did not include a section on double contingency principle, which is required by today's DOE guidelines on criticality evaluation from "DOE-3007-93, DOE G 421 1-1(8/25/99) and ANSI/ANS 8.1". At a minimum, the importance of this principle should be addressed to ensure that a criticality accident is an extremely unlikely event.

The absence of this section in RFE 8902 may have a significant impact if DOE is asked to defend today's guideline. Therefore, it is recommended that a section on this principle be included in RFE 8902 or Section 9.

Classification: Unknown or can not be determined

NeededAction: Unknown

Requirement Change Evaluation Sheet

Seq #: 93

By: DLL Date: 2-15-00

SA Section: 9 Topic: Criticality Analysis

SA Page: Subtopic: Peer review

Item Description: Peer review

Old Value: Old Ref: RFE 8902

New Value: New Ref: DOE G 421.1-1(8/25/99)

Assessment: Neither Section 9 of the Safety Assessment nor RFE 8902 indicate that the criticality evaluation was peer reviewed. DOE G 421.1-1, Section 5.9.2.1," Criticality Safety Good Practices Guide for DOE Nonreactor Nuclear Facilities," requires that a peer review is performed before the safety evaluation may be applied to authorize a fissionable material operation.

The impact is unknown. However, if DOE is asked to comply with today's guideline, then this review is needed. Otherwise, there is no impact because the criticality analysis conclusions will not change.

Classification: Unknown or can not be determined

NeededAction: Unknown

Requirement Change Evaluation Sheet

Seq #: 94

By: DLL Date: 2-15-00

SA Section: 9 Topic: Criticality Analysis

SA Page: Subtopic: KENO code

Item Description: KENO code version

Old Value: KENO IV Old Ref: Ref. 9.2

New Value: KENO V.a New Ref: RSIC, CCC-545, Vol 2, Scale 4.3 package

Assessment: The criticality evaluation was performed using KENO IV. The current widely used version of KENO is V.a. There are no significant differences between the two versions in terms of physics. Version V.a has improved over stage minimization, expanded specific types of geometry, added supergrouping of the cross section and flux data, bias improvement and input. These improvements do not alter the overall safety assessment conclusions.

Classification: None or beneficial

NeededAction: None