Key Technical Issue
Container Life and Source Term CLST 2.01

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ACRONYMS

ASME	American Society of Mechanical Engineers
BSC	Bechtel SAIC Company, LLC
CFR	Code of Federal Regulations
CLST	Container Life and Source Term
DOE	U.S. Department of Energy
DPS1	drip shield top plates
DPS2	drip shield side plates
ESP	external support plate
ISP	internal support plate
KTI	Key Technical Issue
NRC	U.S. Nuclear Regulatory Commission

1 INTRODUCTION

The U.S. Department of Energy (DOE) and U.S. Nuclear Regulatory Commission (NRC) held a Technical Exchange and Management Meeting focused on issues relating to Container Life and Source Term (CLST) on September 12 and 13, 2000 in Las Vegas, Nevada. Based on discussions during this meeting, the NRC and DOE reached a number of agreements on topics related to the adequacy of the technical basis for models describing the degradation of the waste package and drip shield.

The Key Technical Issue (KTI) agreement that is covered by this licensing letter report, CLST 2.01, was reached at this September 2000 meeting (Kelmenson, R. 2000, pp. 4 - 5 and Attachment 1, p. 5). This KTI agreement relates to the DOE providing more information regarding the drip shield simulations based on finite element methods that represent a significant contribution to DOE's safety case. Subject to NRC review, the information provided in this report is sufficient to close the KTI agreement.

1.1 KEY TECHNICAL ISSUE AGREEMENT

The KTI agreement, CLST.2.01, states:

> "Either provide documentation using solid element formulation, or provide justification for not using it, for the drip shield – rock fall analysis. DOE stated that shell elements include normal stresses and transverse stresses in the calculations and provide more accurate results for thin plates and use far fewer elements. Therefore, shell elements will be used instead of solid elements. This justification will be documented in the next revision of AMR ANL-XCS-ME-000001, Design Analysis for the Ex-Container Components, prior to LA."
>
> (NRC 2002, p. A-3 of 38)

1.2 RELEVANCE OF THE AGREEMENT TO REPOSITORY PERFORMANCE

The primary focus of the KTIs related to CLST is the adequacy of the technical basis for the models describing the degradation of the waste package and drip shield design in order to provide reasonable expectation that models capture the range of expected processes and process interactions. The CLST KTIs are focused on evaluating the adequacy of the methodology, testing, and modeling used by DOE in the investigations related to waste package and drip shield integrity, and waste form and the potential for criticality inside the waste package.

The Yucca Mountain regulations include requirements to describe the capability and provide technical basis for the Engineered Barrier System to isolate waste, taking into account parameter ranges and bounding values used in the performance assessment (10 CFR 63.114(b) and 10 CRF 63.115(c)). Agreement CLST 2.01 is related to the use of solid element formulation versus a shell element approach for the evaluation of the drip shield.

2 RESPONSE TO THE KTI

The current finite element representations for analysis of rock falls on the drip shield are entirely composed of solid elements. An example calculation, *Drip Shield Structural Response to Rock Fall* (BSC 2004), is included with this report as Appendix A. Any future evaluation that may use shell elements will be adequately justified for the appropriate use of such elements.

3 BASIS FOR THE KTI RESPONSE

The purpose of this licensing letter report is to demonstrate the use of solid elements in drip shield structural analysis.

3.1 METHODOLOGY

Finite element analysis calculations are performed by using the commercially available LS-DYNA V960 code (BSC 2002). A representative calculation is documented in, *Drip Shield Structural Response to Rock Fall* (BSC 2004) and the calculation is included as Appendix A. In this calculation, the drip shield is subjected to a point-loaded 14.5 metric ton rock fall in the center of a drip shield top plate (DSP1) (see Figure 1).

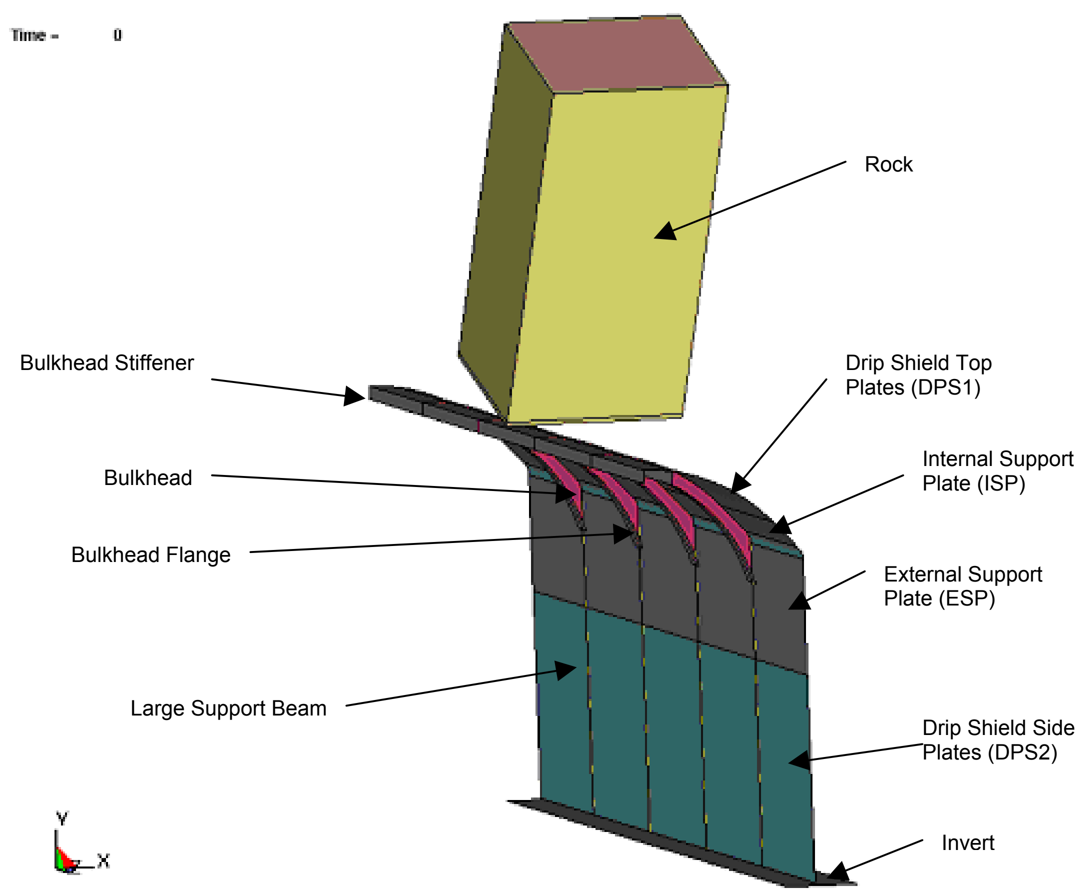

Figure 1. Pertinent Components of Drip Shield

These analyses provide the residual stress values that are used in the assessment of postclosure stress corrosion susceptibility of DSP1 and drip shield side plates (DSP2). Residual stresses are determined on the basis of exceeding 50% of yield strength of Titanium 7.

3.2 CONCLUSIONS

The current representations for analysis of rock fall on drip shield are entirely composed of solid elements. Any change from solid elements to shell elements will be reviewed for suitability of methodology and adequately justified.

4 REFERENCES

10 CFR 63. Energy: Disposal of High-Level Radioactive Wastes in a Geologic Repository at Yucca Mountain, Nevada. Readily available. [DIRS 156605]

BSC 2002. *Software Code: LS-DYNA*. V960.1106. HP9000. 10300-960.1106-00. [DIRS 158898]

BSC 2004. *Drip Shield Structural Response to Rock Fall*. 000-00C-SSE0-00300-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20040405.0019.

Kelmenson, R. 2000. "Meeting Summary, NRC/DOE Technical Exchange Meeting on Container Life and Source Term (CLST), September 12-13, 2000." E-mail from R. Kelmenson to C. Hanlon (DOE/YMSCO), T. Gunter (DOE/YMSCO), A. Gil (DOE/YMP), P. Russell (DOE/YMSCO), September 27, 2000, with attachment. ACC: MOL.20001127.0049. [DIRS 154350]

NRC 2002. *Integrated Issue Resolution Status Report.* NUREG-1762. Washington, D.C.: U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards. TIC: 253064. [DIRS 159538]

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APPENDIX A

Drip Shield Structural Response to Rock Fall
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