Enclosure 7 to TN E-25820

Transnuclear, Inc. Calculation NUH06L-0503, "OS197L Occupational Exposure due to Remote Handling Device Failure," Revision 2 (without disks)

AREVA TRANSNUCLEAR INC.	Form 3.2-1 Calculation Cover Sheet TIP 3.2 (Revision 2)	Calculation No.:	NUH06L-0503
		Revision No.:	1
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DCR NO (if applicable) : *NUH06L-031*	PROJECT NAME: NUHOMS® OS197L Light Onsite Transfer Cask
PROJECT NO: NUH06L	CLIENT: Transnuclear, Inc.

CALCULATION TITLE:

OS197L Occupational Exposure due to Remote Handling Device Failure

SUMMARY DESCRIPTION:

1) Calculation Summary

This calculation estimates the occupational exposure associated with a remote handling device failure during OS197L transfer cask operations. NUHOMS® 32PT design basis source terms and dose rates are *used for the analysis.*

Revision 1 of this calculation addresses the issues related to RAI-1 for Amendment 11 and re-calculates the exposures.

2) Storage Media Description

1 CD-ROM attached. *The CD utilized in Revision 0 is modified to include a new folder for Revision 1 documents.*

If original issue, is licensing review per TIP 3.5 required? ***N/A since this is a revision***

Yes ☐ No ☒ (explain below) Licensing Review No.: _____

The DCR NUH06L-031 performs the TIP 3.5 reviews as required.

Software Utilized:	**Version:**
MCNP	5v1.4

Calculation is complete:	
A Prakash Originator Name and Signature: PRAKASH NARAYANAN	12/21/2007 Date:
Calculation has been checked for consistency, completeness and correctness:	
Yevgeniy Terekhin Checker Name and Signature: YEVGENIY TEREKHIN	12/21/07 Date:
Calculation is approved for use:	
PETER SHIH Project Engineer Name and Signature: P. Shih	12/21/07 Date:

REVISION SUMMARY

REV.	DATE	DESCRIPTION	AFFECTED PAGES	AFFECTED DISKS
0	04/05/2007	Initial Issue	all	1
1	*12/21/07*	*Re-calculate exposure with additional considerations for 1) backscatter factor 2) axial dose rates from the aluminum lid and 3) detailed radial dose rate distribution with the OS197L TC*	*All as indicated by revision bars*	*1*

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1.0 PURPOSE

This calculation estimates the occupational exposure associated with a remote handling device failure during OS197L transfer cask operations when loaded with a design basis NUHOMS® 32PT DSC. Bounding exposure is determined using worst case source terms and dose rates. The calculation should identify the worst hypothetical failure situations and estimate the associated dose consequence. Backscatter from building structures is evaluated. The calculation provides ALARA recommendations to address the resulting dose consequences.

Revision 1 of this calculation is prepared to address issues identified by the NRC in their RAI-1 [2.3] for Amendment 11 to CoC 72-1004. In particular, these issues are centered around the applicability of the assumptions regarding the use of backscatter factors for all calculations, the use of axial distribution based on a configuration that is different from the OS197L cask and the effect of the room size on the exposure calculation. In addition, the top end dose rates based on the "temporary" cask lid are utilized to determine the dose consequences.

2.0 REFERENCES

2.1 NUH06L-0500, "Design of Integral Radiation Shield for On-Site Transfer Cask OS197-L and Calculation of Occupational Exposure due to 32PT DSC Design Basis Fuel," Rev. 1.

2.2 NUH-32PT.0501, "NUHOMS®-32PT Surface Dose Rates and Occupational Exposures," Rev. 3.

2.3 Letter from Joseph M. Sebrosky, Senior Project Manager, USNRC to Donis Shaw, Licensing Manager, Transnuclear, Inc. "REQUEST FOR ADDITIONAL INFORMATION FOR REVIEW OF AMENDMENT 11 TO THE STANDARDIZED NUHOMS® SYSTEM (TAC NO. L24080)," Docket No. 72-1004, TAC No. L24080.

2.4 NUH06L-0504, "Shielding Analysis for On-Site Transfer Cask OS197-L due to 32PT DSC Design Basis Fuel at selected transfer and loading operations," Rev. 0.

3.0 METHODOLOGY AND DESIGN INPUTS

The OS197L is a general purpose, light weight (75 ton) on-site transfer cask. A detailed shielding evaluation of the TC with various configurations is performed in calculation NUH06L-0500 [2.1] *and NUH06L-0504 [2.4]* at normal and accident conditions. The calculations performed in [2.1] include detailed occupational exposure assessments made for normal loading operations associated with the NUHOMS® system.

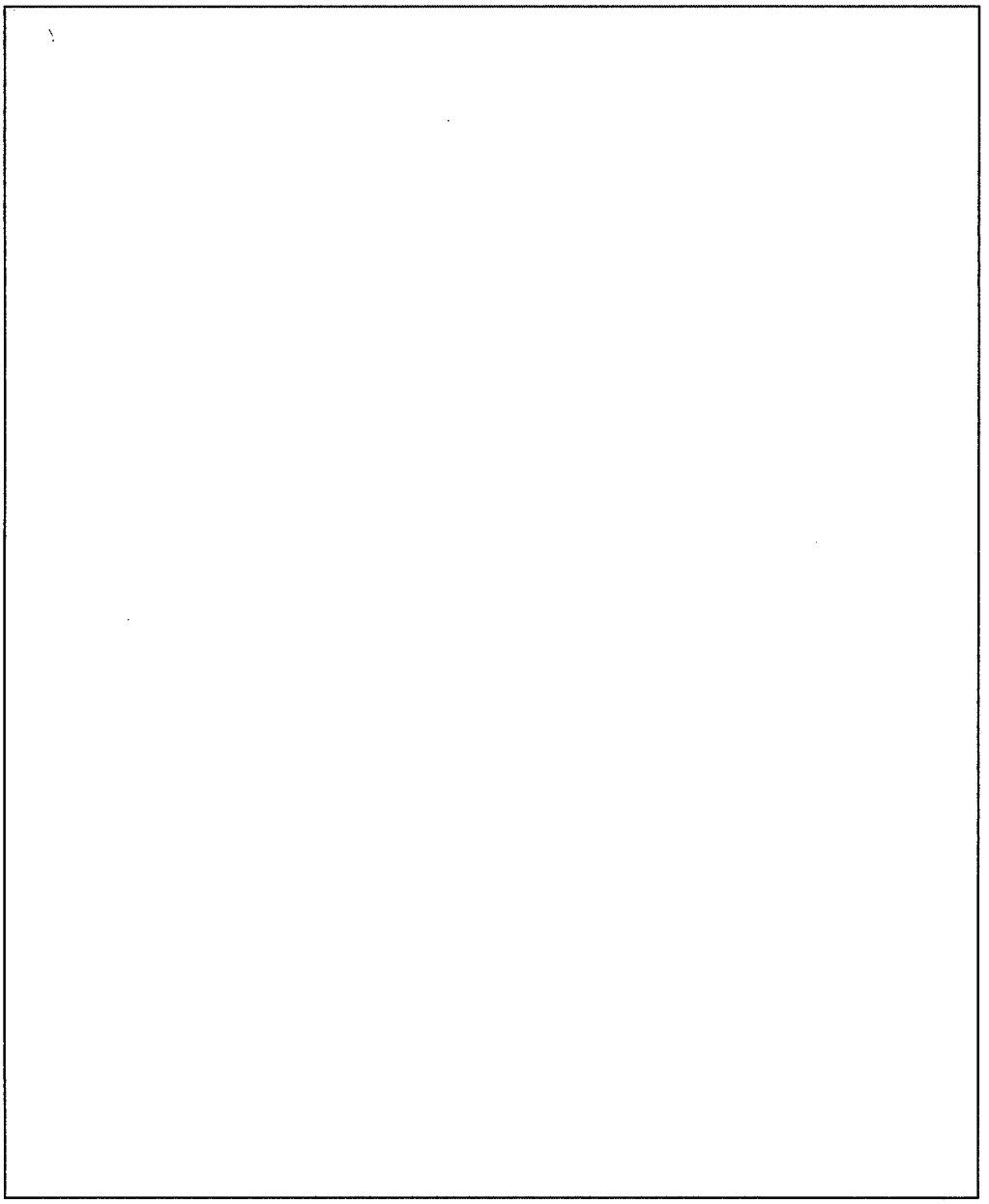
This calculation evaluates a hypothetical failure of a remote handling device, namely a crane failure, while moving the OS197L transfer cask. During crane operations the OS197L is in

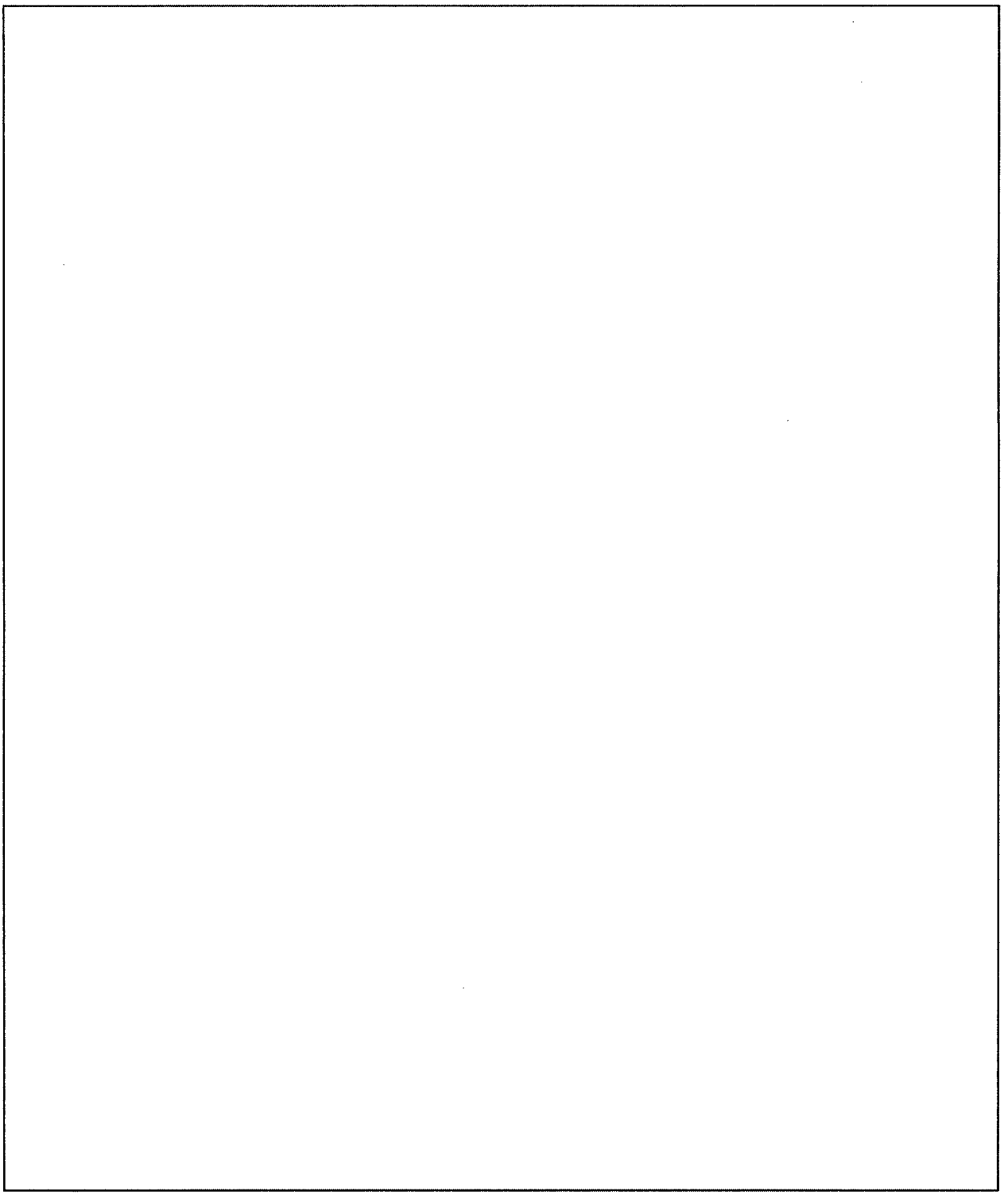
the "bare cask" configuration. This configuration is nearly identical to "Configuration B" in [2.1]. In this configuration there is little shielding on the side of the transfer cask resulting in high dose rates. Therefore, to ensure safety and ALARA this evaluation performed.

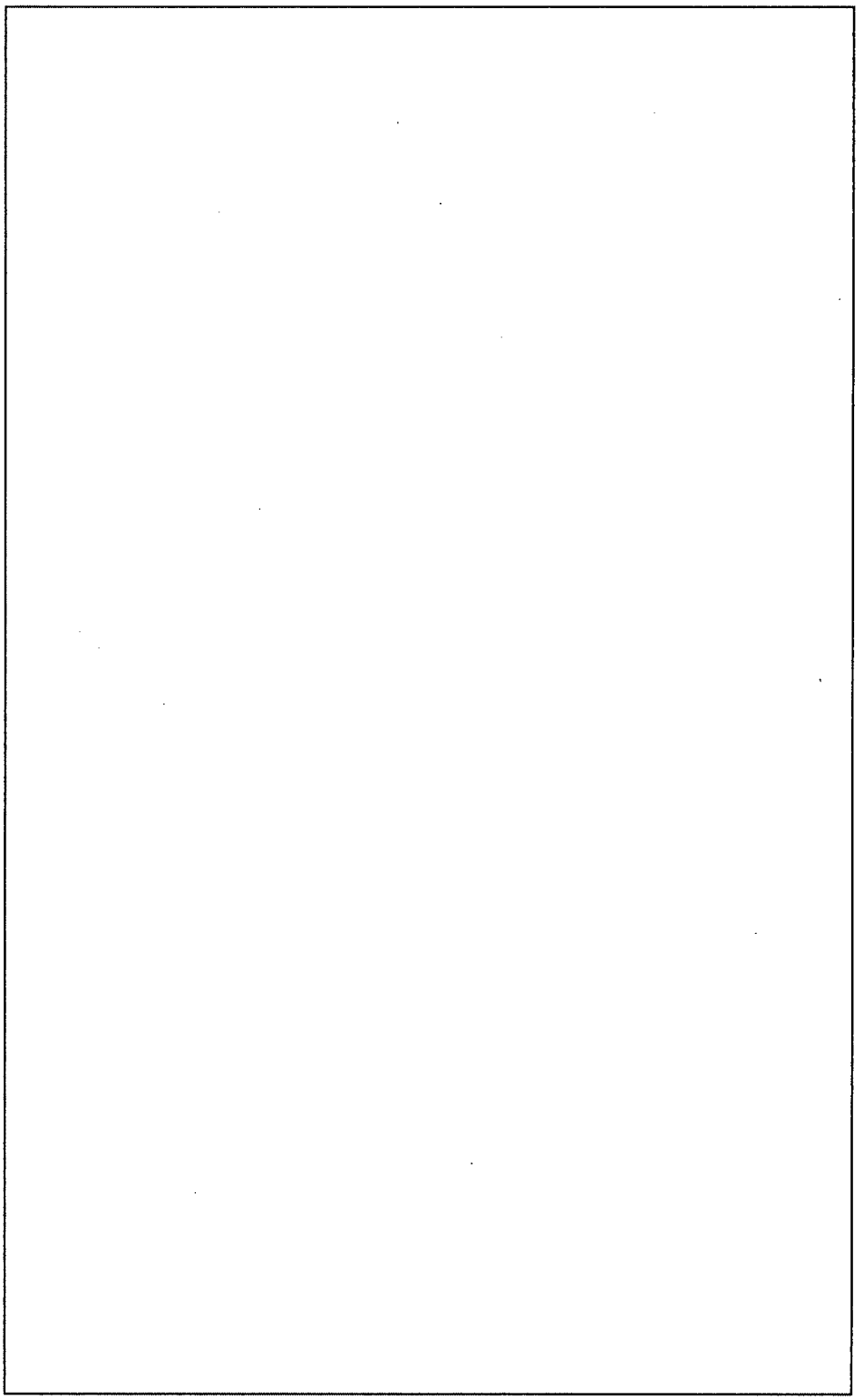
While the OS197L is being moved a crane failure is postulated to occur. After failure workers must perform manual operations to lower the cask and place it into a safe, low dose area. The following operation tasks are postulated for this event:

1. Worker(s) climb a ladder to reach a crane access walkway.
2. Worker(s) traverse the walkway to reach a crane bridge.
3. Worker(s) traverse the crane bridge to reach a manual operations area located directly above the OS197L.
4. Worker(s) perform manual operations to lower the OS197L.

After lowering the transfer cask additional shielding can be utilized and the cask restored to a safe condition. Exposure after lowering the cask is not evaluated in this calculation.







6.0 RESULTS AND CONCLUSIONS

A hypothetical remote handling device failure event has been evaluated for the OS197L transfer cask when loaded with design basis NUHOMS® 32PT fuel. Three crane failure scenarios were evaluated. During these scenarios it was determined that the maximum dose rate field expected was approximately *5,000* mrem/hr. The first scenario involves a crane failure in the refueling area and the cask manually having to be manually lowered to the floor in the vertical position. This scenario results in an occupational exposure of *970* man-mrem. A second scenario was evaluated to assess the consequence of a crane failure during the lowering of the OS197L cask onto the transfer trailer. After failure, the transfer cask is manually lowered onto the transfer trailer in the horizontal position. In this scenario, workers are exposed more directly to the intense side (radial) dose rates. The occupation exposure associated with this scenario was found to be *956* man-mrem.

A third, and final, scenario was evaluated to bound the crane failure event. In this scenario conservative distances and durations were assumed. Initially the cask is assumed to be positioned 40 ft from the worker(s) and the crane is assumed to be 40 ft above the transfer trailer. Once the worker(s) reach the top of the cask manual operations are performed to lower the OS197L. The crane is assumed to fail with the OS197L engaged with the transfer trailer skid and in the vertical position. The worker(s) manually lower the OS197L onto the transfer trailer so that it is in the horizontal position. In this bounding scenario the occupational exposure was calculated to be *1,870* man-mrem.

It should be noted the evaluation also identified additional considerations for enhancing radiation protection. First, since the dose rates from the side (radial) of the OS197L cask are intense so can be the occupational exposure. This can be mitigated by using temporary shielding (or low dose staging areas) and by reducing the time it takes worker(s) to access the manual operations area of the crane. Plant personnel should take whatever measures necessary to make this step as safe and timely as possible. Second, the dose during the manual operations task comprises the majority of the total occupational exposure. Plant personnel should take measures to make this task as efficient as possible. Also, since it is expected that these operations take place at a fixed location, temporary shielding may be a good choice to help reduce exposures. The above considerations will help maintain exposures ALARA.

The exposures shown above are less than the typical occupational exposure for an entire NUHOMS® loading campaign. These exposures are based on bounding assumptions and can be reduced significantly by using ALARA practices. This calculation and the results contained should be used as a basis for developing proper recovery procedures from a crane failure with the OS197L cask. Areas of concern have been identified and suggestions to mitigate the exposure provided.