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Release Date: 11/11/94

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APPROVED FOR PUBLIC RELEASE

WHC Information Release Administration Specialist:

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11/11/94

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5. Key Words Analysis, Bending, Pump pit, Cover plate Riser, Safety margin, Computer model APPROVED FOR PUBLIC RELEASE 11/11/94 D. Sain	6. Author Name: B. L. Coverdell <i>B. L. Coverdell</i> 10-31-94 Signature Organization/Charge Code 8D430/E25292	
7. Abstract The temporary pit cover is necessary for the installation of two risers for the reducing exposure, contamination, and waste. Computer analysis indicates that the safety margin of the pit cover plate with two risers is adequate. The computer stress model and input files are attached in the document.		
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ANALYSIS OF BY-106 PUMP PIT COVER PLATE

October 1994

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MASTER

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DESIGN VERIFICATION METHOD

The need for design verification has been reviewed with the method selected as indicated below:

<u> x </u>	Independent Review
<u> </u>	Alternate Calculations
<u> </u>	Qualification Testing
<u> </u>	Formal Design Review

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SD # WHC-SD-WM-DA-166

ECN # N/A

DWG(S) # N/A

CHECKLIST FOR INDEPENDENT REVIEW

B2E

(CVR PLATE 01)

Document Reviewed Cosmos/M Finite-Element model of Pump Pit Cover (PT-CVR1)

Author B. L. Coverdell

Yes No N/A

☒	☐	☐	Problem completely defined.
☒	☐	☐	Necessary assumptions explicitly stated and supported.
☒	☐	☐	Computer codes and data files documented.
☒	☐	☐	Data used in calculations explicitly stated in document.
☒	☐	☐	Data checked for consistency with original source information as applicable.
☐	☐	☒	Mathematical derivations checked including dimensional consistency of results.
☒	☐	☐	Models appropriate and used within range of validity or use outside range of established validity justified.
☐	☐	☒	Hand calculations checked for errors.
☒	☐	☐	Code run streams correct and consistent with analysis documentation.
☒	☐	☐	Code output consistent with input and with results reported in analysis documentation.
☒	☐	☐	Acceptability limits on analytical results applicable and supported. Limits checked against sources.
☒	☐	☐	Safety margins consistent with good engineering practices.
☒	☐	☐	Conclusions consistent with analytical results and applicable limits.
☒	☐	☐	Results and conclusions address all points required in the problem statement.

MANDATORY

Software QA Log Number 94-028

Reviewer

Date

ENGINEERING ANALYSIS SOFTWARE REPORT FORM

August 4, 1994
DATE ANALYSIS PERFORMED

94-028
SOFTWARE LOG NUMBER

SOFTWARE APPLICATION: COSMOS/M ver. 1.70 on a Silicon Graphics Incorporated, Indigo

B. L. Coverdell 8-8-94
B. L. Coverdell, Equipment Stress Analysis, ANALYST DATE

R. B. Pan 10/28/94
R. B. Pan, Equipment Stress Analysis, MANAGER DATE

DESCRIPTION OF ANALYSIS:

This analysis was performed using the finite-element software COSMOS/M version 1.70 on a Silicon Graphics Incorporated, Indigo. A static analysis was performed using the SHELL4T element type.

The purpose of the analysis was to determine the structural adequacy of a pump pit cover if two 300 lb. risers are added to it. The pump pit cover is support on three sides by concrete walls the fourth side is supported by a W4x19. These supports were modeled as y-direction fixed boundary conditions. Inorder to make the model stable addition translation fixed boundary conditions were applied. The 300 lb. risers were modeled by placing twelve evenly spaced 25 lb. force boundary condtions around each hole.

J. S. Burgess 8/8/94
J. S. Burgess, Equipement Stress Analysis, REVIEWER DATE

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ANALYSIS OF BY-106 PUMP PIT COVER PLATE

1.0 INTRODUCTION

A new cover for the BY-016 pit has been designed to allow the rotary core exhaustor to be hooked up without requiring pit entry, riser modification, or equipment removal. This cover will reduce exposure, contamination, and waste generation. Two 0.3048 m. diameter holes are drilled into the pit cover plate to install two risers; each riser weighs 1,335 N. The structural adequacy of the cover plate was analyzed with COSMOS/M (SRAC 1994) computer software. The design is in accordance with Structural Architectural-Civil Design Criteria (DOE-RL 1989) and is safety class three. The design and fabrication are in accordance with American Institute of Steel Construction, *Manual of Steel Construction* (AISC 1989). All welding and weld inspection is in accordance with American Welding Society D1.1 (AWS 1994).

2.0 SUMMARY

The new pit cover is necessary to allow installation of two risers for reducing exposure, contamination, and waste. Computer analysis indicates that the safety margin of the pit cover plate with two risers is adequate. The computer stress model and input files are attached (see Appendices A and B). The pit cover plate is a replacement for an existing plate; therefore seismic and wind loads were considered for the plate only.

3.0 DESCRIPTION

The pump pit cover is shown on detail H of drawing H-2-70896 (WHC 1978) (Appendix C). COSMOS/M finite-element analysis software was used to model load cases for the pit cover. Load case one is the deadweight of the cover plate, which was modeled by applying an acceleration of 9.81 m/sec^2 . Load case two, reflecting the additional weight imposed by the risers, was modeled by placing force boundary conditions at 16 evenly spaced nodes around each hole. Load case 51 combines cases 1 and 2 linearly.

4.0 DESIGN CRITERIA

The COSMOS/M computer model of the pump pit cover plate is based on the following.

- The pump pit cover plate is supported by the outer edge of the concrete wall border on three sides and a W4x19 beam on the fourth side. These supports were modeled as fixed translational boundary conditions in the y-direction. To prevent rotation of the model, one corner point has all three translations fixed. Moving clockwise around the perimeter, the next corner point is fixed in the x and y-direction. The corner point on the diagonal from the second corner point is fixed in the y and z-direction. The fourth and final point is located diagonally from the initial fixed corner point. This point is fixed in the y-direction only.
- The cover plate is 0.0254 m. thick carbon steel, ASTM A36.
- The weight of the riser is 1,335 N.
- The risers are made of 0.3048 m. schedule 40 pipe.

5.0 RESULTS

The computer stress plot appears in Appendix B. The COSMOS/M computer model considers the bending of the cover plate for the combined load of deadweight and the weights of two risers. As shown in the stress plot, the highest stress is 19,981 kpa, which is well below the yield stress of 248,040 kpa. This value indicates that the safety margin is adequate for the pit cover plate with two holes for the insertion of two risers.

Wind at 31.3 m/sec^2 over a flat 3.78 m. by 2.89 m. by 0.0254 m carbon steel plate by inspection does not create sufficient lift to move the cover plate. From load case 51, the highest stress is 19,981 kpa. A static seismic factor of 0.12 g was used to determine the maximum stress due to seismic loading. This factor results in a stress of 22,379 kpa in the pump pit cover plate which is below the allowable stress of 248,040 kpa. The plate is seismically restrained in the lateral direction per drawing H-2-70896, Cover Plan H (WHC 1978). For these reasons, the design is acceptable.

The input files for the computer model are saved on the attached tape (Appendix C).

6.0 REFERENCE

- AISC, 1989, *Manual of Steel Construction*, 9th Edition, American Institute of Steel Construction, Chicago, Illinois.
- AWS, 1994, *Structural Welding Code*, AWS D1.1, American Welding Society, Miami, Florida.
- DOE-RL, 1989, *Standard Architectural-Civil Design Criteria*,
DOE-RL-SDC 4.1 Revision 11, Westinghouse Hanford Company, Richland, Washington.
- SRAC, 1994, *COSMOS/M*, Structural Research and Analysis Corporation, Version 1.70, Santa Monica, California.
- WHC, 1978, Pump Pit Covers and Detail, Tank Farms 241-B, 241-BX and 241-BY, H-2-70896, Revision 6, Westinghouse Hanford Company, Richland, Washington.

Appendix A

COSMOS/M 1.70 Model, Stress Plot

Lin STRESS Lc-51

Von Mises

2.80E+03

2.54E+03

2.10E+03

1.82E+03

1.46E+03

1.10E+03

741.0000

0.0000

0.0000

COSMOS/M

Version : V1.70

CVRPLATE01

10-5-94

A-2

W/C-SD-WM-DA-166
Rev O

Appendix B

Attached is a 3170 Cartridge tape containing the COSMOS/M input and output files for CVRPLATE01. This tape has the files that were used in the analysis of the new cover plate for BY-106 pit.

Appendix C

Drawings

NEW TEMPORARY PIT COVER, SEE PAGE 4 & 5 FOR FABRICATION DETAILS

WHC-SD-WM-DA-166
REV. 0

DWG. N-2-10896 24.1 REV 6

COVER PLAN **H**
TANK 241-BY-106

COVER TO BE FABRICATED

WHC-SD-WM-DA-166
REV. 0

WHC-SD-WM-DA-166
REV. 0 SECTION

(TYP 2 PL)