NIAGARA MOHAWK NUCLEAR ENGINEERING

CALCULATION COVER SHEET

Page 1 (Next 2)
Total 7
Last A5

NINE MILE POINT NUCLEAR STATION Unit (1, 2 or 0=Both): 1 Discipline: STRUCTURAL

Title	Calculation No.			
LIMITED ANALYTICAL REVIEW OF CABLE TRAY SUPPORT	S0.0SQUGLAR1			
	(Sub)system(s)	Building	Floor Elev.	Index No.
	NA	RB	261	S0.0

Originator(s)
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Checker(s) / Approver(s)
MOHAMMED ALVI

Rev	Description	Design Change No.	By	Date	Chk	Date	App	Date
00	INITIAL ISSUE	NA	CA	7-9-97	M.A	7-9-97	M.A	7-9-97

Computer Output/Microfilm Filed Separately (Yes / No / NA): NA Safety Class (SR / NSR / Qxx): SR

Superseded Document(s): NONE

Document Cross Reference(s) - For additional references see page(s): NA

Ref No	Document No.	Doc Type	Index	Sheet	Rev
1	NER-1S-012	NER	---	---	00

General Reference(s):
2. GENERIC IMPLIMENTATION PROCEDURE (GIP)
3. NMPC Letter to NRC, File Code NMP1L 1044, dated March 11, 1996

Remarks:
NONE

Confirmation Required (Yes / No): No See Page(s):	Final Issue Status (APP / FIO / VOI): APP	File Location (Calc / Hold): Calc	Operations Acceptance Required (Yes / No): No

Evaluation Number(s) / Revision: NR Copy of Applicability Review Attached (Yes / N/R)?N/R	Component ID(s) / EPN(s) / Line Number(s): NA
Key Words: NMP-1, STRUCTURAL, SQUG, SEISMIC VERIFICATION, CABLE TRAY SUPPORT	

Nine Mile Point Nuclear Station Unit: _1___ Disposition: _---___

Originator/Date	Checker/Date	Calculation No.	Revision
A 7-9-97	M.A 7-9-97	S0.0SQUGLAR1	00

Ref.

PURPOSE: Document the Limiting Analytical Review (LAR) evaluation for a typical Reactor Building cable tray support having a cast in-place cast iron insert as a anchor to the underside of the 281 foot elevation concrete slab.

This LAR has been prepared as part of the commitment to use the SQUG (GIP) methodology to document the seismic adequacy of cable tray supports.

CONCLUSION: This cable support meets the GIP requirements.

ATTACHMENTS

A. LAR for a cable tray support having cast iron inserts.

Nine Mile Point Nuclear Station Unit: _1___ Disposition: _---___

Originator/Date	Checker/Date	Calculation No.	Revision
		S0.0SQUGLAR1	00

Ref.

ATTACHMENT A

LIMITING ANALYTICAL REVIEW EVALUATION #1

REVIEWED
ATTACHMENT A, LAR#1
NIAGARA MOHAWK POWER
CORPORATION
NUCLEAR ENGINEERING DEPARTMENT

DISPOSITION OF SUBMITTAL

☒ ACCEPTED
☐ ACCEPTED WITH CHANGES NOTED
☐ NOT ACCEPTED
☐ REVISE & RESUBMIT

SIGNATURE: _____ DATE: 7-9-97

DISCIPLINE: STRUCTURAL UNIT: 1

S&A
STEVENSON & ASSOCIATES
a structural-mechanical consulting engineering firm

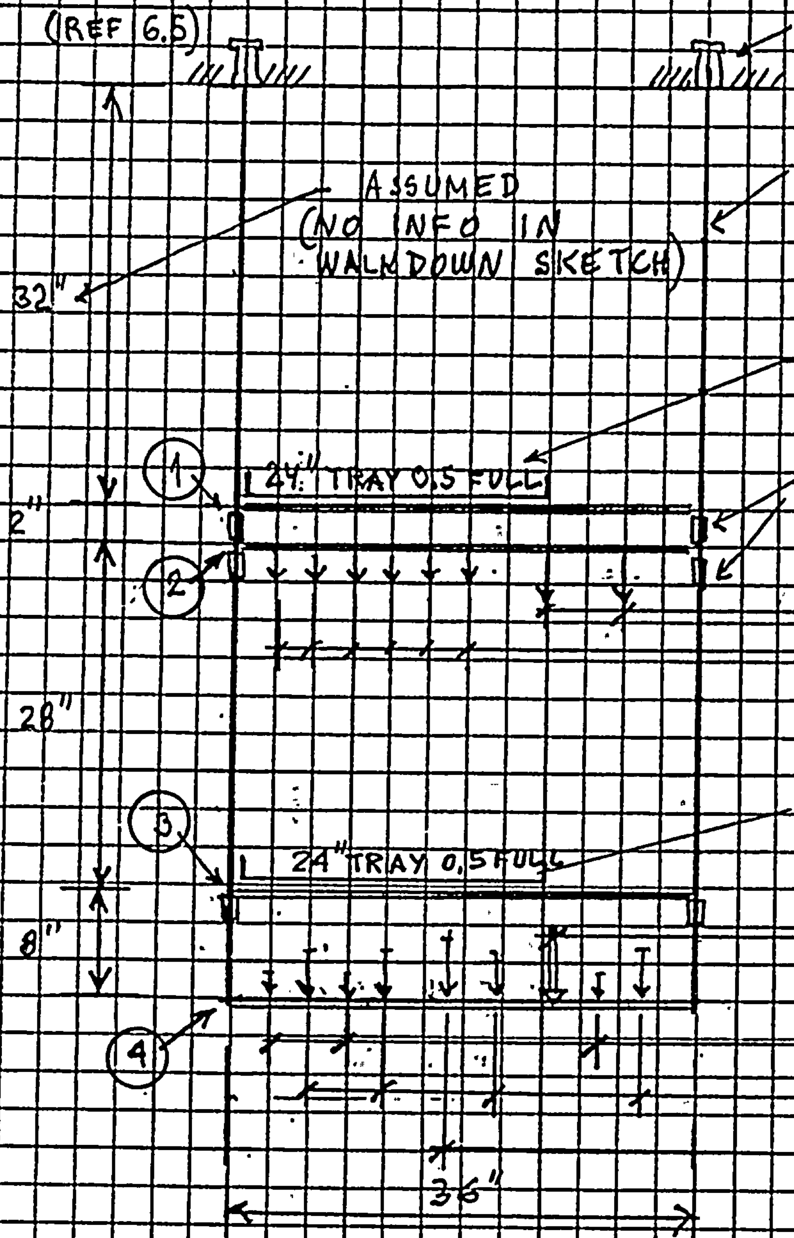
SUBJECT: LAR # 1 — EL 261'   JOB No. 93C2771   SHEET A1-2 OF 4

REVISIONS: 0 — KC 01/06/94 — S.C. 1-11-94

ATTACHMENT: A
CALC NO: [illegible]
REVISION: [illegible]
PAGE NO: A2

LOAD CALCULATION   LOCATION: RB NORTH COR. EL 261'

TYP SUPPORT SPACING - 6'



CAST IRON INSERTS

1/2" ALLTHREAD ROD (TYP)

$25^{\#}/ft^2 \times 2' \times 6' (0.5) = \underline{150^{\#}}$

COUPLER NUT (TYP)

2 - 2"⌀ : 5.1×2 = 10.2#/'
6 - 1"⌀ : 2.2×6 = 13.2#/'
23.4#/'

OR 23.4 × 6 = **140#**

150# (SEE ABOVE)

1 - 4"⌀ : 16.5#/'
3 - 1"⌀ - 2.2×3 = 6.6#/'
4 - 1½"⌀ : 3.6×4 = 14.4#/'
1 - 2½"⌀ : 8.9#/'
46.4#/'

OR 46.4 × 6 = **278#**

ALL HORIZONTAL MEMBERS ARE P1000.

S&A STEVENSON & ASSOCIATES a structural-mechanical consulting engineering firm	JOB NO. 91C2771 CALCULATION: C-006	Sheet A1-3 of 4 Revision 0
	Nine Mile Point Unit 1 Raceway Limited Analytical Review	By: KC 01/11/94 Check: S.C. 1-11-94

LAR #1

ATTACHMENT A
CALC NO S0.0SQUGLAR1
REVISION 00
PAGE NO A3

Dead Load Check

Horizontal member

The worst case is member 4 - unistrut P1000.
For L=36" unistrut capacity = 1130 lb (Ref. 6.2, page 5)
1130 lb > 278 lb Hence the unistrut is OK.

Vertical member (1/2" threaded rod)

Load per one rod:
(150 + 140+ 150 + 278) x 0.50 = 718 x 0.5 = 360 lb
Max safe load = 7670 lb
7670 lb > 360 lb Hence the vertical member is OK.

Connection of treaded rod to concrete

Capacity of cast iron inserts = 1360 lb (Ref. 6.6, page 6)
1360 lb > 360 lb Hence the inserts are OK. SF = 1360 / 360 = 3.78

Vertical Capacity Check

Cast iron inserts

360 x 3 = 1080 lb < 1360 lb OK SF = 1360 / 1080 = 1.26

Ductility Check

This support is considered ductile (see Ref. 6.4, 8.3.3 for Rod Hanger Trapeze Supports).

Lateral Load Check

No lateral load check is required since the support is ductile (Ref. 6.4, 8.3.4).

Rod Hanger Fatigue Evaluation

Support resonant frequency (Ref. 6.4, 8.3.5):

$$f_{sup} = \frac{1}{2\pi}\sqrt{\frac{K_s}{M_s}} = \frac{1}{2\pi}\sqrt{\frac{514}{186}} = 0.84 \text{ Hz}$$ where

W = 360 x 2 = 720 lb (total dead weight on the pair of rod supports)
g = 386.4 in / sec^2

LAR #1

E = 29×10^6 psi (elastic modulus of steel)
I = $0.05 \times 0.406^4 = 136 \times 10^{-3}$ in^4 (moment of inertia of rod root section, d = 0.406 per page 4-147 of Ref. 6.1))
L = 32" (length of rod above top tier)

$$K_s = 2\frac{12EI}{L^3} + \frac{W}{L} = 2\frac{12 \times 29 \times 10^6 \times 136 \times 10^{-3}}{32^3} + \frac{720}{32} = 514 \text{ lb/in}$$

$$M_s = \frac{720}{386.4} = 186 \text{ lb} - \text{sec}^2/\text{in}$$

ATTACHMENT A
CALC NO SD.OSQUALA1
REVISION 00
PAGE NO A4

See attached comparison of Floor Response Spectra to Rod Fatigue Bounding Spectra (RB 281).

Use 0.5 g and go to Fig. 8-12 of Ref. 6.4.
At L = 32" the maximum acceptable weight is > 2.2 k. This is far above 720 lb applied to both rods.

Hence fatigue capacity is OK.

Conclusion

This support meets the GIP requirements.

ATTACHMENT A
CALC NO S0005Q01AM1
REVISION 00
PAGE NO A5

6.0 References

6.1. "Manual of Steel Construction, Allowable Stress Design", 9th Edition, American Institute of Steel Construction, Inc. Chicago, IL, 1989.

6.2. "General Engineering Catalog", No. 10, Unistrut Building Systems, GTE Products Corporation, Wayne, MI, 1983.

6.3. "Design Response Spectra for Nine Mile Point Unit 1, Reactor Building and Turbine Building", Stevenson & Associates, February 1992.

6.4. "Generic Implementation Plan Procedure (GIP), for Seismic Verification of Nuclear Plant Equipment", Revision 2A, March, 1993, Seismic Qualification Utility Group.

6.5. A-46 GIP Walkdown Notes, 1993.

6.6 "Development of Load Capacities of Cast Iron Inserts and Q-Decking at Nine Mile Point Unit 1", Stevenson & Associates, Project No. 92C2757, January 1993.

6.7 "Formulas for Natural Frequency and Mode Shape", R. D. Blevins, Van Nostrand Reinhold, 1979.

6.8 Niagara Mohawk Power Corporation, Nine Mile Point Unit 1, Drawing No. C-15338-C.

6.9 Globe Strut Catalogue G-643, Rev. 9/89, G. S. Metals,

6.10 T. J. Cope Catalogue or Power Strut Catalogue #20-3R, 1973.