

GPU 2700

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HIATT

TMI-2 CALC FILE
32-1106482-00

TASK 27 SYSTEMS

ANALYSIS OF TMI-2 3/28/79
ACCIDENT

B307080792 791205
PDR ADOCK 05000289
P HOL

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DEC 05 1979

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CALCULATION DATA/TRANSMITTAL SHEET

DOCUMENT IDENTIFIER

CALC. 32 - 1106482 - 00

TRANS. 86 - -

TYPE: ☐ RESEARCH & DEVELOPMENT ☐ SAFETY ANALYSIS REPORT ☐ WDC. SERV. INPUT ☐ DESIGN WDC. ☐ DESIGN VERIF. ☐ OTHERTITLE Systems Analysis of TME-2 3/24/79 AccidentPREPARED BY 2nd Lt. H. H. H. / P. H. H. REVIEWED BY C. C. G. H. H.TITLE Engineer / PRINCIPAL ENG DATE 07/15/79 TITLE Engineer DATE 07/15/79

PURPOSE:

To perform a preliminary systems analysis of the
 March 26, 1979 Accident. Analysis time span will
 be 101.5 minutes to 4 hours and 27 minutes.

SUMMARY OF RESULTS (INCLUDE DOC. ID'S OF PREVIOUS TRANSMITTALS & SOURCE CALCULATIONAL PACKAGES FOR THIS TRANSMITTAL)

Attached.

See memo # 36-1106750-00

DISTRIBUTION

See DRN

APPENDIX V
(Volumes)

BABCOCK & WILCOX
GENERAL CALCULATIONS

DOC ID SERIAL NUMBER REV

Purpose: To calculate approximate volumes in use in the preliminary component assessment analysis.

Method: Use VSS drawings, and references as required.

Limitations: Results are approximate only, and should not be used in other cases w/o detailed review of each node volume by the user.

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BABCOCK & WILCOX
GENERAL CALCULATIONS

32-1106102-00

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SERIAL NUMBER

REV

Volume to pump overides = 1329.87 FT³

Steam generator volume

$$(319.0 - 294.3) \left(\frac{26.3}{2} \right) + 2(294.3) + 320.6 = 1329.87 \text{ FT}^3$$

1329.81

Breakdown of 294.3 FT³

Volume of lower head = 268 FT³ (TMS-1 data sheets) ✓

$$\text{Volume of lower shell} = \frac{87.39}{2} + \frac{42.8}{2} + \frac{(31494 - 294.3)(4.276 \text{ FT}^3/\text{ft})}{2}$$

$$= 153.2 \text{ FT}^3$$

Volume of 1/2 of RC pump = $\frac{102 \text{ FT}^3/\text{pump}}{2} = 51 \text{ FT}^3$

Total Cold Leg volume including 1/2 pump per CH leg
= 153.2 + 51 = 204.2 FT³

Total volume to spillways (corrected to at 319')

$$= 1329.87 \text{ FT}^3$$

1329.81

This includes:

- Steam generator
- Cold legs
- 1/2 pump volumes

1-18 1-18 CONT NO 420 00 REC BY CHK BY	DATE DATE 10-15-78	PROP NO DWG NO GROUP NO FILE NO COMP NO SHEET NO 54
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BABCOCK & WILCOX
GENERAL CALCULATIONS

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Cold Leg Discharge

Ref Design: Same as previous sheet.

Part 99 : $L = 15' \frac{1}{2} = 1.26'$

Part 53 : $L = re = \frac{0.5}{3.14} (2\pi) (42''/12) = 2.749'$

Part 44 : $L = 2' - 0 \frac{1}{32} = 2.0'$

Part 93 : $L = 2.749'$

Part 40 : $L = 19' \frac{15}{32} = 1.622'$

Part 39 : $L = re = \frac{0.5}{3.14} (2\pi) (42''/12) = 0.58'$

Part 38 : $L = 5' 7 \frac{25}{32} = 5.64'$

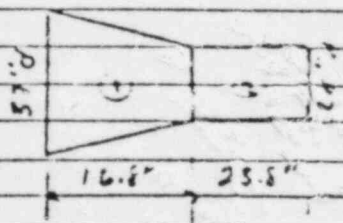
Total Length = 20.6 ft

Vol = $\frac{\pi (20')^2}{4 \times 144} \times 20.6 \times 2 \text{ p. per} = 17.4 \text{ FT}^3 / \text{Cold Leg Discharge}$

Vol $\frac{1}{2}$ of 2 pumps = $\sim 10.2 \text{ FT}^3$

Vol 2 PV initial samples:

From 22-2639-00, pg 5



$V_1 = \frac{\pi (16.6')^2}{4 \times 144} (37.0') = 8.12 \text{ ft}^3$

$V_{12} = \left(\frac{16.6}{12} \right) \left[(37)^2 + (20.4)^2 \right] \left(\frac{\pi}{4 \times 144} \right) \times \frac{\pi}{4} = 8.22$

$V_{12} = \left(\frac{23.4}{12} \right) \left(\frac{\pi}{4 \times 144} \right) (20.4)^2 = 8.92 \checkmark$

Vol/sample = 16.7 FT^3 or $33.9 \text{ FT}^3 / \text{ft}^2$

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BABCOCK & WILCOX
GENERAL CALCULATIONS

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Volume of 2 solid in pump discharge, 2 pumps (above water, assumed to be 52% of pump volume), and 2 unit roughies

$$= 176 + 102 + 33.4 = 311.4 \text{ FT}^3$$

RV Volumes

• Volume of Concrete Head

Reference: 23-3701-03 (11.1 in. File system)

Approximation Rd. Range: 126953E 12

Volume of Hemisphere (actually appears to be slightly < full hemisphere)

$$\frac{V}{2} = \frac{1}{2} \left(\frac{4}{3} \pi r^3 \right) = \frac{1}{2} \times \frac{4}{3} \pi (27.25 \text{ m})^3 = 305 \text{ FT}^3$$

0

Weight of the concrete and assembly = 65,000 lb

$$\text{Volume of LGA} = \frac{\text{Weight}}{\rho} = \frac{65,000 \text{ lb}}{501 \text{ lb/ft}^3} = 130 \text{ FT}^3$$

$$\text{Volume net (hemispherical region)} = 305 - 130 = 175 \text{ FT}^3$$

Bottom of core = 299.1 FT (Elev)

Hemisphere begins at 315.5' - 18' = 297.5 FT

Then, spherical volume between bottom of core and hemisphere

$$= (100.2 \text{ FT}^3/\text{FT}) (299.1 - 297.5 \text{ FT}) = 160.5 \text{ FT}^3$$

$$\text{Total volume in discharge & lower level bilayers} = 1835.3 \text{ FT}^3$$

COMP NO 12345	PROJ NO	FILE NO
DATE 10/10/79	ENG NO	COMP NO
	CIRCLE NO	
10/10/79 DATE 10/10/79 DATE		SHEET NO 7

ERB COCK & WILCOX
GENERAL CALCULATIONS

32-1106482-00

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- Volume of downcomer, coil, and coil headers per unit of elevation from bottom of line to top of coil (299.1' to 311.1')

Reference: 32-7639-00, SAKCKKA

Acc coil = 49.7 FT² (32-3656-00, 86-0667-00)

A T13 coil = 3.19 FT² (32-7639-00)

Acc coil outlet = 12.64 FT²

Acc downcomer = 34.66 FT²

Assume remaining header regions are negligible

Acc total = 49.7 + 12.64 + 34.66 + 3.19 = 100.2 FT²/FT

$\frac{\Delta V}{\Delta t} = 100.2 \text{ FT}^3/\text{FT}$ over coil region

$\left\{ \frac{\Delta V}{\Delta t} \right\}_{\text{coil}} = 49.7$, $\left\{ \frac{\Delta V}{\Delta t} \right\}_{\text{headers}} = 12.64$, $\left\{ \frac{\Delta V}{\Delta t} \right\}_{\text{T13 coil}} = 3.19$

- Volume in downcomer and plenum between top of coil (311.1') and bottom of coil header pipe (314.3354')

Acc downcomer = 34.66 FT²

Acc plenum w/o CFE2 = 55.5 FT² $\Delta V_{\text{line}} = (314.33 - 311.1)(137.65 \frac{\text{FT}^3}{\text{FT}})$

Acc CFE2 = 23.9 FT² = 1444.6 FT³/FT

Acc outlet chamber = 24.09

Total Acc = 137.65 FT²

See sheet 6 for a better (different) breakdown of total. Total ~ 403 FT³

DATE	PROP NO	FILE NO
SHEET	ENG NO	COMP NO
CONT NO 42101	GROUP NO	
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CHIC BY JML	DATE 10/10/79	

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BABCOCK & WILCOX
GENERAL CALCULATIONS

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- Volume in RV from bottom of cold leg pipe to top of cold leg pipe (excluding nipples and cold legs)

$$= \frac{137.65 \text{ Ft}^3}{\text{Ft}} \times \frac{28 \text{ in}}{12 \text{ in/Ft}} = \boxed{321 \text{ Ft}^3} \checkmark$$

- Volume / Ft above nipples also is $\boxed{137.65 \text{ Ft}^3/\text{Ft}}$ up to the top head. $\checkmark$

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DATE	PROJ NO	FILE NO
SHEET	DWG NO	COMP NO
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CHECK BY	DATE	

10/10/9