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MECREDY,R.C. Rochester Gas & Electric Corp.
RECIP.NAME RECIPIENT AFFILIATION
JOHNSON,A.R.

SUBJECT: Responds to NRC 951211 RAI re PTS assessment for plant reactor vessel.

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TITLE: Generic Letter 92-01, Rev 1, Suppl 1 Responses (Reactor Vessel Struct

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ROBERT C. MECREDY
Vice President
Nuclear Operations

December 21, 1995

U.S. Nuclear Regulatory Commission
Document Control Desk
Attn: Allen R. Johnson
Project Directorate I-1
Washington, D.C. 20555

Subject: Response to Request for Additional Information on Pressurized Thermal Shock (PTS) Assessment for Ginna Reactor Vessel
R.E. Ginna Nuclear Power Plant
Docket No. 50-244

Ref.(a): Letter from A.R. Johnson (NRC), to R.C. Mecredy (RGE), Subject: R.E. Ginna Nuclear Power Station - Request for Additional Information Pressurized Thermal Shock (PTS) Assessment for Ginna Reactor Vessel (TAC No. M93827), dated December 11, 1995.

Dear Mr. Johnson:

Rochester Gas and Electric Corporation has reviewed the referenced Request for Additional Information and provides the following responses:

Question 1: *Since the initial reference temperature data for heat 61782 shows large variability (two values at -1°F and -38°F), provide the technical basis for not utilizing the generic mean value and generic standard deviation for the initial reference temperature for B&W fabricated Linde 80 welds. Note: The square of the standard deviation for these values should have been determined by dividing the sum of the squares of the differences between the value and the mean value by n-1 to give an approximate unbiased estimate.*

Response: RG&E proposes to revise the PTS submittal to use an initial reference temperature of -4.8°F and a σ_I value of 19.7°F. These values are supported by the RG&E Generic Letter 92-01 Revision 1 submittal dated July 2, 1992 as provided in BAW 1803, Revision 1 Table 3-3 which measured 34 data points. The use of these values combined with the use of surveillance capsule data yields a margin term of

$$2\sqrt{(19.7)^2 + (14)^2} = 48.3°F \quad \text{(R.G. 1.99, Rev. 2)}$$

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Question 2:	*Provide the unirradiated drop weight test data and charpy test data for welds material fabricated from heat number 61782 weld wire.*
Response:	With the use of the initial reference temperature and standard deviation as discussed in 1. above, the heat number 61782 unirradiated drop weight and charpy test data are no longer required.
Question 3:	*Provide the actual chemistry data utilized in determining the best-estimate chemistry for heat number 61782 welds and the chemistry for the surveillance welds. Identify the source of the data and the reference document. How was the best-estimate and the chemistry for the surveillance weld determined from this data?*
Response:	Attachment A provides a discussion of the heat number 61782 and surveillance capsule weld SA 1036 chemistry.
Question 4:	*Identify whether the surveillance data meets the credibility criteria in Regulatory Guide 1.99, Revision 2. Demonstrate the criteria 3 (scatter about the best-fit line should normally be less than 28°F for welds) has been met by determining the scatter of the ΔRT_{NDT} from surveillance data about the best-fit line described in Regulatory Position 2.1. Does the correlation monitor material in the capsules fall within the scatter band of the data base for the material?*
Response:	Attachment B provides a discussion of the surveillance capsule credibility criteria.

Very truly yours,

Robert C. Mecredy

REJ\412

xc: Mr. Allen R. Johnson (Mail Stop 14B2)
Project Directorate I-1
Washington, D.C. 20555

U.S. Nuclear Regulatory Commission
Region I
475 Allendale Road
King of Prussia, PA 19406

Ginna Senior Resident Inspector

Attachment A

A. Heat number 61782 chemistry

(1) Data used in heat number 61782 chemistry estimate:

The values of Cu and Ni used come from BAW 1500, pg. B-42 for welds SA 1036 and SA 1135 which are archive reactor vessel weldments for this material heat number. A copy of the data table is provided as page (A-2).

(2) The data values were used to determine a mean value of .25 Cu and .54 Ni per 10 CFR 50.61 guidance for best estimate of the mean of the values for the heat number of the material. Using the chemistry factor tables of 10 CFR 50.61 yielded a chemistry factor of 167.6°F.

B. Surveillance capsule chemistry weld SA 1036:

(1) For determining the chemistry factor value used in ratioing (Regulatory Guide 1.99, Rev. 2, position C.2), available data for Cu and Ni chemistry were summed and mean values established. The data came from WCAP 13902 Table 4-1 for tested capsules; BAW 1500 Exhibit B-3 for archived weldment dropouts; and BAW 1500 page B-24 weld qualification report. Hard copies of these data are provided as pages (A-3), (A-4), and (A-5).

(2) The above data values were summed together to yield mean values of .214 Cu and .505 Ni. Using the chemistry factor tables of 10 CFR 50.61, the chemistry factor was determined to be 150.9°F

(A-2)

WELD	FILR WIRE	FLUX SOURCE	C	MN	P	S	SI	CR	NI	MO	CU	V	AL	TI	CO	CB	TA	SN	B	PB	AS	ZR	N
SA 1769	71249	8738 W	.090	1.48	.018	.015	.56	.150	.63	.36	.29	.005	.014	.001	.015	.004	.001	.034	.001	.004	.037	.003	.014
SA 1036	61782	8436NBONSS3	.085	1.46	.014	.008	.58	.070	.49	.38	.27	.010	.018	.0030	.000	.0070	.000	.036	.001	.009	.023	.003	.017
	61782	8436NBONSS3	.083	1.43	.014	.008	.50	.070	.49	.38	.27	.012	.015	.0030	.000	.0060	.000	.005	.001	.007	.022	.003	.048
	61782	8436NBONSS3	.083	1.43	.014	.008	.57	.070	.49	.37	.24	.010	.016	.0030	.000	.0060	.000	.035	.001	.007	.021	.003	.034
	61782	8436NBONSS3	.081	1.39	.013	.007	.55	.080	.49	.38	.22	.009	.013	.0020	.000	.0050	.000	.025	.001	.005	.020	.002	.027
	61782	8436NBONSS3	.083	1.42	.013	.007	.54	.070	.49	.37	.23	.010	.015	.0030	.000	.0160	.000	.005	.001	[illegible]	.021	[illegible]	[illegible]
	61782	8436NBONSS3	.084	1.42	.013	.007	.56	.070	.48	.37	.22	.010	.017	.0030	.000	.0060	.000	.005	.001	.004	.021	.003	.020
	61782	8436NBONSS3	.081	1.41	.013	.007	.55	.070	.48	.36	.21	.011	.017	.0030	.000	.0070	.000	.005	[illegible]	.003	.021	.003	.023
	61782	8436NBONSS3	.092	1.39	.013	.007	.53	.090	.49	.39	.16	.011	.017	.0020	.000	.0070	.000	.005	.001	.004	.019	.002	.023
	61782	8436NBONSS3	.095	1.40	.013	.007	.54	.090	.49	.35	.16	.011	.016	.0020	.000	.0060	.000	.035	.001	.006	.020	.002	.031
	61782	8436NBONSS3	.099	1.41	.013	.007	.54	.090	.50	.39	.17	.011	.017	.0030	.000	.0070	.000	.005	.001	.009	.021	.003	.025
	61782	8436NBONSS3	.091	1.42	.013	.007	.54	.080	.49	.37	.15	.014	.018	.0030	.000	.0060	.000	.005	.001	.008	.020	.003	.027
	61782	8436NBONSS3	.091	1.40	.013	.007	.57	.080	.49	.37	.15	.015	.016	.0020	.000	.0060	.000	.005	.001	.006	.020	.002	.011
SA 1135	61782	8457NBONSS4	.070	1.48	.013	.013	.53	.067	.58	.36	.27	.005	.007	.001	.016	.004	.013	.002	.001	.001	.003	.003	.012
	61782	8457NBONSS4	.070	1.48	.013	.013	.54	.067	.58	.37	.31	.005	.007	.002	.017	.005	.011	.003	.001	.002	.005	.001	.015
	61782	8457NBONSS4	.070	1.46	.013	.014	.59	.068	.58	.37	.31	.005	.007	.002	.017	.005	.008	.003	.001	.002	.009	.004	.015
	61782	8457NBONSS4	.070	1.48	.012	.013	.51	.066	.58	.37	.27	.005	.008	.002	.017	.009	.010	.002	.001	.001	.008	.003	.014
	61782	8457NBONSS4	.080	1.46	.013	.013	.58	.068	.58	.37	.27	.005	.007	.002	.017	.004	.005	.003	.001	.001	.009	.004	.016
	61782	8457NBONSS4	.070	1.44	.014	.013	.60	.070	.58	.37	.28	.005	.006	.002	.017	.004	.008	.003	.001	.001	.008	.003	.014
	61782	8457NBONSS4	.080	1.47	.012	.013	.52	.070	.58	.37	.29	.005	.007	.002	.017	.005	.008	.003	.001	.002	.008	.003	.017
	61782	8457NBONSS4	.070	1.46	.012	.013	.51	.070	.58	.37	.27	.005	.007	.002	.017	.004	.008	.003	.001	.002	.008	.004	.019
	61782	8457NBONSS4	.070	1.47	.012	.013	.50	.070	.58	.37	.28	.005	.008	.002	.017	.004	.007	.003	.001	.002	.008	.003	.015
	61782	8457NBONSS4	.070	1.47	.012	.013	.52	.071	.58	.38	.29	.005	.009	.002	.018	.005	.009	.003	.001	.002	.010	.006	.015
	61782	8457NBONSS4	.070	1.46	.012	.013	.51	.074	.59	.38	.28	.005	.007	.002	.018	.005	.009	.003	.001	.002	.015	.003	.017
	61782	8457NBONSS4	.070	1.48	.012	.013	.52	.077	.58	.38	.29	.005	.008	.002	.012	.005	.010	.003	.001	.002	.014	.003	.019
	61782	8457NBONSS4	.070	1.48	.011	.013	.47	.070	.59	.37	.24	.005	.008	.002	.017	.005	.011	.002	.001	.001	.006	.002	.015
	61782	8457NBONSS4	.070	1.48	.011	.013	.48	.072	.58	.37	.25	.005	.009	.002	.017	.005	.010	.002	.001	.002	.007	.003	.014
	61782	8457NBONSS4	.090	1.49	.011	.013	.46	.072	.59	.39	.22	.005	.009	.002	.017	.005	.014	.003	.001	.001	.009	.003	.014
	61782	8457NBONSS4	.070	1.45	.012	.013	.49	.075	.59	.38	.22	.005	.008	.002	.017	.005	.014	.003	.001	.001	.006	.003	.013
	61782	8457NBONSS4	.095	1.43	.012	.013	.51	.080	.59	.39	.31	.006	.009	.002	.018	.005	.015	.003	.001	.002	.006	.003	.023
	61782	8457NBONSS4	.090	1.43	.011	.013	.48	.081	.58	.39	.32	.006	.008	.002	.018	.005	.006	.003	.001	.002	.037	.003	.014
	61782	8457NBONSS4	.090	1.45	.011	.013	.47	.084	.59	.39	.31	.006	.009	.002	.018	.005	.006	.003	.001	.002	.036	.004	.016
	61782	8457NBONSS4	.080	1.45	.011	.013	.48	.078	.59	.38	.34	.006	.008	.002	.018	.005	.003	.003	.001	.002	.037	.003	.019
	61782	8457NBONSS4	.080	1.45	.010	.013	.47	.081	.59	.39	.34	.006	.010	.002	.017	.005	.002	.003	.001	.002	.037	.004	.018
	61782	8457NBONSS4	.090	1.44	.010	.013	.45	.087	.59	.39	.33	.007	.009	.002	.017	.005	.002	.003	.001	.002	.037	.004	.018
	61782	8457NBONSS4	.080	1.40	.010	.012	.43	.090	.58	.39	.26	.008	.009	.002	.017	.004	.005	.003	.001	.001	.034	.003	.015
	61782	8457NBONSS4	.100	1.44	.011	.013	.46	.096	.60	.41	.22	.009	.009	.002	.018	.005	.007	.003	.001	.002	.037	.004	.018
	61782	8457NBONSS4	.100	1.41	.010	.012	.42	.110	.60	.41	.22	.011	.010	.002	.018	.005	.009	.004	.001	.002	.036	.004	.017
	61782	8457NBONSS4	.090	1.38	.010	.012	.44	.110	.60	.41	.23	.010	.008	.002	.018	.006	.007	.003	.001	.002	.037	.004	.015
	61782	8457NBONSS4	.090	1.43	.010	.013	.44	.096	.59	.40	.21	.013	.009	.002	.018	.005	.007	.003	.001	.002	.039	.004	.013
	61782	8457NBONSS4	.090	1.43	.009	.012	.38	.110	.60	.41	.23	.012	.011	.002	.018	.005	.008	.003	.001	.002	.037	.004	.015
	61782	8457NBONSS4	.100	1.31	.009	.012	.39	.130	.59	.41	.17	.013	.013	.002	.017	.005	.007	.004	.001	.001	.036	.004	.018
SA 1585	72445	8597NBONSS8	.070	1.44	.016	.016	.54	.079	.59	.37	.23	.005	.010	.002	.014	.004	.012	.003	.001	.002	.037	.003	.012
	72445	8597NBONSS8	.070	1.45	.016	.016	.56	.077	.59	.37	.23	.005	.009	.001	.014	.004	.012	.003	.001	.002	.037	.003	.012
	72445	8597NBONSS8	.070	1.43	.016	.015	.54	.076	.59	.37	.23	.005	.009	.002	.014	.004	.012	.004	.001	.002	.007	.003	.013
	72445	8597NBONSS8	.090	1.43	.016	.016	.56	.077	.58	.37	.24	.005	.009	.001	.014	.004	.010	.003	.001	.002	.038	.003	.014
	72445	8597NBONSS8	.080	1.43	.016	.016	.52	.079	.58	.37	.21	.005	.010	.002	.014	.004	.010	.003	.001	.002	.037	.003	.016
	72445	8597NBONSS8	.080	1.44	.016	.016	.54	.079	.59	.37	.22	.005	.013	.002	.014	.005	.009	.003	.001	.002	.037	.004	.016

TABLE 4-1				
Chemical Composition (wt%) of the R. E. Ginna Reactor Vessel Surveillance Materials[a]				
Chemical Analysis (wt. %)	Lower Shell Forging 125P666	Intermediate Shell Forging 125S255	Surveillance Weld[b]	
C	0.19	0.18	0.075	(0.06)
Mn	0.67	0.66	1.31	(1.29)
P	0.010	0.010	0.012	(0.006)
S	0.011	0.007	0.016	(0.020)
Si	0.20	0.23	0.59	(0.41)
Ni	0.69	0.69	0.56	(0.50)
Cr	0.37	0.33	0.59	(0.03)
Co	0.013	0.015	0.001	(----)
Mo	0.57	0.58	0.36	(0.22)
V	0.02	0.02	0.001	(----)
Cu	0.05	0.07	0.23	(0.22)
Al	0.004	0.003	0.020	(----)
N	----	----	0.015	(----)
Sn	0.01	0.01	----	(----)

[a] The values presented here are from References 2, 13 and 14.

[b] The values in parenthesis are from an analysis performed on an irradiated Capsule T weld metal charpy specimen, W26 (Reference 2).

WELD	FILR WIRE	FLUX	SOURCE	C	MN	P	S	SI	CR	NI	MO	CU	V	AL	TI	CO	CB	TA	SN	B	PB	AS	ZR	W
SA 1769	71249	8738	W	.090	1.48	.018	.015	.56	.150	.63	.36	.29	.005	.014	.001	.015	.004	.001	.034	.001	.004	.037	.003	.014
	61782	8436NBDNSS3		.065	1.46	.014	.008	.53	.070	.49	.38	.27	.010	.018	.0030	.000	.0070	.000	.036	.001	.009	.023	.003	.017
	61782	8436NBDNSS3		.083	1.43	.014	.008	.50	.070	.49	.38	.27	.012	.015	.0030	.000	.0060	.000	.005	.001	.007	.022	.003	.048
	61782	8436NBDNSS3		.083	1.43	.014	.008	.57	.070	.49	.37	.24	.010	.016	.0030	.000	.0060	.000	.035	.001	.007	.021	.003	.034
	61782	8436NBDNSS3		.081	1.39	.013	.007	.55	.080	.49	.38	.22	.009	.013	.0020	.000	.0050	.000	.035	.001	.005	.020	.002	.037
	61782	8436NBDNSS3		.083	1.42	.013	.007	.54	.070	.49	.37	.23	.010	.015	.0030	.000	.0160	.000	.005	.001	.004	.021	.003	[illegible]
	61782	8436NBDNSS3		.084	1.42	.013	.007	.56	.070	.48	.37	.22	.010	.017	.0030	.000	.0060	.000	.005	.001	.004	.021	.003	.028
SA 1036	61782	8436NBDNSS3		.081	1.41	.013	.007	.55	.070	.48	.36	.21	.011	.017	.0030	.000	.0070	.000	.005	.001	.003	.021	.003	.023
	61782	8436NBDNSS3		.092	1.39	.013	.007	.53	.090	.49	.39	.16	.012	.017	.0020	.000	.0060	.000	.005	.001	.006	.019	.002	.023
	61782	8436NBDNSS3		.095	1.40	.013	.007	.54	.090	.49	.35	.16	.011	.015	.0020	.000	.0060	.000	.005	.001	.006	.020	.002	.031
	61782	8436NBDNSS3		.099	1.41	.013	.007	.54	.090	.50	.39	.17	.011	.017	.0030	.000	.0070	.000	.005	.001	.009	.021	.003	.025
	61782	8436NBDNSS3		.091	1.42	.013	.007	.54	.080	.49	.37	.15	.010	.018	.0030	.000	.0060	.000	.005	.001	.008	.020	.003	.027
	61782	8436NBDNSS3		.091	1.40	.013	.007	.57	.080	.49	.37	.15	.010	.016	.0020	.000	.0060	.000	.005	.001	.006	.020	.002	.011
	61782	8457NBDNSS4		.070	1.48	.013	.013	.53	.067	.58	.36	.27	.005	.007	.001	.016	.004	.013	.002	.001	.001	.009	.003	.012
	61782	8457NBDNSS4		.070	1.48	.013	.013	.54	.067	.58	.37	.31	.005	.007	.002	.017	.005	.011	.003	.001	.002	.018	.003	.015
	61782	8457NBDNSS4		.070	1.45	.013	.014	.59	.068	.59	.37	.31	.005	.007	.002	.017	.005	.008	.003	.001	.002	.019	.004	.015
	61782	8457NBDNSS4		.070	1.48	.012	.013	.51	.056	.58	.37	.27	.005	.008	.002	.017	.009	.010	.002	.001	.001	.018	.003	.014
	61782	8457NBDNSS4		.080	1.46	.013	.013	.56	.068	.58	.37	.27	.005	.007	.002	.017	.004	.005	.003	.001	.001	.019	.004	.016
	61782	8457NBDNSS4		.070	1.44	.014	.013	.60	.070	.58	.37	.28	.005	.006	.002	.017	.004	.008	.003	.001	.001	.018	.003	.014
	61782	8457NBDNSS4		.080	1.47	.012	.013	.52	.070	.58	.37	.29	.005	.007	.002	.017	.005	.008	.003	.001	.002	.018	.003	.017
	61782	8457NBDNSS4		.070	1.46	.012	.013	.51	.070	.58	.37	.27	.005	.007	.002	.017	.004	.008	.003	.001	.002	.018	.004	.019
	61782	8457NBDNSS4		.070	1.47	.012	.013	.50	.070	.58	.37	.28	.005	.008	.002	.017	.004	.007	.003	.001	.002	.018	.003	.015
	61782	8457NBDNSS4		.070	1.47	.012	.013	.52	.071	.58	.38	.29	.005	.009	.002	.018	.005	.009	.003	.001	.002	.010	.006	.015
	61782	8457NBDNSS4		.070	1.46	.012	.013	.51	.074	.59	.38	.28	.005	.007	.002	.018	.005	.009	.003	.001	.002	.015	.003	.017
	61782	8457NBDNSS4		.070	1.48	.012	.013	.52	.037	.58	.38	.29	.005	.008	.002	.012	.005	.010	.003	.001	.002	.014	.003	.019
SA 1135	61782	8457NBDNSS4		.070	1.45	.011	.013	.47	.070	.59	.37	.24	.005	.008	.002	.017	.005	.011	.002	.001	.001	.016	.003	.015
	61782	8457NBDNSS4		.070	1.48	.011	.013	.48	.072	.58	.37	.25	.005	.009	.002	.017	.005	.010	.002	.001	.002	.007	.003	.014
	61782	8457NBDNSS4		.090	1.49	.011	.013	.46	.072	.59	.35	.22	.005	.009	.002	.017	.005	.014	.003	.001	.001	.015	.003	.014
	61782	8457NBDNSS4		.070	1.45	.012	.013	.45	.075	.59	.38	.22	.005	.008	.002	.017	.005	.014	.003	.001	.001	.016	.003	.013
	61782	8457NBDNSS4		.093	1.43	.012	.013	.51	.080	.59	.39	.31	.006	.003	.002	.018	.005	.005	.003	.001	.002	.016	.003	.023
	61782	8457NBDNSS4		.090	1.43	.011	.013	.48	.081	.58	.39	.32	.006	.008	.002	.018	.005	.006	.003	.001	.002	.037	.003	.014
	61782	8457NBDNSS4		.090	1.45	.011	.013	.47	.084	.59	.39	.31	.006	.009	.002	.018	.005	.006	.003	.001	.002	.036	.004	.016
	61782	8457NBDNSS4		.080	1.45	.011	.013	.48	.078	.59	.38	.34	.006	.008	.002	.018	.005	.003	.003	.001	.002	.037	.003	.019
	61782	8457NBDNSS4		.080	1.46	.010	.013	.47	.081	.59	.39	.34	.006	.010	.002	.017	.006	.002	.003	.001	.003	.037	.004	.018
	61782	8457NBDNSS4		.090	1.44	.010	.013	.45	.087	.59	.39	.33	.057	.009	.002	.017	.005	.002	.003	.001	.002	.037	.004	.015
	61782	8457NBDNSS4		.080	1.40	.010	.012	.43	.090	.58	.39	.26	.008	.009	.002	.017	.004	.005	.003	.001	.001	.034	.003	.015
	61782	8457NBDNSS4		.100	1.44	.011	.013	.46	.096	.60	.41	.22	.009	.009	.002	.018	.005	.007	.003	.001	.002	.037	.004	.018
	61782	8457NBDNSS4		.100	1.41	.010	.012	.42	.110	.60	.41	.22	.011	.010	.002	.018	.005	.009	.004	.001	.002	.036	.004	.017
	61782	8457NBDNSS4		.090	1.38	.010	.012	.44	.110	.60	.41	.23	.010	.008	.002	.018	.005	.007	.003	.001	.002	.037	.004	.015
	61782	8457NBDNSS4		.090	1.43	.010	.013	.44	.096	.59	.40	.21	.009	.009	.002	.018	.005	.007	.003	.001	.002	.039	.004	.015
	61782	8457NBDNSS4		.090	1.43	.009	.012	.39	.110	.60	.41	.23	.010	.011	.002	.018	.005	.008	.003	.001	.002	.037	.004	.015
	61782	8457NBDNSS4		.100	1.31	.009	.012	.39	.130	.59	.41	.17	.013	.013	.002	.017	.005	.007	.004	.001	.001	.036	.004	.018
	72445	8597NBDNSS8		.070	1.44	.016	.015	.54	.079	.59	.37	.23	.005	.010	.002	.014	.004	.012	.003	.001	.002	.037	.003	.012
SA 1585	72445	8597NBDNSS8		.070	1.45	.016	.016	.56	.077	.59	.37	.23	.005	.009	.001	.014	.004	.012	.003	.001	.002	.037	.003	.012
	72445	8597NBDNSS8		.070	1.43	.016	.015	.54	.076	.59	.37	.23	.005	.009	.002	.014	.004	.012	.004	.001	.002	.007	.003	.013
	72445	8597NBDNSS8		.080	1.43	.016	.016	.56	.077	.58	.37	.24	.005	.009	.001	.014	.004	.010	.003	.001	.002	.038	.003	.014
	72445	8597NBDNSS8		.080	1.43	.016	.016	.52	.079	.58	.37	.21	.005	.010	.002	.014	.004	.010	.003	.001	.002	.037	.003	.016
	72445	8597NBDNSS8		.080	1.44	.016	.016	.54	.079	.59	.37	.22	.005	.010	.002	.014	.005	.009	.003	.001	.002	.037	.004	.016

-E BABCOCK & WILCOX COMPANY
LER DIVISION

	MR. R. GLASKI - PRODUCTION CONTROL	
From	MR. H. WALSH - QUALITY CONTROL	
Cust.		File No. or Ref.
Subj.	QUALIFICATION OF WIRE & FLUX FOR AUTOMATIC SUBMERGED ARC WELDING	Date: APRIL 29, 1967

This letter to cover one customer and one subject only.

The necessary qualification test plate No. SA-1036 was successfully welded in the Quality Control Laboratory to meet the heat treatment, chemistry, charpy V-notch impact and tensile test requirements as per NAVShips 250-1500-1.

Listed below is the heat of wire and type of flux used and the results of these tests.

1/8" dia. Page Mn-Mo-Ni, Ht-No. 61782
Linde #80 48 XD flux, lot #8436
Size of Weld Pad: 4" x 6" x 1-1/2" high
Welding Conditions: A.C., 450 Amps, 30 Volts
10" per minute
Stress Relieved: Eight, 6 hour cycles at 1100-1125°F

WELD CHEMICAL ANALYSIS

C	Mn	P	S	Si	Cr	Ni	Mo	Cu
.07	1.24	.017	.014	.50	.07	.04	.41	.31

CHARPY V-NOTCH IMPACT TEST AT +10°F

#1 Ft. Lbs. = 40.0
#2 Ft. Lbs. = 42.0
#3 Ft. Lbs. = 50.0

ALL WELD METAL TENSILE

DIA.	YIELD POINT	ULTIMATE STRENGTH	ELONGATION % IN 2"
.505	84,500	82,500	30.0
.504	84,500	82,250	28.0

Linde #80 48 XD flux, lot #8436 and 1/8" dia., Page Mn-Mo-Ni, Ht-No. 61782, has been approved for welding on 80,000 material.

H. WALSH

HW:mab
cc: [illegible]. Becker — N. Downs — A. Kozlowski
W. Buckey — H. Helmbrecht — A. Roese
E. Carlson — R. Kennemer — R. Roseman
N. Cagnotti — M. Kozak — J. Schneider
[illegible]. Simon

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(A-50)

Attachment B
Evaluation of the R.E. Ginna Reactor Vessel Surveillance Data Credibility

INTRODUCTION:

Regulatory Guide 1.99, Revision 2, describes general procedures acceptable to the NRC staff for calculating the effects of neutron radiation embrittlement of the low-alloy steels currently used for light-water-cooled reactor vessels. Position C.2 of Regulatory Guide 1.99, Revision 2, describes the method for calculating the adjusted reference temperature and Charpy upper-shelf energy of reactor vessel beltline materials using surveillance capsule data. The methods of Position C.2 can only be applied when two or more credible surveillance data sets become available from the reactor in question.

To date there have been four surveillance capsules removed from the R.E. Ginna reactor vessel. To use these surveillance data sets, they must be shown to be credible. In accordance with the discussion of Regulatory Guide 1.99, Revision 2, there are five requirements that must be met for the surveillance data to be judged credible.

The purpose of this evaluation is to apply the credibility requirements of Regulatory Guide 1.99, Revision 2, to the R.E. Ginna reactor vessel surveillance data and determine if the R.E. Ginna surveillance data is credible.

EVALUATION:

Criterion 1: Materials in the capsules should be those judged most likely to be controlling with regard to radiation embrittlement.

The beltline region of the reactor vessel is defined in Appendix G to 10 CFR Part 50, "Fracture Toughness Requirements," May 27, 1983 to be:

> "the reactor vessel (shell material including welds, heat affected zones, and plates or forgings) that directly surrounds the effective height of the active core and adjacent regions of the reactor vessel that are predicted to experience sufficient neutron radiation damage to be considered in the selection of the most limiting material with regard to radiation damage."

The R.E. Ginna reactor vessel consists of the following beltline region materials:

a) Intermediate shell forging heat number 125S255,

b) Lower shell forging heat 125P666, and

c) Intermediate to lower shell circumferential weld seam SA-847 (fabricated with 1/8 inch Mn-Mo-Ni weld filler wire, heat number 61782 and Linde 80 flux, lot number 8350).

The R.E. Ginna surveillance program utilizes test specimens from both the intermediate and lower shell forgings. The weldment used in the surveillance program was fabricated with 1/8 inch Mn-Mo-Ni weld filler wire, heat number 61782 and Linde 80 flux, lot number 8436. Since all beltline materials are contained in the surveillance program of the R.E. Ginna reactor vessel, the limiting material is contained in the surveillance program. Hence, the R.E. Ginna reactor vessel surveillance program meets this criteria.

Criterion 2: Scatter in the plots Charpy energy versus temperature for the irradiated and unirradiated conditions should be small enough to permit the determination of the 30 ft-lb temperature and upper shelf energy unambiguously.

Plots of Charpy energy versus temperature for the unirradiated condition are presented in WCAP-7254, "Rochester Gas and Electric Robert E. Ginna Unit No. 1 Reactor Vessel Radiation Surveillance Program," dated May 1969.

Plots of Charpy energy versus temperature for the irradiated condition are presented in:

- Westinghouse Report FP-RA-1, "Analysis of Capsule V from the Rochester Gas and Electric R.E. Ginna Unit No. 1 Reactor Vessel Radiation Surveillance Program," dated April 1973,

- WCAP-8421, "Analysis of Capsule R from the Rochester Gas and Electric Corporation R.E. Ginna Unit No. 1 Reactor Vessel Radiation Surveillance Program," dated November 1974,

- WCAP-10086, "Analysis of Capsule T from the Rochester Gas and Electric Corporation R.E. Ginna Nuclear Plant Reactor Vessel Radiation Surveillance Program," dated April 1982, and

- WCAP-13902, "Analysis of Capsule S from the Rochester Gas and Electric Corporation R.E. Ginna Unit Reactor Vessel Radiation Surveillance Program," dated April 1993.

The scatter in the data presented in these plots was small enough to permit the determination of the 30 ft-lb temperature and the upper shelf energy of the R.E. Ginna surveillance materials unambiguously. Therefore, the R.E. Ginna

surveillance program meets this criterion.

Criterion 3: When there are two or more sets of surveillance data from one reactor, the scatter of ΔRT_{NDT} values about a best-fit line drawn as described in Regulatory Position 2.1 normally should be less than 28°F for welds and 17°F for base metal. Even if the fluence range is large (two or more orders of magnitude), the scatter should not exceed twice those values. Even if the data fail this criterion for use in shift calculations, they may be credible for determining decrease in upper shelf energy if the upper shelf can be clearly determined, following the definition given in ASTM E185-82.

The least squares method as described in Regulatory Guide 1.99, Revision 2 will be utilized to determine a best-fit line for that data and to determine if the scatter of these ΔRT_{NDT} values about this line in less than 28°F for welds and less than 17°F for the plate.

Following is the calculation of the best fit line as described in Regulatory Guide 1.99, Revision 2.

TABLE 1						
Ginna Surveillance Capsule Data						
Material	Capsule	$F^{(1)}$	$FF^{(2)}$ (x)	$\Delta RT_{NDT}{}^{(3)}$ (y)	$FF x \Delta RT_{NDT}$ (xy)	FF^2 (x^2)
Lower Shell Forging 125P666 (Tangential)	V	0.556	0.836	25	20.9	0.699
	R	1.15	1.039	25	26.0	1.080
	T	1.97	1.185	30	35.6	1.404
	S	3.87	1.349	42	56.7	1.820
		$\Sigma^n_{i=1}$	4.409	122	139.2	5.003
Intermediate Shell Forging 125S255 (Tangential)	V	0.556	0.836	0	0	0.699
	R	1.15	1.039	0	0	1.080
	T	1.97	1.185	0	0	1.404
	S	3.87	1.349	60	80.9	1.820
		$\Sigma^n_{i=1}$	4.409	60	80.9	5.003
Weld Metal	V	0.556	0.836	140	117.0	0.699
	R	1.15	1.039	165	171.4	1.080
	T	1.97	1.185	150	177.8	1.404
	S	3.87	1.349	205	276.5	1.820
		$\Sigma^n_{i=1}$	4.409	660	742.7	5.003

(1) F = Fluence (10^{19} n/cm^2, E > 1.0 MeV)

(2) FF = Fluence Factor = $F^{(0.28 - 0.1 * \log F)}$

(3) ΔRT_{NDT} values do not include the adjustment ratio procedure of Regulatory Guide 1.99, Revision 2, Position 2.1, since the surveillance capsule materials are equivalent to the actual beltline materials

Per the 27th Edition of the CRC Standard Mathematical Tables (page 497), for a straight line fit by the method of least squares, the values b_0 and b_1 are obtained by solving the normal equations

$$nb_0 + b_1 \Sigma x_i = \Sigma y_i \quad \text{and}$$

$$b_0 \Sigma x_1 + b_1 \Sigma x_i^2 = \Sigma x_i y_i$$

These equations can be re-written as follows ($b_0 = a$ and $b_1 = b$):

$$\sum_{i=1}^{n} y_i = an + b\sum_{i=1}^{n} x_i \quad \text{and}$$

$$\sum_{i=1}^{n} x_i y_i = a\sum_{i=1}^{n} x_i + b\sum_{i=1}^{n} x_i^2$$

<u>Lower Shell Forging 125P666</u>:

Based on the data provided in Table 1 these equations become:

$$122 = 4a + 4.409b \quad \text{and}$$

$$139.2 = 4.409a + 5.003b$$

Thus, $b = 33.004$ and $a = -5.879$, and the equation of the straight line which provides the best fit in the sense of least squares is:

$$Y' = 33.004\ (X)\ -5.879$$

The scatter in predicting a value Y corresponding to a given X value is:

$$e = Y - Y'$$

TABLE 2			
Lower Shell Forging 125P666			
FF	ΔRT_{NDT} (30 ft-lb) (°F)	Best Fit ΔRT_{NDT} (°F)	Scatter of ΔRT_{NDT} (°F)
0.836	25	21.7	3.3
1.039	25	28.4	-3.4
1.185	30	33.2	-3.2
1.349	42	38.6	3.4

The scatter of ΔRT_{NDT} values about a best-fit line drawn as described in Regulatory Position 2.1 (Table 2) is less than 17°F. Therefore, this criteria is met for the surveillance data of lower shell forging 125P666.

Intermediate Shell Forging 125S255:

Based on the data provided in Table 1 the equations become:

$$60 = 4a + 4.409b \quad \text{and}$$

$$80.9 = 4.409a + 5.003b$$

Thus, b = 103.122 and a = -98.666, and the equation of the straight line which provides the best fit in the sense of least squares is:

$$Y' = 103.122\ (X)\ -98.666$$

The scatter in predicting a value Y corresponding to a given X value is:

$$e = Y - Y'$$

TABLE 3			
Intermediate Shell Forging 125S255			
FF	ΔRT_{NDT} (30 ft-lb) (°F)	Best Fit ΔRT_{NDT} (°F)	Scatter of ΔRT_{NDT} (°F)
0.836	0	-12.5	12.5
1.039	0	8.5	-8.5
1.185	0	23.5	-23.5
1.349	60	40.4	19.6

The scatter of ΔRT_{NDT} values about a best-fit line drawn as described in Regulatory Position 2.1 (Table 3) is less than 34°F (2 x 17°F). Therefore, this criteria is met for the surveillance data of intermediate shell forging 125S255.

Weld Metal:

Based on the data provided in Table 1 the equations become:

$$660 = 4a + 4.409b \quad \text{and}$$

$$742.7 = 4.409a + 5.003b$$

Thus, b = 106.265 and a = 47.869, and the equation of the straight line which provides the best fit in the sense of least squares is:

$$Y' = 106.265\ (X) + 47.869$$

The scatter in predicting a value Y corresponding to a given X value is:

$$e = Y - Y'$$

TABLE 4

Surveillance Weld Metal

FF	ΔRT_{NDT} (30 ft-lb) (°F)	Best Fit ΔRT_{NDT} (°F)	Scatter of ΔRT_{NDT} (°F)
0.836	140	136.7	3.3
1.039	165	158.3	6.7
1.185	150	173.8	-23.8
1.349	205	191.2	13.8

The scatter of ΔRT_{NDT} values about a best-fit line drawn as described in Regulatory Position 2.1 (Table 4) is less than 28°F. Therefore, this criteria is met for the surveillance data of the circumferential weld material.

Criterion 4: The irradiation temperature of the Charpy specimens in the capsule should match the vessel wall temperature at the cladding/base metal interface within ±25°F.

The capsule specimens are located in the reactor between the core barrel and the vessel wall and are positioned opposite the center of the core. The test capsules are in baskets attached to the thermal shield. The location of the specimens with respect to the reactor vessel beltline provides assurance that the reactor vessel wall and the specimens experience equivalent operating conditions such that the temperatures will not differ by more than 25°F.

Criterion 5: The surveillance data for the correlation monitor material in the capsule should fall within the scatter band of the data base for that material.

The correlation monitor material SA302 Grade B utilized in the R.E. Ginna surveillance program was furnished by the U.S. Steel Corporation through Subcommittee II of ASTM Committee E10 on Radioisotopes and Radiation Effects. A plot of the Measured Shift minus the Regulatory Guide 1.99, Revision 2, shift was obtained from the Oak Ridge National Laboratory and is described on page B-9 and B-10 of this attachment. The plot shows the Ginna data as solid points. The data has been shifted such that the Mean Value is at zero and the two-sigma bound at 25°F. All the Ginna surveillance correlation monitor material data fall within the two-sigma bounds (scatter band) of the SA302 Grade B data per the criterion as described by the CPED transmittal of page B-9.

CONCLUSION:

Based on the preceding positive responses to all five criteria of Regulatory Guide 1.99, Revision 2, Section B, the R.E. Ginna surveillance data is credible.

OAK RIDGE NATIONAL LABORATORY

Computational Physics & Engineering (CPED)

Nuclear Analysis & Shielding Section

Facsimile Transmittal

TO: Ed Telck

FAX NO. (412) 374-6337
VERIFY NO.
OFFICE NO.

FROM: Joe Pace

FAX NO. (423) 574-9619
VERIFY NO. (423) 576-1610
OFFICE NO.

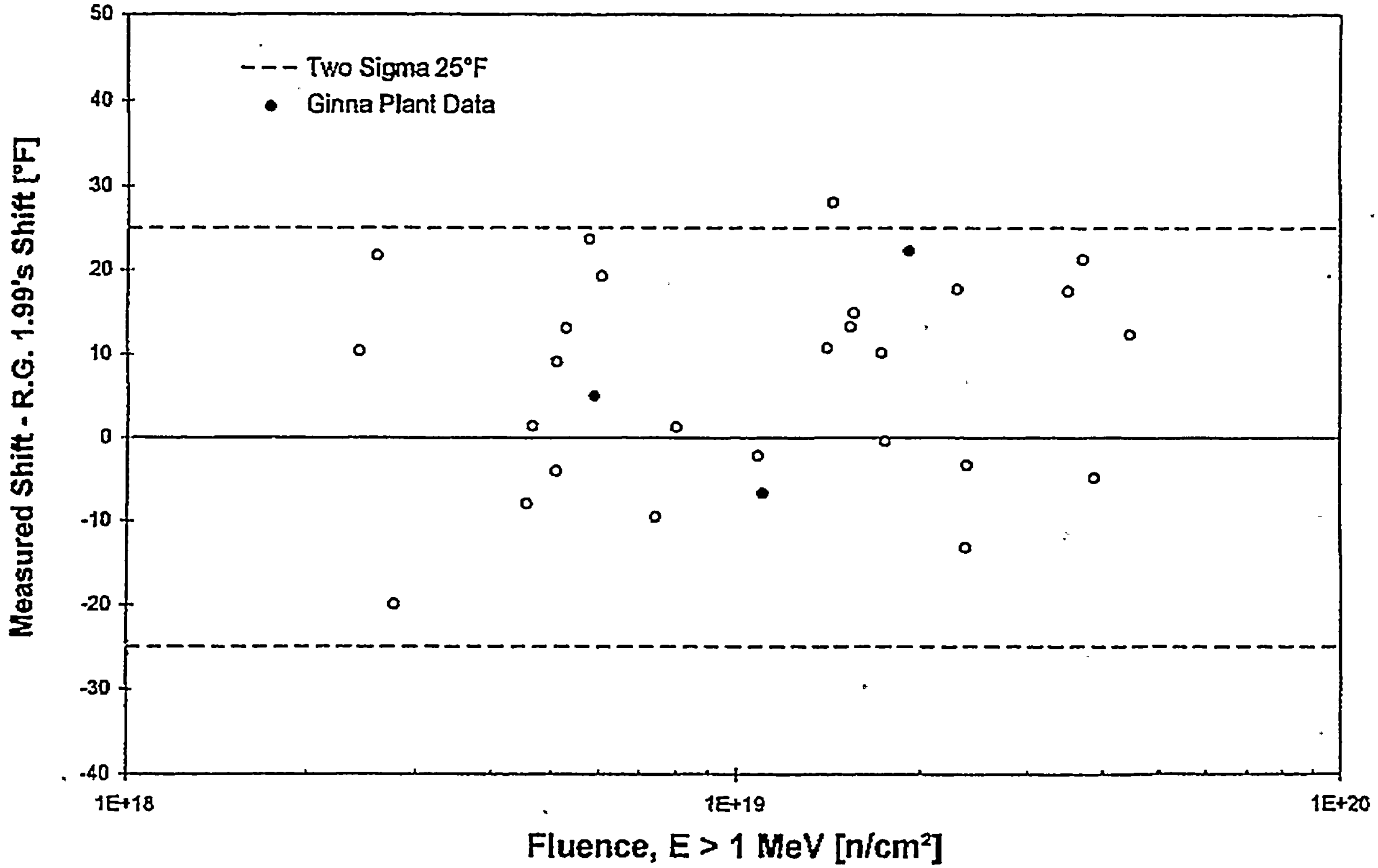
COMMENTS: An additional plot has been generated and shows the Ginna data as a solid symbol. Moreover, the data has been shifted such that the Mean Value is at zero and the two-sigma bound at 25 degrees F. All the Ginna surveillance CMM data fall within the R.G. 1.99 two-sigma bounds.

THIS TRANSMITTAL CONSISTS OF 1 PAGES (EXCLUDING COVER SHEET)

DATE: December 15, 1995

TIME: 11:30

Residual vs Fast Fluence for A302B ASTM Correlation Monitor Materials from Westinghouse Reported Data (w/o Yankee Rowe)



(B-10)