PRIORITY 1
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AUTH.NAME AUTHOR AFFILIATION
PARRISH,J.V. Washington Public Power Supply System
RECIP.NAME RECIPIENT AFFILIATION
Document Control Branch (Document Control Desk)

SUBJECT: Forwards info supporting review of First & Second 10-yr ISI program plans. SQR Reports

DISTRIBUTION CODE: A047D COPIES RECEIVED:LTR 1 ENCL 1 SIZE: 69
TITLE: OR Submittal: Inservice/Testing/Relief from ASME Code - GL-89-04

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	NRR/DE/EMEB	1	1	NUDOCS-ABSTRACT	1	1
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	NOAC	1	1	NRC PDR	1	1

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PRIORITY 1 DOCUMENT

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

P.O. Box 968 • 3000 George Washington Way • Richland, Washington 99352-0968 • (509) 372-5000

May 12, 1995
GO2-95-094

Docket No. 50-397

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Gentlemen:

Subject: **WNP-2, OPERATING LICENSE NPF-21**
SECOND 10-YEAR INSERVICE INSPECTION PROGRAM PLAN

Reference: Letter GO2-94-286, dated December 27, 1994, JV Parrish (SS) to NRC, "Second 10-Year Inservice Inspection Program Plan"

Based on discussions with members of the staff, the attached information is provided in support of your review of the First and Second 10-year Inservice Inspection Program Plans for WNP-2. If additional information is required to clarify the Plan, this information will be provided on request.

Should you have any questions or desire additional information regarding this matter, please call me or D. A. Swank at (509) 377-4563.

Sincerely,

J. V. Parrish (Mail Drop 1023)
Vice-President, Nuclear Operations

DAS/ml
Attachments

cc: LJ Callan - NRC RIV w/o
KE Perkins, Jr. - NRC RIV, Walnut Creek Field Office w/o
NS Reynolds - Winston & Strawn w/o
JW Clifford - NRC
DL Williams - BPA/399 w/o
NRC Sr. Resident Inspector - 927N w/o

A047

FIRST INTERVAL ISI PROGRAM PLAN

ISI-2-003

Questions:

1. This request for relief is titled as revised, which revision is this?

2. It is stated that "The component supports and welded attachments are completely or partially inaccessible to all examination techniques. No alternate examinations are proposed."

   Is it being asked to only do partial examinations or no examinations?
   a) component supports
   b) integral attachments

Responses:

1. This is revision 1 to the relief request that adds the items starting with FPC-64.

2. We are requesting both partial examinations and no examination depending on the item. The attached table summarizes the specific relief requested for each item. The drawings of the affected items are included.

ISI-2-011

Questions:

1. It is stated that "Relief is required from ASME Section XI examination requirements for the two C3.40 welds on the basis of inaccessibility of the welds due to their location in a pipe chase where access will place a hardship on the plant to gain access." What are the hardships?

2. The basis states that the welds are inaccessible. Under impact on plant quality and safety it is stated that a partial code exam will be done. What examinations will be performed on the C3.40 welds?

3. If they are partial, what is the % completion?

4. As part of the impact on quality and safety discussion, items 1, 3, and 4 are used. Is there an item 2?

Responses:

1. To gain access to the attachment welds RHR-77(W) and RHR-410(W) to perform a surface examination will require disassembly of the shielding wall for the pipe chase which creates a hardship on the plant.

2. The welds are inaccessible. In the first sentence of after item 4 on page 2 of ISI-2-001, the phrase "doing only a partial Code" should read "not performing".

3. No examination is requested.

4. There is no item 2. The paragraphs should be renumbered 1, 2, and 3.

SECOND INTERVAL ISI PROGRAM PLAN

2ISI-06

The Reactor Plant Cold Startup procedure 3.1.2 revision 26 identifies a Drywell inspection at 400 psig and 920 psig. This inspection is not required by the procedure for all plant startups, but the inspection is performed following refueling outages. Corrective measures taken for leakage at the CRD flanged connections during the pressure test depend on the degree that the flange leaks. The corrective measures include retorguing the bolting, scramming the drive, removing and re-installing the drive, and evaluating the leak to determine if it is decreasing.

Program Plan

page 5-52 The examination of B1.12 items complies with Section XI. Under column "Complies with Section XI" should be "Yes" and under column "Request for Relief No." should be blank for item B1.12.

List of Component Supports
and Class 3 Welded Attachments
For Which Relief is Requested

Identification Number	Degree of Examination Coverage	Relief Requested
SW-69	No coverage	To perform no examinations on component support attachment welds.
SW-67	No coverage	To perform no examinations on component support attachment welds.
SW-72	No coverage	To perform no examinations on component support attachment welds.
SW-317	No coverage	To perform no examinations on component support attachment welds.
SW-152	No coverage	To perform no examinations on component support attachment welds.
SW-431	No coverage	To perform no examinations on component support attachment welds.
SW-137	No coverage	To perform no examinations on component support attachment welds.
SW-438	No coverage	To perform no examinations on component support attachment welds.
SW-203	No coverage	To perform no examinations on component support attachment welds.

List of Component Supports
and Class 3 Welded Attachments
For Which Relief is Requested

Identification Number	Degree of Examination Coverage	Relief Requested
SW-77	No coverage	To perform no examinations on component support attachment welds.
SW-34	No coverage	To perform no examinations on component support attachment welds.
SW-142	No coverage	To perform no examinations on component support attachment welds.
SW-60	No coverage	To perform no examinations on component support attachment welds.
SW-916N	No coverage	To perform no examinations on component support attachment welds.
SW-75	No coverage	To perform no examinations on component support attachment welds.
RCIC-18	No coverage	To perform no examinations
FPC-64	Less than 10% of hanger can be examined. The rest is buried in fire barrier.	To perform no examinations
FPC-64(W)	No coverage	To perform no examinations
FPC-98	No coverage	To perform no examinations on component support attachment welds.
FPC-114	No coverage	To perform no examinations on component support attachment welds.

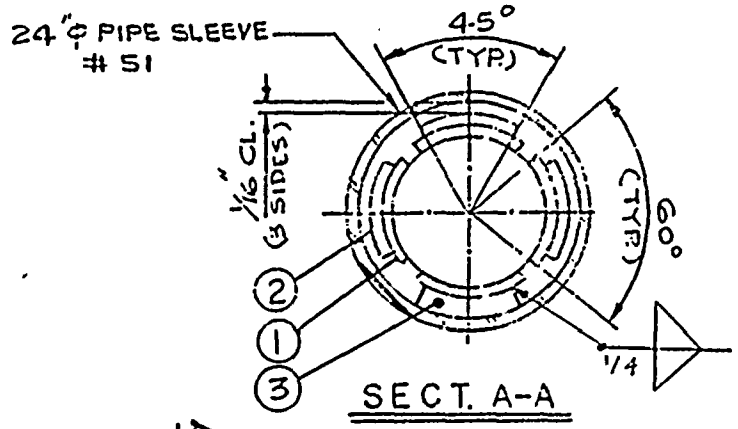
List of Component Supports
and Class 3 Welded Attachments
For Which Relief is Requested

Identification Number	Degree of Examination Coverage	Relief Requested
FPC-203	Bottom kicker plate covered by fire barrier. Greater than 90% of support is examined.	To examine at least 90% of component support
LPCS-19	No coverage	To perform no examinations
RHR-53	Greater than 90% of the hanger can be examined including the spring.	To examine at least 90% of component support
RHR-99	No coverage	To perform no examinations on component support attachment welds.
RHR-174	No coverage	To perform no examinations
RHR-605	Enclosed in cubicle or pipe chase	To perform no examinations
RHR-606	Enclosed in cubicle or pipe chase	To perform no examinations
SLC-4453-57	Less than 50% examination coverage. Most of the hanger is covered by fire barrier.	To perform no examinations
SW-90	No coverage	To perform no examinations
SW-90(W)	No coverage	To perform no examinations
SW-123	75% of hanger can be examined, the rest is buried in fire barrier.	To examine at least 75% of component support

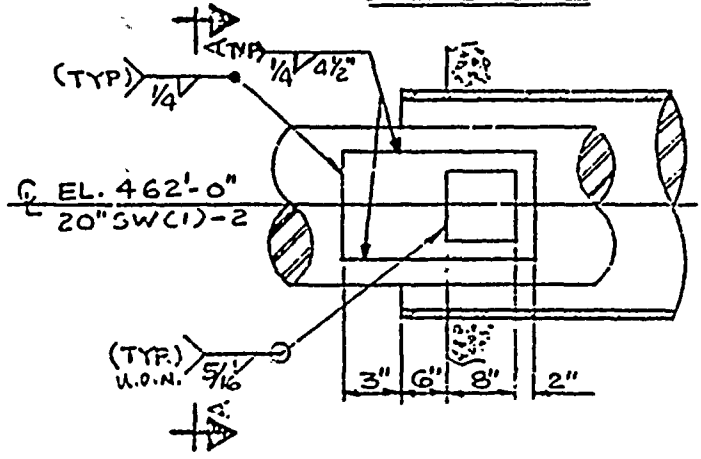
List of Component Supports
and Class 3 Welded Attachments
For Which Relief is Requested

Identification Number	Degree of Examination Coverage	Relief Requested
SW-123(W)	75% of the lugs can be examined. The rest is buried in fire barrier.	To examine 75% of the lugs.
SW-439	No coverage	To perform no examinations
SW-439(W)	No coverage	To perform no examinations
SW-946N	No coverage	To perform no examinations
SW-946N(W)	No coverage	To perform no examinations
SW-951N	No coverage	To perform no examinations
SW-951N(W)	No coverage	To perform no examinations
SW-950N	No coverage	To perform no examinations

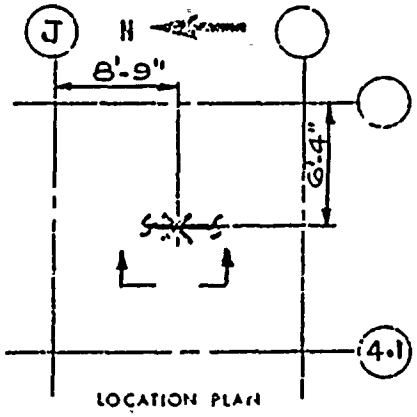
ITEM NO	NO. REQ'D.	SIZE	DESCRIPTION	ASTM	WT.	
1	4	10 3/4"	X 9/16" X 1'-7" LG PAD	A36	130	
2	3	8 3/4"	X 1" X 8" LG PAD	A36	60	
3	1	10 3/4"	X 5/8" X 1'-7" LG PAD	A36	37	
				TOTAL	227	#



SECT. A-A



ELEV. LOOKING EAST



LOCATION PLAN

DD 215-08 CVI NO	11585 CVI SHT	1 REV	DWG SHT

BCBR-215-1487

ZONE: R-22

SEIS. LOADS: VERT.= ± 5426# N-S= —— E-W= ±13531#			OP. LD.= 2734#	HYDRO. LD.= 2734#	THERM. LD.= —
CODE / CLASS: III/3	GROUP: 2	Q.A. LEVEL I	PAINT: I	PIPE CALC. P1459	STEEL CALC. 8.16.2348

OWNER: WASHINGTON PUBLIC POWER SUPPLY SYSTEM
PROJECT: HANFORD NO. 2 | ENGINEER: BURNS & ROE INC.
CUSTOMER: BOVEE & CRAIL / GERI

PIPING SYSTEM: STANDBY SERVICE WATER
ISO: SW-250-31.40
REFERENCE DWG.: PIPING: M712
MARK NO.: SW-69 | AM-186

REV	DATE	DESCRIPTION
1	5-5-81	REV. IN ACCORDANCE W/NBG STATUS AS-BUILT

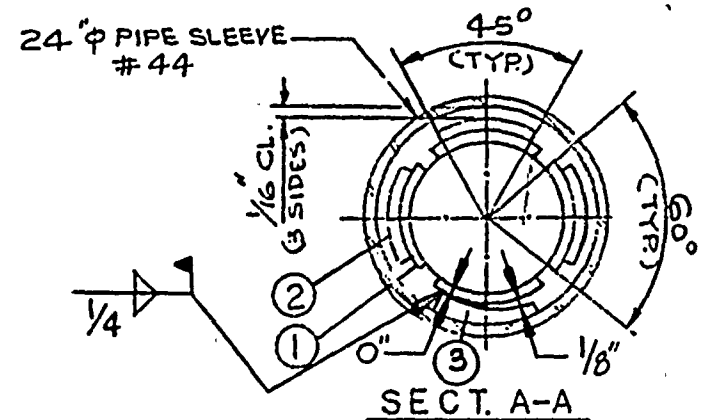
nps industries, inc.
CONTRACT 215

a subsidiary of nuclear power services, inc.
25 broadway new york, n.y. 10004

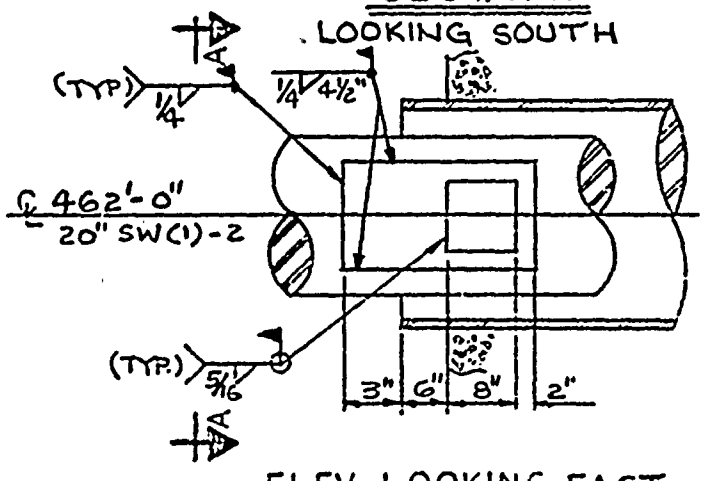
DRAWN	DATE	CHK'D	DATE	APP'D	DATE
MF	9-1-76	RAJ	9-3-76	JC	11-3-77

JOB NO
DWG NO SW-69 | SH. 1

ITEM NO	NO. REQ'D	SIZE	DESCRIPTION	ASTM	WT.	
1	4	10 3/4" x 9/16" x 1'-7" LG	PAD	A36	130	
2	3	8 3/4" x 1" x 8" LG	PAD	A36	59	
3	1	10 3/4" x 5/8" x 1'-7" LG	PAD	A36	36	
				TOTAL	225	



SECT. A-A



ELEV. LOOKING EAST

ZONE: R-22

FOR INFORMATION ONLY

2-15-08	11579	1	
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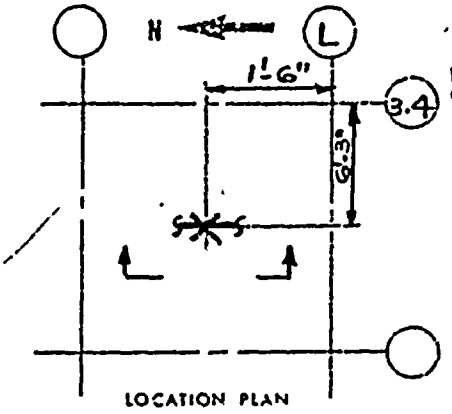


LOCATION PLAN

BCGR-215-1487-

SEIS. LOADS: VERT = ±11553#	N-S = —	E-W = ±17039#	OP. LD. = 5807#	HYDRO. LD. = 5807#	THERM. LD. = —
CODE / CLASS: III/3	GROUP: 2	Q.A. LEVEL: I	PAINT: I	PIPE CALC. P1459	STEEL CALC. 8.16.2346

OWNER: WASHINGTON PUBLIC POWER SUPPLY SYSTEM
PROJECT: HANFORD NO.2 | ENGINEER: BURNS & ROE INC.
CUSTOMER: BOVEE & CRAIL / GERI

PIPING SYSTEM: STANDBY SERVICE WATER
ISO: SW-250-31.40H
REFERENCE DWG.: PIPING: M712
MARK NO.: SW-67 | AM-186

REV.	DATE	DESCRIPTION
1	5/6/81	REVISED IN ACCORDANCE W/ W.B.G. STATUS AS-BUILT

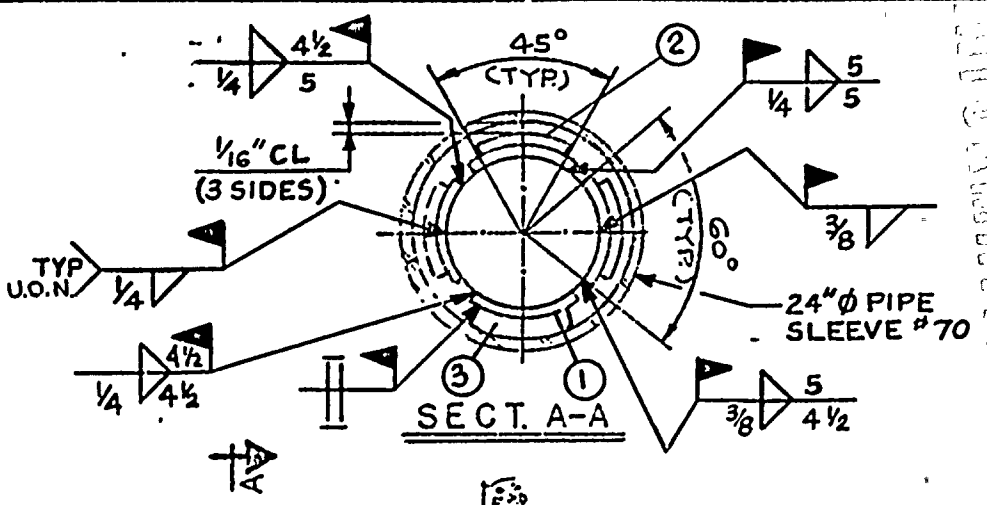
nps industries, inc.
CONTRACT 215

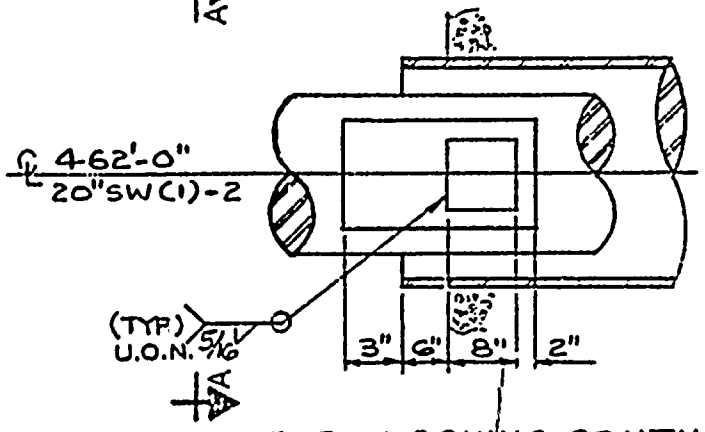
a subsidiary of nuclear power services, inc.
26 broadway · new york, n.y. 10004

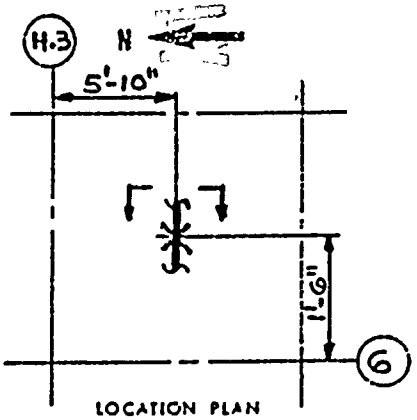
DRAWN	DATE	CHK'D	DATE	APP'D	DATE
MF	9-3-76	RAJ	9-9-76	JG	11-3-77

JOB NO
DWG. NO SW-67 | REV 1

ITEM NO	NO. REQ'D	SIZE	DESCRIPTION	ASTM	WT.
1	4	10 3/4" x 9/16" x 1'-7" LG	PAD	A36	148
2	3	8 3/4" x 1" x 8" LG	PAD	A36	39
3	1	10 3/4" x 5/8" x 1'-7" LG	PAD	A36	37
				TOTAL	224#







DWG SHT	REV	CVI SHT	CVI NO
	1	11	213-08

BCBR-215-1487

ZONE: R-22

SEIS. LOADS: VERT = ±5968# N-S = ±9658# E-W = —			OP. LD. = 3003#	HYDRO. LD. = 3003#	THERM. LD. = —
CODE / CLASS: III/3	GROUP: 2	Q.A. LEVEL: I	PAINT: I	PIPE CALC. P1459	STEEL CALC 816.2312

OWNER: WASHINGTON PUBLIC POWER SUPPLY SYSTEM

PROJECT: HANFORD NO. 2 | ENGINEER: BURNS & ROE INC.

CUSTOMER: BOVEE & CRAIL / GERI

PIPING SYSTEM: STANDBY SERVICE WATER

ISO: SW-250-31.40 H

REFERENCE DWG.: PIPING: M712

MARK NO.: SW-72 | AM-186

REV.	DATE	DESCRIPTION	DR.	APP.
1	3-4-77	REVISED IN ACCORDANCE W/WBS STATUS AS BUILT		

AS BUILT

nps industries, inc.
CONTRACT 215

a subsidiary of nuclear power services, inc.
26 broadway-new york, n.y. 10004

DRAWN	DATE	CHK'D	DATE	APV'D	DATE
MF PL	9-1-76	R.A.J.	93-76	JC	11.3.77

JOB NO.

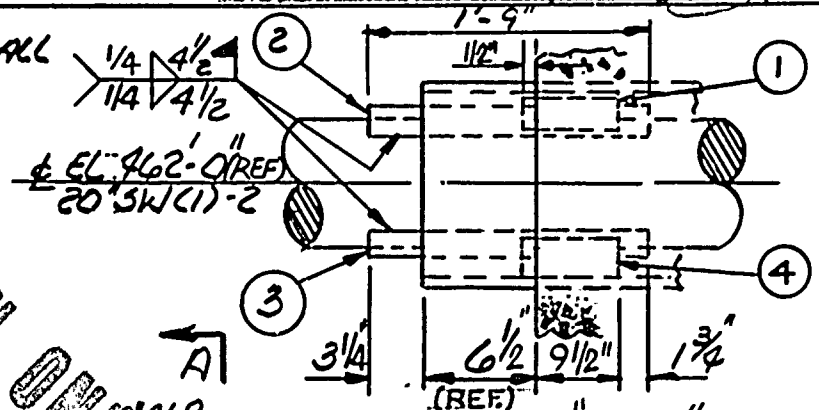
DWG NO SW-72 | REV. 1

ITEM NO.	QUAN.	SIZE — DESCRIPTION	ASTM	WT.
1	1	R 1" X 6 1/8" X 0'-10" (BEND TO 10 3/4" RAD.)	A-36	17
2	1	R 5/8" X 11 1/8" X 1'-9" (BEND TO RAD. OF PIPE)	A-36	50
3	1	R 3/4" X 11 1/8" X 1'-9" (BEND TO RAD OF PIPE)	A-36	66
4	1	R 1" X 6 1/8" X 0'-10" (COPE TO MATCH PIPE SLEEVE)	A-36	17
		TOTAL WT.		150#

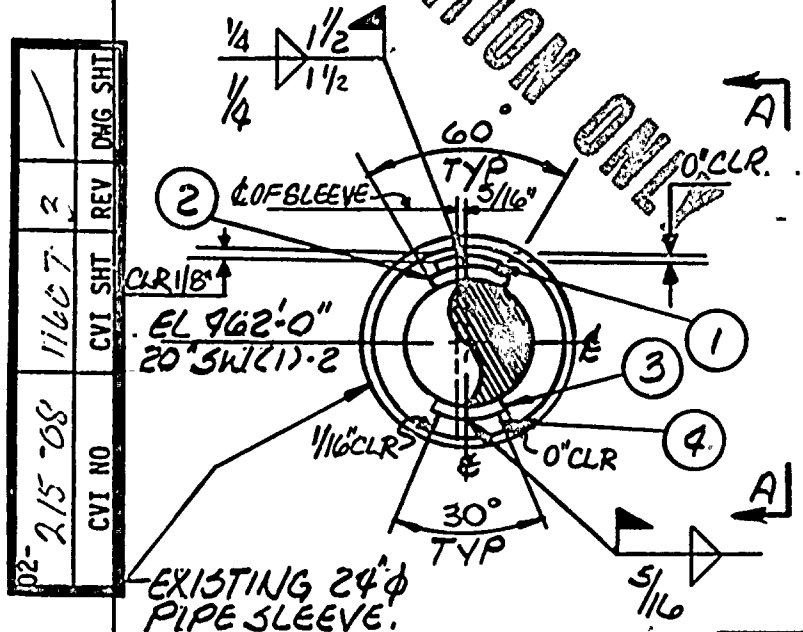
SUPERSEDES DRAWING SHT. 8 ...

NOTE: SHOP TO BEND ALL ITEMS PER DWG

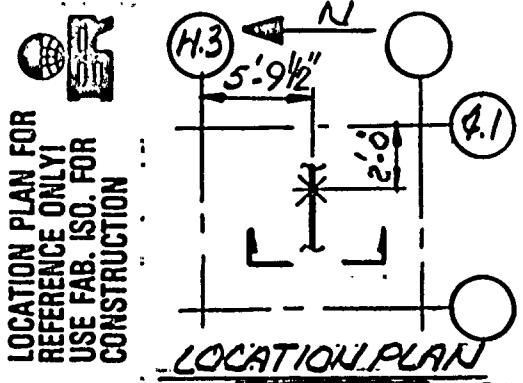
INFORMATION ONLY



SECTION A-A



ELEV. LKG EAST



LOCATION PLAN FOR REFERENCE ONLY! USE FAB. ISO. FOR CONSTRUCTION

LOCATION PLAN

DWG SHT	REV	CVI SHT	CVI NO
1	2	11667	02-215-'88

REV NO	REVISION	DATE	DWN CHKD	APVD
3	DOCUMENT UP-DATE	3/11/83	JMT	MH S.F.
2	INCORPORATED PED-215-H-C050 & REV'D. IN ACCORD. W/WBG STATUS AS-BUILT	9/23/80	CM	MCD
1	REDRAWN BY BER TO INCORPORATE PED-H-3748	9/23/80	VP PN	MCD

ZONE: R-22	OP. LD.: -5175#	HYDRO. LD.: -5175#	
THERMAL LD.: VERT: —	N-S: —	E-W: —	
SEISMIC LD.: VERT: ±5210#	N-S: —	E-W: —	
CODE/CLASS: III/3	GROUP: 2	Q.A. LEVEL: I	
PAINT: I	PIPE CALC: 8.42.023	STL. CALC: 8.16.1327	
PIPING SYSTEM: STAND-BY SERVICE WATER	REF. DWG. ISO.: SW-250-31.90	PIPING: M 712	

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO. 2 58.0 PS

DWN: J. PARKER | CHKD: HW P.N. | SCALE: NTS
SL/LDE: MCD | DATE: 9.24.80

MARK NO. SW-317

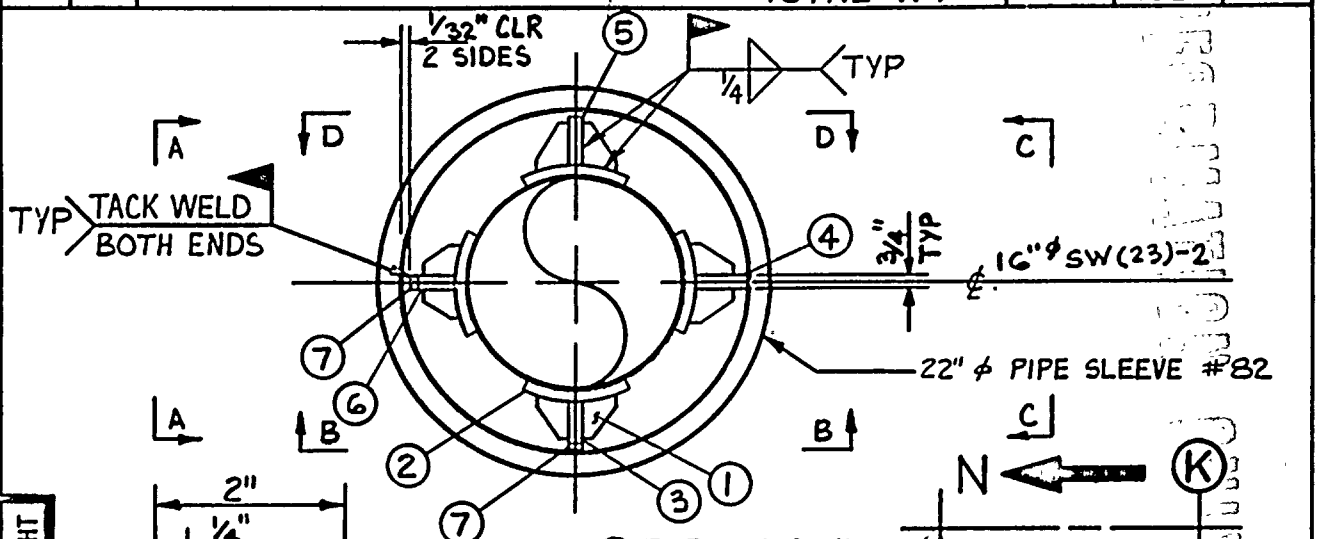
ENGINEERING REVIEW

MECH	CIVIL M. Hoz 9/16/80
ELEC	
REVD H.R. Teague 9/30/80 CHIEF DRAFTSMAN	APVD [signature] DATE 9/30/80 CHIEF MECH. ENGINEER

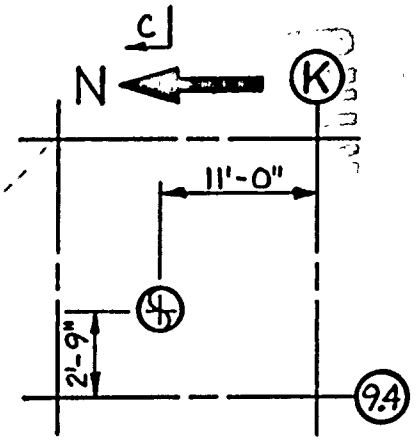
BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

W.O. 3808 | DWG. SW-317 | REV 3

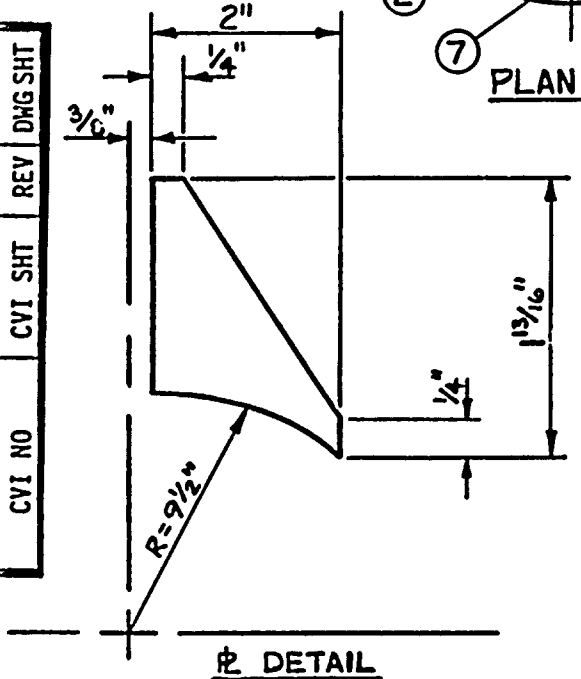
ITEM NO.	QUAN.	SIZE — DESCRIPTION	ASTM	WT.	
1	24	PL 3/8" × 1 13/16" × 0'-2" (SEE PL DETAIL)	A36	9	
2	4	PL 1/2" × 9 7/16" × 1'-9" (PAD) (BEND TO PIPE RAD)	A36	112	
3	1	PL 3/4" × 2 1/16" × 0'-9" (SHEAR LUG)	A36	4	
4	1	PL 3/4" × 1 1/8" × 0'-9" (SHEAR LUG)	A36	2	
5	1	PL 3/4" × 1 3/4" × 0'-9" (SHEAR LUG)	A36	3	
6	1	PL 3/4" × 2 5/8" × 0'-9" (SHEAR LUG)	A36	5	
7	2	PL 1/8" × 1" × 1'-7" (SHIM)	A36	1	
		TOTAL WT		136#	



PLAN @ ELEV 548'-0"



LOCATION PLAN



PL DETAIL

ZONE: R-51	OP. LD.: —	HYDRO. LD.: —
THERMAL LD.: VERT: —	N-S: —	E-W: —
SEISMIC LD.: VERT: —	N-S: ±18,673#	E-W: ±2,790#
CODE/CLASS: III/3	GROUP: 2	Q.A. LEVEL: I
PAINT: I	PIPE CALC.: P-1465	STL. CALC.: 8.16.2399
PIPING STANDBY SYSTEM SERVICE WATER	REF. DWG. NO.: SW-296-1.5H PIPING: M-712	

REV NO	REVISION	DATE	DWN CHKD	APVD
1	REVISED IN ACCORDANCE W/WBG STATUS AS-BUILT	4/29/81	ACH @	MCD JH

DWN A HARGRAVES CHKD (V) SCALE NTS

SL/LDE [signature] DATE 5/4/81

ENGINEERING REVIEW

MECH	CIVIL
ELEC	

REVD H.R. Trapp [signature] CHIEF DRAFTSMAN

APVD [signature] CHIEF MECH ENGINEER DATE 5/4/81

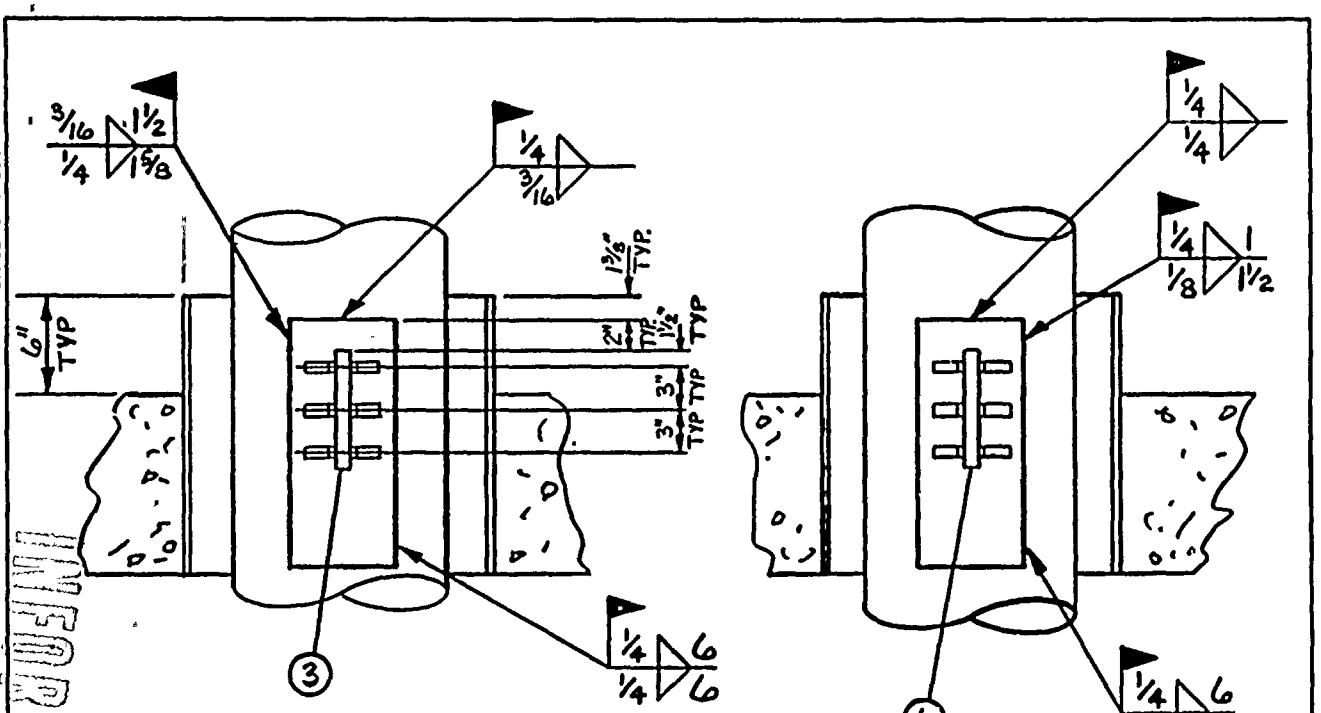
WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO. 2

MARK NO. SW-152

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

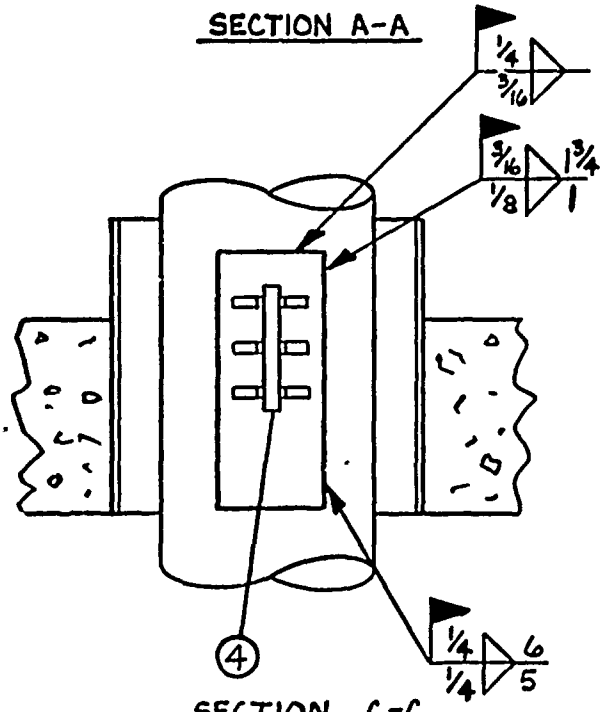
W.O. 3808 | DWG. SW-152 SHT 1 OF 2 | REV 1

DWG SHT	REV	CVI SHT	CVI NO
	1	11/0/11	02-215-598

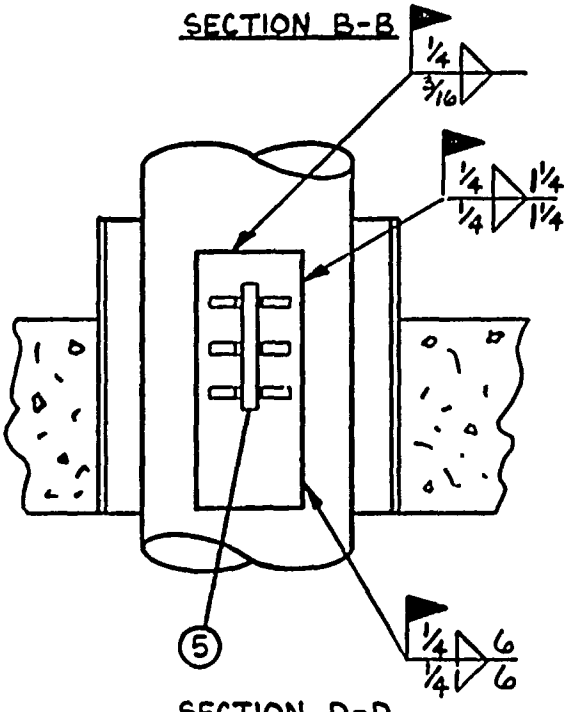


SECTION A-A

SECTION B-B



SECTION C-C



SECTION D-D

REV NO	REVISION	DATE	DWN	CHKD	APVD
1	REVISED IN ACCORDANCE W/WBG STATUS AS-BUILT	4/29/81	ACH	⌀	SH

DWN A HARGRAVES CHKD ⌀ SCALE NTS

SL/LDE DATE 5/4/81

ENGINEERING REVIEW

MECH CIVIL

ELEC

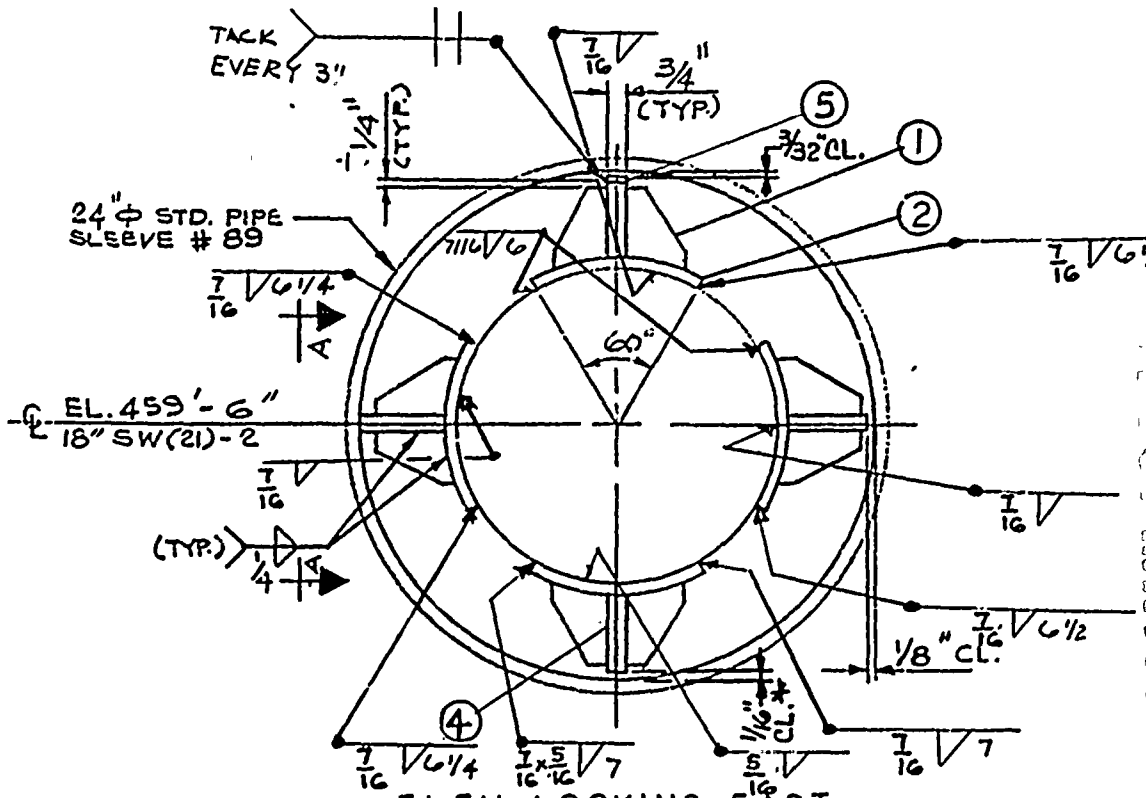
REVD H.R. Trapp CHIEF DRAFTSMAN APVD CHIEF MECH ENGINEER DATE 4/6 11/81

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO.2

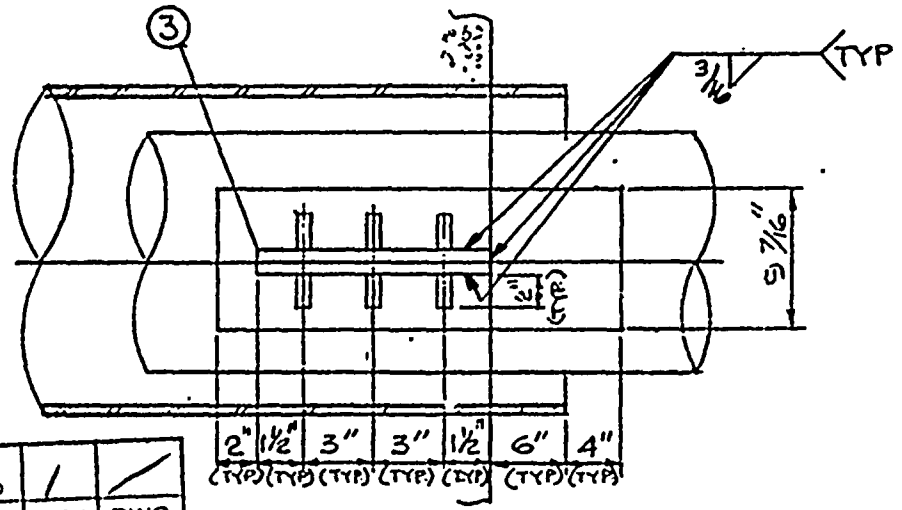
MARK NO. SW-152

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

W.O.3808 DWG. SW-152 SHT 2 OF 2 REV 1



ELEV. LOOKING EAST



SECTION A-A

*DESIGN CLEARANCE = 0"

02-215-08	11026	1	
CVI NO	CVI SHT	REV	DWG SHT

DATE	DESCRIPTION
5-4-81	REV. IN ACCORDANCE W/WSG STATUS AS-BUILT

DR. APP. DATE REV. DR. APP.

V BESK-215-1493

OWNER: WASHINGTON PUBLIC POWER SUPPLY SYSTEM
PROJECT: HANFORD NO. 2 | ENGINEER: BURNS & ROE INC.
CUSTOMER: BOVEE & CRAIL / GERI

PIPING SYSTEM: SERVICE WATER
REFERENCE DWG.: ISO.: SW-296-7.16 H; PIPING: M 712
MARK NO.: SW-431 | AM-184

nps industries, inc.
CONTRACT 215

a subsidiary of nuclear power services, inc.
26 broadway · new york, n.y. 10004

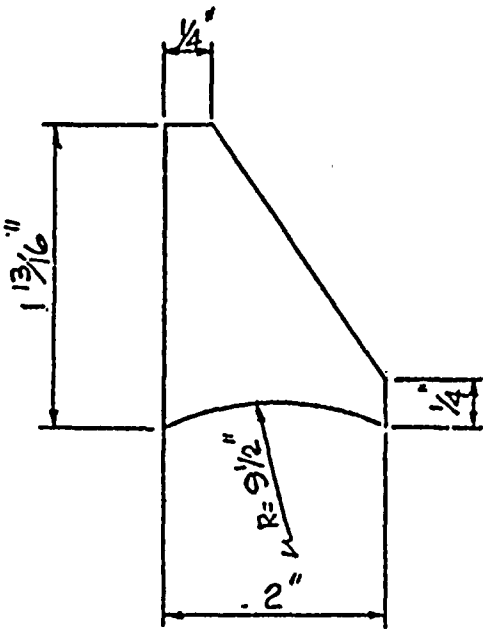
DRAWN	DATE	CHK'D.	DATE	APPV'D.	DATE
AB	9.11.77	HS	9.13.77	JG	11-6-77

JOB NO.
DWG NO. SW-431 (1 OF 2) | REV. 1

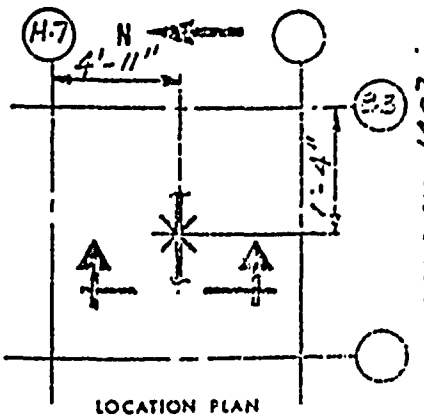
ITEM NO.	NO. REQ'D	SIZE	DESCRIPTION	ASTM	WT.	
1	24	3/8" X 1 13/16" X 2" LG.	PLATE (SEE PLATE DET.)	A36	24	
2	4	1/2" X 9 7/16" X 1'-9" LG.	PLATE	A36	108	
3	3	3/4" X .2 1/16" X 9" LG.	SHEAR LUG	A36	12	
4	1	3/4" X 2 1/8" X 9" LG.	SHEAR LUG	A36	4	
5	1	3/4" x 1/8" x 9" LG	SHIM PL	A36	1	
			TOTAL WT		149.#	

REV.	DATE	DESCRIPTION
1	5-4-81	REV. IN ACCORDANCE W/WBG STATUS AS-BUILT

APP.	DR.	DESCRIPTION	DATE



PL DETAIL



LOCATION PLAN

ZONE: R-21

SEIS. LOADS: VERT = ± 4,344# N-S = 20,743# E-W = —— | OP. LD. = 2,017# | HYDRO. LD. = 2017# | THERM. LD. = ——

CODE / CLASS: III/3 | GROUP: 2 | O.A. LEVEL: I | PAINT: I | PIPE CALC. P-1465 | STEEL CALC. B.16.2567

OWNER: WASHINGTON PUBLIC POWER SUPPLY SYSTEM

PROJECT: HANFORD NO. 2 | ENGINEER: BURNS & ROE INC.

CUSTOMER: BOVEE & CRAIL / GERI

PIPING SYSTEM: SERVICE WATER
ISO.: SW-296-7.16 H
REFERENCE DWG.: PIPING: M 712
MARK NO.: SW-431 | AM-184

nps industries, inc.
CONTRACT 215

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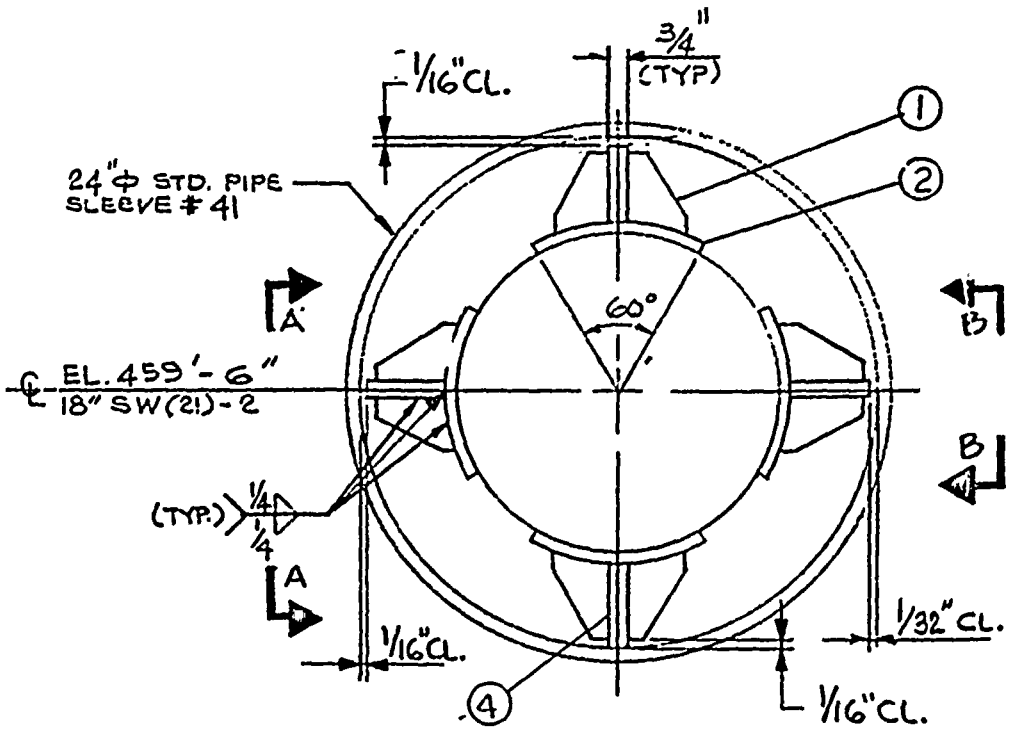
nuclear power services, inc.
25 broadway·new york, n.y. 10004

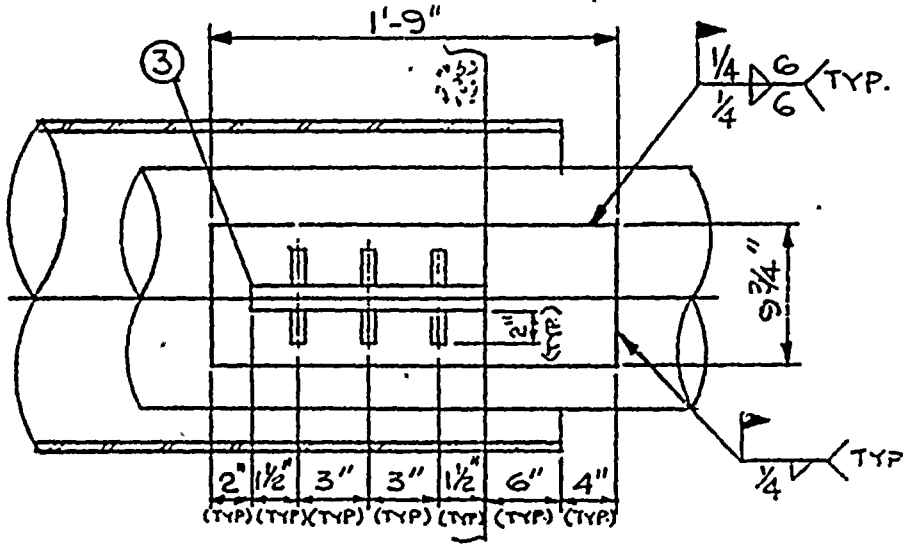
DRAWN	DATE	CHK'D	DATE	APPV'D	DATE
AB	9.11.77	HG	9.13.77	JC	11-4-77

JOB NO.

DWG NO SW-431 (2652) | REV 1



ELEV. LOOKING SOUTH



SECTION A-A

DWG SHT	REV	CVI SHT	CVI NO
/	1	10-22-76	12-5-05

REV.	DATE	DESCRIPTION	DR.	APP.	REV.	DATE	DESCRIPTION	DR.
1	4/29/81	REV. IN ACCORDANCE W/WBG STATUS AS-BUILT	[illegible]	[illegible]				

OWNER: WASHINGTON PUBLIC POWER SUPPLY SYSTEM
PROJECT: HANFORD NO. 2 | ENGINEER: BURNS & ROE INC.
CUSTOMER: BOVEE & CRAIL / GERI

PIPING SYSTEM: SERVICE WATER
REFERENCE DWG.: ISO.: SW-256-17.26H; PIPING: M 712
MARK NO.: SW-137 | AM-184

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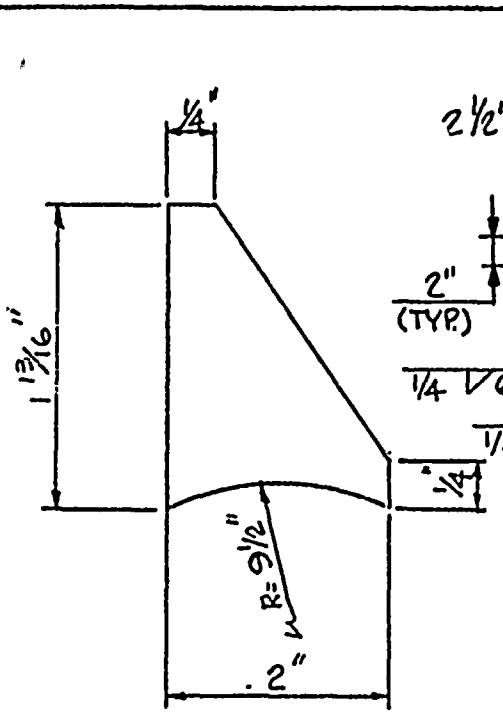
DRAWN	DATE	CHK'D.	DATE	APPV'D.	DATE
MF/SL	9-22-76	JJM	10-1-76	JG	11-4-77

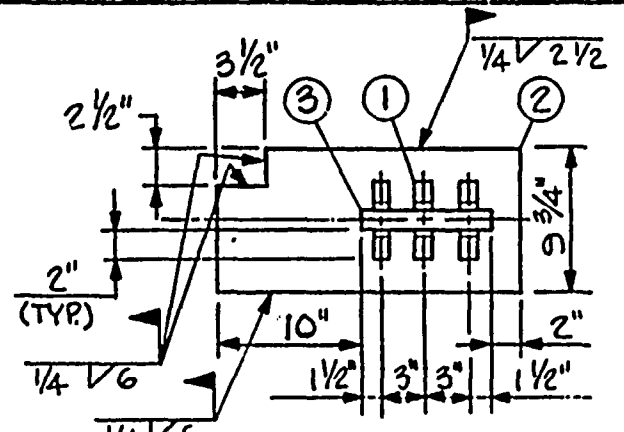
JOB NO.
DWG NO. SW-137 (1 OF 2) | REV. 1

BCBI-215-14 93

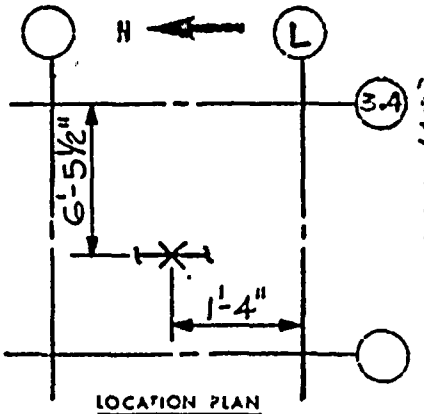
ITEM NO	NO. REQ'D.	SIZE	DESCRIPTION	ASTM	WT.	
1	24	3/8" X 1 13/16" X 2" LG.	PLATE (SEE PLATE DET.)	A36	24	
2	4	1/2" X 9 7/16" X 1'-9" LG.	PLATE	A36	116	
3	3	3/4" X 2 1/16" X 9" LG.	SHEAR LUG	A36	12	
4	1	3/4" X 2 1/8". X 9" LG.	SHEAR LUG	A36	4	
			TOTAL WT.		156	#



DETAIL-1



VIEW B-B



LOCATION PLAN

BCEP-715-1422-

ZONE: R-22

SEIS. LOADS: VERT= ±8127 # N-S=	# E-W= 13507 #	OP. LD.= 4560 #	HYDRO. LD.= 4560 #	THERM. LD.: Fy ±1000 Fz ±1000	
CODE / CLASS: III/3	GROUP: 2	Q.A. LEVEL: I	PAINT: I	PIPE CALC. P-1465	STEEL CALC. S-2463

OWNER: WASHINGTON PUBLIC POWER SUPPLY SYSTEM

PROJECT: HANFORD NO. 2 | ENGINEER: BURNS & ROE INC.

CUSTOMER: BOVEE & CRAIL / GERI

PIPING SYSTEM: SERVICE WATER

ISO.: SW-296-17.26H

REFERENCE DWG.: PIPING: M 712

MARK NO.: SW-137 | AM-184

REV.	DESCRIPTION	DATE	DR.	APP.
1	REV. IN ACCORDANCE W/WBG STATUS AS-BUILT	4/23/81		

nps industries, inc.

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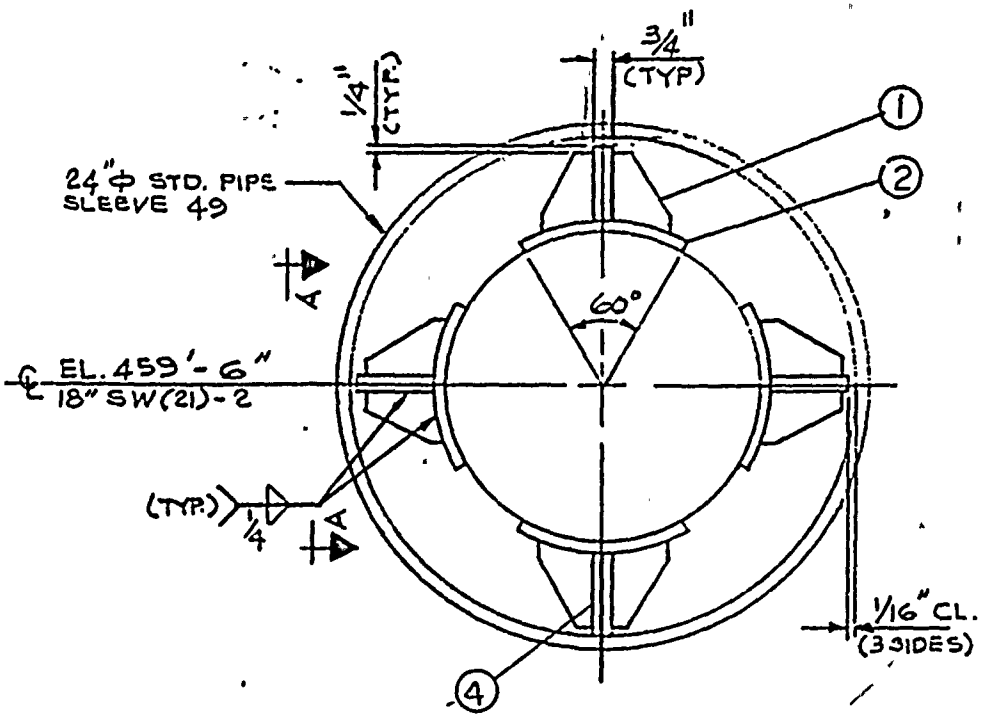
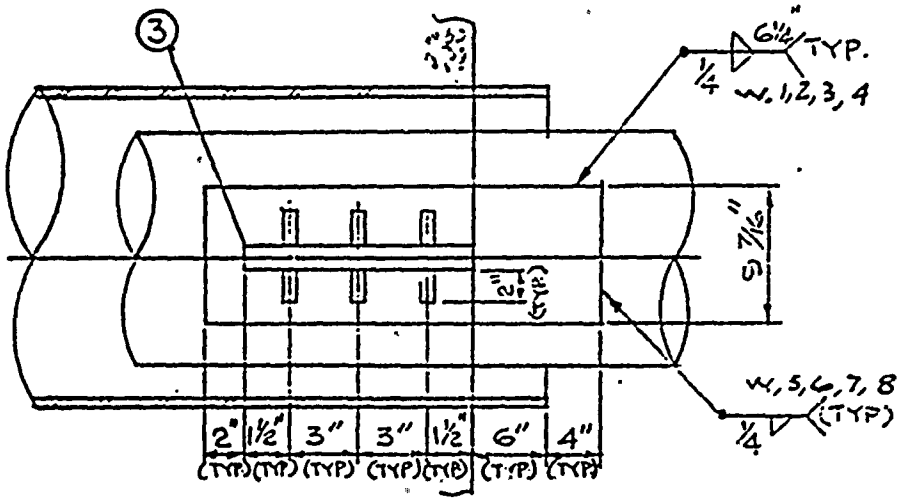
DRAWN	DATE	CHK'D	DATE	APPV'D	DATE
MF PL	9.26.74	JJM	10.1.74	JC	10/1/74

JOB NO.

DWG. NO SW-137 (2 OF 2) | REV 1



ELEV. LOOKING SOUTH



SECTION A-A

DWG SHT	REV	CVI SHT	CVI NO
	1	11039	02-215-08

ZONE: R22 SU. 58.0

OWNER: WASHINGTON PUBLIC POWER SUPPLY SYSTEM
PROJECT: HANFORD NO. 2 | ENGINEER: BURNS & ROE INC.
CUSTOMER: BOVEE & CRAIL / GERI

PIPING SYSTEM: SERVICE WATER
REFERENCE DWG. ISO.: SW-256-17.26H
PIPING: M712
MARK NO. SW-438 | A.M-184

nps industries, inc.
CONTRACT 215

a subsidiary of nuclear power services, inc.
26 broadway-new york, n.y. 10004

DRAWN	DATE	CHK'D.	DATE	APPV'D.	DATE
AB	9.6.77	HS	9.13.77	JG	11-4-77

JOB NO.
DWG NO. SW-438 (1 OF 2) | REV.

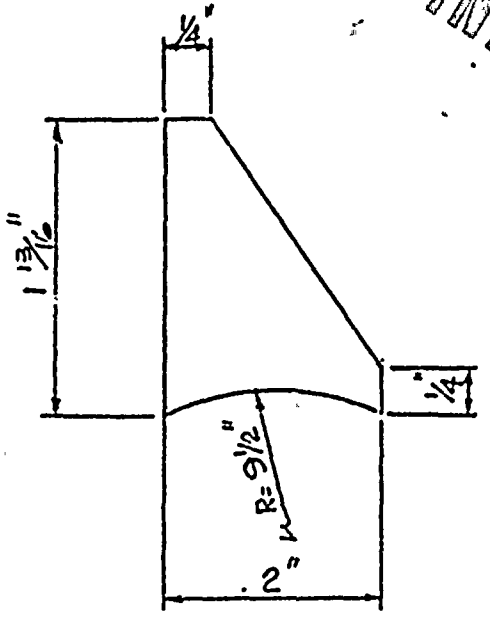
NO.	DATE	DESCRIPTION
1	4-30-81	REV. IN ACCORDANCE W/WBG STDS AS-BUILT

WAGER-215-1493

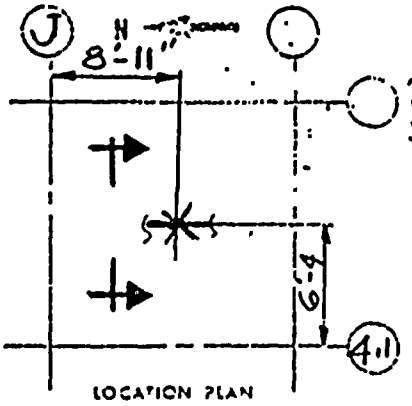
APP.	DR.	DESCRIPTION	DATE	REV.	APP.	DR.	DESCRIPTION	DATE	REV.
							REV IN ACCORDANCE W/WBG STATUS	4-30-81	1

ITEM NO	NO. REQ'D.	SIZE	DESCRIPTION	ASTM	WT.
1	24	3/8" X 1 13/16" X 2" LG.	PLATE (SEE PLATE DET.) / FIELD TRIM TO SUIT	A36	10.1
2	4	1/2" X 5 7/16" X 1'-9" LG.	PLATE	A36	123.3
3	3	3/4" X 2 1/16" X 9" LG.	SHEAR LUG FIELD TRIM TO SUIT	A36	13.0
4	1	3/4" X 2 1/8" X 9" LG.	SHEAR LUG FIELD TRIM TO SUIT	A36	4.5
		MATERIAL WT	A = 150.9 B = 0 C = 0	TOTAL	150.9

INFORMATION ONLY



R DETAIL



LOCATION PLAN

W-SEP-215-1493

ZONE: R-22 SU. 58.0

SEIS. LOADS: VERT = ±6,218# N-S = E-W = 11,664# | OP. LD. = 3115# | HYDRO. LD. = 3115# | THERM. LD. = —

CODE / CLASS: III/2 | GROUP: 2 | Q.A. LEVEL: I | PAINT: I | PIPE CALC. P-465 | STEEL CALC. 8.16.2570

OWNER: WASHINGTON PUBLIC POWER SUPPLY SYSTEM

PROJECT: HANFORD NO. 2 | ENGINEER: BURNS & ROE INC.

CUSTOMER: BOVEE & CRAIL / GERI

PIPING SYSTEM: SERVICE WATER

REFERENCE DWG. ISO.: SW-[illegible]-17.2SH | PIPING: M-712

MARK NO. SW-438 | AM-184

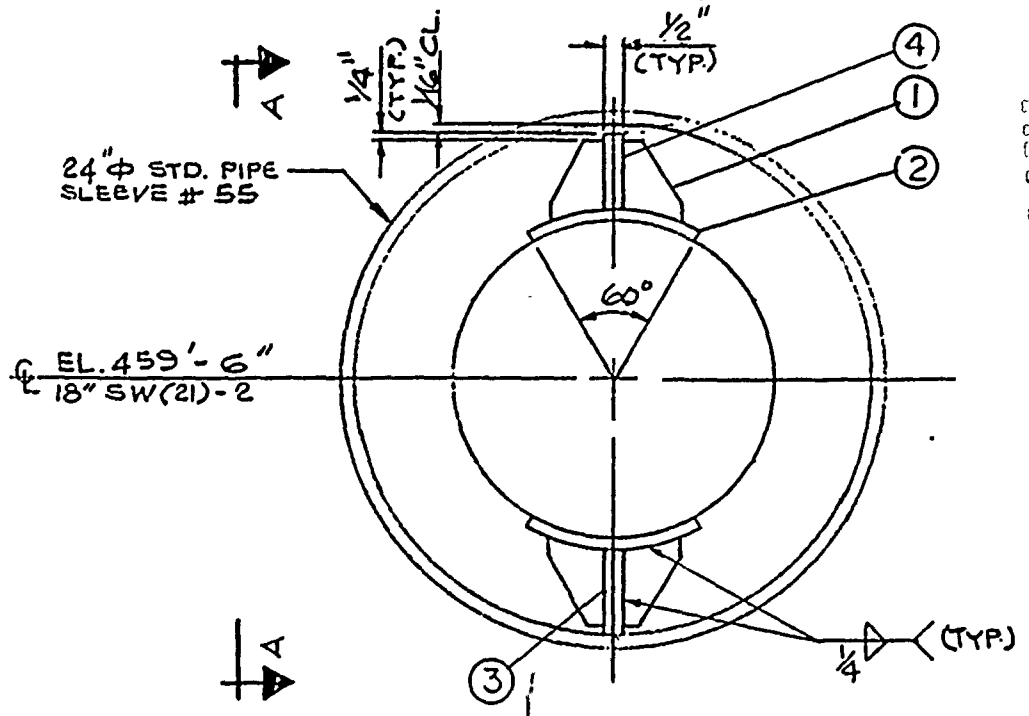
nps industries, inc.
CONTRACT 215

a subsidiary of nuclear power services, inc.
26 broadway new york, n.y. 10004

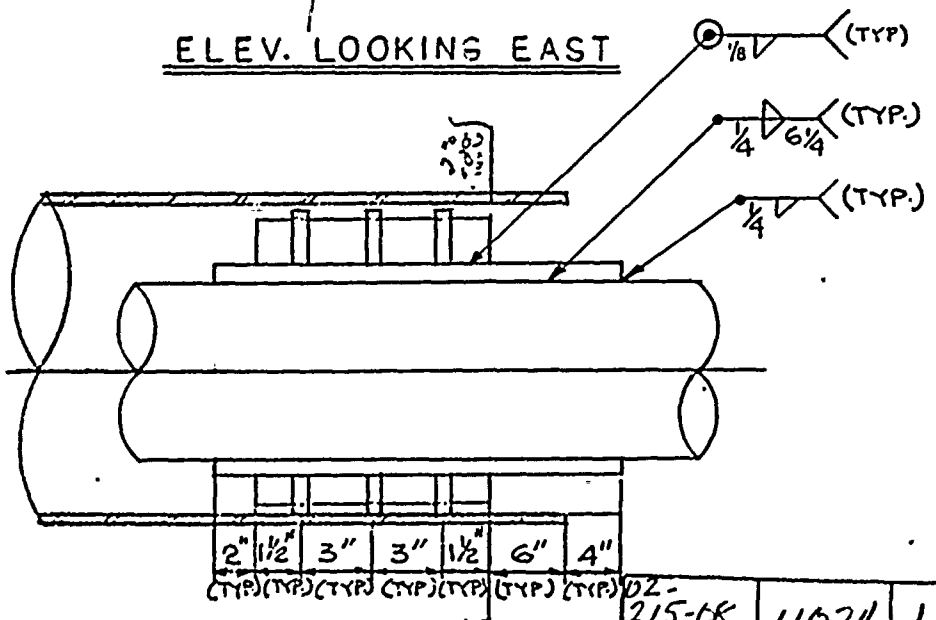
DRAWN	DATE	CHK'D	DATE	APPV'D	DATE
AB	9.6.77	HS	9.13.77	[illegible]	11-4

JOB NO.

DWG NO SW-438 (2 OF 2) | REV 1



ELEV. LOOKING EAST



SECTION A-A

DZ-215-68	11024	1	
CVI NO	CVI SHT	REV	DWG SHT

BCBR-215-1493

REV.	DATE	DESCRIPTION
1	4-29-81	REV. IN ACCORDANCE W/WBS STATUS AS BUILT

DR. APP. DATE REV. DESCRIPTION

OWNER: WASHINGTON PUBLIC POWER SUPPLY SYSTEM
PROJECT: HANFORD NO.2 | ENGINEER: BURNS & ROE INC.
CUSTOMER: BOVEE & CRAIL / GERI

PIPING SYSTEM: STAND BY SERVICE WATER
REFERENCE DWG.: ISO.: SW-296-17.26; PIPING: M 712
MARK NO.: SW-203 | AM-184

nps industries, inc.
CONTRACT 215

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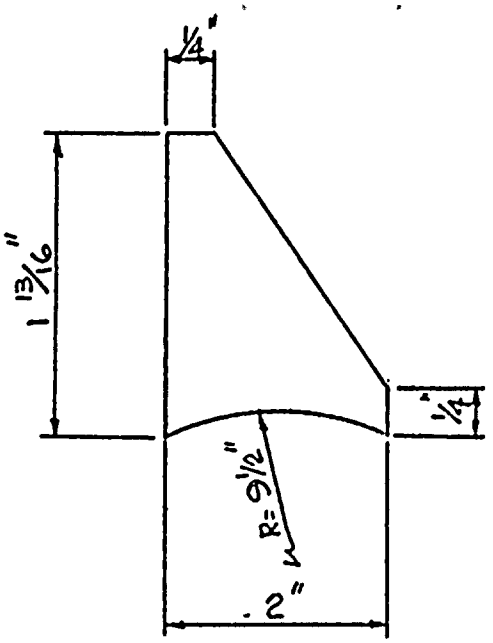
26 broadway · new york, n.y. 10004

DRAWN	DATE	CHK'D.	DATE	APPV'D.	DATE
HF PL	9.27.76	RW	10.1.76	JG	11-4-71

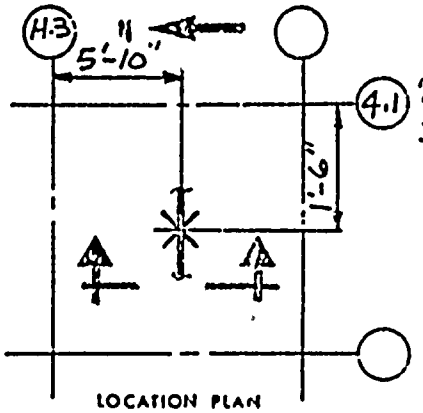
JOB NO.
DWG NO. SW-203 (1 OF 2) REV. 1

ITEM NO.	NO. REQ'D.	SIZE	DESCRIPTION	ASTM	WT.	
1	12	3/8" X 1 13/16" X 2" LG. PLATE (SEE R DETAIL)		A36	6	
2.	2	1/2" X 9 7/16" X 1'-9" LG. PLATE		A36	60	
3	1	1/2" X 2 1/16" X 9" LG. SHEAR LUG		A36	3	
4	1	1/2" X 2 1/8" X 9" LG. SHEAR LUG		A36	3	
				TOTAL	72	



R DETAIL

INFORMATION ONLY



LOCATION PLAN

SCCR-215-1423-

REV.	DATE	DESCRIPTION
1	4-29-81	REV. IN ACCORDANE W/WBG STATUS AS BUILT

ZONE: R-22

SEIS. LOADS: VERT = ±7,332# N-S = ~ E-W = —

OP. LD. = 3,669# HYDRO. LD. = 3669 THERM. LD. = —

CODE / CLASS: III/3 GROUP: 2 Q.A. LEVEL: I

PAINT: I PIPE CALC. P-1465 STEEL CALC. 8.16.2428

OWNER: WASHINGTON PUBLIC POWER SUPPLY SYSTEM

PROJECT: HANFORD NO.2 ENGINEER: BURNS & ROE INC.

CUSTOMER: BOVEE & GRAIL / GERI

PIPING SYSTEM: STANDBY SERVICE WATER

ISO.: SW-296-17-26 H

REFERENCE DWG.: PIPING: M 712

MARK NO.: SW-203 AM-184

nps industries, inc.

CONTRACT 215

a subsidiary of nuclear power services, inc.

26 broadway · new york, n.y. 10004

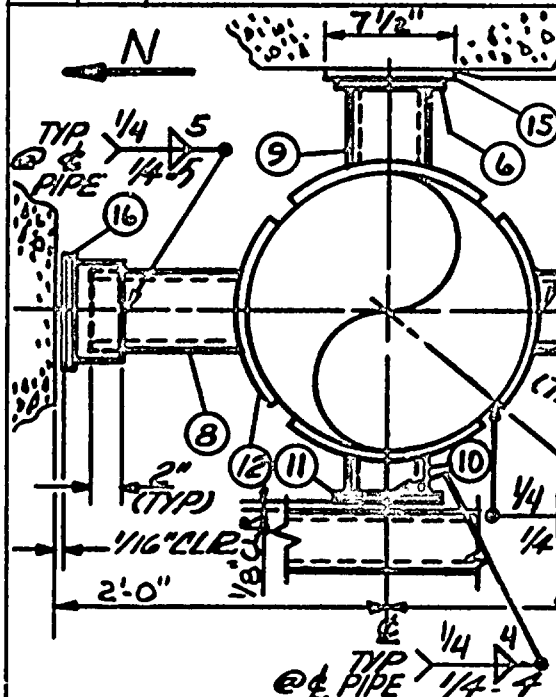
DRAWN	DATE	CHK'D	DATE	APPV'D	DATE
MF PL	9.27.76	RW	10.1.76	VG	11 1 11

JOB NO.

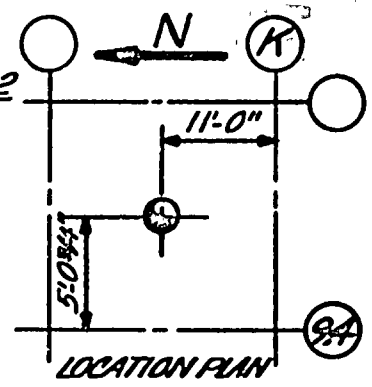
DWG. NO SW-203 (2 OF 2) REV 1

ITEM NO.	QUAN.	SIZE — DESCRIPTION	ASTM	WT.	
1	1	TS 5X5 X .375 X 2'-6" LG.	A500GRB	55	
2	2	TS 4X4 X .375 X 2'-2 1/2" LG.	A500GRB	74	
3	2	L 2"X 2" X 1/4" X 1'-3 7/8" LG.	A36	8	
4	2	PL 1/2" X 6" X 0'-8"	A36	14	
5	2	PIPE 6"Ø SCH. 80 X 0'-3" LG.	A106GRB	14	
6	1	PL 1/2" X 7" X 0'-7"	A36	7	
7	1	TRUNION 5"Ø SCH. 80 PIPE X 0'-10 3/16" LG.	A106GRB	18	
8	1	5"Ø SCH. 80 PIPE X 0'-11 1/2" LG. (TRIM		20	
9	1	5"Ø SCH. 80 PIPE X 0'-4 1/2" LG. TO SUIT)		8	
10	1	TRUNION 5"Ø SCH. 80 PIPE X 0'-17 1/8" LG.	A106GRB	3	
11	1	PL 1/2" X 6 1/8" X 0'-6 1/8"	A36	12	
12	4	TRUNION PAD-PL 1/2" X 14" X 1'-2 11/16"	A36	120	
13	2	1/2"Ø X 1 1/4" LG. HVY. HEX. MACH. BOLTS W/L.W.		1	
14	1	L 2" X 2" X 1/4" X 1'-8" LG.	A36	5	
15	1	PL 1/8" X 7 3/8" X 7 1/2"	A36	2	
16	2	PL 1/2" X 8" X 8"	A36	18	
		TOTAL:		379#	

02- 215 -68.	11589	2	1
CVI NO	CVI SHT	REV	DWG SHT



PLAN @ ELEV. 470'-3"



LOCATION PLAN

ZONE: E21	OP. LD.: ~		HYDRO. LD.: ~	
THERMAL LD.: VERT: ~	N-S: ~		E-W: ~	
SEISMIC LD.: VERT: ~	N-S: ±18794#		E-W: ±18022#	
CODE/CLASS: III/3	GROUP: 2		Q.A. LEVEL: I	
PAINT: I	PIPE CALC.: P1459		STL. CALC.: B-G-60-1	
PIPING SYSTEM: SERVICE WATER	REF. DWG. NO.: SW-250-41.5 SH		PIPING: M712	

REV NO	REVISION	DATE	DWN	CHKD	APVD
2	REVISED IN ACCORDANCE W/WB6 STATUS AS-BUILT	6-2-81			
1	REDESIGNED BY B&R	3-10-80			KP

DWN B. SANDERS CHKD BTM SCALE NONE
SL/LDE PORTER DATE 3-7-80

ENGINEERING REVIEW

MECH	CIVIL
ELEC	

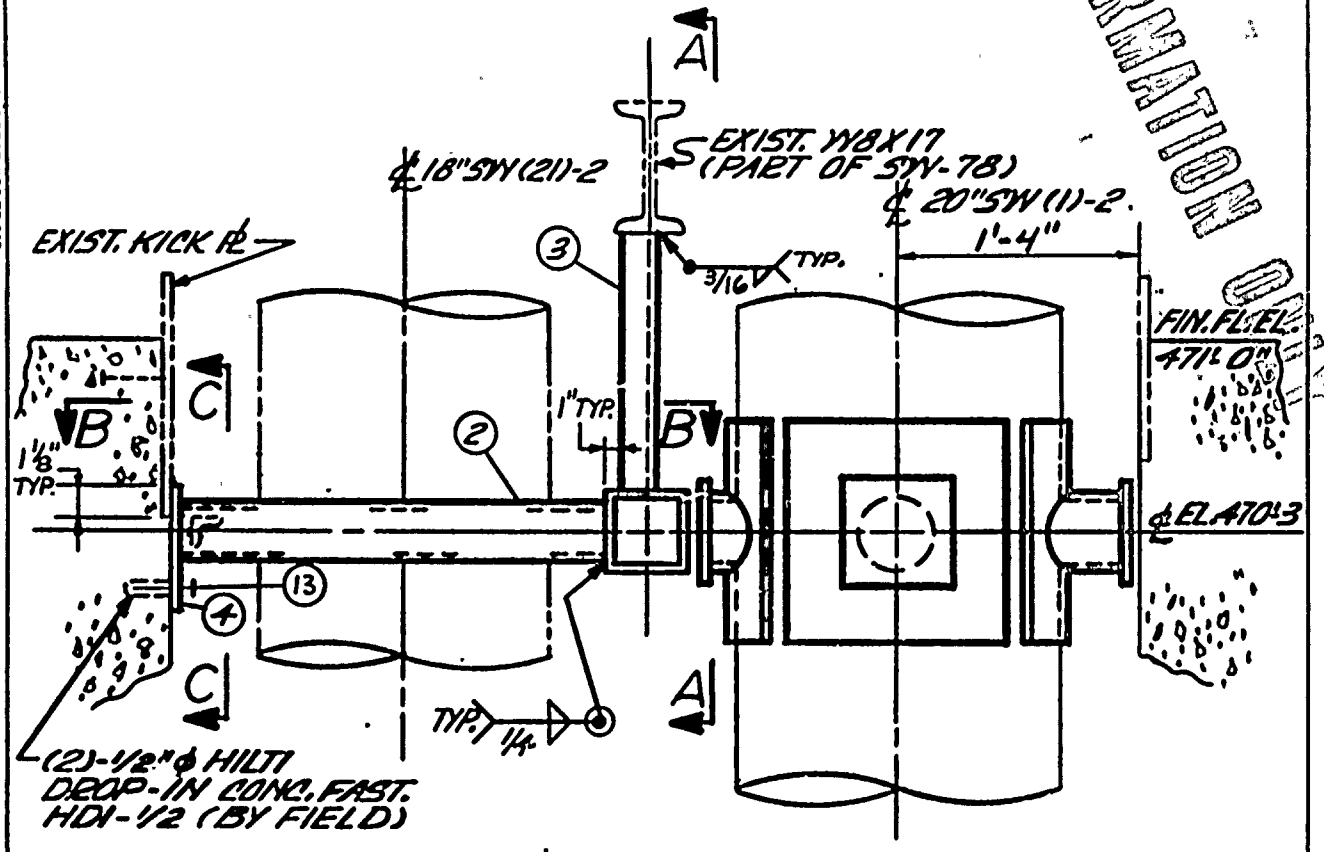
REVD H.R. Teague CHIEF DRAFTSMAN
APVD Dragano DATE 3-13-80 CHIEF ENGR. ENGINEER

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO. 2

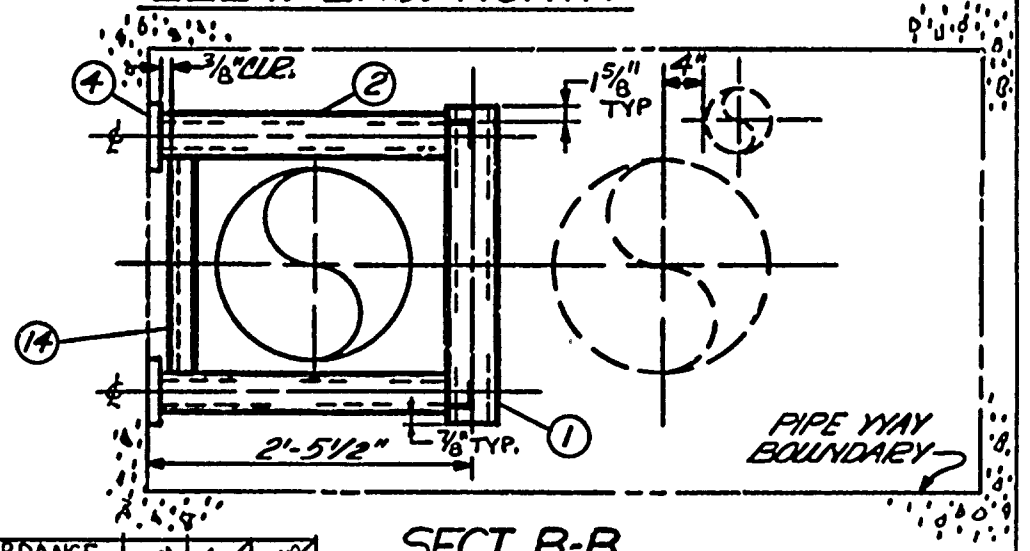
MARK NO. SW-77

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

W.O. 3808	DWG. SW 77 SHT. 1 OF 3	REV 2



ELEV. LKG. NORTH

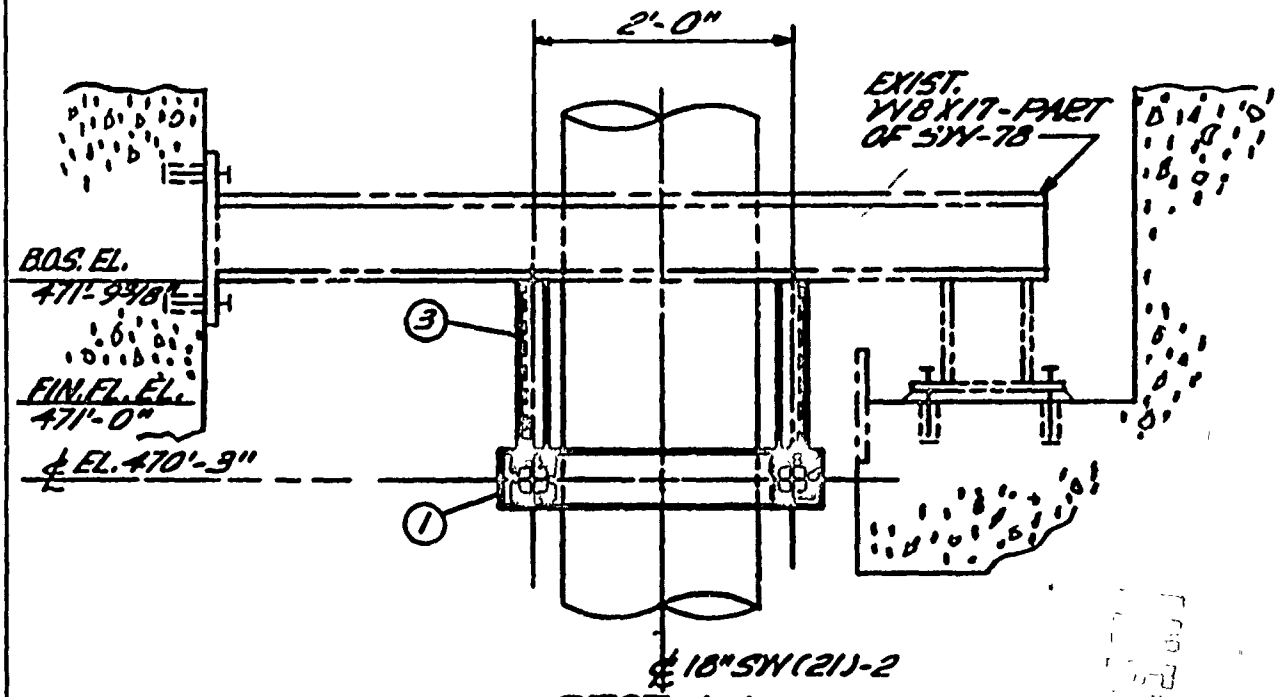


SECT. B-B

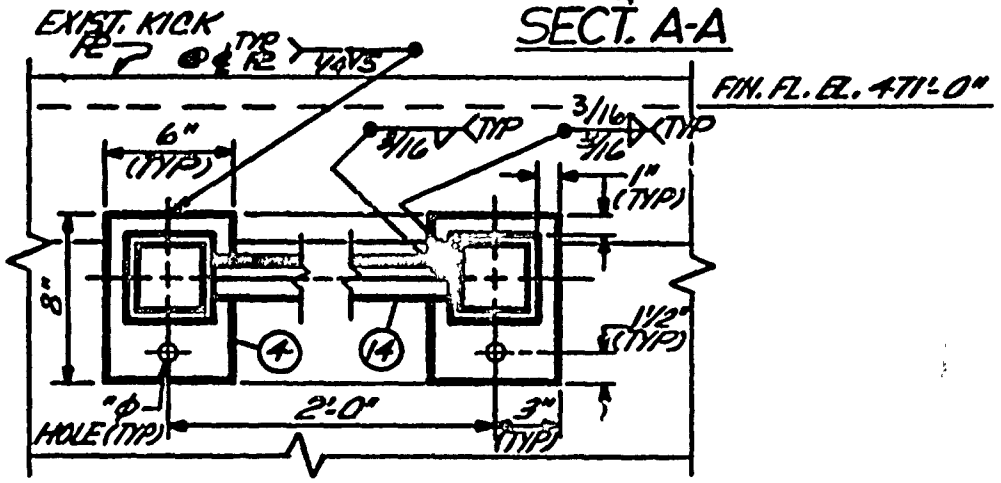
REV NO	REVISION	DATE	DWN	CHKD	APVD
2	REVISED IN ACCORDANCE W/WBG STATUS AS-BUILT	5-2-80	TA	MCP	JH
1	REDESIGNED BY R&E	03-30-80	BS	KP	

DWN B. SANDERS CHKD BTM SCALE NONE
SL/LDE PORTER DATE 3-7-80
ENGINEERING REVIEW
MECH CIVIL
ELEC
REVD H.R. Teague CHIEF DRAFTSMAN
APVD D.R. Sheppard CHIEF MECH. ENGINEER DATE 3-13-80

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO. 2
MARK NO. SW-77
BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California
W.O. 3808 | DWG. SW-77 SHT. 2 OF 3 | REV 2



SECT. A-A



SECT. C-C

REV NO	REVISION	DATE	DWN	CHKD	APVD
2	REVISED IN ACCORDANCE W/ WBG STATUS AS-BUILT	5-2-80			MCD JH
1	REDESIGNED BY B&R	3-7-80		BM	KP

DWN B. SANDERS CHKD BM SCALE NONE
SL/LDE PORTER DATE 3-7-80

ENGINEERING REVIEW

MECH	CIVIL
ELEC	

REVD L.R. Porter CHIEF DRAFTSMAN
REVD M. Mayhew DATE 3-13-80 CHIEF TECH. ENGINEER

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO. 2

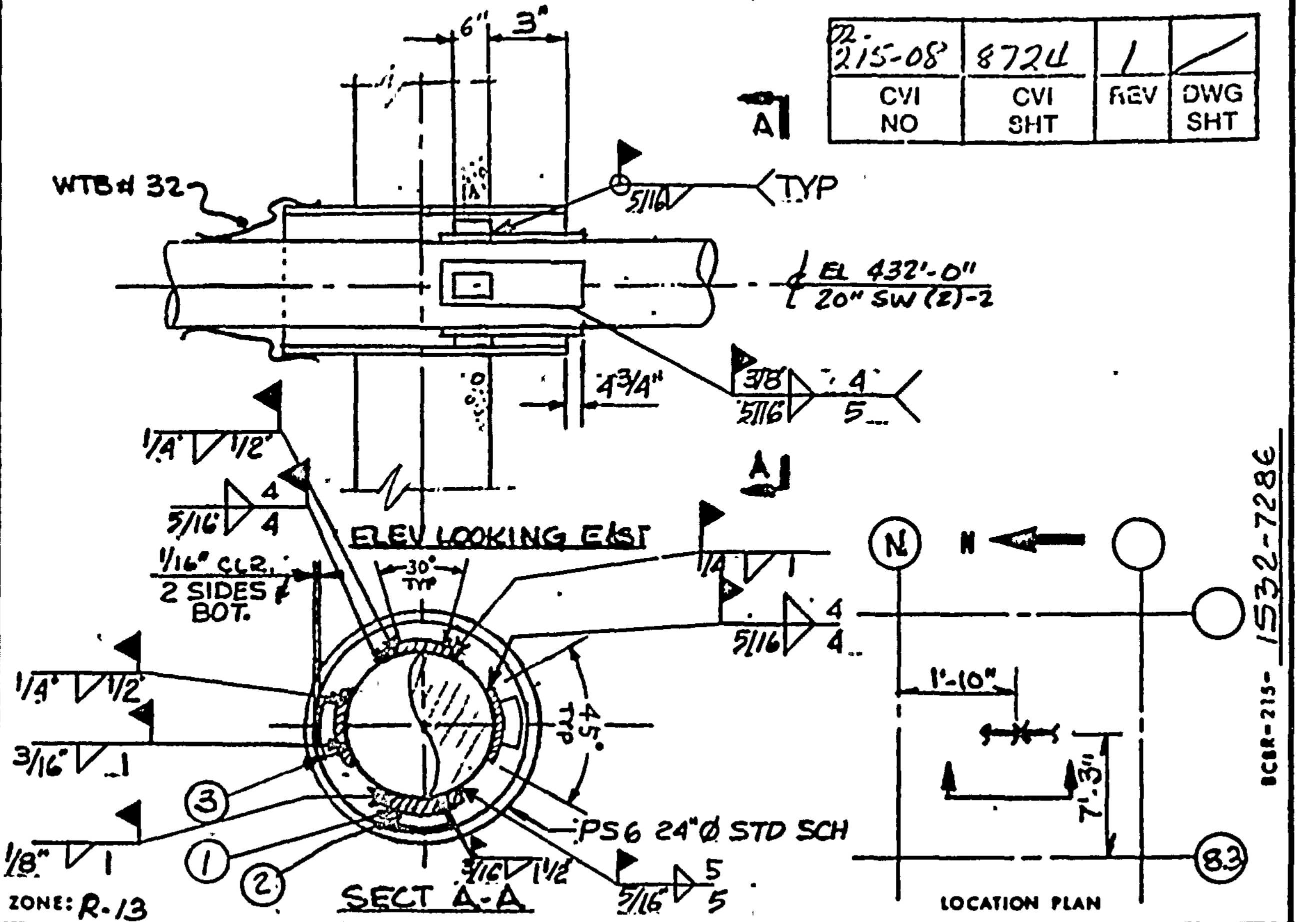
MARK NO. SW-77

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

W.O. 3808 | DWG. SW-77 SHT. 3 OF 3 | REV 2

ITEM NO	NO. REQ'D	SIZE	DESCRIPTION	ASTM	WT.
1	4	1" x 9" x 1'-4" LG	PAD	A-36	164
2	1	5/8" x 2" x6" LG	PAD	A-36	2
3	3	9/16" x 2" x6" LG	PAD	A-36	6
			INFORMATION ONLY		
				TOTAL	172#

215-08	8724	1	
CVI NO	CVI SHT	REV	DWG SHT



ZONE: R-13

BCBR-215-1532-7286

REV.	DATE	DESCRIPTION	DR.	APP.
1	4-26-83	REVISED IN ACCORDANCE WITH WBG STATUS AS-BUILT		

SEIS. LOADS: VERT= ±7195 N-S= ~ E-W= ±16,037	OP. LD.= 3326	HYDRO. LD.= ~	THERM. LD.= VERT ±2000
CODE/CLASS: III-3 GROUP: 2 Q.A. LEVEL: I	PAINT: I	PIPE CALC. P1463	STEEL CALC 8.16.2.18

OWNER: WASHINGTON PUBLIC POWER SUPPLY SYSTEM

PROJECT: HANFORD NO.2

ENGINEER: BURNS & ROE INC.

CUSTOMER: BOVEE & CRAIL / GERI

PIPING SYSTEM: STANDBY SERVICE WATER

REFERENCE DWG.: ISO: SW-251-23.29H PIPE: M-711

MARK NO.: SW-34 AM-149

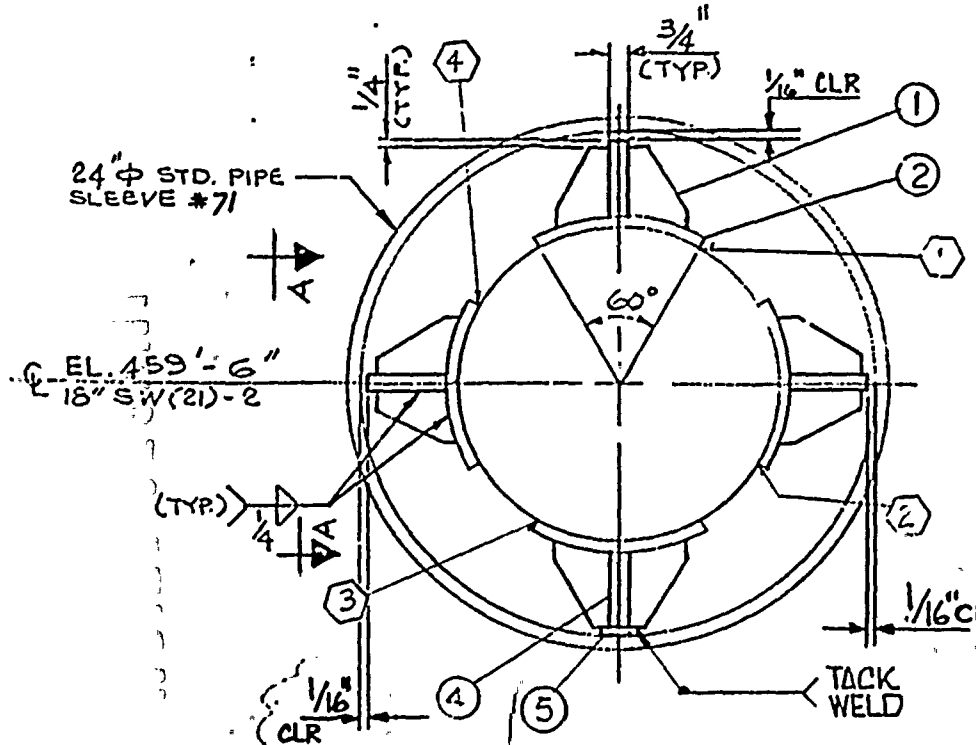
nps industries, inc.
CONTRACT 215

a subsidiary of nuclear power services, inc.
26 broadway-new york, n.y. 10004

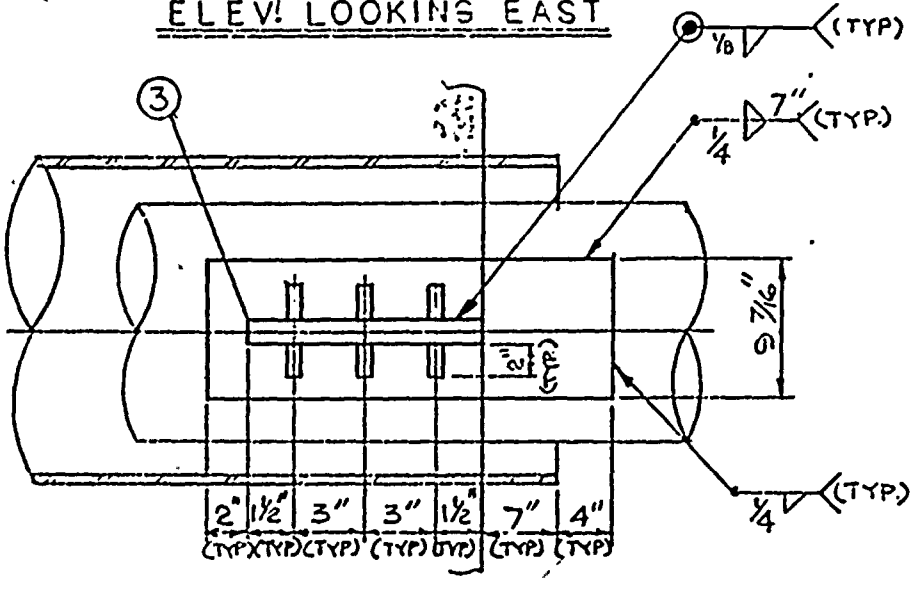
DRAWN	DATE	CHK'D	DATE	APPV'D	DATE
JS RK	8/24/76	JS	8/25/76	JG	4-28-77

JOB NO.:

DWG. NO. SW-34 REV. 1



ELEV. LOOKING EAST



SECTION A-A

DWG SHT	REV	CVI SHT	CVI NO
	2	11004	215-05

OWNER: WASHINGTON PUBLIC POWER SUPPLY SYSTEM
PROJECT: HANFORD NO. 2
ENGINEER: BURNS & ROE INC.
CUSTOMER: BOVEE & CRAIL / GERI

PIPING SYSTEM: SERVICE WATER
ISO.: SW-296-17.26H
REFERENCE DWG.: PIPING: M 712
MARK NO.: SW-142 58.0 PS
AM-184

nps industries, inc.
CONTRACT 215

a subsidiary of nuclear power services, inc.
26 broadway · new york, n.y. 10004

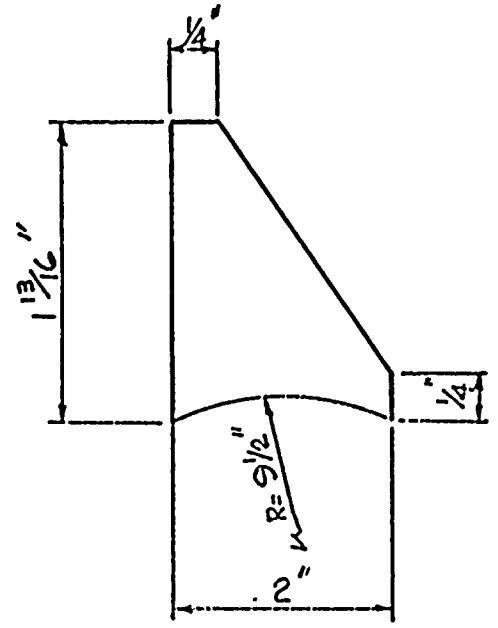
DRAWN	DATE	CHK'D.	DATE	APPV'D.	DATE
HF PL	9.28.76	JJM	10.1.76	JG	11-4-77

JOB NO.
DWG NO. SW-142 (1 OF 2) REV. 2

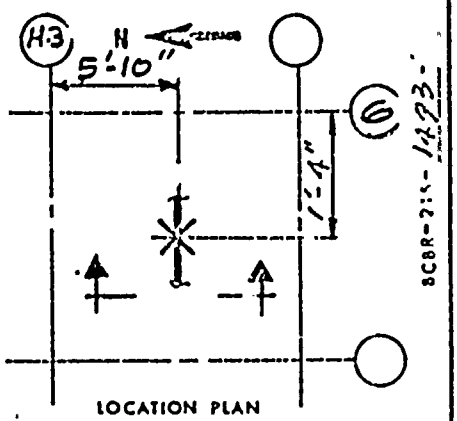
REV. 2 DATE 3/25/77 DESCRIPTION REVD BY B&R DR. APP. DATE

BCBR-215-1493

ITEM NO	NO REQD	SIZE	DESCRIPTION	ASTM	WT.	
1	24	3/8" X 1 3/16" X 2" LG.	PLATE (SEE DET. 1)	A36	24	
2	4	1/2" X 9 7/16" X 1'-9" LG	PLATE	A36	112	
3	3	3/4" X 2 1/16" X 9" LG.	SHEAR LUG	A36	12	
4	1	3/4" X 2 1/8" X 9" LG.	SHEAR LUG	A36	4	
5	1	1/4" X 2" X 0'-6" LG	PL.	A36	1	
				TOTAL	153 #	



DETAIL 1



LOCATION PLAN

LOCATION PLAN FOR REFERENCE ONLY! USE FAB. ISO. FOR CONSTRUCTION

BCBR-211-1423-

ZONE: R-21

SEIS. LOADS: VERT = ±6115 # N-S = ±10,247 # E-W = —

OP. LD. = 3395 # HYDRO. LD. = — THERM. LD. = —

CODE / CLASS: III/3 GROUP: 2 Q.A. LEVEL: I

PAINT: I PIPE CALC. 8-42-243 STEEL CALC 8.16.2393

OWNER: WASHINGTON PUBLIC POWER SUPPLY SYSTEM

PROJECT: HANFORD NO.2 ENGINEER: BURNS & ROE INC.

CUSTOMER: BOVEE & CRAIL / GERI

PIPING SYSTEM: SERVICE WATER

ISO. : SW-296-1726 H

REFERENCE DWG. PIPING: M 712 58.0 P3

MARK NO. SW-142 AM-184

REV.	DATE	DESCRIPTION
2	3/25/83	REV'D BY B&R

DR.	APP.	DATE	REV.	APP.	DESCRIPTION
MF	PL	9.28.76			

nps industries. inc.

CONTRACT 215

a subsidiary of nuclear power services. inc.

25 broadway · new york, n.y. 10004

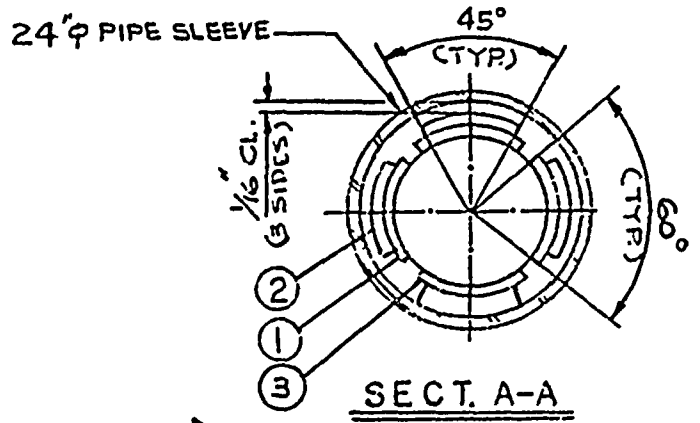
DRAWN	DATE	CHK'D	DATE	APPV'D	DATE
MF PL	9.28.76	JJM	10.1.76	JG	11-1-11

JOB NO.

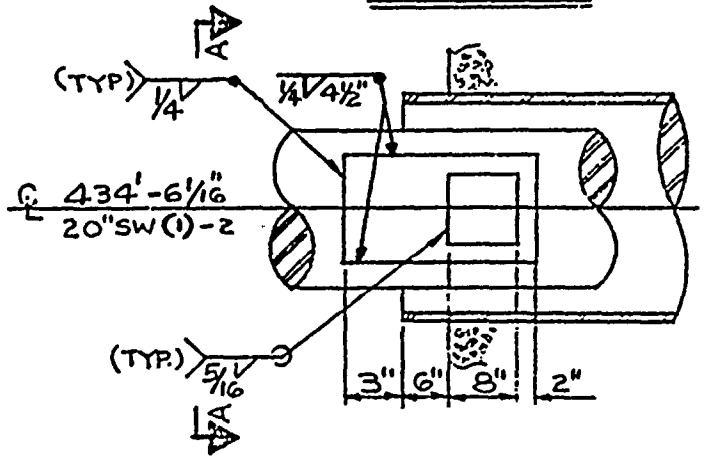
DWG. NO. SW-142 (2 OF 2) REV 2

ITEM NO	NO. REQ'D.	SIZE	DESCRIPTION	ASTM	WT.
1	3	10 3/4" x 9/16" x 1'-7" LG	PAD	A36	107
2	4	8 3/4" x 1" x 8" LG	PAD	A36	87
3	1	10 3/4" x 5/8" x 1'-7" LG	PAD	A36	40
				TOTAL	234

DR. | DESCRIPTION | DATE | REV. | APP | DR.
REVISED IN ACCORDANCE W/WBS STATUS AS BUILT | 5/7/81 | 1 | [illegible]

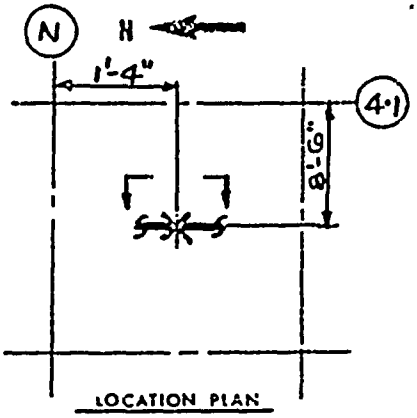


SECT. A-A



ELEV. LOOKING WEST

02-215-08	11573	1	
CVI NO	CVI SHT	REV	DWG SHT



LOCATION PLAN

ECAR-215-1487

ZONE: R-23

SEIS. LOADS: VERT = ± 3430# N-S = — E-W = ± 21995# | OP. LD. = 974# | HYDRO. LD. = 974# | THERM. LD. =

CODE / CLASS: III/3 | GROUP: 2 | Q A LEVEL: I | PAINT: I | PIPE CALC. P1459 | STEEL CALC. B16.2341

OWNER: WASHINGTON PUBLIC POWER SUPPLY SYSTEM

PROJECT: HANFORD NO. 2 | ENGINEER: BURNS & ROE INC.

CUSTOMER: BOVEE & CRAIL / GERI

PIPING SYSTEM: STANDBY SERVICE WATER

REFERENCE DWG.: 150# SW-250-25.30 H PIPING - M711

MARK NO.: SW-60 | AM-186

nps industries, inc.
CONTRACT 215

a subsidiary of nuclear power services, inc.
26 broadway-new york, n.y. 10004

DRAWN	DATE	CHK'D	DATE	APP'D	DATE
MF PL	8.30.76	JDS	9.3.76	JG	11.3.77

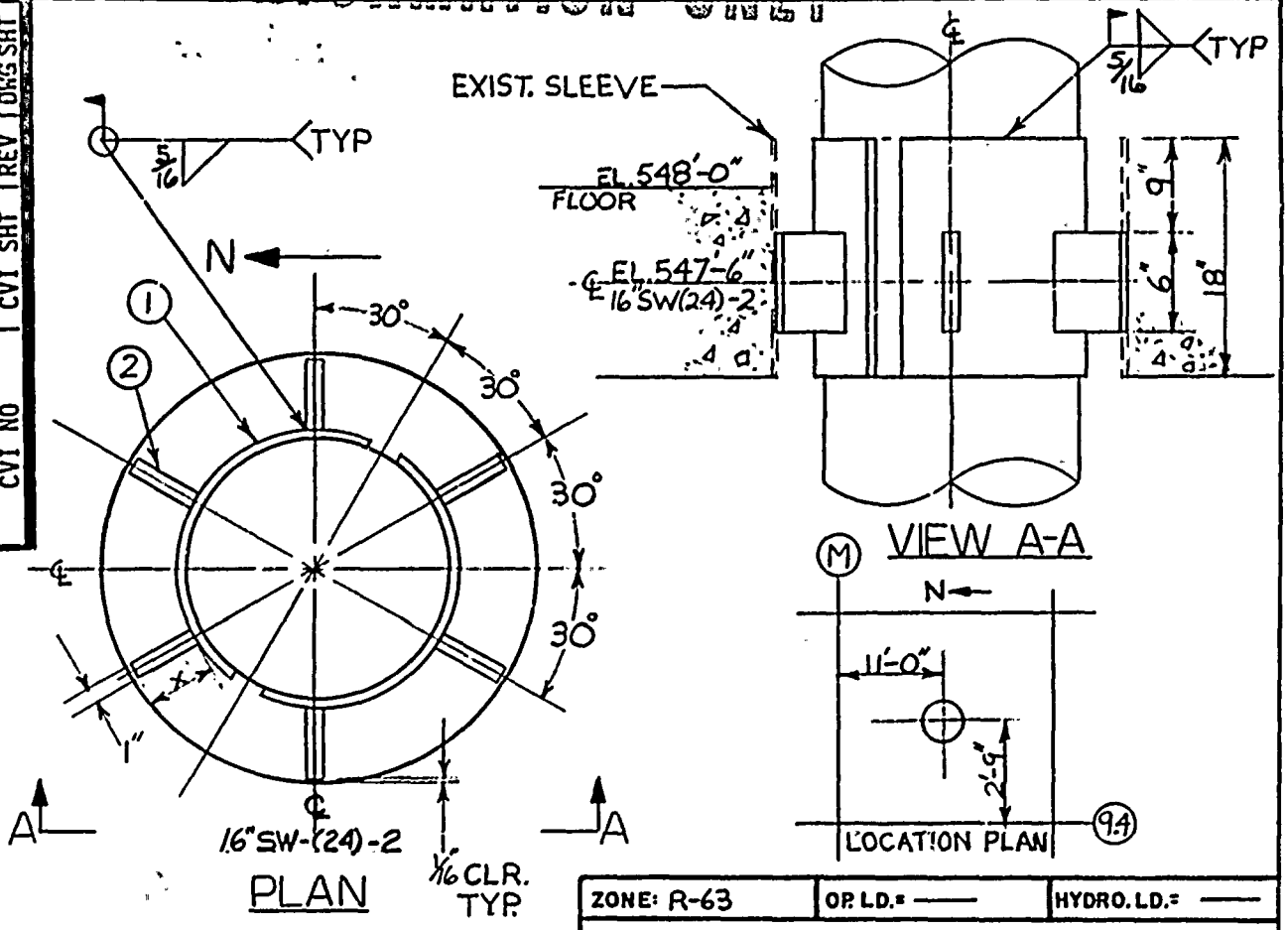
JOB NO

DWG. NO SW-60 | REV 1

SUPERIOR REPROGRAPHICS 18 x 24

ITEM NO.	QUAN.	SIZE — DESCRIPTION	ASTM	WT.	
1	2	PL 3/4" X 18" X 2'-2" BEND TO 8 3/4" RADIUS	A-36	198.9	
2	6	PL 1" X 2 1/2" X 0'-6" FIELD CUT X DIMENSION			
		TO SUIT.	A-36	25.5	
		INFORMATION ONLY	TOTAL	224.4#	

DWG SHT	REV	CVI SHT	CVI NO
/	1	12/52	02-215-05



NOTE: ITEM ② TO BE WELDED TO PLATE ① BEFORE WELDING PLATE ① TO PIPE.

CUT X DIMENSION OF ITEM 2 BEFORE WELDING.

REV NO	REVISION	DATE	DWN	CHKD	APVD
1	REVISED IN ACCORDANCE W/WBG STATUS AS-BUILT	4/24/81	JM	MCD	

DWN D. MEHEEN CHKD [illegible] APVD [illegible] SCALE N.T.S.

SL/LDE [illegible] DATE 7/21/80

ENGINEERING REVIEW

MECH	CIVIL
ELEC	

REVD H.R. Teague CHIEF DRAFTSMAN

APVD [illegible] DATE 7/23/80 CHIEF MECH. ENGINEER

ZONE: R-63	OP. LD.: —	HYDRO. LD.: —
THERMAL LD.: VERT: —	N-S: —	E-W: —
SEISMIC LD.: VERT: —	N-S: ±17,876#	E-W: ±11,367#
CODE/CLASS: III/3	GROUP: II	Q.A. LEVEL: I
PAINT: I	PIPE CALC.: P1458	STL. CALC.: 8.16.1232
PIPING SYSTEM STAND-BY SERVICE H_2O	REF. DWG. ISO.: SW-295-4.6 H PIPING: M-715	

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

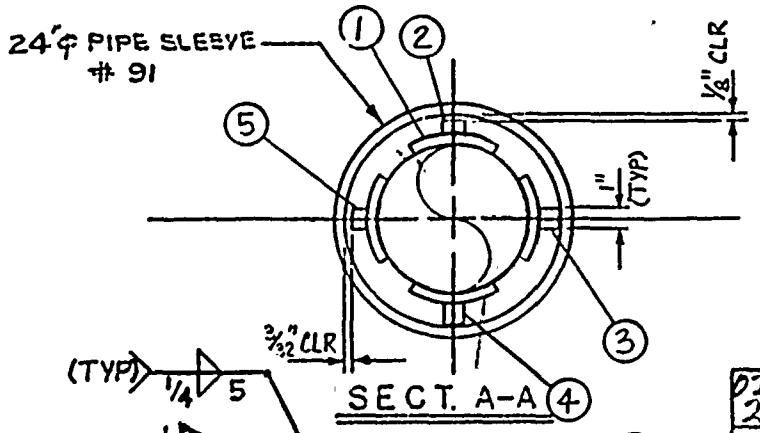
HANFORD NO. 2

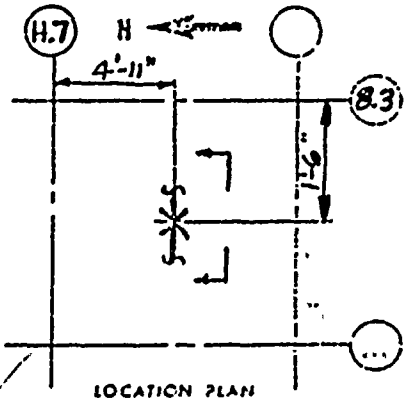
MARK NO. SW-916N

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

W.O. 3808	DWG. SW-916N	REV 1

ITEM NO	NO. REQ'D	SIZE	DESCRIPTION	ASTM	WT.
1	4	10 3/4"	x 5/8" x 1'-9" LG (PAD)(BEND TO PIPE RAD)	A36	164
2	1	PL	1" x 1 1/8" x 1'-0"	A36	3
3	1	PL	1" x 1 1/4" x 1'-0"	A36	3
4	1	PL	1" x 1 3/16" x 1'-0"	A36	3
5	1	PL	1" x 3/4" x 1'-0"	A36	3
		MATERIAL WT.		TOTAL	176 #





02 215-05	11586	1	/
CVI NO	CVI SHT	REV	DWG SHT

ZONE: R-21

SEIS. LOADS: VERT.= ±6903# N-S = ±25445# E-W = ——			OP. LD.= 3206#	HYDRO. LD.= 3206#	THERM. LD.= ——
CODE / CLASS: III/3	GROUP: 2	Q.A. LEVEL: I	PAINT: I	PIPE CALC. P1453	STEEL CALC 8.16.2351

OWNER: WASHINGTON PUBLIC POWER SUPPLY SYSTEM
PROJECT: HANFORD NO.2 | ENGINEER: BURNS & ROE INC.
CUSTOMER: BOVEE & CRAIL / GERI

PIPING SYSTEM: STANDBY SERVICE WATER
ISO: SW-250-41.50 H
REFERENCE DWG.: PIPING: M712
MARK NO: SW-75 | AM-186

REV	DATE	DESCRIPTION
1	5-01-81	REVISED IN ACCORDANCE W/WBG STATUS AS-BUILT

nps industries, inc.
CONTRACT 215

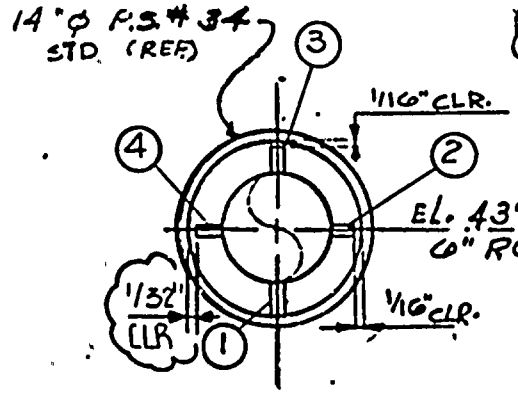
a subsidiary of nuclear power services, inc.
25 broadway · new york, n.y. 10004

DRAWN	DATE	CHK'D	DATE	APPV'D	DATE
ME/PL	9-1-76	RAJ	9-3-76	JG	11-3-77

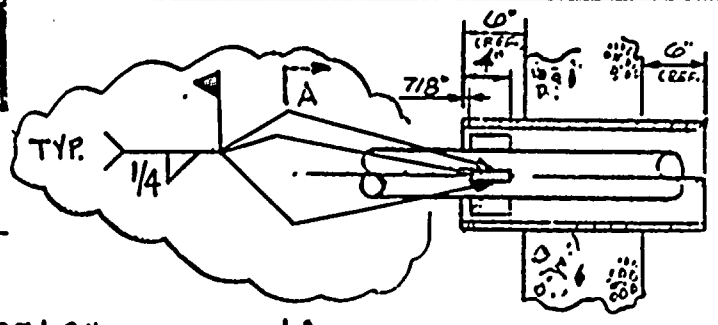
JOB NO
DWG NO SW-75 | REV. 1

ITEM NO.	QUAN.	SIZE — DESCRIPTION	ASTM	WT.	
1	1	PL 1/2"X 4"X0'-2 5/8" (LUG)	A-36	1	
2	1	PL 1/2"X 4"X0'-3 1/8" (LUG)	A-36	2	
3	1	PL 1/2"X 4"X0'-3 7/8" (LUG)	A-36	2	
4	1	PL 1/2"X 4"X0'-3 3/16" (LUG)	A-36	2	
		TOTAL WT.		7#	

02-215-08	5847	4	
CVI NO	CVI SHT	REV	DWG SHT

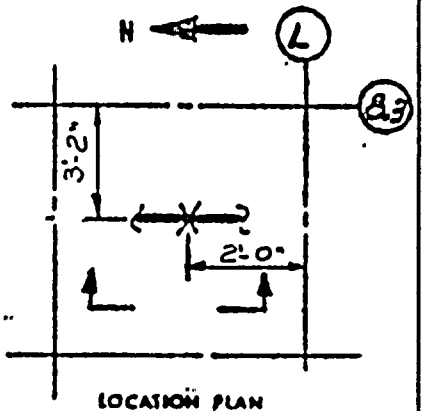


SECTION A-A



A

ELEVATION LKG. EAST



LOCATION PLAN

LOCATION PLAN FOR REF ONLY! SEE ISO FOR HANGER ALONG PIPE.

THERM MVTS	
DX	0.303" S
DY	.000"
DZ	.000"

B & R ISO M-200-115
DATA PT. #44 PS16(4) & PS17(2)

AS BUILT INFORMATION

ZONE: R-II	OP. LD.: FX=-714# FZ=1124#	HYDRO. LD.: -692#
THERMAL LD.: VERT: 118# N-S: ——		E-W: 203#
SEISMIC LD.: VERT: ±198# N-S: ——		E-W: ±243#
CODE/CLASS: III/2	GROUP: 1	Q.A. LEVEL: I
PAINT: I	PIPE CALC: 8.14.96C	STL. CALC.: 8-15-2142
PIPING/REACTOR CORE SYSTEM/INSULATION/COOLING	REF. DWG. ISO.: RCIC-659-7-10 PIPING: M-711	

REV	DATE	REMARKS	DRN/CHD	DS	ENG.
4	11/2/85	CONSTR. COMPLETE PER PRR REV. 1 & PED 215-H-G883.	RM/CB	EBA	JHF

DWN Ali Sanjabani CHKD R Cook SCALE N TS
SL/LDE B DATE 6-21-82

ENGINEERING REVIEW

MECH	CIVIL
ELEC	

REVD [signature] CHIEF DRAFTSMAN
APVD [signature] DATE 7/25/82 CHIEF MECH. ENGINEER

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO. 2 006.0-P2

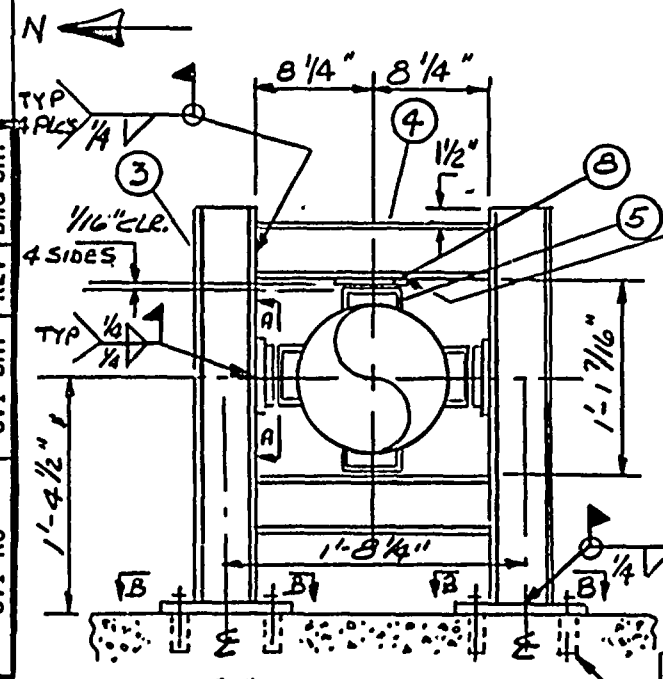
MARK NO. RCIC-18

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

W.O. 3808	DWG. RCIC-18	REV 4

ITEM NO.	QUAN.	SIZE — DESCRIPTION	ASTM	WT.	
1	2	PL 3/4" X 9" X 0'-9" (SEE SECT. B-B)	A-36	34	
2	8	5/8" ϕ X 1 1/2" LG HVY. HEX. MACH. BOLT W/L.W	A-307 GrB	2	
3	2	M 4 X 13 X 2'-4 3/4" LG.	A-36	62	
4	2	M 4 X 13 X 1'-4 1/2" LG.	A-36	35	
5	4	C 4 X 5.4 X 0'-6" LG (CUT TO SUIT)	A-36	11	
6	2	PL 3/4" X 5" X 0'-5"	A-36	11	
7	2	PL 3/4" X 4" X 0'-4"	A-36	7	
8	1	PL 1/16" X 4" X 0'-5"	A-36	1	
		TOTAL WGT.		163#	

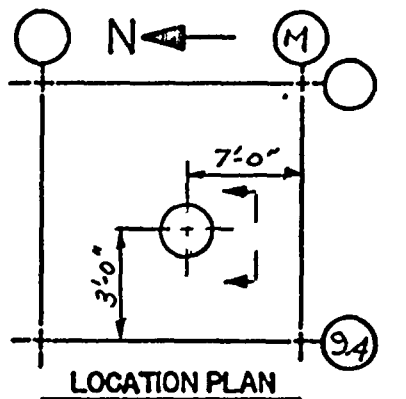
SUPERIOR REPROGRAPHICS 18 x 24



PLAN @ ELEV. 470'-1"

BER 150 M200 SHT 173
DATA PT. 116 PS15 (X), PS16 (Z)

THERM MVT'S	
DX	0.0"
DY	0.155" UP
DZ	0.0



ZONE: R-23	OP. LD.: FZ = 5#		HYDRO. LD.: FZ = 5#
THERMAL LD.: VERT: —	N-S:		E-W: 3#
SEISMIC LD.: VERT:	N-S: 524#		E-W: 504#
CODE/CLASS: III/3	GROUP: 1		Q.A. LEVEL: I
PAINT: I	PIPE CALC.: 8.14.154		STL. CALC.: 8.16.3628
PIPING SYSTEM: FUEL POOL COOLING	REF. DWG. ISO.: FPC-605-5.9	PIPING: M-701	

REV NO	REVISION	DATE	DWN	CHKD	APVD
2	RELEASE FOR PSI INSPECTION	3/31/83	MB	TK	
1	REVISE/REDRAW. BY BER IN ACCORD W/WBG STATUS AS-BUILT	11/1/82	RCK	TK	SK MCD

DWN R.E. Keck Se. CHKD J. GRIFFIN SCALE NTS
SL/IDE DATE 12-2-82

ENGINEERING REVIEW

MECH	CIVIL
ELEC	

REVD [signature] 12/4/82 MANAGER - DESIGN AND DRAFTING
APVD [signature] DATE 12/7/82 CHIEF MECH. ENGINEER

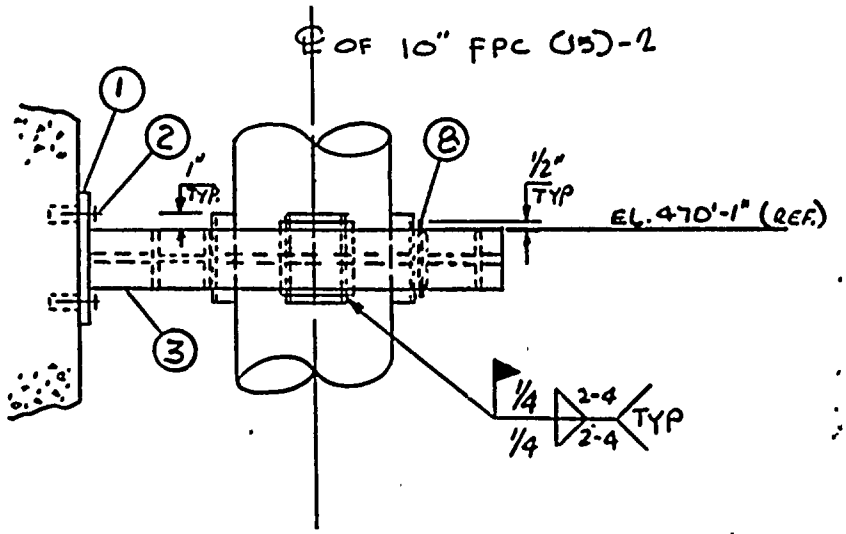
WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO. 2 009.0-P4

MARK NO. FPC-64

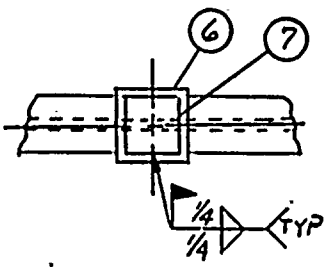
BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

W.O. 3808	DWG. FPC-64 SHT. 1 of 2	REV 2

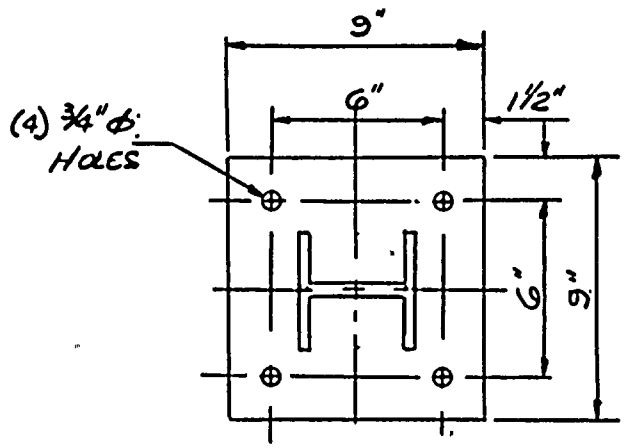
02-215-2?? | CVI NO | CVI SHT 11402 | REV 2 | DWG SHT 1



ELEV. LK'G NORTH



SECTION A-A



SECTION B-B
TYP.

REV NO	REVISION	DATE	DWN	CHKD	APVD
2	RELEASE FOR P.S.I. INSPECTION	3/31/83	TAG	TYC	
1	REV'D & REDRAWN BY B&R IN ACCORD W/W.B.G. STATUS AS BUILT	11/1/82	KEK	SK	MCD

DWN R.E. Keck SR. CHKD J. GRIFFIN SCALE NTS
SL/LDE DATE 12-2-82

ENGINEERING REVIEW

MECH	CIVIL
ELEC	
REVD 12/4/82 MANAGER-DESIGN AND DRAFTING	APVD DATE 12/7/82 CHIEF MECH. ENGINEER

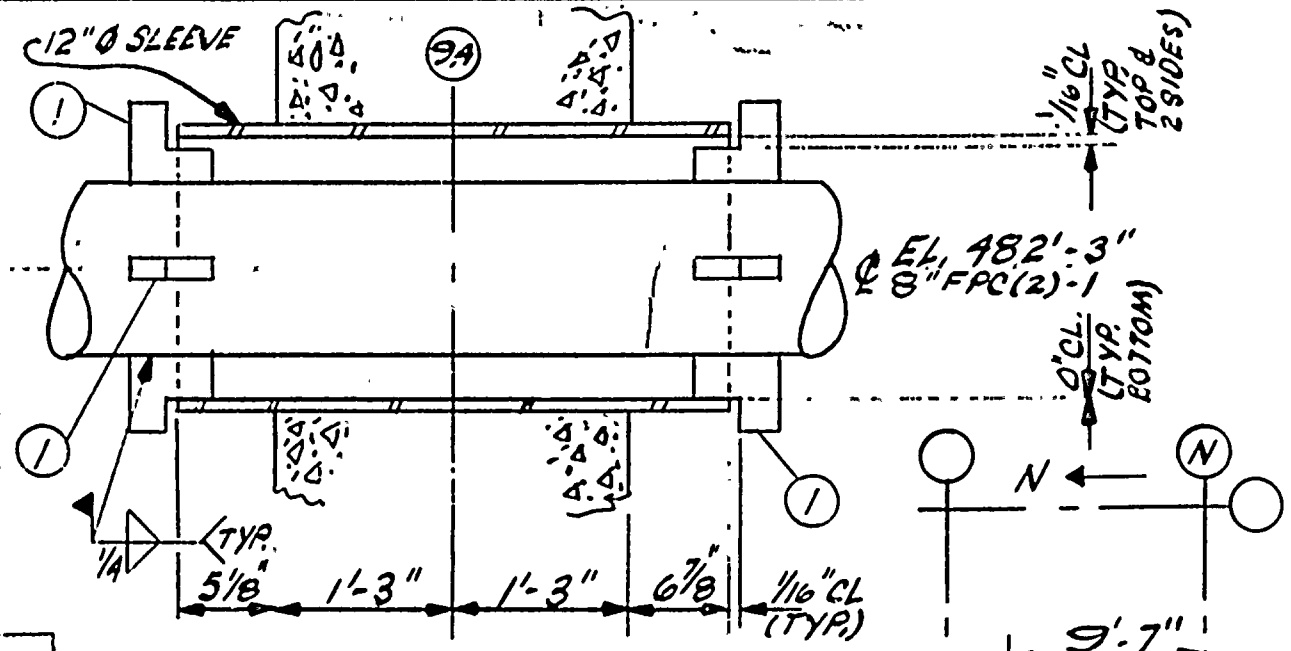
WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO. 2

MARK NO. FPC-64

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

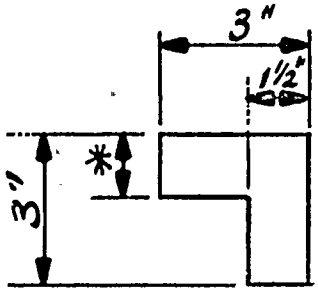
W.O. 3808 | DWG. FPC-64 SHT 2 of 2 | REV 2

ITEM NO	QUAN.	SIZE — DESCRIPTION	ASTM	WT.	
1	8	PL 1/2"x3"x0'-3" (SEE DETAIL 1)	A36	10.2	
			TOTAL	10.2#	



ELEVATION LKG. NORTH

LOCATION PLAN



DETAIL 1

* CUT TO SUIT

1	INCORPORATED PEC-H-A 284	4-22-1981	MB	AK	LK
REV NO	REVISION	DATE	DWN	CHKD	APVD

DWN M. GWINN	CHKD	SCALE N.T.S.	
SL/LDE	DATE 7/17/81		

ENGINEERING REVIEW

MECH	CIVIL
ELEC	
REVD H.R. Teague CHIEF DRAFTSMAN	APVD CHIEF MECH. ENGINEER DATE 7/16/81

ZONE: R-33	OP. LD.: 220 #	HYDRO. LD.: 220#	
THERMAL LD.: VERT: ——	N-S: ——	E-W: ——	
SEISMIC LD.: VERT: ±438#	N-S: ±600#	E-W: ±972#	
CODE/CLASS: III/3	GROUP: 2	Q.A. LEVEL: I	
PAINT: I	PIPE CALC.: P-1651	STL. CALC.: 8.16.1116	
PIPING SYSTEM FUEL POOL COOLING	REF. DWG. ISO.: FPC-636-16.21	PIPING: M 703	

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO. 2

MARK NO. FPC-98 2-10-83

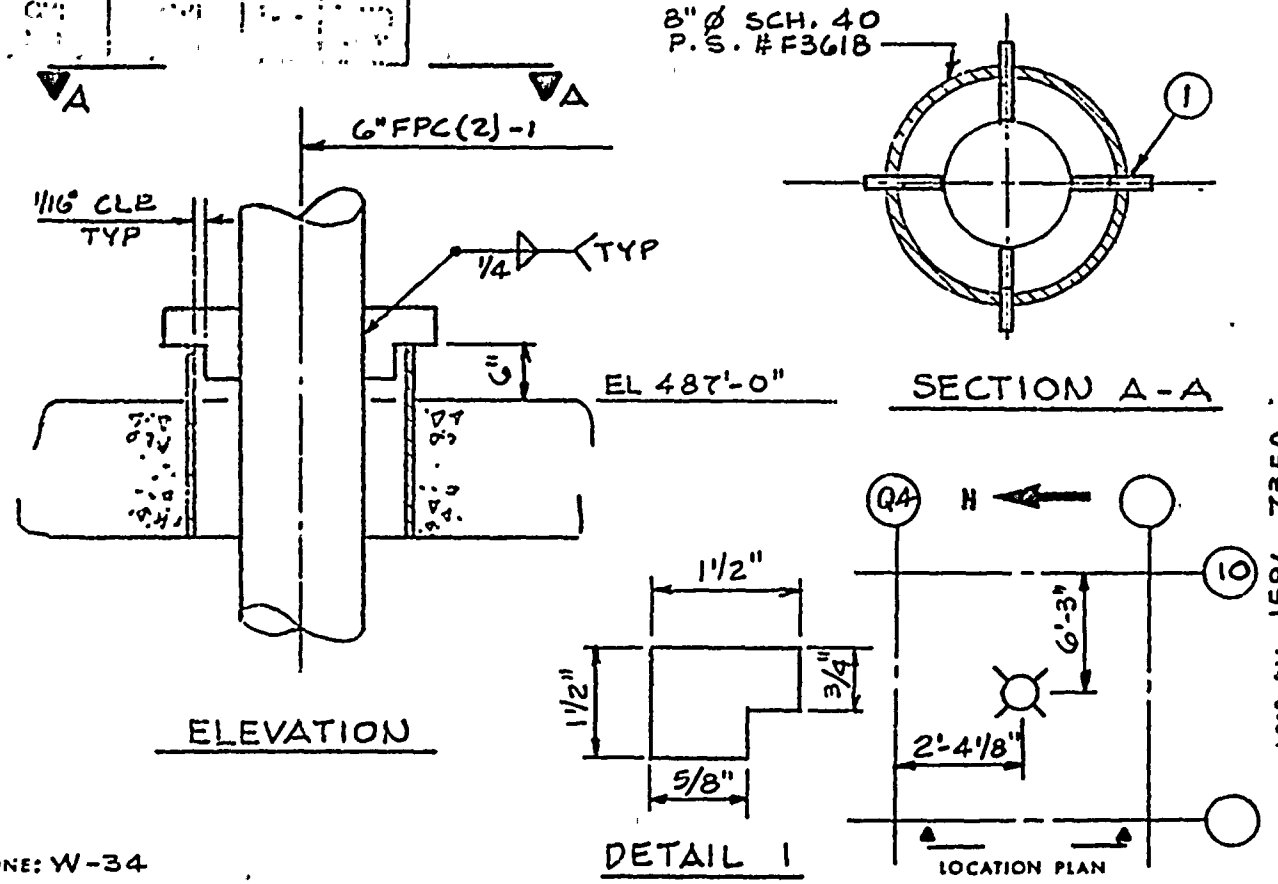
BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

W.O. 3808	DWG. FPC-98	REV 1

1	3533	CVI	SHT	
02-219-03		CVI	NO	

ITEM NO	NO REQD.	SIZE	DESCRIPTION	ASTM	WT.	
1	4	1 1/2"	x 1 1/2 x 3/8" THK LUG.	A36	1.1	
			MATERIAL WT A = 1.1 B = 0 C = 0	TOTAL	1.1	

SZ.			
215-03	4971	0	
CM			



ZONE: W-34

SEIS. LOADS: VERT = ± 94 # N-S = ± 139 # E-W = ± 67 #			OP. LD. = 478 #	HYDRO. LD. = 478 #	THERM. LD. = —
CODE / CLASS: III/3	GROUP: 4	Q.A. LEVEL: II	PAINT: I	PIPE CALC. P-1514	STEEL CALC. —

OWNER: WASHINGTON PUBLIC POWER SUPPLY SYSTEM

PROJECT: HANFORD NO. 2 | ENGINEER: BURNS & ROE INC.

CUSTOMER: BOVEE & CRAIL / GERI

PIPING SYSTEM: FUEL POOL COOLING

ISO. FPC-636-25.26 H

REFERENCE DWG.: PIPING M-767

MARK NO.: FPC-114 | AM-83

nps industries, inc.

CONTRACT 215

a subsidiary of nuclear power services, inc.

26 broadway-new york, n.y. 10004

DRAWN	DATE	CHK'D	DATE	APPV'D	DATE
CG JO	9/1/76	HB	9-4-76	JG	10/26/76

JOB NO.

DWG. NO. FPC-114 | REV 0

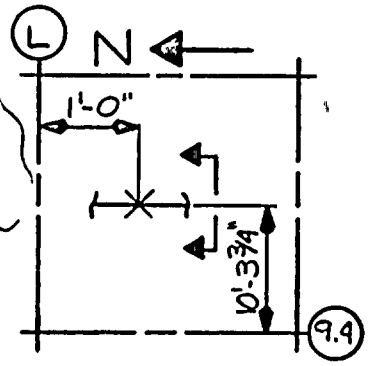
BCBR-715-1596-7350-1

SUPERIOR REPROGRAPHICS TB 398

ITEM NO.	QUAN.	SIZE — DESCRIPTION	ASTM	WT.	
1		DELETED			
2		DELETED			
3		DELETED			
4	1	PL 3/8" x 2" x 0'-5"	A-36	1	
5		DELETED			
6		DELETED			
7		DELETED			
8		DELETED			
9		DELETED			
10		DELETED			
11		DELETED			
12		DELETED			
13	8	3/4"Ø x 2¼" LG HVY. HEX MACH. BOLT W/LW	A307GRB	5	
14		DELETED			
15		DELETED			
16	1	TS 5x5x.375 x 10'-7½" LG	A500GRB	233	
17	1	TS 4x4x.375 x 1'-3" LG	A500GRB	21	
18	2	PL 3/4" x 9" x 0'-11"	A-36	42	
19	1	PL 1" x 17½" x 3'-4" (SEE SECTION D-D)	A-36	191	
20	1	TS 6x4x.375 x 8'-0 1/8" LG	A500GRB	176	
21	1	TS 3x3x.375 x 0'-9½" LG	A500GRB	17	

INFORMATION

LOCATION PLAN FOR REFERENCE ONLY! USE FAB. ISO. FOR CONSTRUCTION



LOCATION PLAN

02-215-08	11717	3	
CVI Number	CVI Sheet	Rev.	Dwg. Sheet

ZONE: R-33	OP. LD.: F1 = -1442# F2 = 101#	HYDRO. LD.:	
THERMAL LD.: VERT: —	N-S: —	E-W: —	
SEISMIC LD.: VERT = ±798#	N-S: —	E-W: ±1604#	
CODE/CLASS III/3	GROUP: 2	Q.A. LEVEL: I	
PAINT: I	PIPE CALC: 8.42.035	STL. CALC: 8.16.1638	

REV NO	REVISION	DATE	DWN CHKD	APVD
3	RELEASE FOR P.S.I. INSPECTION. INCORP. I.E.D. H-B260, H-B630, H-E530, H-M095	4/14/83	11/20	

DWN [illegible] CHKD [illegible] SCALE NTS

SL/LDE [illegible] DATE 9/9/81

ENGINEERING REVIEW

MECH	CIVIL
ELEC	

REVD [illegible] CHIEF DRAFTSMAN

APVD [illegible] CHIEF MECH. ENGINEER DATE 9/14/81

PIPING SYSTEM FUEL POOL COOLING

REF. DWG. ISO.: FPC-636-14.15H

PIPING: M 703

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

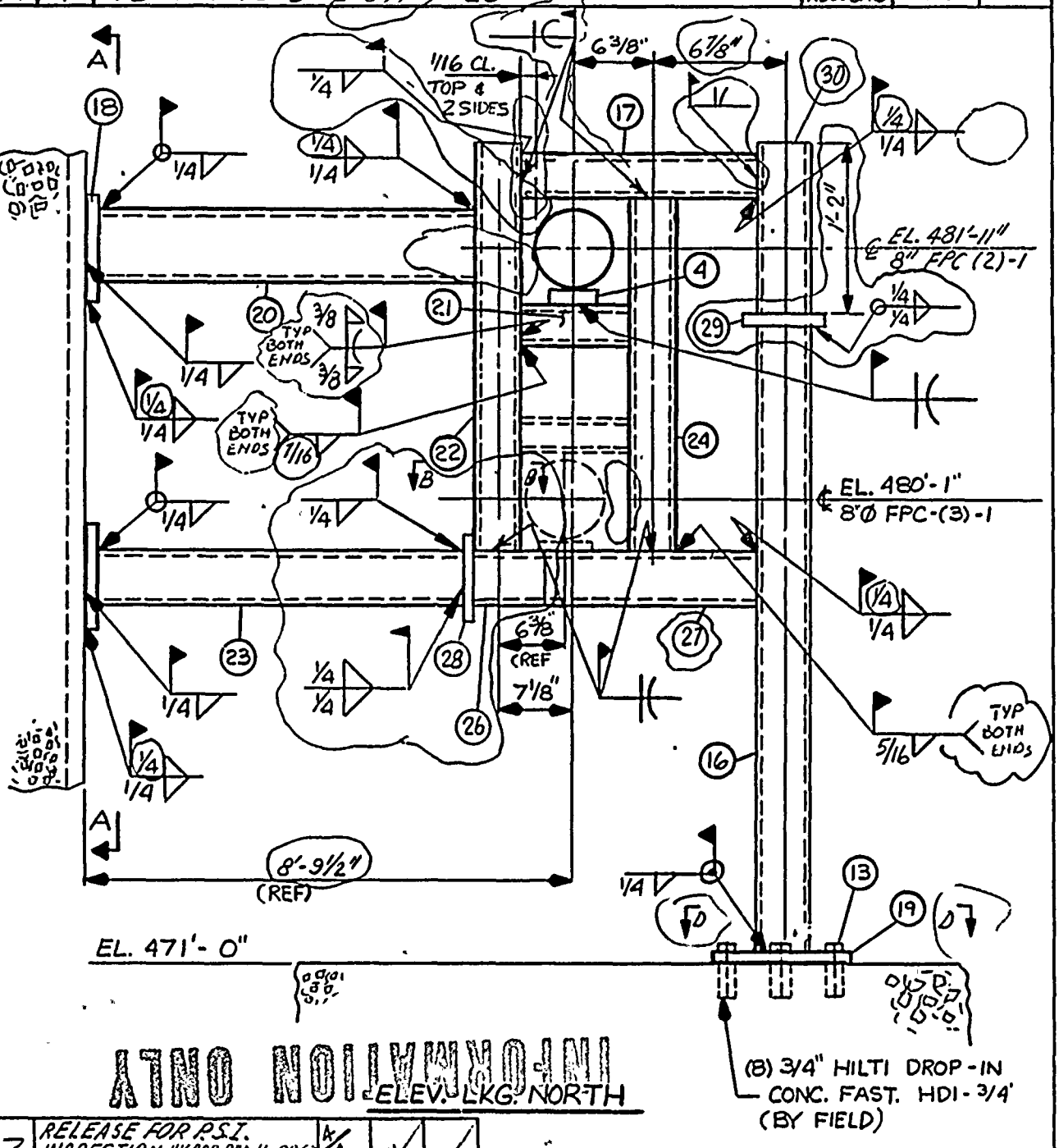
HANFORD NO. 2

MARK NO. FPC-203

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

W.O. 3808 | DWG. FPC-203 SH. 16A4 | REV 3

22	1	TS 4x4x.375 x 3'-1¼" LG	A500GRB	51	
23	1	TS 5x5x.375 x 7'-10¾" LG	A500GRB	173	
24	1	TS 4x4x.375 x 2'-8¾" LG	A500GRB	44	



INFORMATION ONLY

ELEV. LKG. NORTH

REV NO	REVISION	DATE	DWN	CHKD	APVD
3	RELEASE FOR P.S.I. INSPECTION, INCORP. PED H-B260, H-B680, H-E589 & H-M095	4/14/83	TH	FB	

DWN [illegible] CHKD [illegible] SCALE NTS

SLIDE [illegible] DATE 9/5/81

ENGINEERING REVIEW

MECH CIVIL

ELEC

REVD H.R. Traque CHIEF DRAFTSMAN APVD [illegible] CHIEF MECH ENGINEER DATE 4/14/83

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

HANFORD NO.2

MARK NO. FPC-203

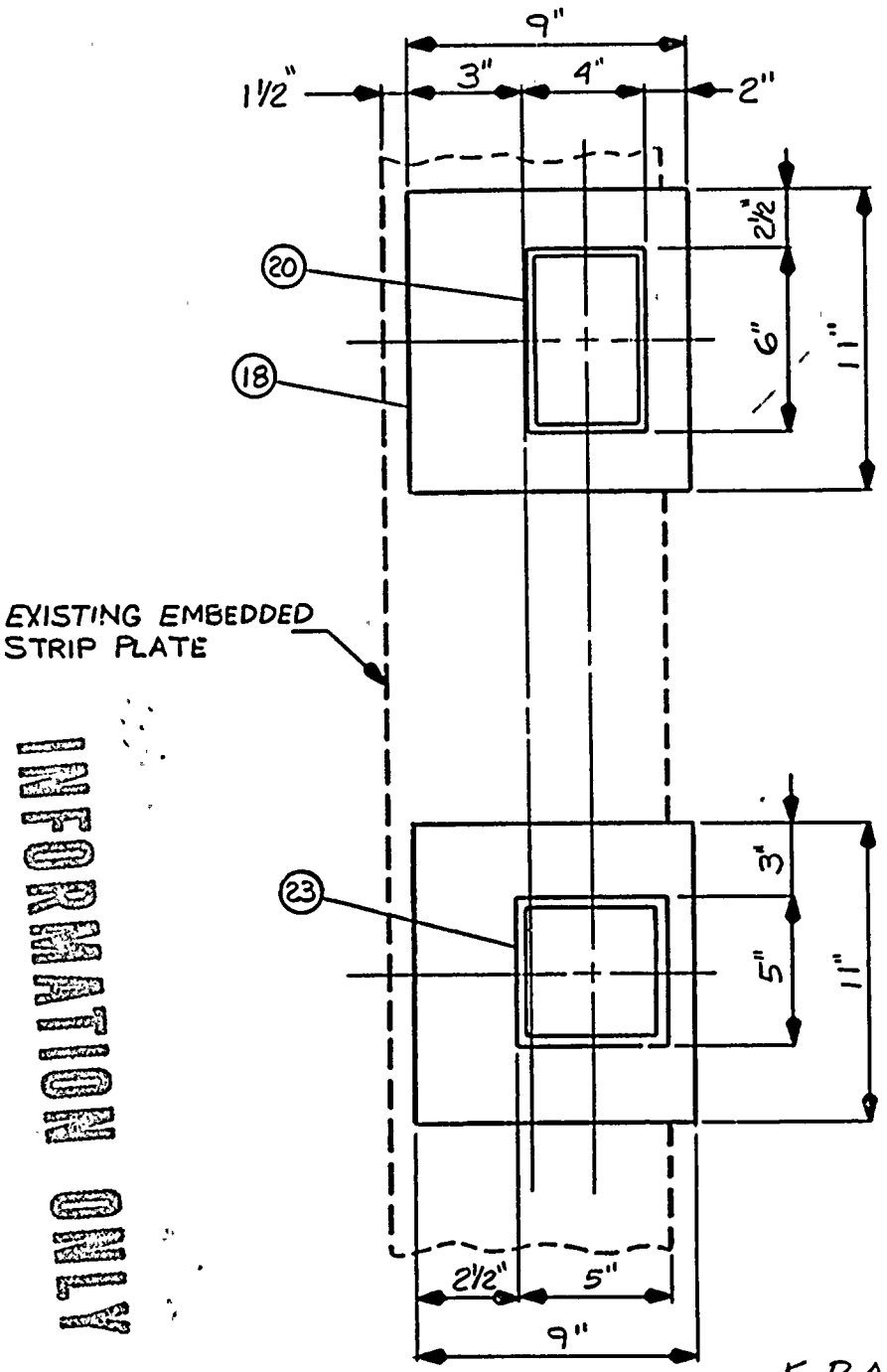
BURNS AND ROE, INC.

Engineers and Constructors

New Jersey • New York • Connecticut • California

W.O.3808 DWG. FPC-203 SH. 2 OF 4 REV 3

SUPERIOR REPROGRAPHICS TB 397



FRAME 1 OF 2

SECTION A-A

REV NO	REVISION	DATE	DWN	CHKD	APVD
3	RELEASE FOR P.S.I. INSPECTION, INCORP. PED-H-B260, -H-B680, H-E583 & H-N025	4/14/83	TH	RB	

DWN	CHKD	SCALE	NTS
SLAVE		DATE	9/9/81

ENGINEERING REVIEW

MECH	CIVIL
ELEC	

REVD	APVD	DATE
CHIEF DRAFTSMAN	CHIEF MECH. ENGINEER	9/14/81

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO.2

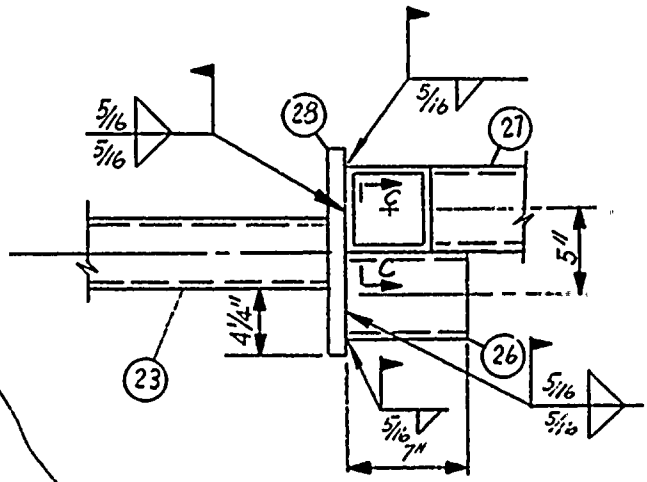
MARK NO. FPC-203

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

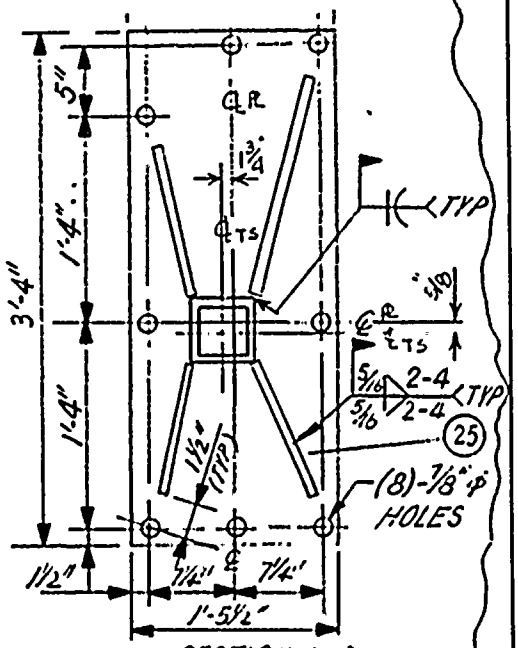
W.O.3808 | DWG. FPC-203 SH.30A4 | REV 3

SUPERIOR REPROGRAPHICS TB 397

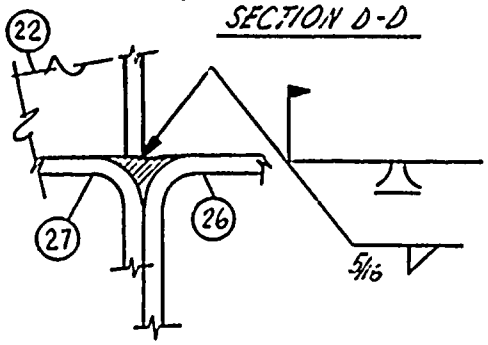
ITEM NO.	QUAN	SIZE-DESCRIPTION	ASTM	WT.
25	4	PL 3/4" x 2 3/8" x 1'-3" (CUT TO SUIT)	A36	51
26	1	TS 5 x 5 x .375 x 0'-7" LG.	A500GrB	13
27	1	TS 5 x 5 x .375 x 1'-7 3/4" LG.	A500GrB	37
28	4	PL 3/4" x 7" x 1'-1"	A36	71
29	1	PL 3/4" x 6" x 0'-6"	A36	7
30	1	TS 5 x 5 x .375 x 1'-2" LG.	A500GrB	26
		TOTAL WT.		1158 #



SECTION B-B



SECTION D-D



SECTION C-C
(WELD DETAIL)

INFORMATION ONLY

02-215-08	11717	3	
CVI Number	CVI Sheet	Rev.	Dwg. Sheet

REV NO	REVISION	DATE	DWN	CHKD	APVD
3	RELEASE FOR P.S.I. INSPECTION, INCORP. P.O. H-B260, H-B680, H-E589 & H-M095	4/14/83	TH	RB	

DWN TRAVIS CHKD F. BOURNICLE SCALE NTS

SL/LDE DATE

ENGINEERING REVIEW

MECH CIVIL

ELEC

REVD APVD DATE

MANAGER-DESIGN AND DRAFTING CHIEF MECH. ENGINEER

FRAME 2 OF 2

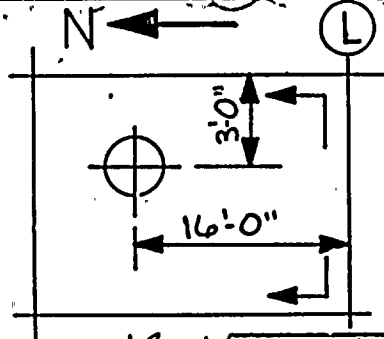
WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO. 2

MARK NO. FPC-203

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

W.O. 3808 | DWG. FPC-203 SH. 4 OF 4 | REV 3

ITEM NO.	QUAN.	SIZE — DESCRIPTION	ASTM	WT.	
1	1	PL 1" x 39½" x 3'-1¾" (SEE DETAIL 1)	A36	422	
2		DELETED			
3	2	TS 5 x 5 x .375 x 3'-5 3/8"	A500GRB	151	
4	2	TS 5 x 5 x .375 x 1'-10½"	A500GRB	82	
5	2	TS 5 x 5 x .375 x 3'-0"	A500GRB	66	
6	2	TS 5 x 5 x .375 x 2'-4¾"	A500GRB	105	
7	2	14"Φ x 0'-6¼" LG STD PIPE TRUNNION (COPE TO SUIT)	A106GRB	57	
8	2	PL ½" x 16" x 1'-4"	A36	72	
9	2	PL 3/8" x 21½" x 2'-4" (BEND TO RADIUS of 16"Φ PIPE)	A36	125	
10	12	3/4"Φ x 2 3/8" LG HVY HEX MACH BOLT W/LW	A307GRB	6	
11		DELETED			
12	2	STIFF PL ½" x 3" x 2'-7" (SEE DETAIL-12)	A36	26	
13	2	STIFF PL ½" x 3" x 1'-2"	A36	10	
14	8	WASHER PL 1/4" x 2½" x 0'-2½"	A36	4	
15	8	3/4"Φ x 2 5/8" LG HVY HEX MACH BOLT W/LW	A307GRB	4	
16	2	PL 1" X 4" X 2'-9½" (SEE DETAIL-1) (CUT TO SUIT)	A36	76	
17	9	PL 1" X 4" X 0'-4 5/8" (SEE DETAIL-1)	A36	3	
18	4	PL ¾" X 3" X 1'-2½" (SEE SECTION A-A)	A36	8	
19	4	PL ¾" X 3" X 1'-4" (SEE SECTION A-A)	A36	3	
20		DELETED			
21	1	PL 1" X 4" X 0'-7" (SEE DETAIL-1)	A36	8	
22	1	PL 1" X 4" X 0'-5" (SEE DETAIL-1)	A36	6	
23	2	PL 1" X 16" X 2'-0" (SEE SECTION A-A)	A36		
24	18	5/8" Ø X 2" LG. HVY. HEX MACH. BOLT W/LW			
25	2	1" Ø HSKB W/LW			



LOCATION PLAN

3.4

LOC. PLAN FOR REF. ONLY! SEE ISO FOR HANGER LOC. ALONG PIPE.

02-215 -08	9795	6	
CVI NO	CVI SHT	REV	DWG SHT

B;R 150. M200-13 DATA PT. 76 ANCHOR (X, Y, Z)

Fx=9 Fy=9090 Fz=96

MOMENT lb-ft	MX	MY	MZ
THERM	-5652 / +3330	-91 / 54	6186 / 3645
DEADWT	-944	-281	1240
SEISMIC	±28175	±2976	±29956

ZONE: R-32 | OP. LD. | HYDRO. LD.: ——

THERMAL LD.: VERT: 547# / -352# N-S: 845# / 497# E-W: 390# / -221#

SEISMIC LD.: VERT: ±2881#, N-S: ±2969# E-W: ±3273#

CODE/CLASS: III/2 | GROUP: 1 | Q.A. LEVEL: I

PAINT: I | PIPE CALC.: 8.14.69 RID | STL. CALC.: 8.16.450

PIPING SYSTEM: LOW PRESSURE CORE SPRAY | REF. DWG. ISO.: LPCS-756-11.15 | PIPING: M701 THRU M705

REV NO	DATE	REMARKS	D	DS	ENG.
6	5/3/85	CONSTR. COMPLETE PER PRR REV. 7 (5FI) & PED 215-H-E158, E129 & K872.	RA (B)	EBH	JAP

DWN RAKoch | CHKD | SCALE NTS

SL/LDE | DATE 8-5-85

ENGINEERING REVIEW

MECH | CIVIL

ELEC

REVD [signature] 9/11/85 CHIEF DRAFTSMAN

APVD [signature] DATE 8/31/85 CHIEF MECH. ENGINEER

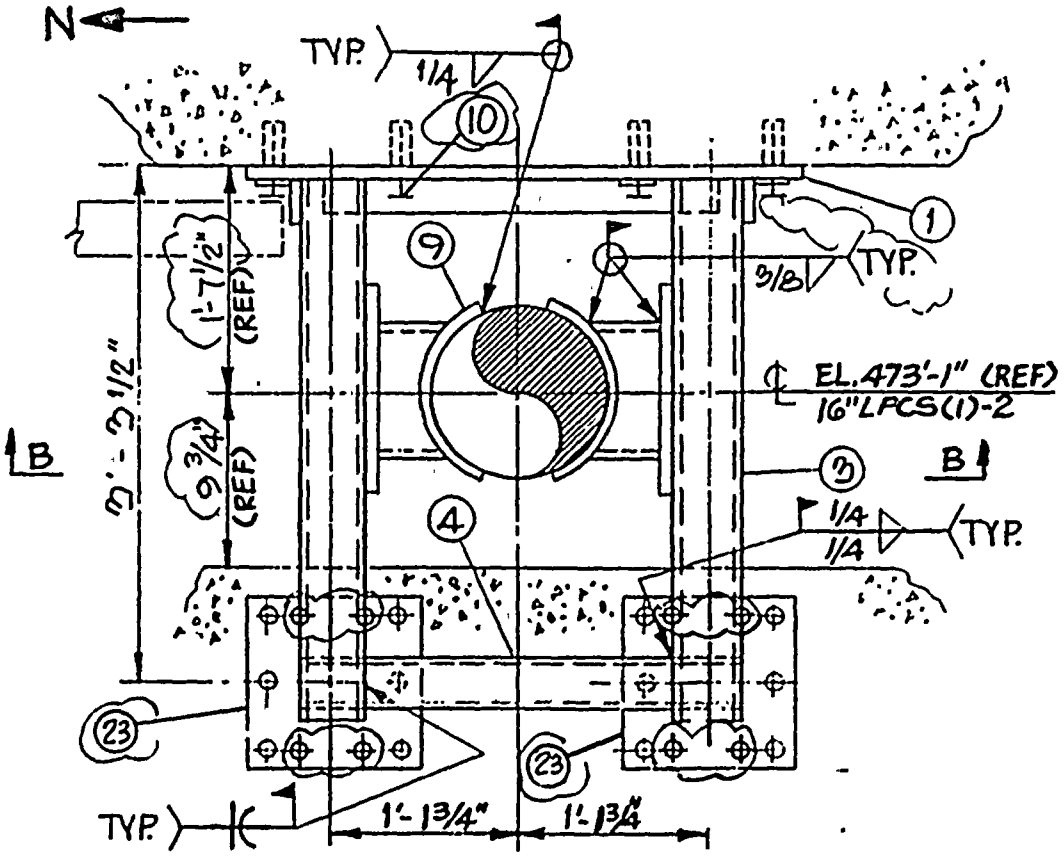
WASHINGTON PUBLIC POWER SUPPLY SYSTEM

HANFORD NO. 2 008.0-T1

MARK NO. LPCS-19

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

W.O. 3808 | DWG. LPCS-19 SH 1 of 5 | REV 6



PLAN @ EL. 473'-1"

INFORMATION ONLY

REV NO	REVISION	DATE	DWN	CHKD	APVD
5	DOCUMENT UPDATE	12/19/82	[illegible]	[illegible]	[illegible]

DWN RAKoch CHKD [illegible] SCALE NTS
SL/LDE [illegible] DATE 8-5-82

ENGINEERING REVIEW

MECH	CIVIL
ELEC	

REVD [illegible] 9/15/82 CHIEF DRAFTSMAN
APVD [illegible] DATE [illegible] CHIEF MECH. ENGINEER

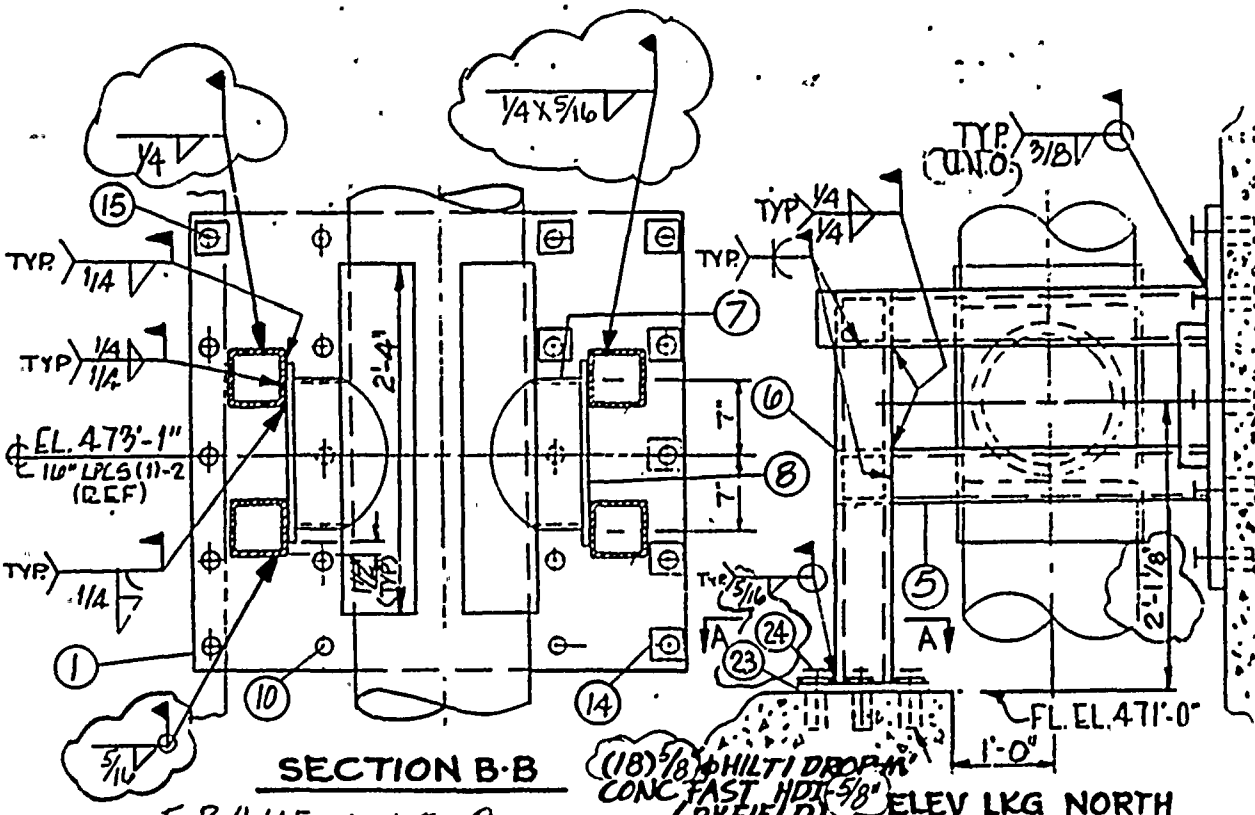
WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO. 2

MARK NO. LPCS-19

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

W.O. 38C8 | DWG. LPCS-19 SH 2 of 5 | REV 6

INFORMATION ONLY



SECTION B-B

ELEV LKG NORTH

FRAME 1 OF 2

REV NO	REVISION	DATE	DWN	CHKD	APVD
5	DOCUMENT UPDATE	12-10-82	[illegible]	[illegible]	[illegible]

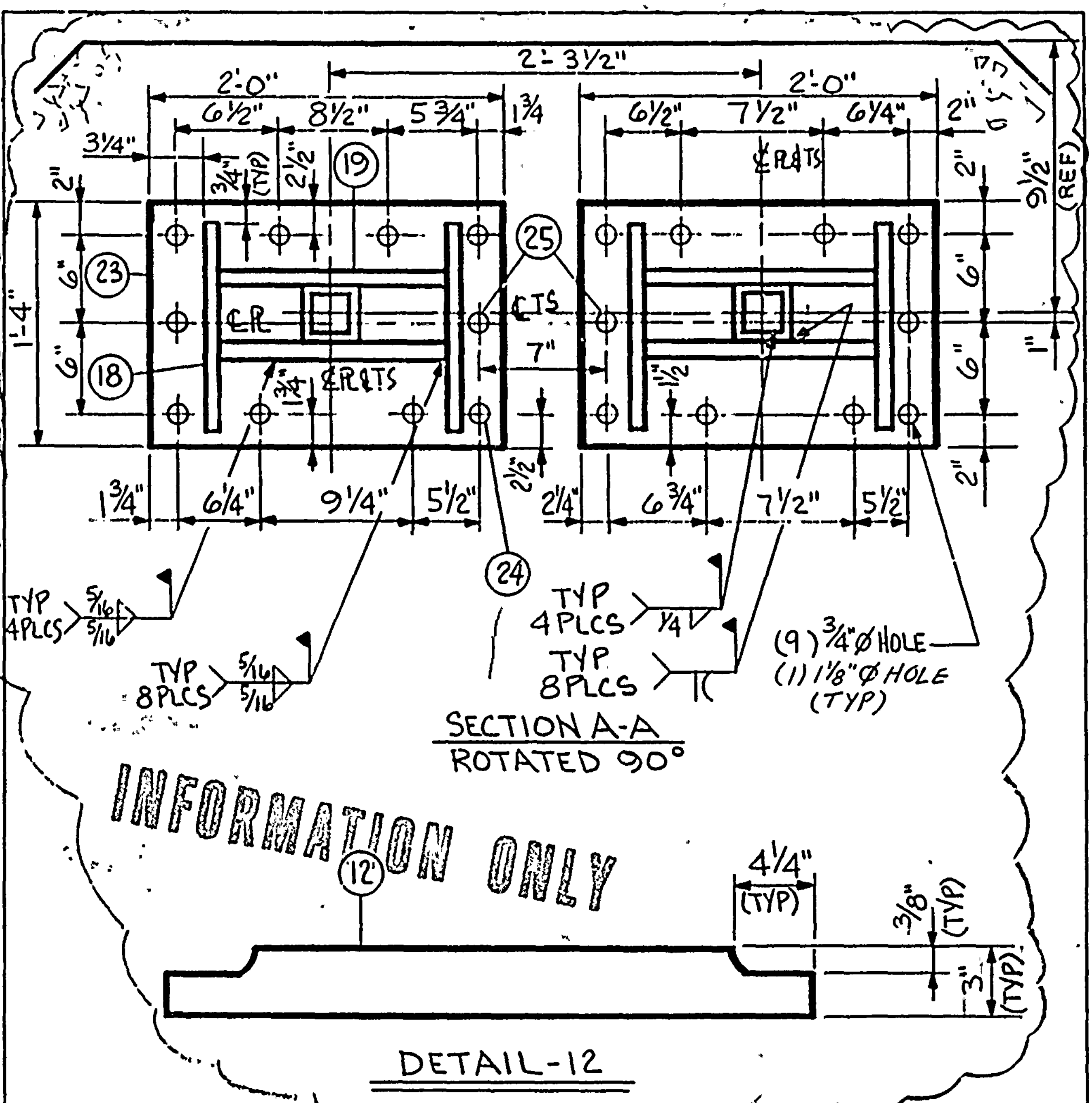
DWN RAKoch	CHKD [illegible]	SCALE NTS	
SL/LDE [illegible]	DATE 8-5-82		
ENGINEERING REVIEW			
MECH	CIVIL		
ELEC			
REVD [illegible] 9/1/82 CHIEF DRAFTSMAN	APVD [illegible] DATE 9/1/82 CHIEF MECH. ENGINEER		

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO.2

MARK NO. LPCS-19

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

W.O.3808	DWG. LPCS-19 SH 3 of 5	REV 6



5	~~DOCUMENT UPDATE~~	12-10-82		S.F.	
REV NO	REVISION	DATE	DWN / CHKD	APVD	

DWN	CHKD F. BONANDER
SCALE	NTS
SL/LDE	DATE 8-5-82

ENGINEERING REVIEW

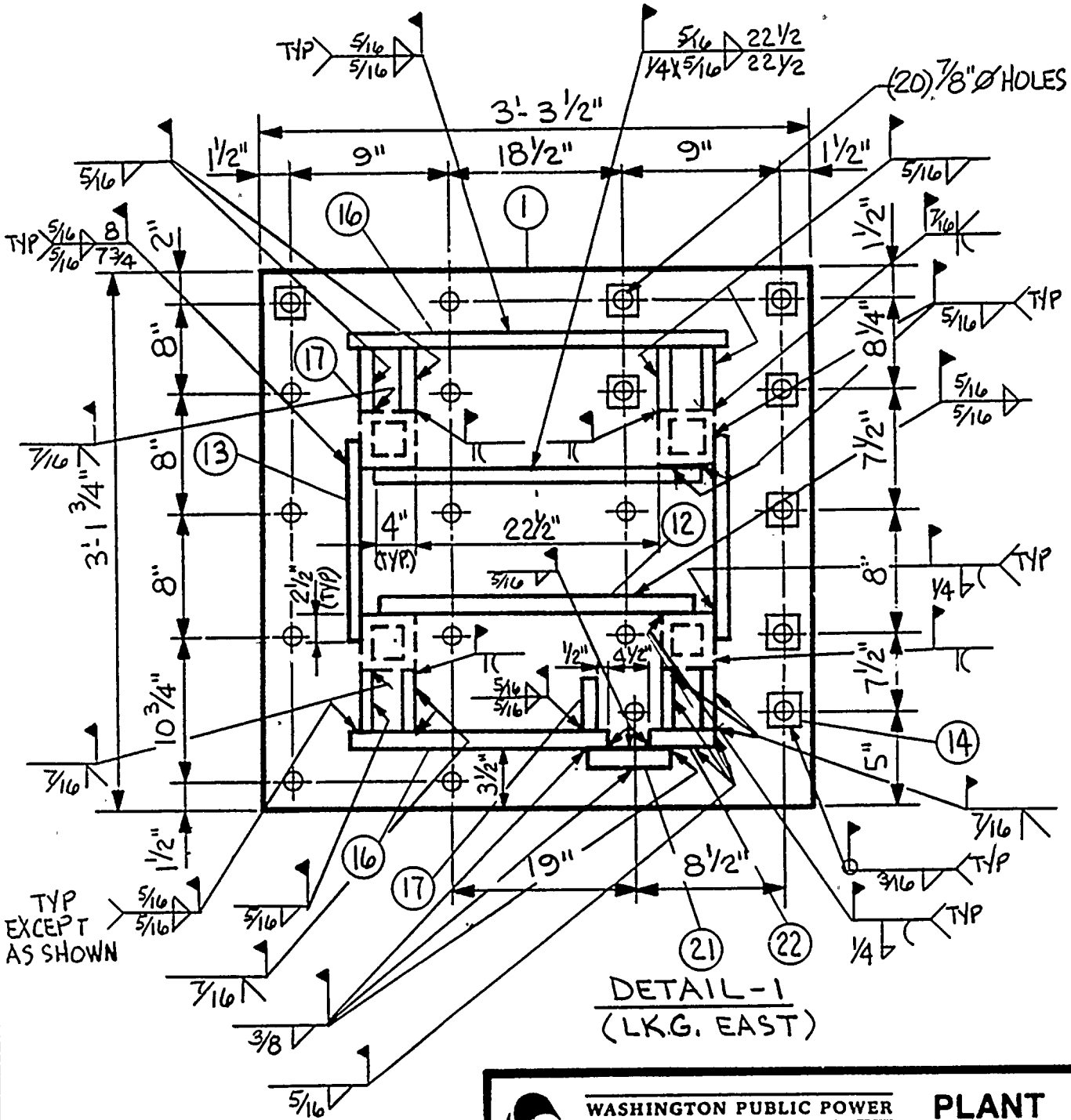
MECH	CIVIL
ELEC	
REVD H. R. T. 8-5-82 CHIEF DRAFTSMAN	APVD DATE CHIEF MECH. ENGINEER

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO.2

MARK NO. LPCS-19

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

W.O.3808 | DWG. LPCS-19 | SHT 4 of 5 | REV 6



DETAIL-1
(LK.G. EAST)

INFORMATION ONLY

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

PLANT 2

MARK NO. LPCS-19

DWG. LPCS-19 SH. 5 OF 5 REV. 6

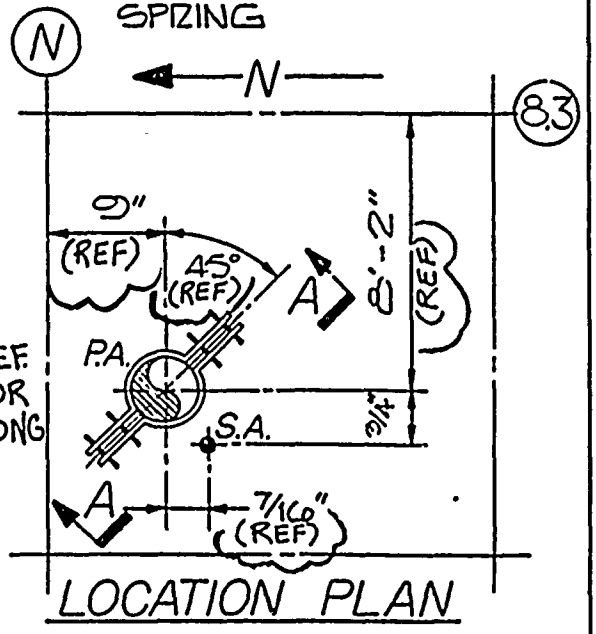
SR 796

ITEM NO.	QUAN.	SIZE — DESCRIPTION	ASTM	WT.	
1	1	1" FIG. 140A BEAM BRACKET		8.3	
2	1	#L011 TYPE "D" VAR. SPRING H.I.=3333 C.L.=3347# W/T.S.		70	
3	1	1" ϕ x 60" LG HANGER ROD FIG. 165 W/2 HVY HEX NUTS		1.60	
4	2	PL 1/4" x 4" x 6"	A36	3.4	
5	2	PL 5/8" x 4" x 4." (SEE DETAIL 5)	A36	5.66	
6	2	C4 x 7.25 x 2'-10 1/2" LG	A36	41.7	
7	4	LUG 3/4" x 1" x 4"	A36	1.7	
8	2	1" FIG. 155 WELDLESS EYE NUT		4.5	
9	1	14" SPECIAL RISER CLAMP C-C=2'-6" STOCK SIZE: 3/4"X4" RW/5/8" X 3 1/2" W/HVY HEX NUTS SPACER SIZE 1" O.D (SEE DET. 9).		85	
10	2	1" ϕ X 12'-4" LG HANGER ROD FIG. 165 W/2 HVY HEX NUTS		65	
11	1	PL 5/8" x 3 1/2" x 6" (SEE DETAIL 11)	A36	3.72	
			TOTAL	291	

SUPERIOR REPROGRAPHICS TB 592

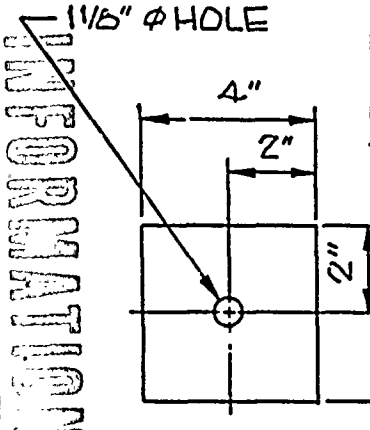
THERMAL MVTS
Dx = .029" S
Dy = .024 " UP
Dz = .037" W

D & Z ISO # M-200-107
DATA PT. #1320
SPRING

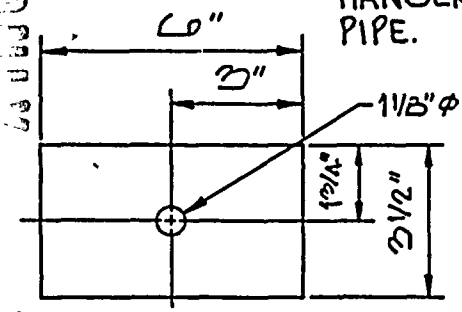


LOCATION PLAN

LOC. PLAN FOR REF. ONLY! SEE ISO FOR HANGER LOC ALONG PIPE.



DETAIL (5)



DETAIL (11)

CVI Number	CVI Sheet	Rev.
02-215-08	9413	6

REV NO	DATE	REMARKS	D/CHD	DS	ENG.
6	3/22/85	CONSTR. COMPLETE PER PRR REV. 0 (GFO) & PED 215-H-M117.	PAA/B	EJS	JAR

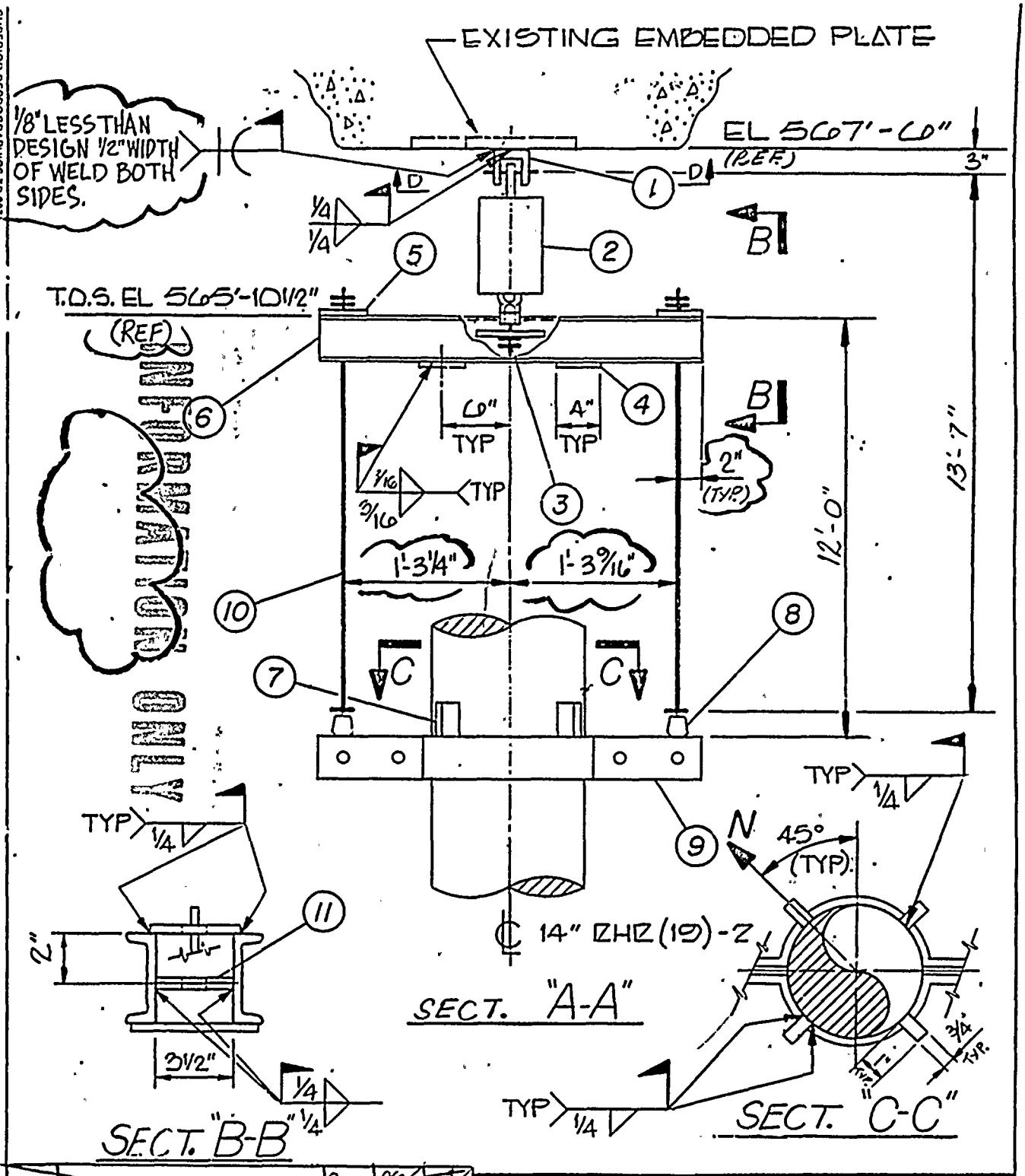
ZONE: IZ-03	OP. LD.: 3042#	HYDRO. LD.: 3042#	
THERMAL LD.: VERT: ~	N-S: ~	E-W: ~	
SEISMIC LD.: VERT: ~	N-S: ~	E-W: ~	
CODE/CLASS: III/2	GROUP: 1	Q.A. LEVEL: I	
PAINT: I	PIPE CALC.: 8.14.1278	E-L. CALC.: 8.16.477	
PIPING RESIDUAL SYSTEM HEAT REMOVAL	REF. DWG. ISO.: IZHZ-978-1.4 . PIPING: M706		

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO. 2 0098-P5

MARK NO. IZHZ-53

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

DWN SULLIVAN	CHKD J. RODGERS	SCALE N.T.S.	
SL/DE PORTER	DATE 11-14-79		
ENGINEERING REVIEW			
MECH —	CIVIL M. HAQ		
ELEC .			
REVD H.R. Traquair / [illegible] CHIEF DRAFTSMAN	APVD [signature] DATE 11/16/79 CHIEF MECH. ENGINEER	W.O. 3808	DWG. IZHZ-53 SH. 1 OF 3 REV 6



REV NO	REVISION	DATE	DWN	CHKD	APVD
5	DOCUMENT UP-DATE	8/15/62	RG	RG	MAH

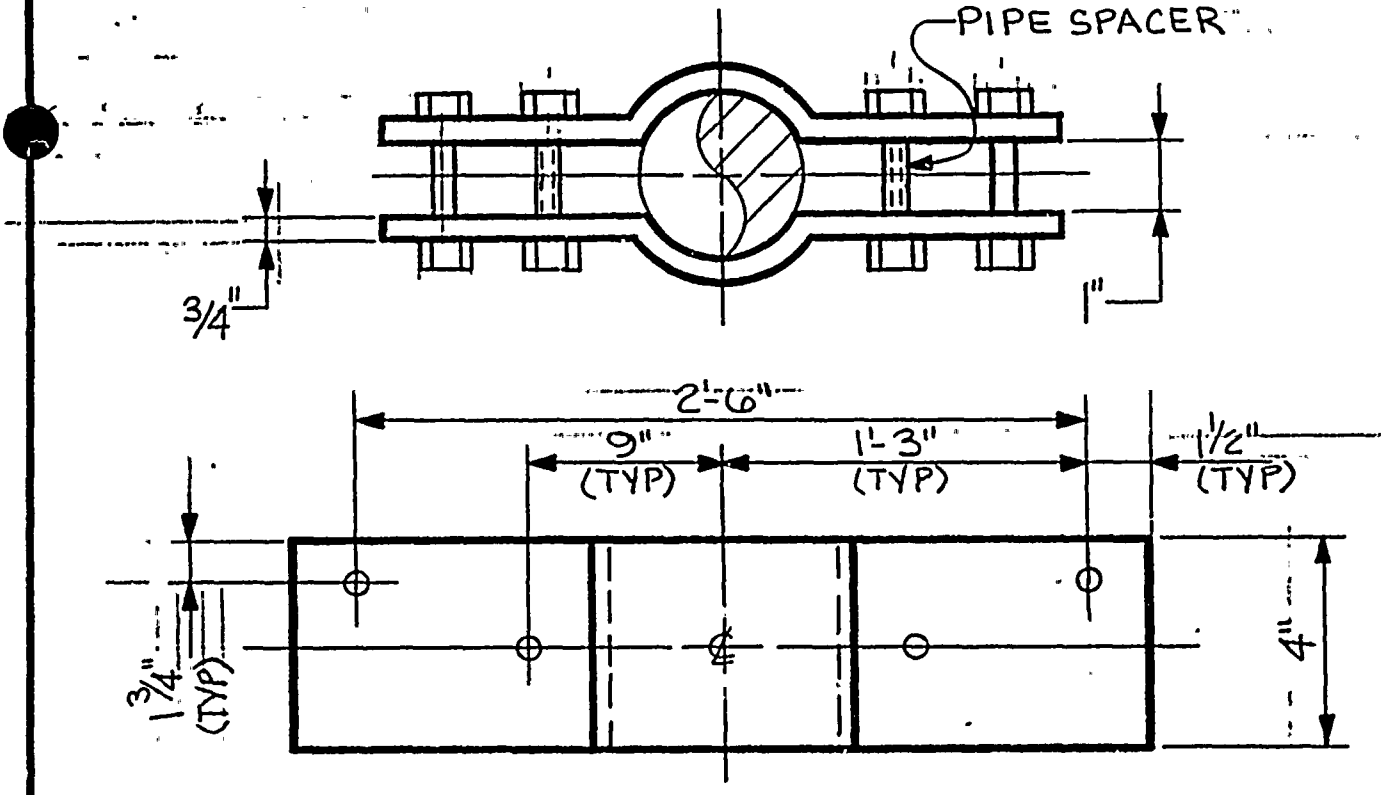
DWN SULLIVAN	CHKD L. A. RODGERS	SCALE N.T.S.	
SL/DE PORTER	DATE 11-14-79		
ENGINEERING REVIEW			
MECH	CIVIL M. HAQ		
ELEC			
REVD H.R. Thomas 11/14/79 CHIEF DRAFTSMAN	APVD W. Graziano 11-14-79 CHIEF MECH. ENGINEER		

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO. 2

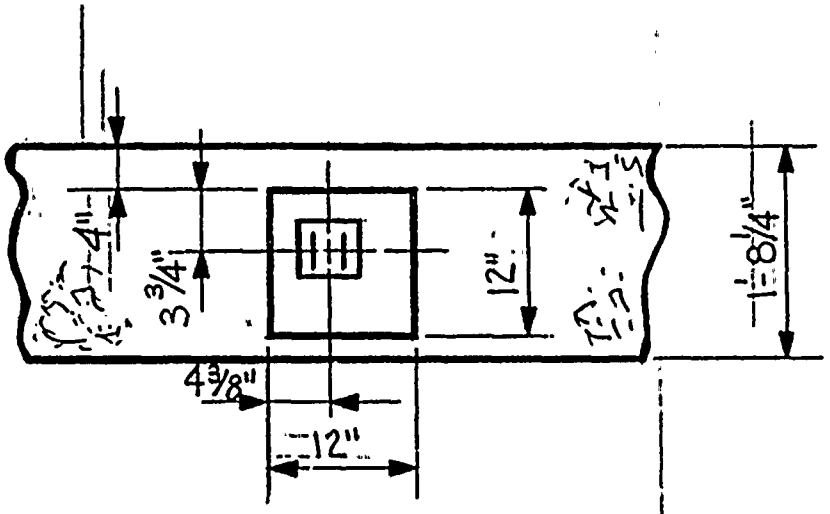
MARK NO. ZHZ-53

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

W.O. 3808	DWG. ZHZ-53 SH. 2 OF 3	REV 6



DETAIL-9



SECTION D-D

INFORMATION ONLY

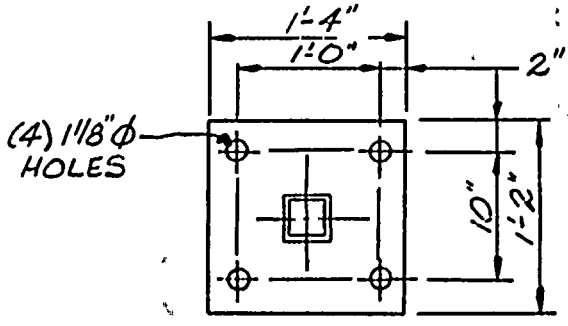
WASHINGTON PUBLIC POWER SUPPLY SYSTEM HANFORD NO 2	
MARK NO. RHR-53	
DWG. RHR-53 SH. 3 OF 3	REV. 6

ITEM NO.	QUAN.	SIZE — DESCRIPTION	ASTM	WT.	
		ITEMS 1 THRU 13, 15 THRU 21 HAVE BEEN DELETED			
14	1	PL 1"x 22"x 1'-10"	A36	137	
23	1	TS 10x10x.500x 2'-0"LG (CUT TO SUIT)	A500GRB	71	
24	1	PL 1/2"x 11"x 1'-0"	A36	19	
25	1	TS 6x6x.375x 4'-2"LG (CUT TO SUIT)	A500GRB	113	
26	1	TS 10x10x.500x 3'-5"LG	A500GRB	208	
27	1	TS 8x8x.500x 4'-4" LG (CUT TO SUIT)	A500GRB	205	
28	1	PL 3/4"x.9 1/2"x 1'-6"	A36	36	
29	1	TS 8x8x.500x 3'-6" (CUT TO SUIT)	A500GRB	166	
30	1	PL 1"x 28"x 3'-4"	A36	317	
31	1	TS 10x10x.500x 2'-4"LG (CUT TO SUIT)	A500GRB	142	
32	1	PL 1"x 14 1/4"x 1'-9 1/8"	A36	85	
33	1	PL 1"x 22 1/2"x 2'-0 5/8"	A36	157	
34	1	PL 1"x 14"x 1'-4"	A36	56	
35	2	PL 3/4"x 4"x 2'-10 1/2"	A36	59	
36	1	PL 3/4"x 4"x 2'-2 1/2"	A36	23	
37	4	PL 3/4"x 4"x 0'-3 1/2"	A36	107	
38	2	PL 3/4" x 4"x 1'-7 1/8"	A36	33	
39	1	PL 3/4"x 4"x 1'-9"	A36	13	

AND ADDED

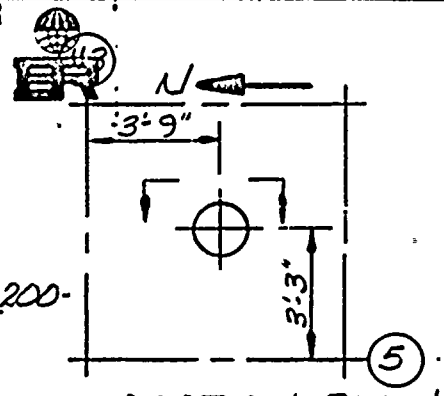
SUPERIOR REPROGRAPHICS TB 398

CUT # 215-08, 7871



DETAIL 34

LOCATION PLAN FOR REFERENCE ONLY! USE FAB. ISO. FOR CONSTRUCTION



B & R ISO M200-109 DATA PT. 48 ANCHOR

LOCATION PLAN

	MOMENTS (LBS-FT)		
	MX	MY	MZ
THERMAL	-3743	-23860	-3683
DEAD WT.	-1105	+1206	-37
SEISMIC	±16329	±7105	±9105

ZONE: R-32 | OP. LD.: FX=-1# FY=-56.91# FZ=+101# | HYDRO. LD.:

THERMAL LD.: VERT=+1984# N-S=+339# E-W=+173#

SEISMIC LD.: VERT=±2434# N-S=±1167# E-W=±1845#

CODE/CLASS: III/2 | GROUP: 1 | Q.A. LEVEL: I

PAINT: I | PIPE CALC.: 8.30.182 | STL. CALC.: 8.16.555

PIPING SYSTEM: RESIDUAL HEAT REMOVAL | REF. DWG. ISO.: RHR-897-10.14 | PIPING: M-703

REV NO	REVISION	DATE	DWN	CHKD	APVD
7	DOCUMENT UP: DATE	8/19/82	RAK		S.F.

DWN RAK CHKD | SCALE NTS

SL/LDE | DATE 7-20-82

ENGINEERING REVIEW

MECH | CIVIL | ELEC

REVD CHIEF DRAFTSMAN | APVD CHIEF MECH. ENGINEER | DATE

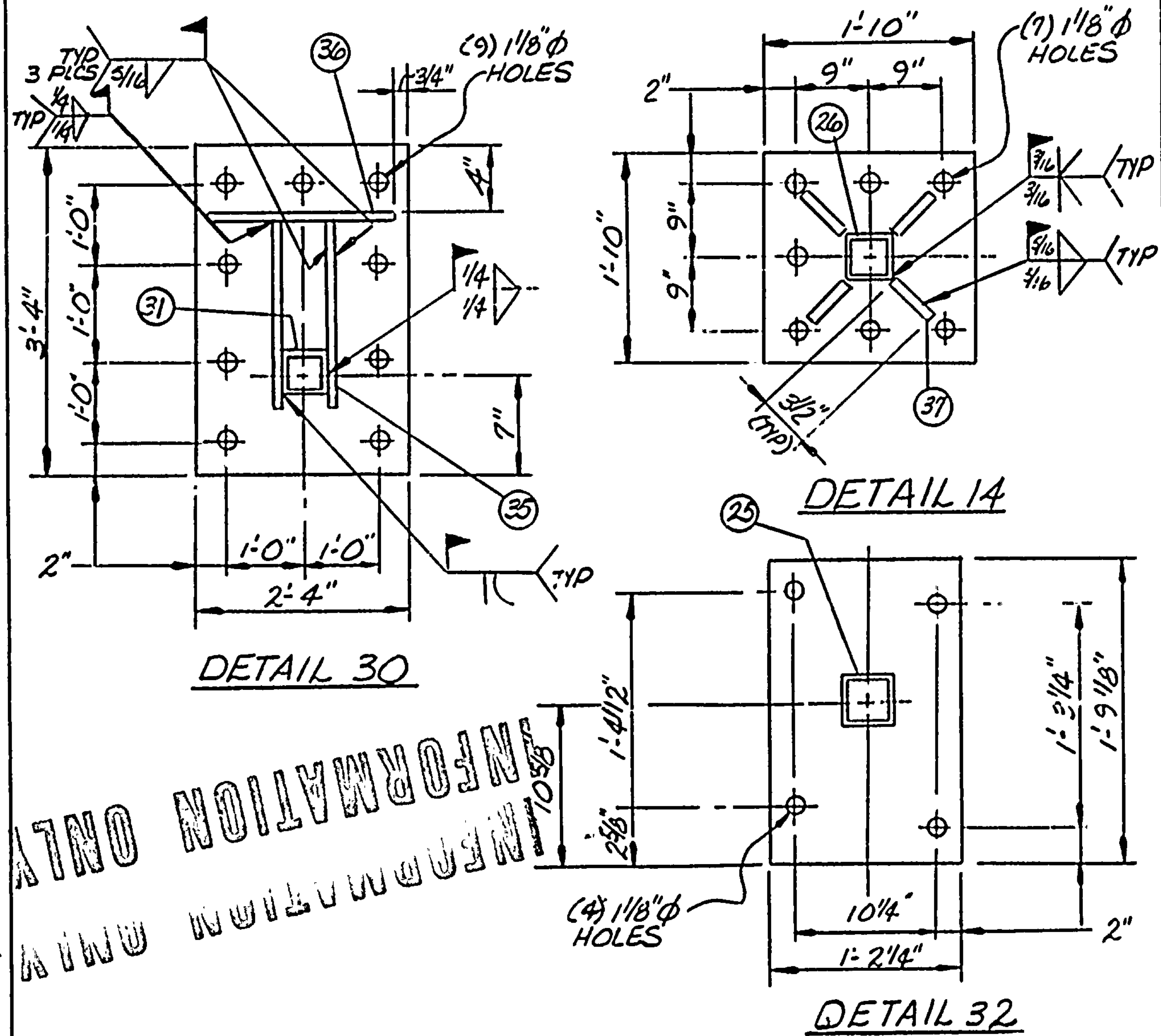
WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO. 2

MARK NO. RHR-99

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

W.O. 3808 | DWG. RHR-99 SH. 1 OF 4 | REV 7

ITEM NO	QUAN	SIZE-DESCRIPTION	ASTM	WT	
40	2	PL 3/4" x 14" x 1'-8" (PAD)(BEND TO RADIUS OF 14" PIPE)	A36	45	
41	31	1"Φ x 6 1/2" EMBED SUPER KWIK BOLT w/HVY HEX NUT & LW			
42.	2	PL 7/8 x 9" x 0'-9" (COPE TO SUIT)	A36	17	



REV NO	REVISION	DATE	DWN / CHKD	APVD
7	DOCUMENT UP-DATE	8 19 82	RAK / [illegible]	S.F.

DWN [illegible] CHKD [illegible] SCALE NTS
SL/LDE [illegible] DATE 7-20-82

ENGINEERING REVIEW
MECH
CIVIL [signature] 7/24/82
ELEC

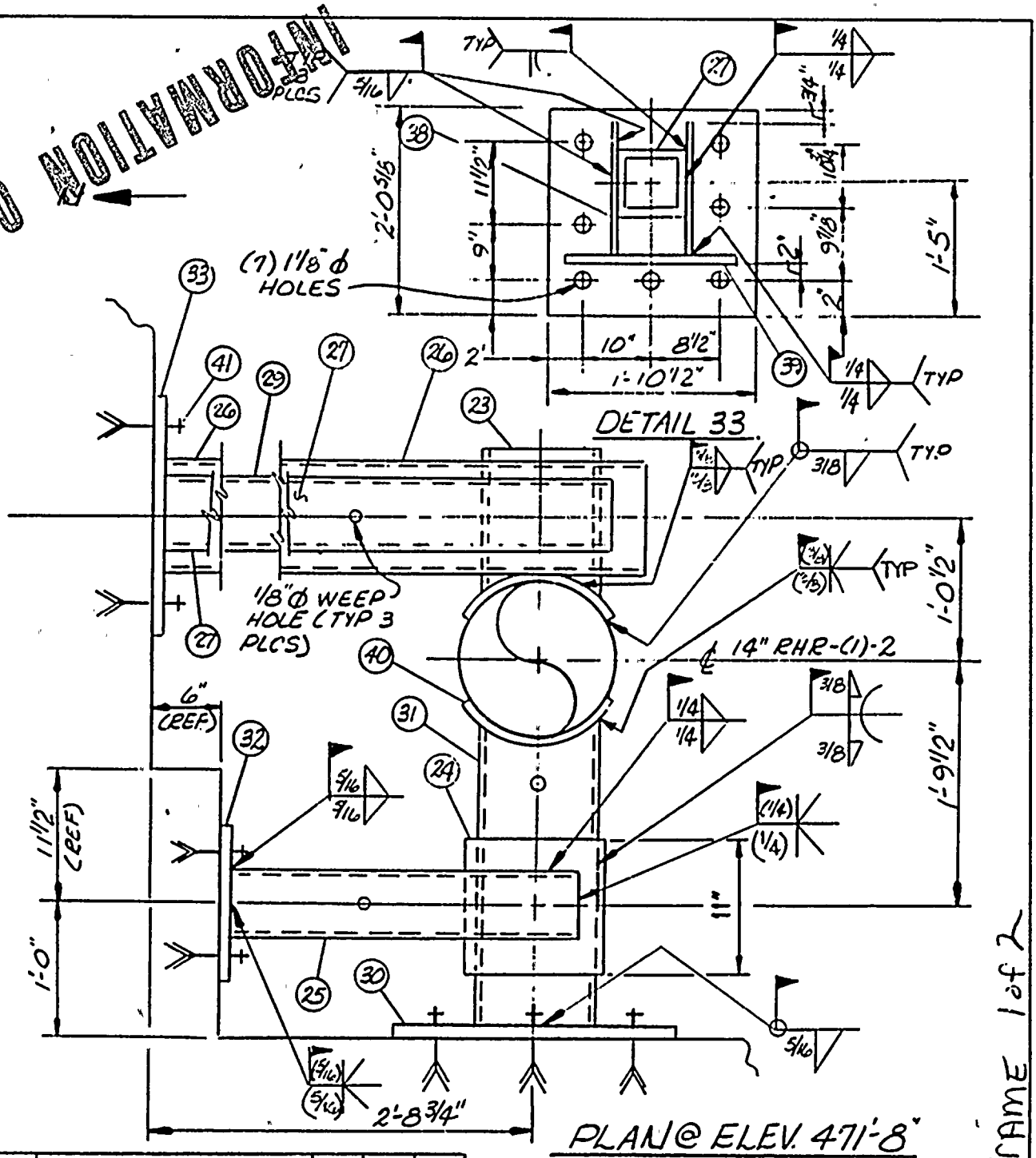
REVD [signature] 7/.../82 CHIEF DRAFTSMAN
APVD [signature] 8/5/82 CHIEF MECH. ENGINEER DATE

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO.2 9.6 1-06

MARK NO. RHR-99

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

W.O.3808 DWG. RHR-99 SH 2 OF 4 REV 7



FRAME 1 of 2

REV NO	REVISION	DATE	DWN	CHKD	APVD
7	DOCUMENT UP-DATE	8/19/82	RAK		S.F.

DWN LCBrock CHKD [illegible] SCALE NTS

SL/LDE (P) DATE 7/20/82

ENGINEERING REVIEW

MECH CIVIL [illegible]

ELEC

REVD [illegible] APVD [illegible] DATE 8/5/82

CHIEF DRAFTSMAN CHIEF MECH. ENGINEER

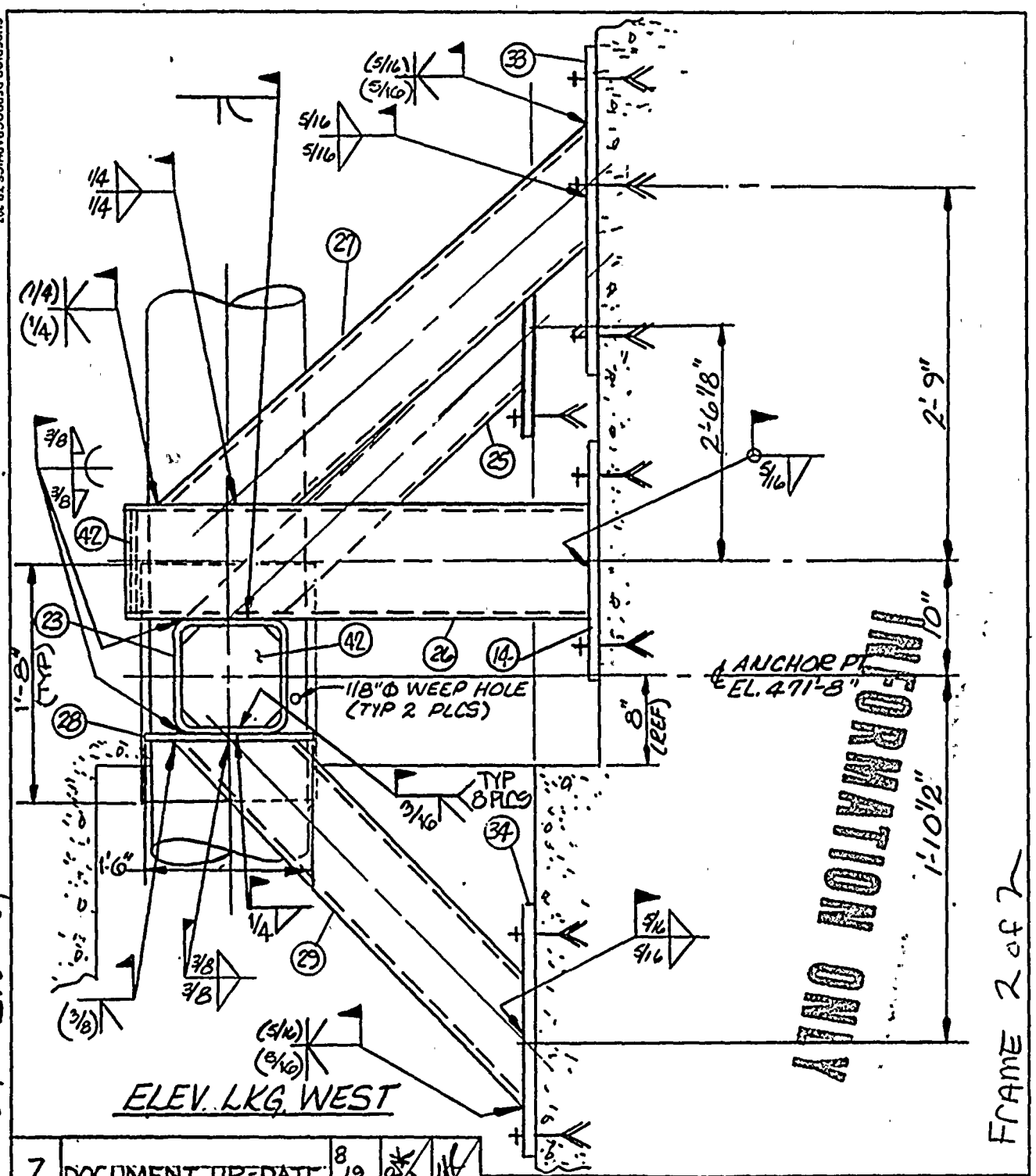
WASHINGTON PUBLIC POWER SUPPLY SYSTEM

HANFORD NO.2 9.Ø P06

MARK NO. RHR-99

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

W.O.3808	DWG. RHR-99 SH 3 OF 4	REV 7



CU # 215-08) 7807

FRAME 2 of 2

REV NO	REVISION	DATE	DWN	CHKD	APVD
7	DOCUMENT UP-DATE	8/19/82	RK		S.F

DWN R.K. Bach CHKD [illegible] SCALE NTS

SL/LDE [illegible] DATE 7-20-82

ENGINEERING REVIEW

MECH

ELEC

CIVIL [illegible] 8/19

REVD [illegible] CHIEF DRAFTSMAN

APVD [illegible] DATE 8/15/82 CHIEF MECH. ENGINEER

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

HANFORD NO.2 9.0 P06

MARK NO. RHR-99

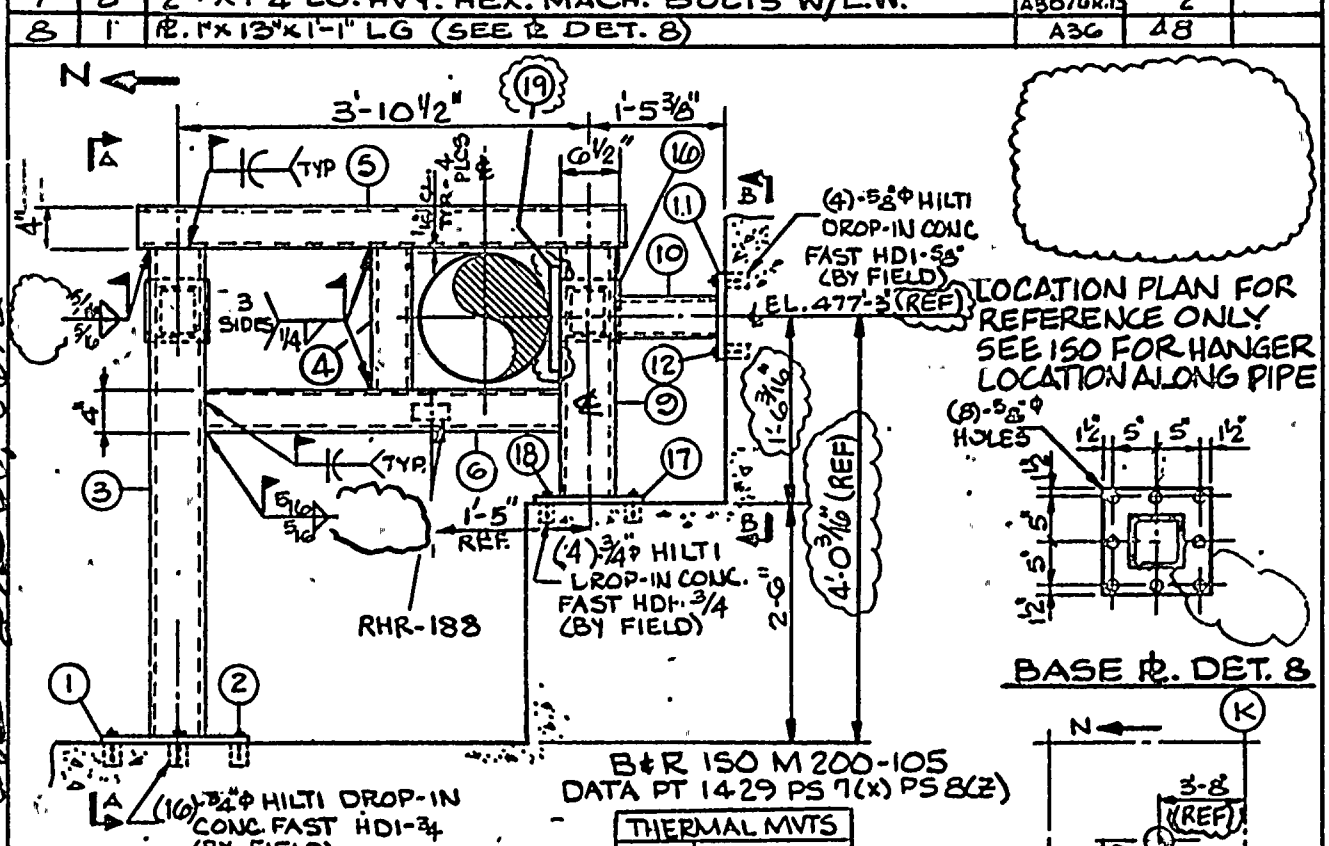
BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

W.O.3808 | DWG. RHR-99 SH 4 OF 4 | REV 7

215-08

7871

ITEM NO.	QUAN.	SIZE – DESCRIPTION	ASTM	WT.	
1	2	PL 1"x17"x1'-5" LG.	A36	164	
2	16	3/4"Φ x 2'4" LG. HVY. HEX. MACH. BOLTS. W/L.W.	A307 GR.B	8	
3	1	TS 6x6x.375 x 4'-8 1/4" LG	A500 GR.B	127	
4	1	TS 4x4x.375 x 1'-6 1/4" LG		26	
5	1	TS 6x4x.375 x 4'-5 7/8" LG		99	
6	1	TS 6x4x.375 x 3'-4 1/2" LG		75	
7	8	1/2"Φ x 1 3/4" LG. HVY. HEX. MACH. BOLTS W/L.W.	A307 GR.B	2	
8	1	PL 1"x13"x1'-1" LG (SEE 2 DET. 8)	A36	48	



THERMAL MVTS	
DX	.000"
DY	.386" DN
DZ	.000" E

ZONE: R-31	OP. LD.: FX=-78# FZ=-4#	HYDRO. LD.: —	
THERMAL LD.: VERT=	N-S=-1016#	E-W=-1582#	
SEISMIC LD.: VERT=	N-S=±1813#	E-W=±841#	
CODE/CLASS: III/2	GROUP: IB	Q.A. LEVEL: I	
PAINT: I	PIPE CALC.: 8.14.630	STL. CALC.: 8.15.471	
PIPING RESIDUAL SYSTEM HEAT REMOVAL	REF. DWG. ISO.: RHR-867-8.12 PIPING: M704		

REV NO	DATE	REVISION	DR	DS	ENG
4	3/15/79 QD	CONST. COMPLETE PER PRR REV 2. (4FO) LF 4 PEDS 215-H-P286 215-H-W019, 215-H-W409	B		

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO.: 089.0-P4

DWN D.H.	CHKD PAPADOPOULOS	SCALE NTS	
SL/LDE D.J. Wilmoth	DATE 11/12/79		
ENGINEERING REVIEW			
MECH R. Ballew	CIVIL J. O'Donnell		
ELEC	11/19/79		
REVD HR Tiagwe/EBE 4/5/79 CHIEF DRAFTSMAN	APVD DB Bradley/HR ENGINEER	DATE	

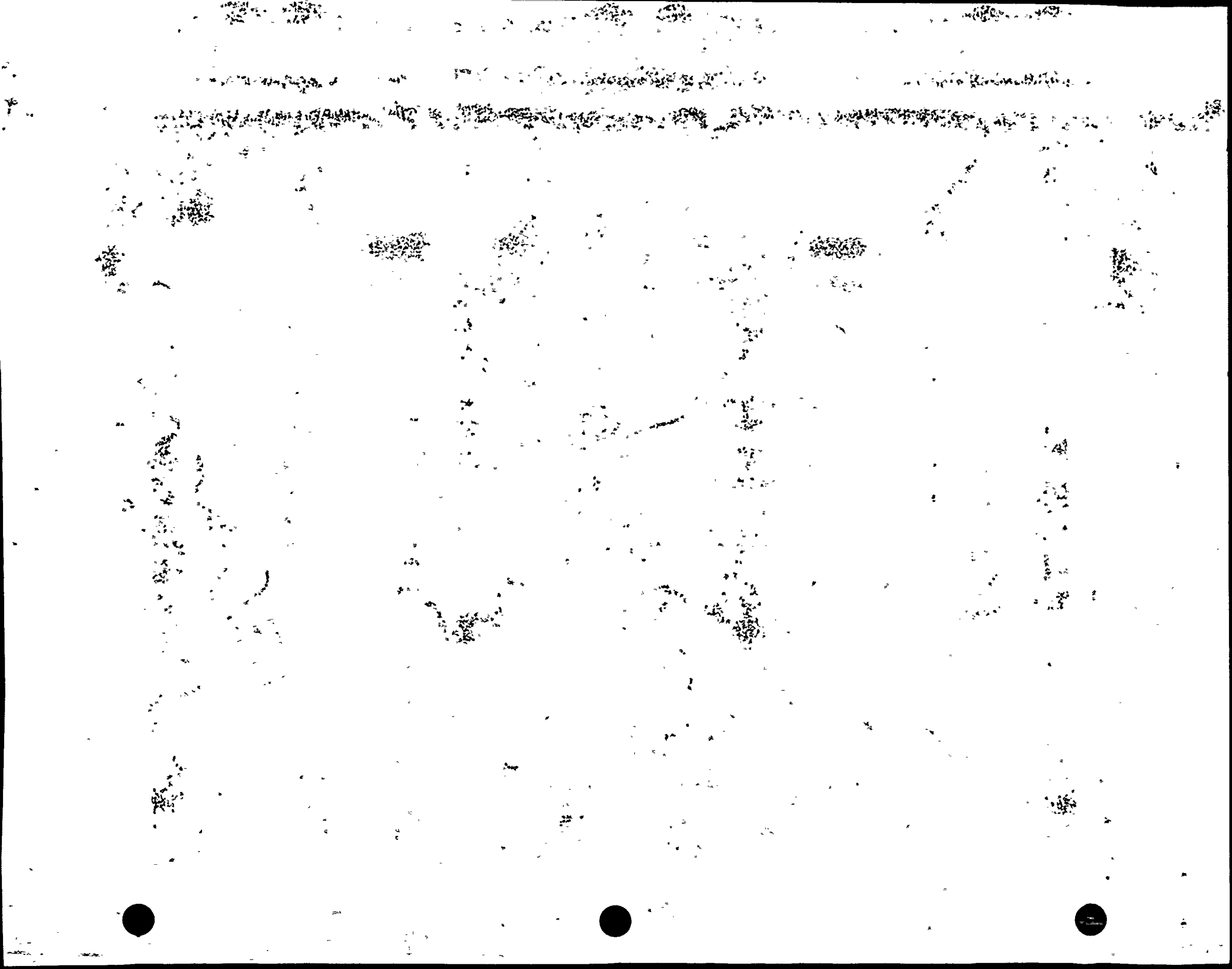
MARK NO. RHR-174

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

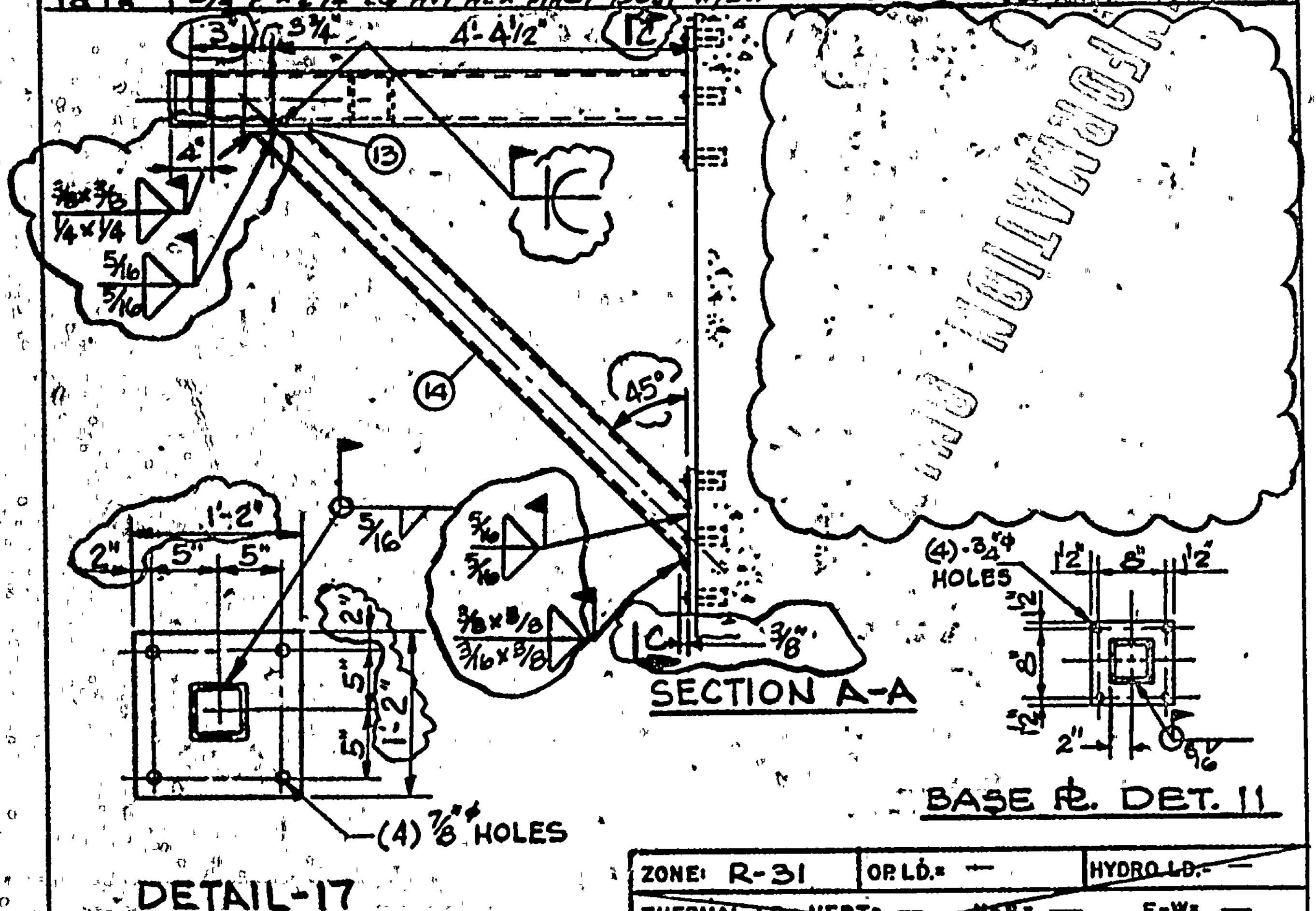
W.O. 3808 | DWG. H RHR-174 SHT. 1 OF 4 | REV 4

CWE-2208, 8612

INFORMATION ONLY



ITEM NO.	QUAN.	SIZE—DESCRIPTION	ASTM	WT.
9	1	TS 6×6×.375×2'-2" LG	A500GR.B	59
10	1	TS 6×4×.375×1'-1¼" LG	A500GR.B	24
11	1	PL 1×11"×0'-11" LG. (SEE PL. DET. 11)	A36	34
12	4	⅝"Φ×2" LG. HVY. HEX. MACH. BOLTS W/L.W.	A307GR.B	1
13	1	PL 1×7"×0'-7" LG.	A36	14
14	1	TS 4×4×.375×6'-2" LG (CUT TO SUIT)	A500GR.B	99
15	1	TS 4×4×.375×2'-9½" LG (CUT TO SUIT)	A500GR.B	40
16	1	PL 1"×6½"×0'-7"	A36	14
17	1	[illegible]	A36	26
18	[illegible]	¾"Φ×2¼" LG HVY HEX MACH BOLT W/LW	A307GRA	1



ZONE: R-31		OP. LD.: —		HYDRO LD.: —	
THERMAL LD.: VERT: —		N-S: —		E-W: —	
SEISMIC LD.: VERT:		N-S:		E-W:	
CODE/CLASS: III/2		GROUP: 1B		Q.A. LEVEL: I	
PAINT: I		PIPE CALC.: 8.14.63C		STL. CALC.: 8.15.471	
PIPING RESIDUAL SYSTEM HEAT REMOVAL		REF. DWG. ISO.: RHR-867-8.12 PIPING: M704			

REV NO	REVISION	DATE	DWN	CHKD	APVD
3	REVD. BY B&R, INCORP. PED-H-C219 & REVD. IN ACCORDANCE W/ NRC STATUS AS-BUILT	8/82	AC	RG	KR / MCO
2	REDESIGNED BY B&R.	9/21/78	D.H.	P.P.	KGJ
1	REV'D BY N.P.S	7/24/78	HCR	JG	

DWN D.H. CHKD PAPADOPOULOS SCALE NTS
SL/LDE [signature] DATE 1/12/79

ENGINEERING REVIEW
MECH [signature] CIVIL [signature] 1/15/79
ELEC

REVD [signature] 1/15/79 CHIEF DRAFTSMAN — APVD [signature] CHIEF MECH. ENGINEER

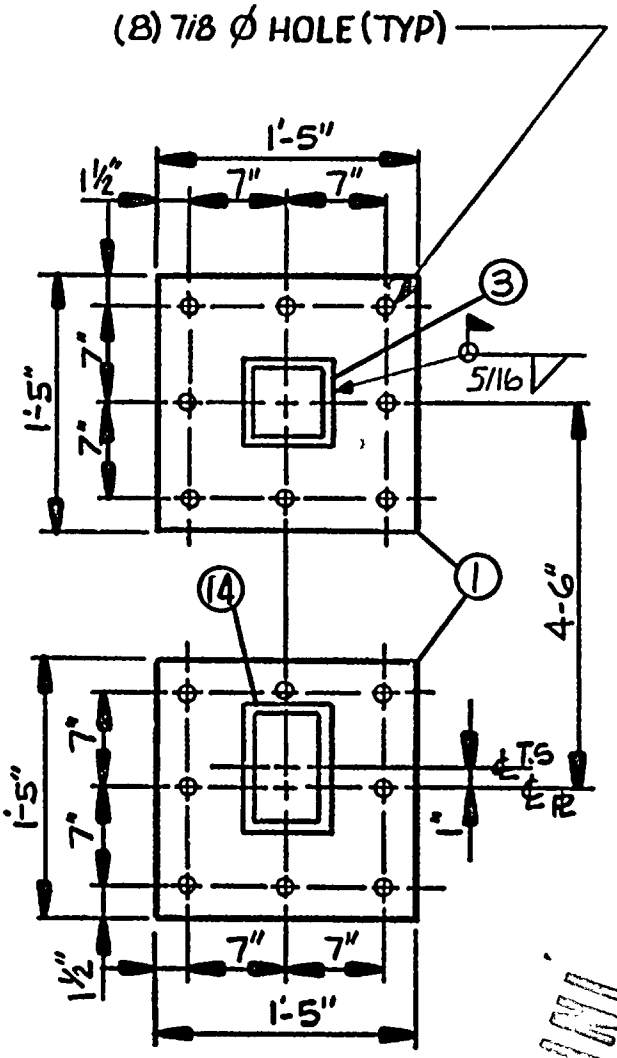
WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO.2

MARK NO. RHR-174

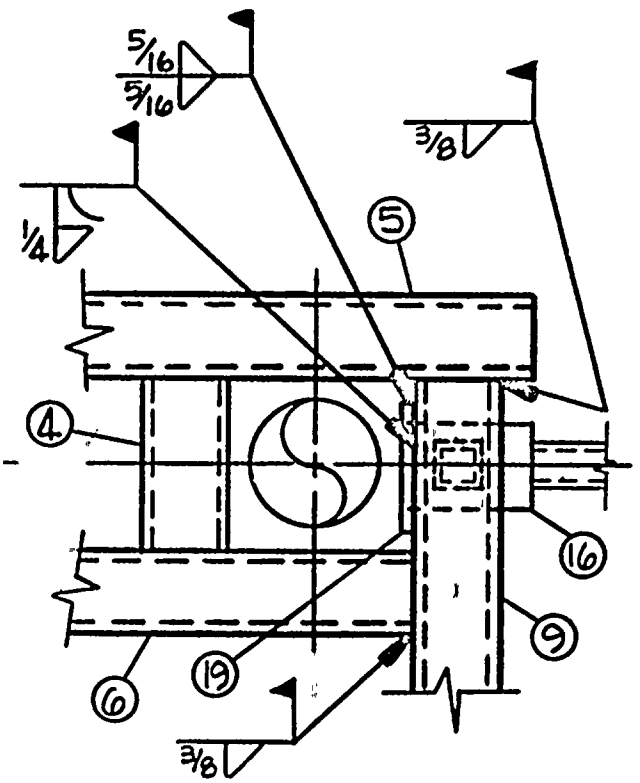
BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

W.O. 3808 | DWG. H RHR-174 | SHT. 2 OF 4 | REV 4

ITEM	QUAN	SIZE-DESCRIPTION	ASTM	WT.
19	1	PL 1/2 x 6" x 0'-10" LG		

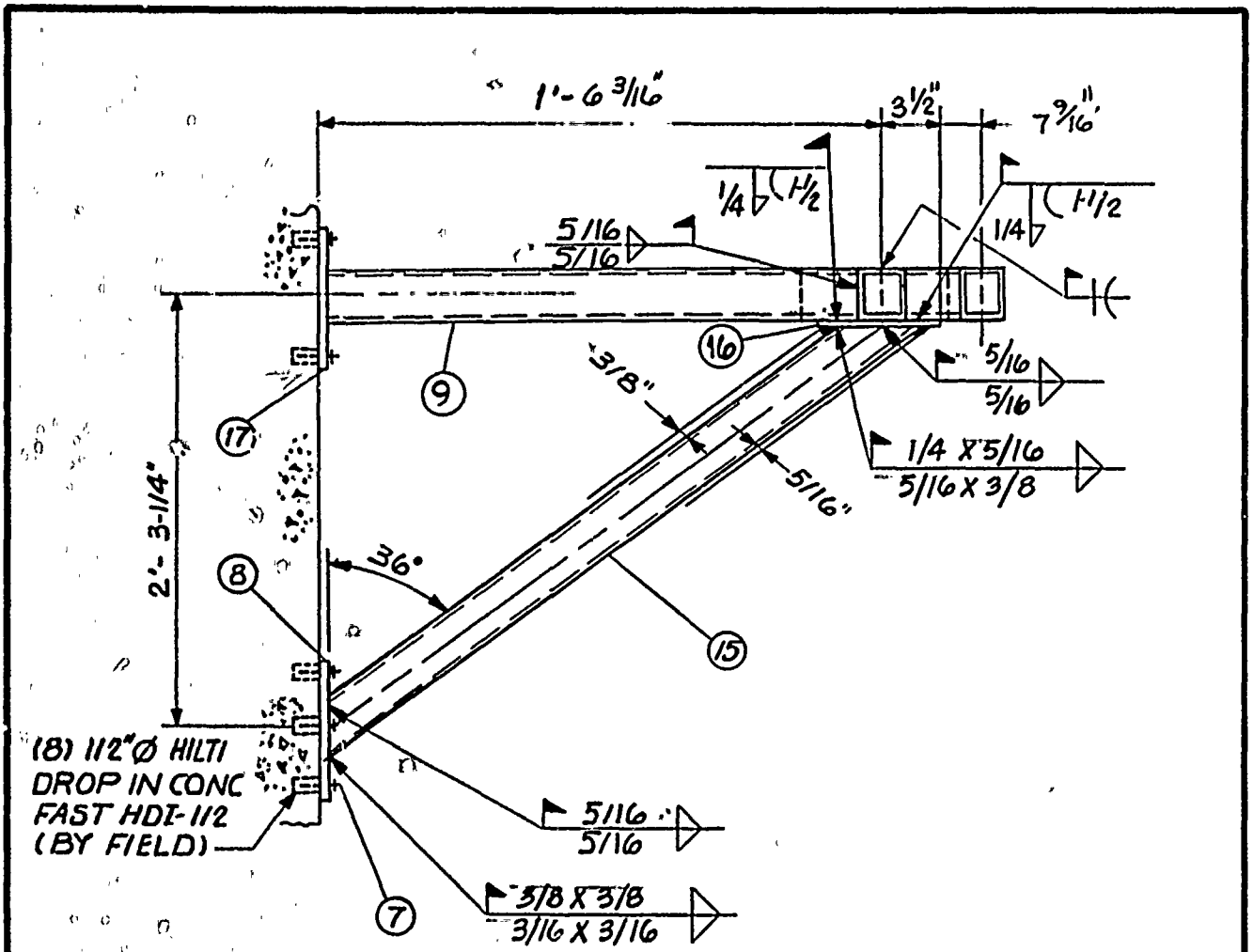


SECTION C-C



DETAIL-A

WASHINGTON PUBLIC POWER SUPPLY SYSTEM	PLANT 2
MARK NO. RHR-174	
DWG. RHR-174 SH. 3 OF 4	REV. 4



SECTION B-B

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

WNP 2

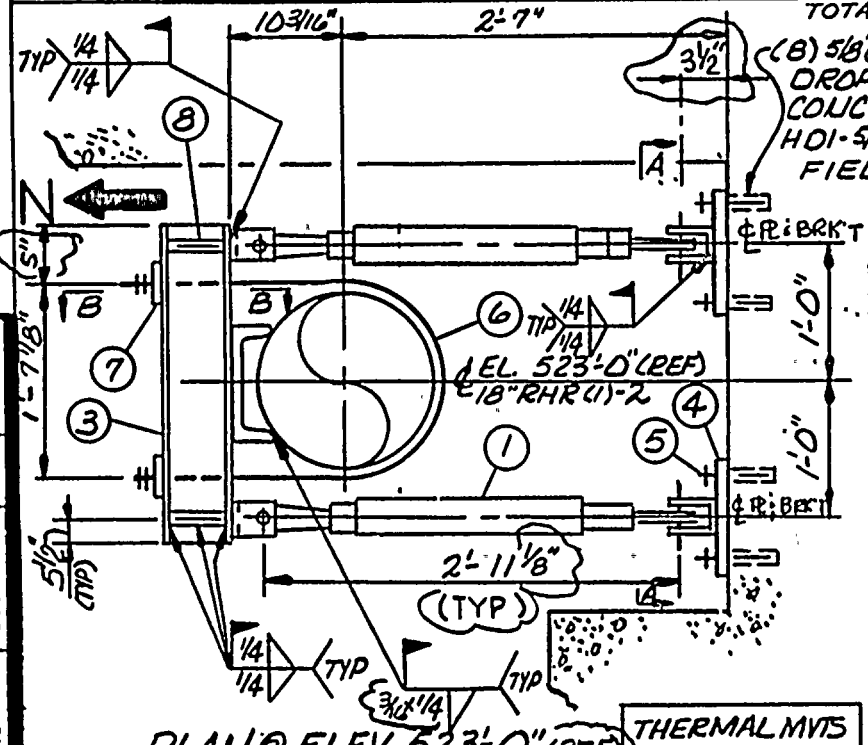
DWG. RHR-174 SHT 4 OF 4 REV 4

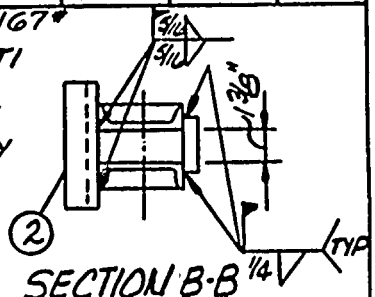
Form No. 1787-1

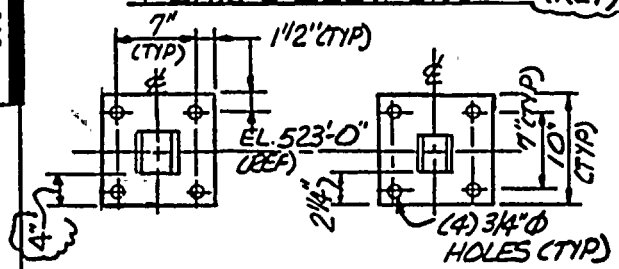
SUPERIOR REPROGRAPHICS 18 998

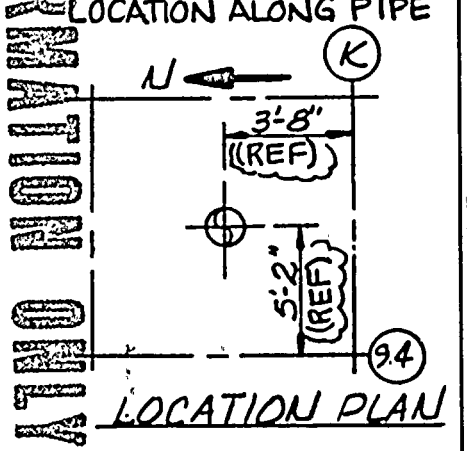
ITEM NO.	QUAN.	SIZE — DESCRIPTION	ASTM	WT.	
1	2	RIGID SWAY STRUT SIZE 15 FIG 350 x = 1'-11¼" W/(2) H146 REAR BRKTS.		26	
2	1	C10 x 21 x 1'-0" LG	A36	21	
3	2	C6 x 10.5 x 2'-6" LG.	A36	53	
4	2	PL 3/4" x 10" x 0'-10" (SEE SECTION A-A)	A36	42	
5	8	5/8"Ø x 1 3/4" LG HVY HEX MACH. BOLT W/LW	A307GRB	4	
6	1	18"Ø U-BOLT STD. FIG 100A B=2'2"		13	
7	2	WASHER PL 1"Ø FIG 160		4	
8	4	STIFF PL 3/8" x 1 11/16" x 0'-5 1/4"	A36	4	

TOTAL WT. 167#









THERMAL MVTS	
DX	.000" N
DY	.042" UP
DZ	.001" W

ZONE: R-51	OP. LD. = FX = -154#		HYDRO. LD. = —
THERMAL LD.: VERT = —	N-S = +717/-188	E-W = —	
SEISMIC LD.: VERT = —	N-S = ±4535#	E-W = —	
CODE / CLASS: III/2	GROUP: 1		Q.A. LEVEL: I
PAINT: I	PIPE CALC.: 8.14.127C		STL. CALC.: 8.15.2066
PIPING SYSTEM RESIDUAL HEAT REMOVAL	REF. DWG. ISO.: RHR-867-8.12	PIPING: M-705	

REV NO	DATE	REVISION	DRP	DS	ENG
3	6/12/82	CONST. COMPLETE PER PRR REV 2 (3FO) & PED. 215-H-N733, #6434			

DWN TLC CHKD [illegible] SCALE NTS
SL/LDE [illegible] DATE 8-19-82

ENGINEERING REVIEW

MECH	CIVIL
ELEC	
REVD H.R. Traquair 8-19-82 CHIEF DRAFTSMAN	APVD [illegible] DATE 8/25/82 CHIEF MECH. ENGINEER

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO. 2 5/4 9.Ø P04

MARK NO. RHR-605

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

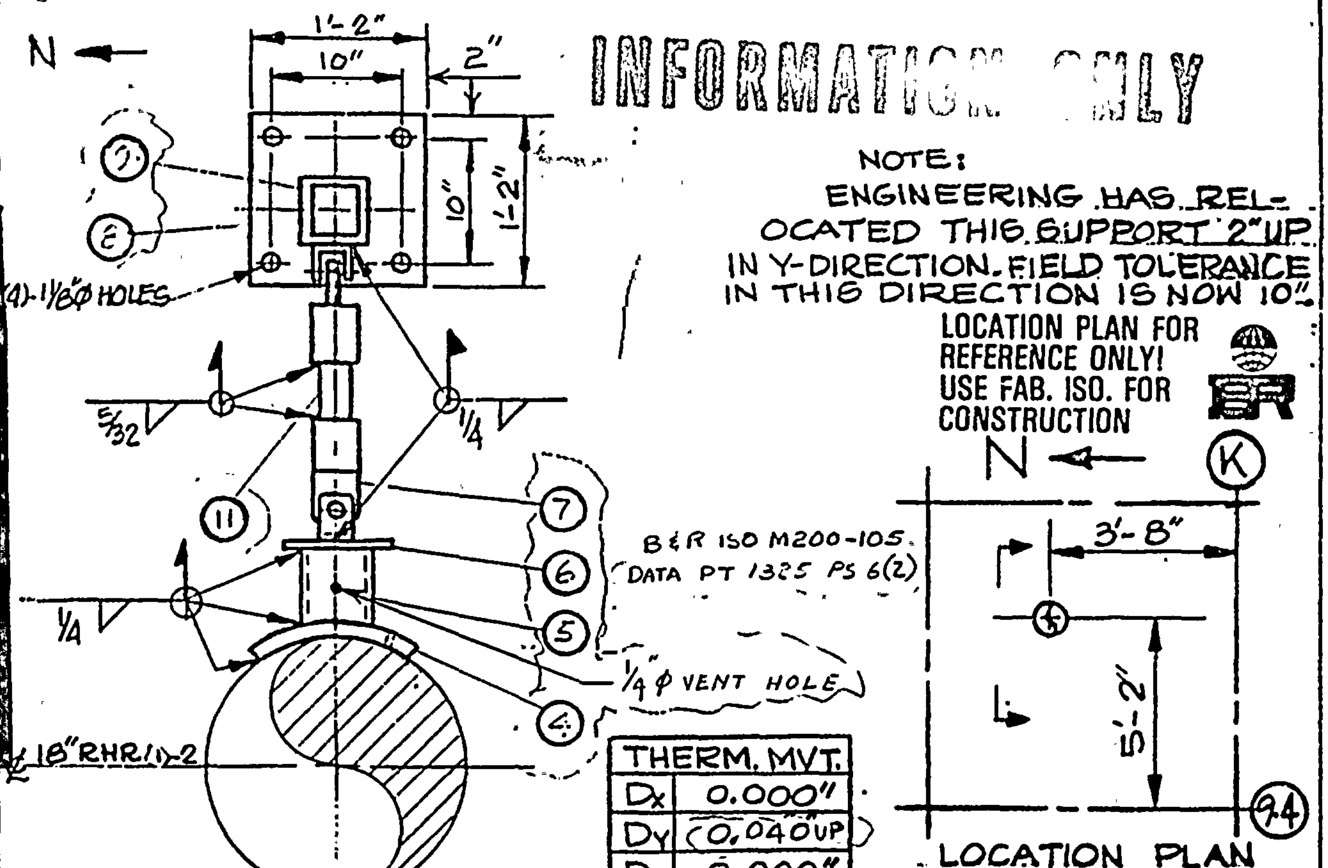
W.O. 3808	DWG. RHR-605	REV 3

DWG SHT	REV	CVI SHT	CVI NO
1	3	12563	"

02-215-08

ITEM NO.	QUAN.	SIZE—DESCRIPTION	ASTM	WT.	
4	1	PL 3/8" x 12" x 1'-5." PAD (BEND TO RADIUS OF 18"PIPE)	A-36	21	
5	1	8" φ SCH. 40 PIPE x 0'-6 1/2" LG. (CUT TO SUIT)	A106GR B	15	
6	1	PL 1/2" x 9" x 0'-9"	A-36	5	
7	2	PACIFIC SCIENTIFIC PSA-3 FORWARD ADAPTER P/N 1801319-CA		12	
-		W/REAR BRACKET P/N 1801558-05			
8	1	PL 1" x 14" x 1'-2" (SEE PLAN)	A-36	56	
9	1	TS 5 x 5 x .375 x 0'-11 1/2" LG	A500 GR B	21	
10	4	1" φ x 6 1/2" EMBED HILTI SUPER-KWIK BOLT W/HVY HEX NUT & LW			

INFORMATION ONLY



NOTE:
ENGINEERING HAS RELOCATED THIS SUPPORT 2" UP IN Y-DIRECTION. FIELD TOLERANCE IN THIS DIRECTION IS NOW 10".

LOCATION PLAN FOR REFERENCE ONLY! USE FAB. ISO. FOR CONSTRUCTION

LOCATION PLAN

THERM. MVT.	
Dx	0.000"
Dy	0.040" UP
Dz	0.000"

PLAN @ EL. 522'-10"

ITEM #12 NOT SHOWN FOR CLARITY

ZONE: R-51	OP. LD. = Fz = -121	HYDRO. LD. = Fz 121	
THERMAL LD.: VERT = —	N-S = —	E-W = +271 / -1132	
SEISMIC LD.: VERT = —	N-S = —	E-W = ±2812	
CODE/CLASS: III/2	GROUP: 1	Q.A. LEVEL: I	
PAINT: I	PIPE CALC. 8.14.1270	STL. CALC. 8152067	
PIPING SYSTEM: RESIDUAL HEAT REMOVAL	REF. DWG. ISO.: RHR-867-812	PIPING: M-70	

REV NO	REVISION	DATE	DWN CHKD	APVD
2	REDESIGNED BY B&R & REV'D IN ACCORDANCE W/ WBG STATUS AS BUILT	10-28-82	JMT RG	MP

DWN [signature] CHKD [signature] SCALE NTS
SL/LDE [signature] DATE 11-1-82

ENGINEERING REVIEW
MECH — CIVIL
ELEC
REVD [signature] 11/1/82 CHIEF DRAFTSMAN — APVD [signature] DATE 11/5/82 CHIEF MECH ENGINEER

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO. 2 009.0-P4

MARK NO. RHR-606

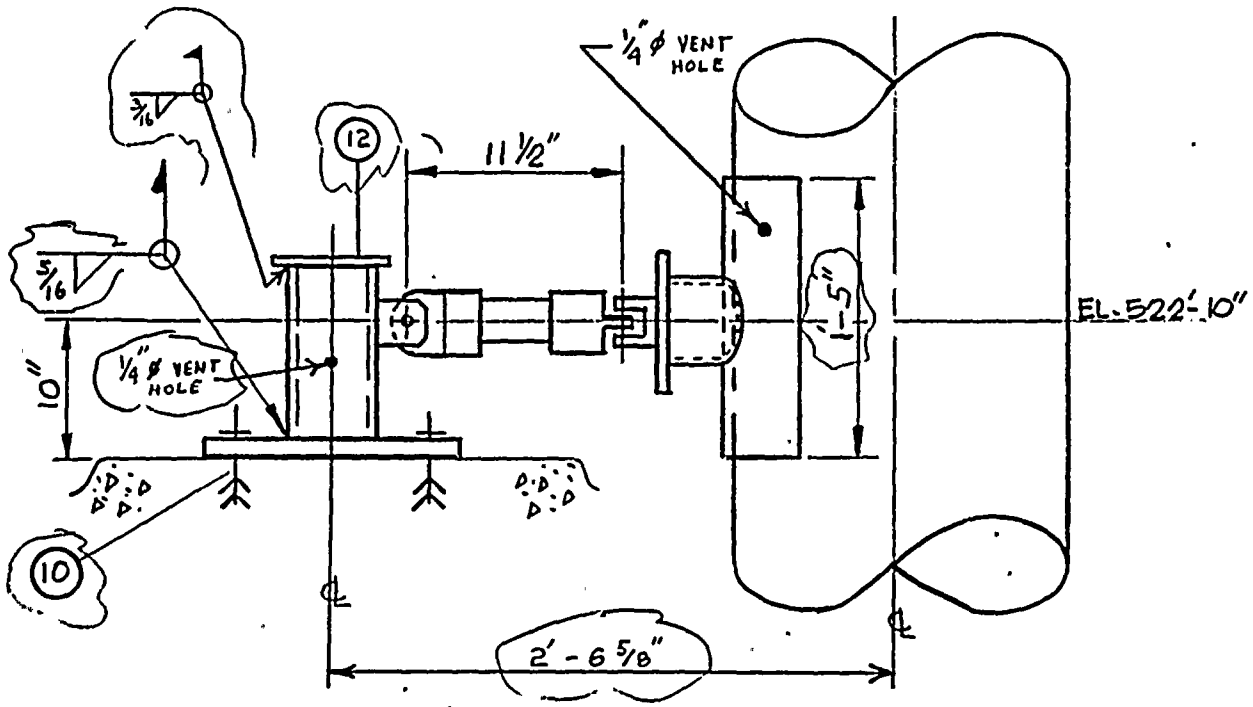
BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

W.O. 3808 DWG. RHR-606 SH 1 OF 2 REV 2

CVI NO	CVI SHT	REV	DWG SHT
02-2150			

SUPERIOR REPROGRAPHICS TB 397

ITEM NO	QUAN	SIZE - DESCRIPTION	ASTM	WT.	
11	1	1½"ø PIPE SCH. 40 X 0'-6½" LG	A106GRB	2	
12	1	PL ¼" x 7" x 0'-7"	A-36	3	
		ITEMS 1 THROUGH 3 DELETED TOTAL WT			



ELEV. LKG. SOUTH

REV NO	REVISION	DATE	DWN	CHKD	APVD
2	REDESIGNED BY BERE REV'D IN ACCORDANCE W/ WPPSS STATUS AS BUILT	10-29-82	JMT	RB	MP MCM

DWN SHQ CHKD [signature] SCALE NTS
SL/LDE [signature] DATE 11-1-82

ENGINEERING REVIEW

MECH	CIVIL
ELEC	
REVD [signature] 11/1/82 CHIEF DRAFTSMAN	APVD [signature] DATE 11/5/82 CHIEF MECH. ENGINEER

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO. 2

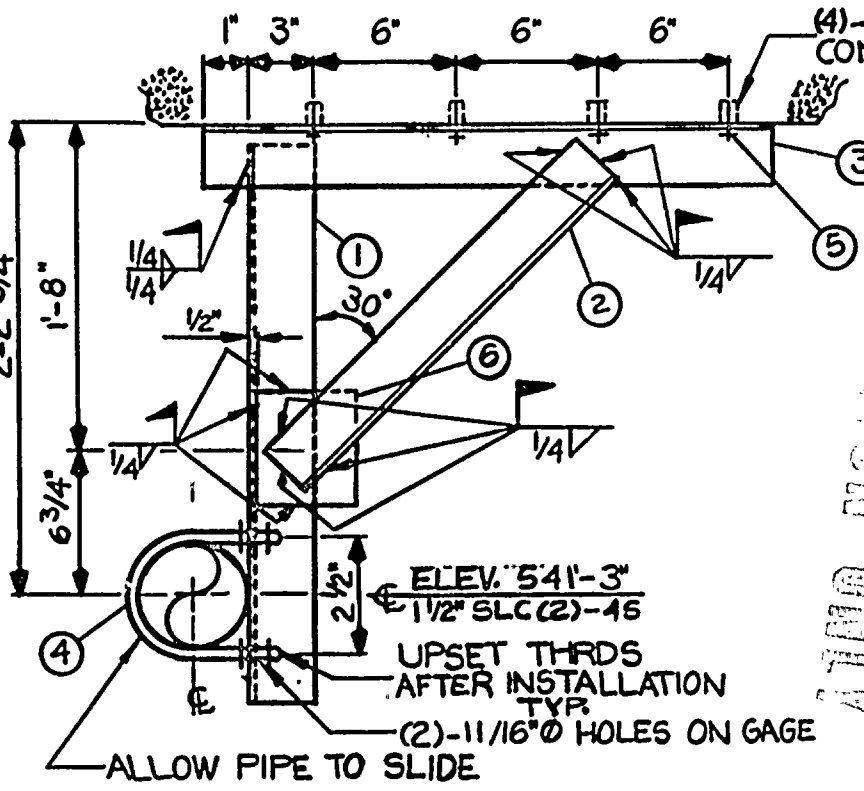
MARK NO. RHR-606

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

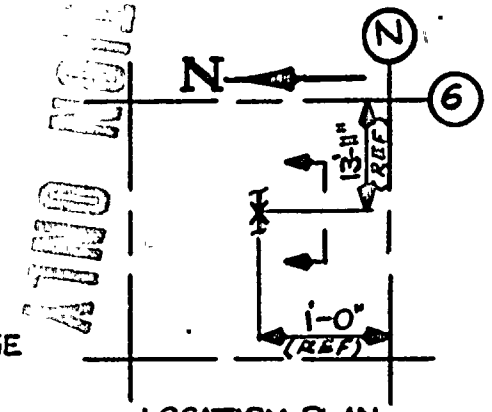
W.O. 3808	DWG. RHR-606 SH 2 OF 2	REV 2

SUPERIOR REPROGRAPHICS TB 398

ITEM NO.	QUAN.	SIZE — DESCRIPTION	ASTM	WT.	
1	1	L 4X4X3/8X2'-4 1/2" LG	A-36	23	
2	1	L 4X4X3/8X1'-11 3/8" LG	A-36	19	
3	1	L 4X4X3/8X2'-3" LG	A-36	22	
4	1	1V2"Ø U BOLT-HVY DUTY FIG. 101		1	
5	4	3/4"ØX2" LG-HVY.HEX.MACH BOLT W/LW	A325RB	2	
6	1	PL 3/8"X6"X0'-8"	A-36	6	
		TOTAL WT.		73 #	



ELEV. LKG. NORTH



LOCATION PLAN

ZONE: R-53	OP. LD.: 78#	HYDRO. LD.: —	
THERMAL LD.: VERT: 117#	N-S: —	E-W: 46#	
SEISMIC LD.: VERT: ±79#	N-S: —	E-W: ±58#	
CODE/CLASS: III/1	GROUP: 1	Q.A. LEVEL: I	
PAINT: 1	PIPE CALC.: 8-14-156	STL. CALC.: 8-16-3201	
PIPING STANDBY LIQUID SYSTEM CONTROL	REF. DWG. NO.: SLC-4453-S PIPING: M705 (II)		

REV NO	REVISION	DATE	DWN	CHKD	APVD
1	DOCUMENT UPDATE	9.4.82			

DWN A. Sarjahani CHKD Q.A. orton SCALE NTS
SL/LDE [signature] DATE 10/20/81

ENGINEERING REVIEW

MECH	CIVIL
ELEC	

REVD H.R. Traeger [signature] CHIEF DRAFTSMAN
APVD [signature] DATE 12/28/81 CHIEF MECH. ENGINEER

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO.2 S/U 10.0 PI

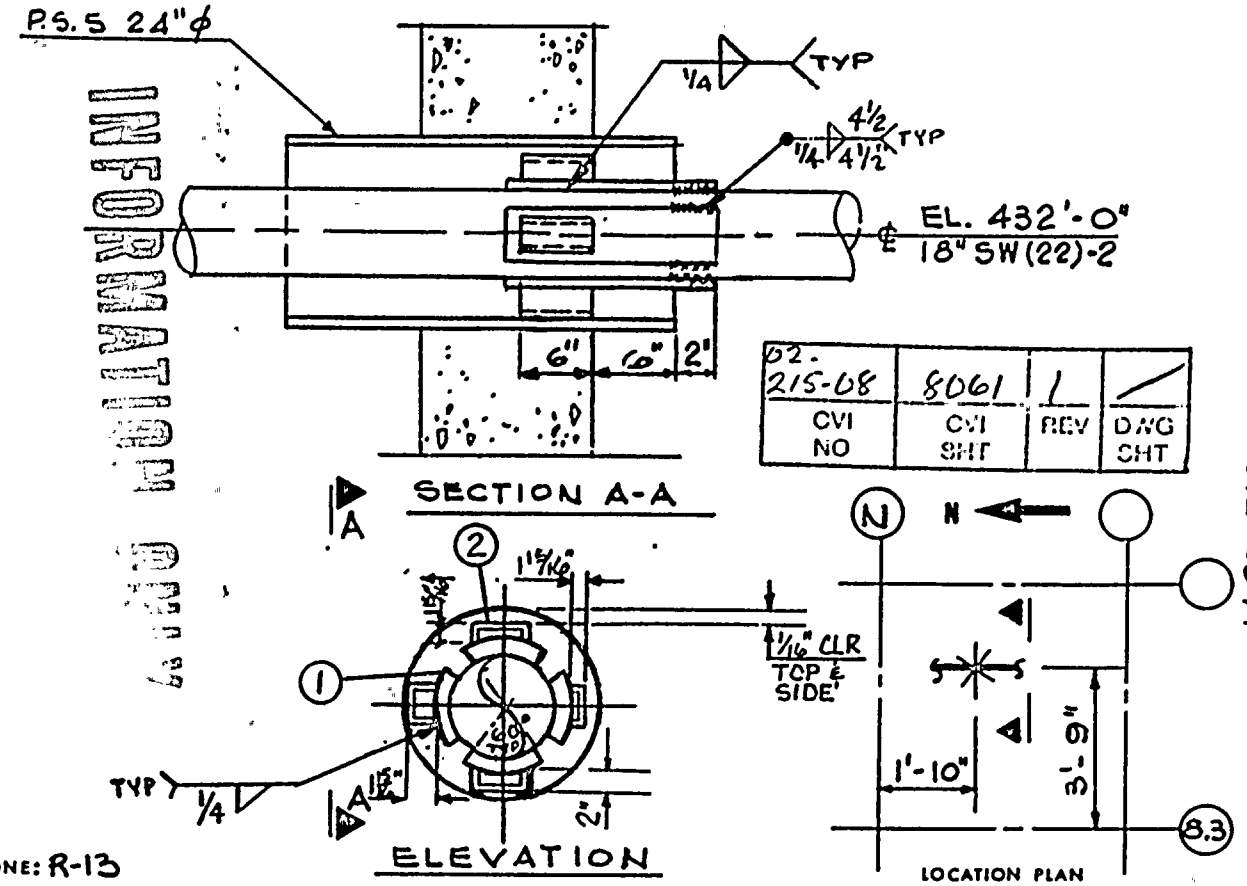
MARK NO. SLC-4453-57

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

W.O. 3808 | DWG. SLC-4453-57 | REV 1

DWG SHT	REV	CVI SHT	CVI NO
1	1	5712	215 708

ITEM NO	NO. REQ'D.	SIZE	DESCRIPTION	ASTM	WT.	
1	4	3/4" x 9 13/16" x 1'-4" LG. PAD F-218		A36	136	
2	4	C 8 x 11.5 x 6" LG (TRIM FLANGES AS SHOWN IN ELEVATION VIEW)		A36	23	
				TOTAL	159	#



02-215-08	8061	1	
CVI NO	CVI SHT	REV	DWG CHT

BCBR-215-14.88-7193-

ZONE: R-13

SEIS. LOADS: VERT=± 8740# N-S= ~ E-W=± 15339# OP. LD.= 4077# HYDRO. LD.= 4077# THERM. LD.= ~

CODE / CLASS: III-3 | GROUP: 2 | Q.A. LEVEL: I | PAINT: I | PIPE CALC. P-1468 | STEEL CALC. 8.16.2361

OWNER: WASHINGTON PUBLIC POWER SUPPLY SYSTEM

PROJECT: HANFORD NO. 2 | ENGINEER: BURNS & ROE INC.

CUSTOMER: BOVEE & CRAIL / GERI

PIPING SYSTEM: STANDBY SERVICE WATER

REFERENCE DWG.: ISO: SW-295-12.184 PIPING: M-711

MARK NO.: SW-90 | AM-147

DR.	DESCRIPTION	DATE	REV.
AM	REVISED IN ACCORDANCE W/WBG STATUS AS-BUILD	5-02-81	1

nps industries, inc.
CONTRACT 215

a subsidiary of nuclear power services, inc.
26 broadway-new york, n.y. 10004

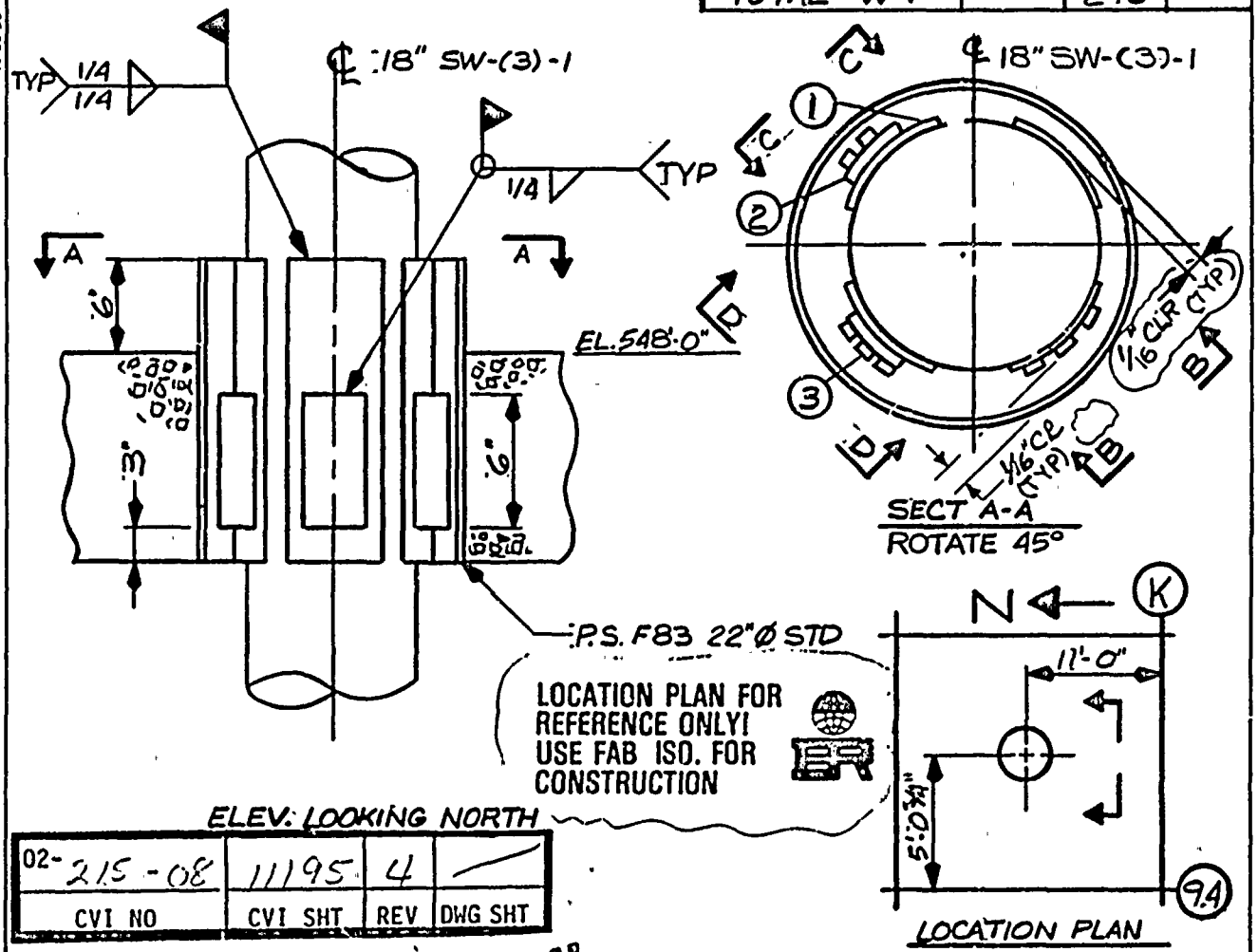
DRAWN	DATE	CHK'D	DATE	APPV'D	DATE
JS FM	8-27-76	JS	8-30-76	JG	4.19.77

JOB NO.

DWG. NO. SW-90 | REV. 1

SUPERIOR REPROGRAPHICS 8.3K

ITEM NO.	QUAN.	SIZE — DESCRIPTION	ASTM	WT.	
1	4	PL 1"x11"x1'-6" (PAD)(BEND TO RAD OF 18" Ø PIPE)	A-36	22.4	
2	2	PL 9/16"x6"x0'-6" (PAD)(BEND TO RAD OF ITEM 1)	A-36	12	
3	8	PL 3/4" x 7/8"x0'-6" (GRIND THK. TO SUIT)	A-36	10	
		TOTAL WT		246#	



02-215-08	11195	4	
CVI NO	CVI SHT	REV	DWG SHT

INFORMATION ONLY

REV NO	REVISION	DATE	DWN	CHKD	APVD
4	REV'D BY B&R	3/11/83	ZP	MH	SF
3	REVISED IN ACCORDANCE W/WBG STATUS AS-BUILT	5/30/81	JM	MCO	DKH

DWN	CHKD KLM	SCALE NTS	
SLADE	DATE 7/8/81		

ENGINEERING REVIEW

MECH	CIVIL	
ELEC		
REVD H.P. Tragesser CHIEF DRAFTSMAN	APVD CHIEF MECH. ENGINEER	DATE 7/14/81

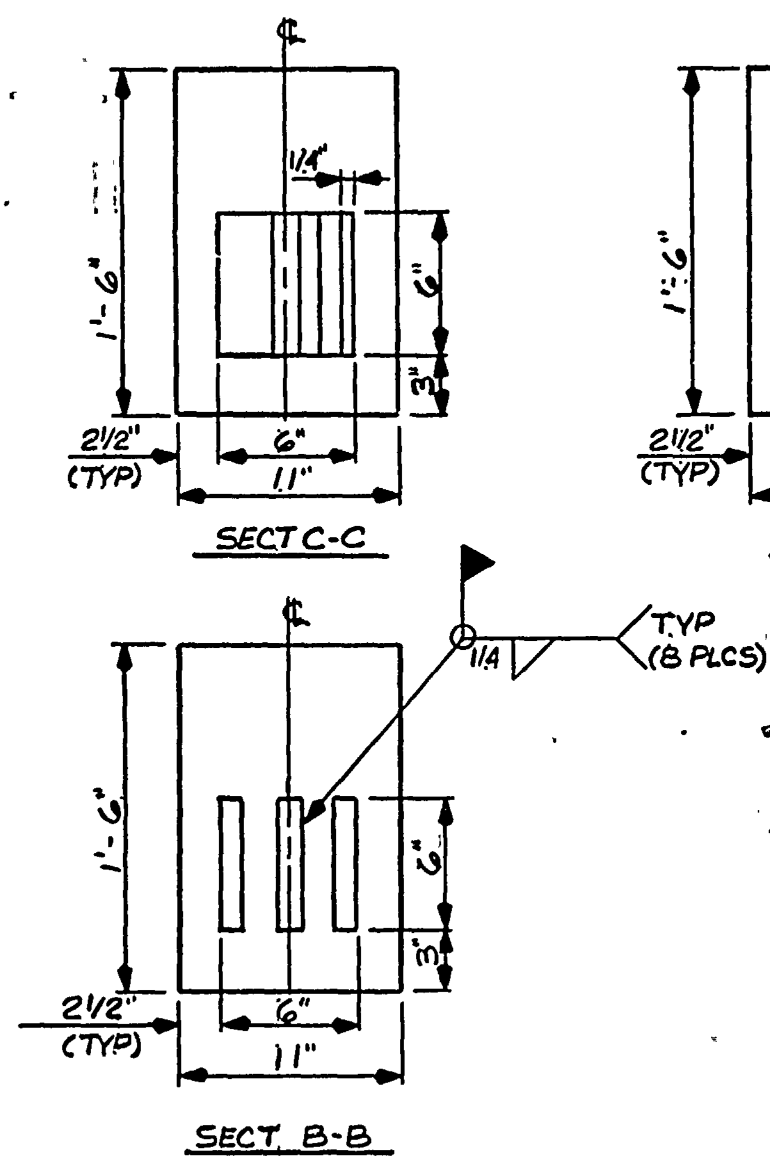
ZONE: R-61	OP. LD.: Fz=-265# Fz=-499#	HYDRO. LD.: —	
THERMAL LD.: VERT: —	N-S: —	E-W: —	
SEISMIC LD.: VERT: —	N-S: ±3793#	E-W: ±3808#	
CODE/CLASS III/3	GROUP: 2	Q.A. LEVEL: I	
PAINT: I	PIPE CALC: 8.12.023	STL. CALC: 8.16.2381	
PIPING STAND-BY SYSTEM SERVICE WATER	REF. DWG. ISO.: SW-250-52, 54	PIPING: M-715	

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO. 2 58.0 P5

MARK NO. SW-123

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

W.O. 3808	DWG. SW-123 1 OF 2	REV 4



REV NO	REVISION	DATE	DWN	CHKD	APVD
4	REV'D BY B&R	3/11/83	EP	TTH	MH S.F
3	REVISED IN ACCORDANCE W/WBG STATUS AS-BUILT	5/30/81	JM	KLM	MCO RWS

DWN [signature]	CHKD KLM	SCALE NTS	
SL/LDE [signature]		DATE 7/8/81	
ENGINEERING REVIEW			
MECH		CIVIL	
ELEC			
REVD [signature] CHIEF DRAFTSMAN	APVD [signature] CHIEF MECH. ENGINEER	DATE 7/11/81	

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO.2 58.0 P5

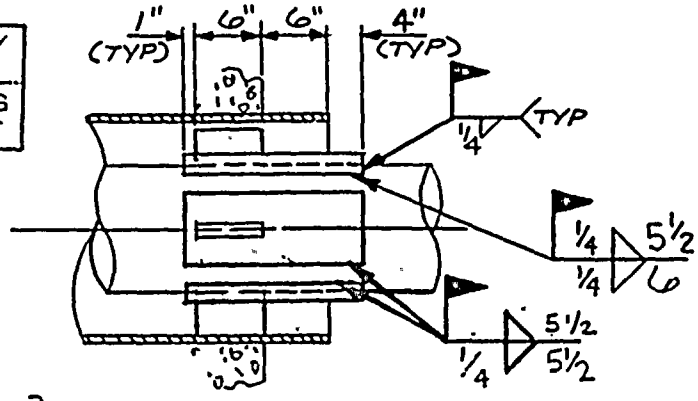
MARK NO. SW-123

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

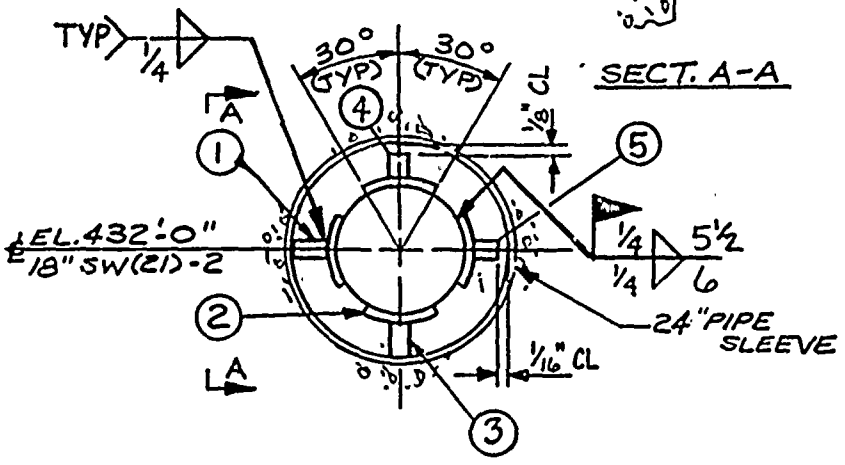
W.O.	DWG.	REV
W.O.3808	SW-123 2 OF 2	4

ITEM NO.	NO. REQ'D.	SIZE	DESCRIPTION	ASTM	WT.	
1	1	1/2" X 2 1/8" X 6" LG PL		A36	2	
2	4	9 5/8" X 3/4" PL X 1'-5" LG. ROLLED PLATE		A36	139	
3	1	1/2 X 1 5/8" X 6" LG PL		A36	1	
4	1	PL 1/2" X 1 7/8" X 0'-6"		A36	2	
5	1	PL 1/2" X 7/8" X 0'-6"		A36	1	
		MATERIAL WT.		TOTAL	145	#

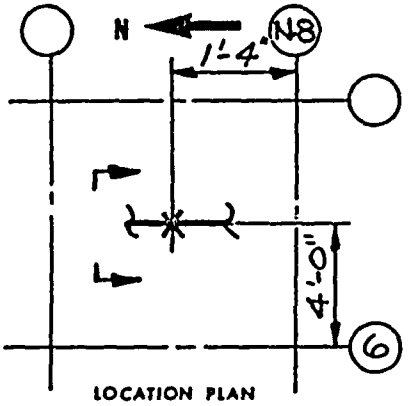
02-215-08	11040	1	/
CVI NO	CVI SHT	REV	DWG SHT



SECT. A-A



ELEV. LOOKING SOUTH



LOCATION PLAN

ZONE: R-13

SEIS. LOADS: VERT = 2026* N-S = —	E-W = 3,358*	OP. LD. = 999*	HYDRO. LD. = 999*	THERM. LD. = FV: 1000* EX: 10000*	
CODE / CLASS: III/3	GROUP: 2	Q.A. LEVEL: I	PAINT: I	PIPE CALC. R1465	STEEL CALC. 8.16.2571

OWNER: WASHINGTON PUBLIC POWER SUPPLY SYSTEM

PROJECT: HANFORD NO. 2 | ENGINEER: BURNS & ROE INC.

CUSTOMER: BOVEE & CRAIL / GERI

PIPING SYSTEM: STAND-BY SERVICE WATER
ISO: SW-296-33-36H

REFERENCE DWG.: PIPING: M712

MARK NO.: SW-439 | AM-184

nps industries, inc.
CONTRACT 215

a subsidiary of nuclear power services, inc.
26 broadway-new york, n.y. 10004

DRAWN	DATE	CHK'D	DATE	APPV'D	DATE
MF PL	9-30-76	JJM	10-17-76	JG	11/4/77

JOB NO.

DWG. NO. SW-439 | REV. 1

NO.	DESCRIPTION	DR.	APP.	DATE
1	REVISED IN ACCORDANCE W/WBG STATUS AS-BUILT			4.26.81

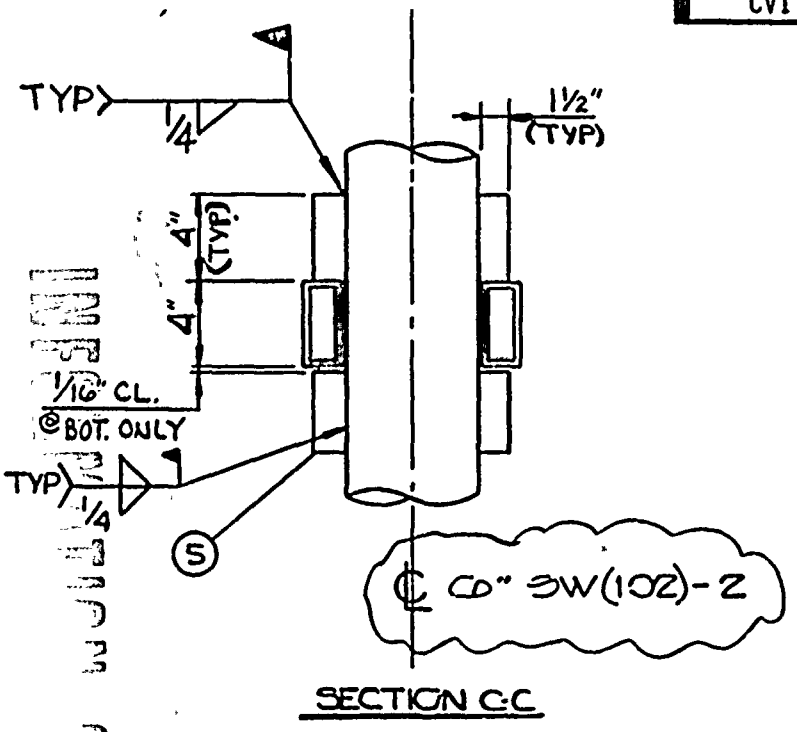
AS BUILT

BCBR-215-1493-

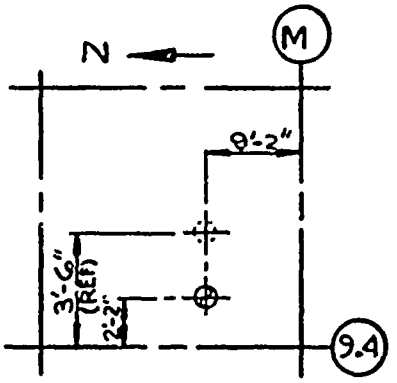
ITEM NO.	QUAN.	SIZE — DESCRIPTION	ASTM	WT.	
1	2	TS 4 x 2 x .250 x 0'-11½" LG	A500GRB	17	
2	1	TS 4 x 2 x .250 x 0'-3½" LG.	A500GRB	5	
3	1	PL ⅝" x 3" x 0'-5"	A 36	3	
4	1	PL ⅝" x 3" x 0'-7"	A 36	4	
5	4	PL 1" x 1½" x 0'-4" (LUG)	A 36	7	
		TOTAL WT		34	#

02-215-68	13300	2	—
CVI NO	CVI SHT	REV	DWG SHT

SUPERIOR REPROGRAPHICS TB 398



SECTION C-C



LOCATION PLAN

2	DOCUMENT UPDATE	8/24/81	TLE	LL
1	DOCUMENT UPDATE	8/7/81	CAS	LL
0	RELEASE FOR FABRICATION	7/13/81	JG KLM	LL RKG
REV NO	REVISION	DATE	DWN CHKD	APVD

DWN	CHKD KLM	SCALE N.T.S.	
SL/LDE		DATE 7/17/81	
ENGINEERING REVIEW			
MECH	CIVIL		
ELEC			
REVD H.R. Teague	APVD	DATE 7/23/81	
CHIEF DRAFTSMAN	CHIEF MECH ENGINEER		

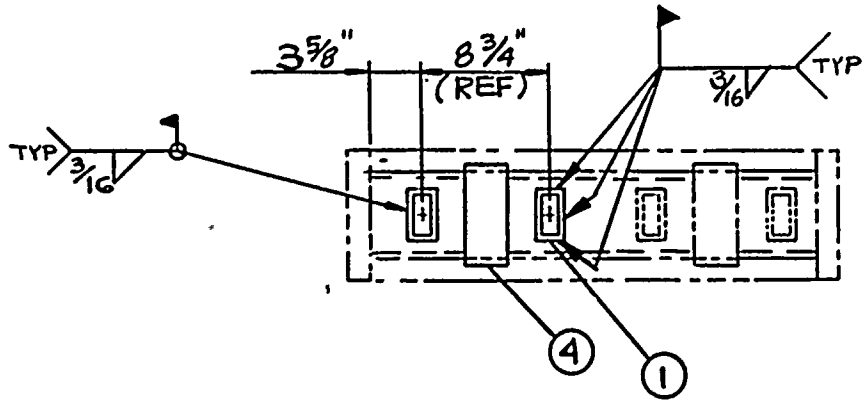
ZONE: R-63	OP. LD. = 899#	HYDRO. LD. = 899#
THERMAL LD.: VERT = ——	N-S = ——	E-W = ——
SEISMIC LD.: VERT = ±1798#	N-S = ±1900#	E-W = ±1796#
CODE/CLASS III/3	GROUP: 2	Q.A. LEVEL: I
PAINT: I	PIPE CALC. 8-42-3001	STL. CALC. 8-16-2762
PIPING SYSTEM STAND BY SERVICE WATER	REF. DWG. ISO:	SW-251-38.46
	PIPING:	M-714

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO. 2

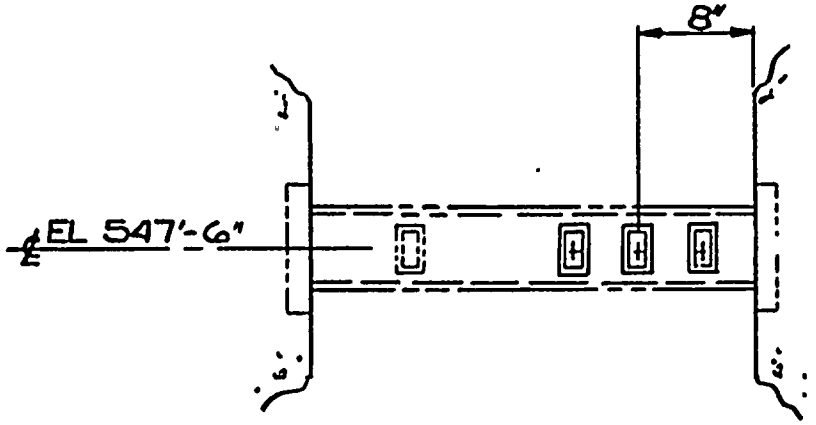
MARK NO. SW-946N

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

W.O. 3808	DWG. SW-946N	SHT. 1 OF 3	REV 2



SECT. A-A



SECT. B-B

REV NO	REVISION	DATE	DWN	CHKD	APVD
2	DOCUMENT UPDATE	8/24/81	TLC		M+D
1	DOCUMENT UPDATE	8/7/81	CMS		M CH
0	RELEASED FOR FABRICATION	7/13/81	JCS	KLM	BVG

DWN TLC CHKD KLM SCALE NTS

SL/LDE DATE 7/17/81

ENGINEERING REVIEW

MECH CIVIL

ELEC

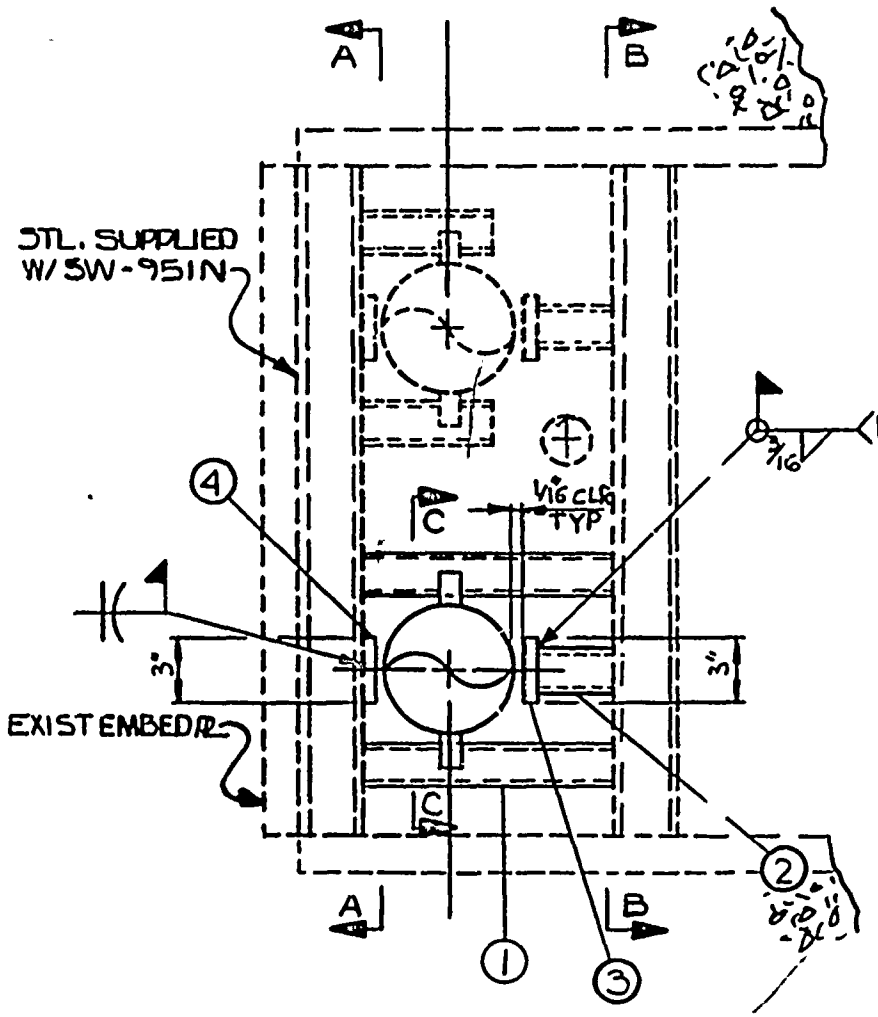
REVD H.R. Teague CHIEF DRAFTSMAN APVD OHIEF MECH. DATE 7/23/81 ENGINEER

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO. 2

MARK NO. SW-946N

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

W.O. 3808 | DWG. SW-946N | SHT 2 OF 3 | REV 2



PLAN @
EL. 547'-6"

REV NO	REVISION	DATE	DWN CHKD	APVD
2	DOCUMENT UPDATE	9/24/81	TLC	
1	DOCUMENT UP-DATE	8/11/81		
0	RELEASE FOR FABRICATION	7/13/81	KLM	

DWN T. Clothier CHKD KLM SCALE NTS
SL/CDE DATE 7/17/81
ENGINEERING REVIEW
MECH CIVIL
ELEC

REVD H.R. Teague CHIEF DRAFTSMAN
APVD CHIEF MECH ENGINEER DATE 7/23/81

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO. 2

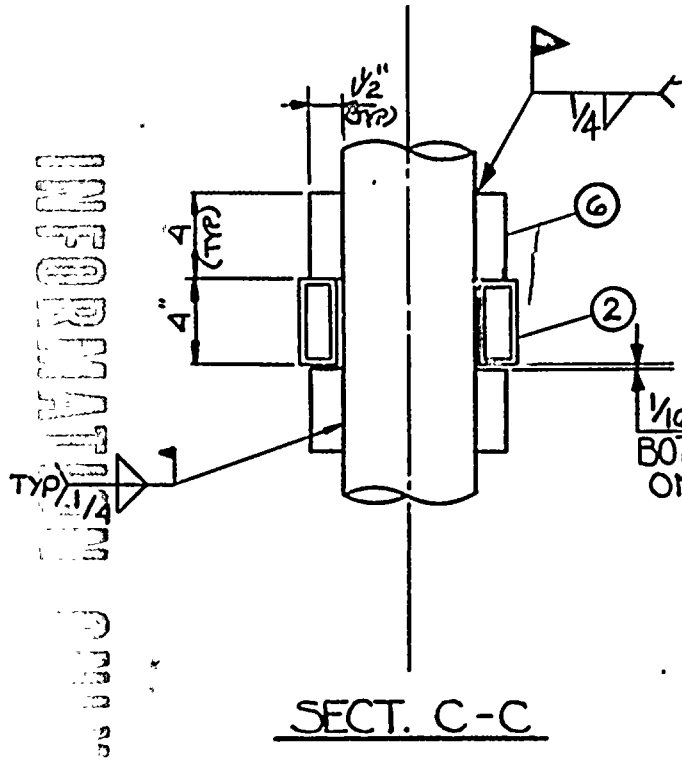
MARK NO. SW-946N

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

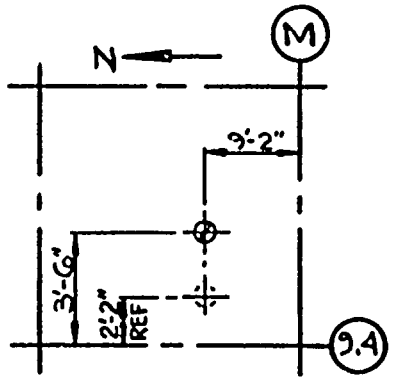
W.O. 3808 | DWG. SW-946N | SHT 3 OF 3 | REV 2

ITEM NO.	QUAN.	SIZE — DESCRIPTION	ASTM	WT.	
1	2	TS 6 x 3 x .375 x 2'-7" LG.	A500GRB	100	
2	2	TS 4 x 2 x .250 x 0'-6" LG.	A500GRB	9	
3	1	TS 4 x 2 x .250 x 0'-3½" LG.	A500GRB	3	
4	1	PL 5/8" x 3" x 0'-5"	A36	3	
5	1	PL 5/8" x 3" x 0'-7"	A36	4	
6	4	PL 1" x 1½" x 0'-4" (LUG)	A36	7	
		TOTAL WT		126	#

02-215-08	13287	2	—
CVI NO	CVI SHT	REV	DWG SHT



SECT. C-C



LOCATION PLAN

ZONE: R-63	OP. LD.: 911 #	HYDRO. LD.: 911 #
THERMAL LD.: VERT: —	N-S: —	E-W: —
SEISMIC LD.: VERT: ±1822#	N-S: ±2319 #	E-W: ±1662 #
CODE/CLASS: III/3	GROUP: 2	Q.A. LEVEL: I
PAINT: I	PIPE CALC.: 8-42-3001	STL. CALC.: 816-2762
PIPING SYSTEM: STAND BY SERVICE WATER	REF. DWG. NO.: SW-295-43.68	PIPING: M-714

REV NO	REVISION	DATE	DWN	CHKD	APVD
2	DOCUMENT UPDATE	8/24/81	TLC		
1	DOCUMENT UPDATE	8/7/81			
0	RELEASE FOR FABRICATION	7/13/81	JG	KLM	

DWN J. G. Hoffman CHKD KLM SCALE NTS

SL/LDE DATE 7/17/81

ENGINEERING REVIEW

MECH	CIVIL
ELEC	

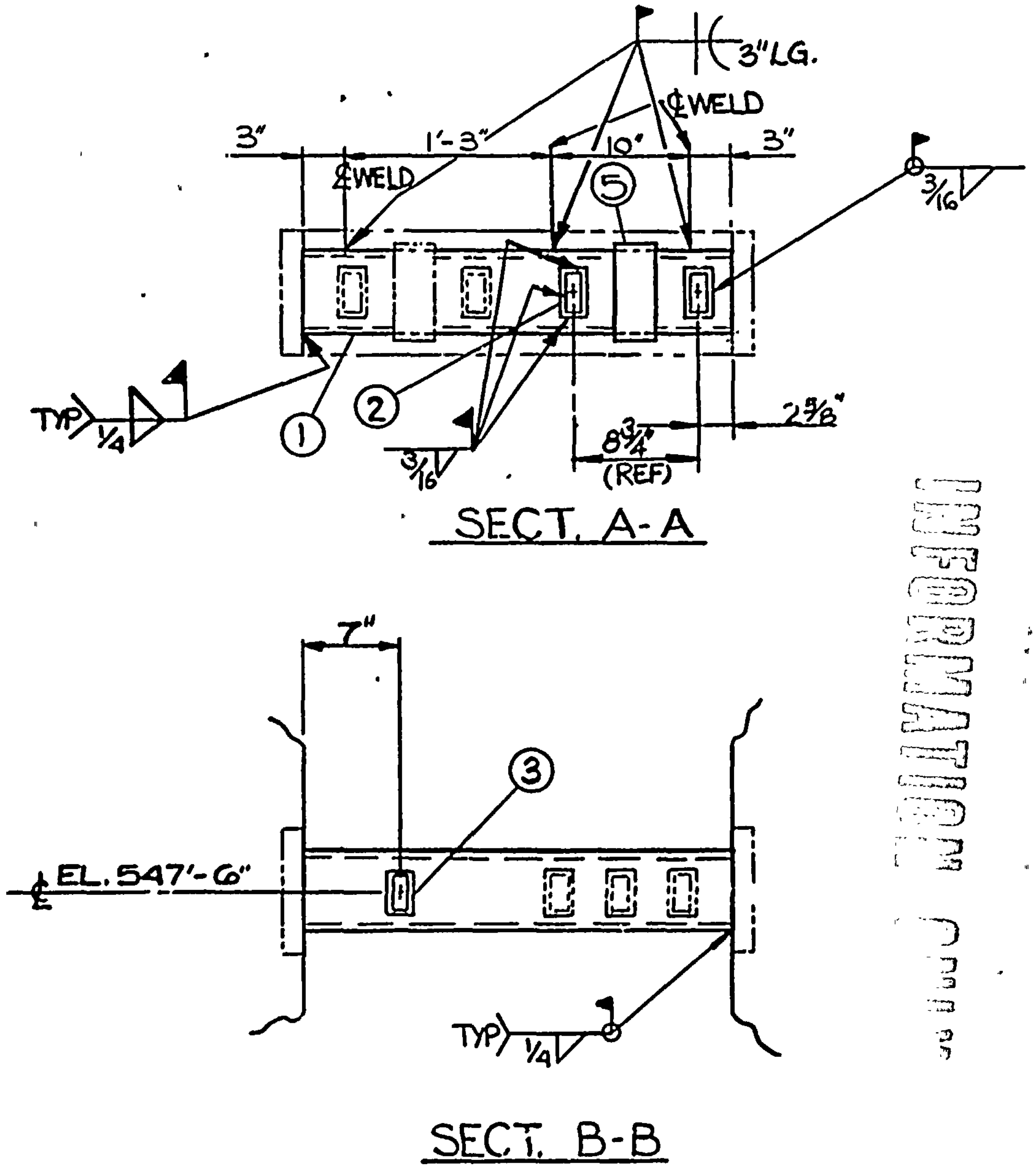
REVD H.R. Teague CHIEF DRAFTSMAN APVD CHIEF MECH. DATE 7/23/81 ENGINEER

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO. 2

MARK NO. SW-951N

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

W.O. 3808	DWG. SW-951N	SHT. 1 OF 3	REV 2



REV NO	REVISION	DATE	DWN	CHKD	APVD
2	DOCUMENT UPDATE	8/24/81	TLC		EL / MCO
1	DOCUMENT UP-DATE	8/7/81	GWS		EL / MCO
0	RELEASED FOR FABRICATION	7/13/81	JG	KLM	RKG

DWN	CHKD KLM	SCALE	NTS
SL/LDE		DATE	7/17/81
ENGINEERING REVIEW			
MECH		CIVIL	
ELEC			
REVD CHIEF DRAFTSMAN		APVD CHIEF MECH ENGINEER	DATE 7/23/81

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

HANFORD NO. 2

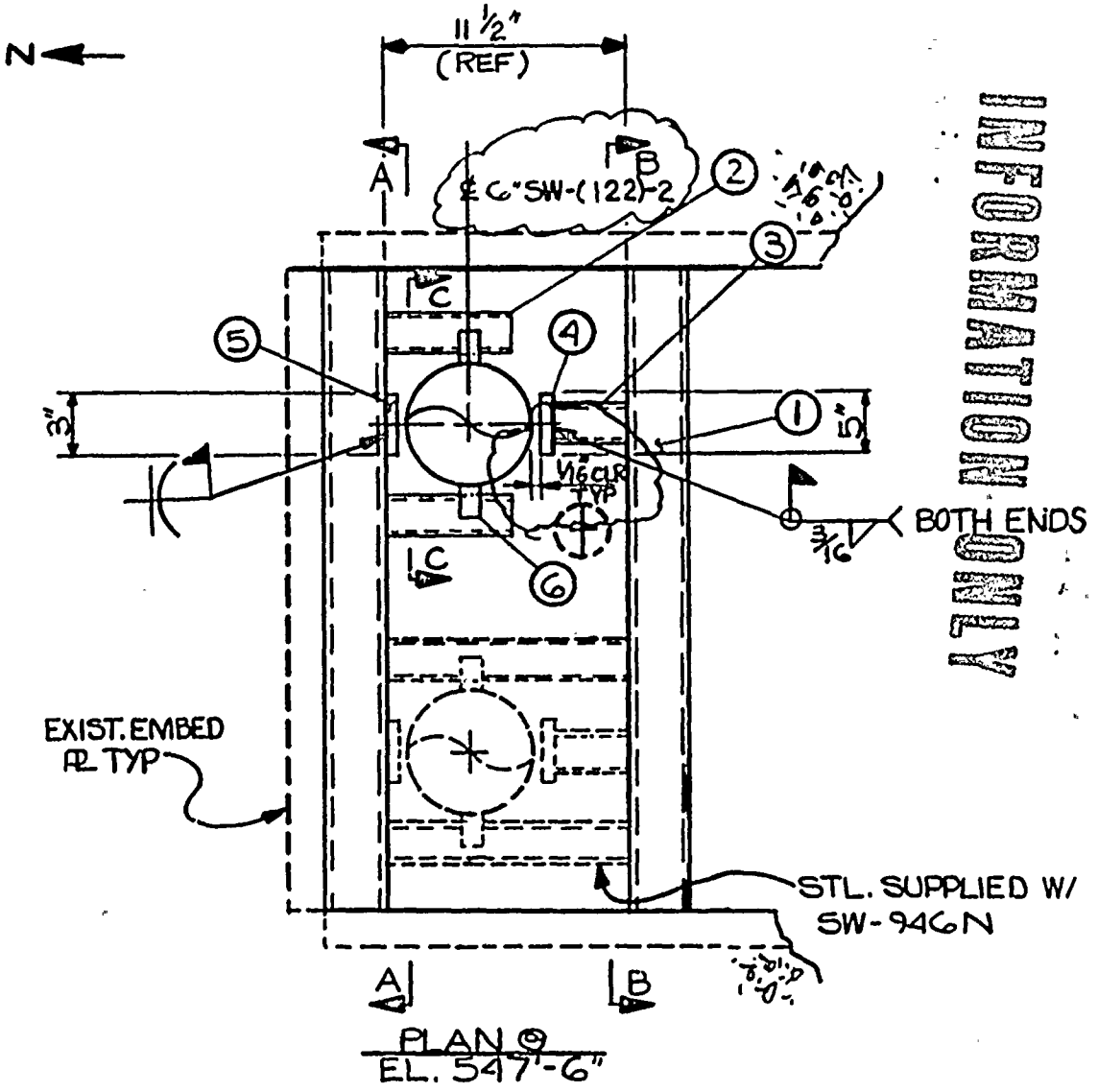
MARK NO. SW-951N

BURNS AND ROE, INC.

Engineers and Constructors

New Jersey • New York • Connecticut • California

W.O.	DWG.	SHT	REV
3808	SW-951N	2 OF 3	2



INFORMATION ONLY

REV NO	REVISION	DATE	DWN	CHKD	APVD
2	DOCUMENT UPDATE	8/24/81	HC		
1	DOCUMENT UP-DATE	8/7/81			
0	RELEASE FOR FABRICATION	7/13/81	JG	KLM	

DWN [illegible] CHKD KLM SCALE NTS

SL/LDE [illegible] DATE 7/17/81

ENGINEERING REVIEW

MECH CIVIL

ELEC

REVD [illegible] CHIEF DRAFTSMAN APVD [illegible] CHIEF MECH. ENGINEER DATE 7/23/81

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD NO. 2

MARK NO. SW-951N

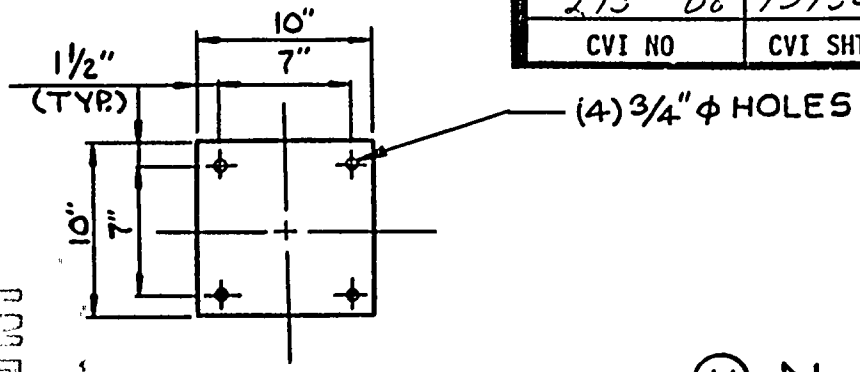
BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

W.O. 3808 | DWG. SW-951N | SHT 3 OF 3 | REV 2

ITEM NO.	QUAN.	SIZE — DESCRIPTION	ASTM	WT.	
1	1	TS 4 x 4 x .250 x 2'-2" LG.	A500GRB	26	
2	2	TS 4 x 4 x .250 x 2'-0 1/2" LG.	A500GRB	49	
3	2	TS 2 x 4 x .250 x 1'-4 11/16" LG.	A500GRB	12	
4	2	TS 4 x 4 x .250 x 0'-8 3/4" LG. (BEVEL PER DETAIL 4)	A500GRB	16	
5	1	TS 4 x 4 x .250 x 4'-2" LG. (CUT TO SUIT)	A500GRB	50	
6	1	TS 4 x 4 x .250 x 1'-1 5/16" LG	A500GRB	14	
7	2	PL 3/4" x 10" x 0'-10" (SEE DETAIL 7)	A-36	21	
8	8	5/8" ø x 1 3/4" LG. HVY HEX MACH BOLTS W/LW	A307GRB	3	

TOTAL WT. 191 LBS

02-			
215 - 08	13754	0	✓
CVI NO	CVI SHT	REV	DWG SHT



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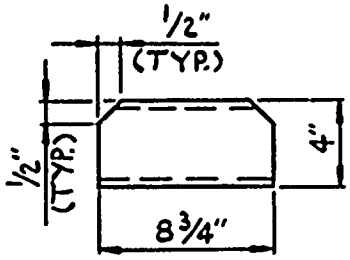

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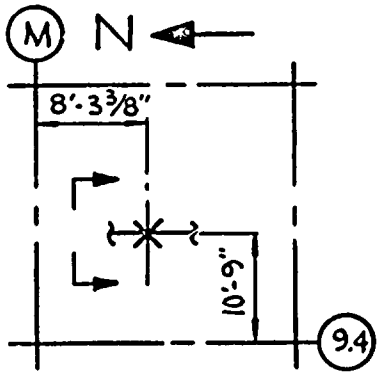


LOCATION PLAN

ZONE: R-53	OP. LD.: 736#	HYDRO. LD.: 736#
THERMAL LD.: VERT: —	N-S: —	E-W: —
SEISMIC LD.: VERT: ± 1472#	N-S: —	E-W: ± 2020#
CODE/CLASS: III/3	GROUP: 2	Q.A. LEVEL: I
PAINT: I	PIPE CALC.: —	STL. CALC.: 8.16.2761
PIPING STAND BY SYSTEM SERVICE WATER	REF. DWG. ISO.: SW-295-43.68 PIPING: M-715	

REV NO	REVISION	DATE	DWN CHKD	APVD
0	RELEASE FOR FABRICATION	7/8/81	RWL	

DWN R. Williams CHKD — SCALE NTS.
SL/LDE — DATE 7/21/81

ENGINEERING REVIEW

MECH	CIVIL
ELEC	

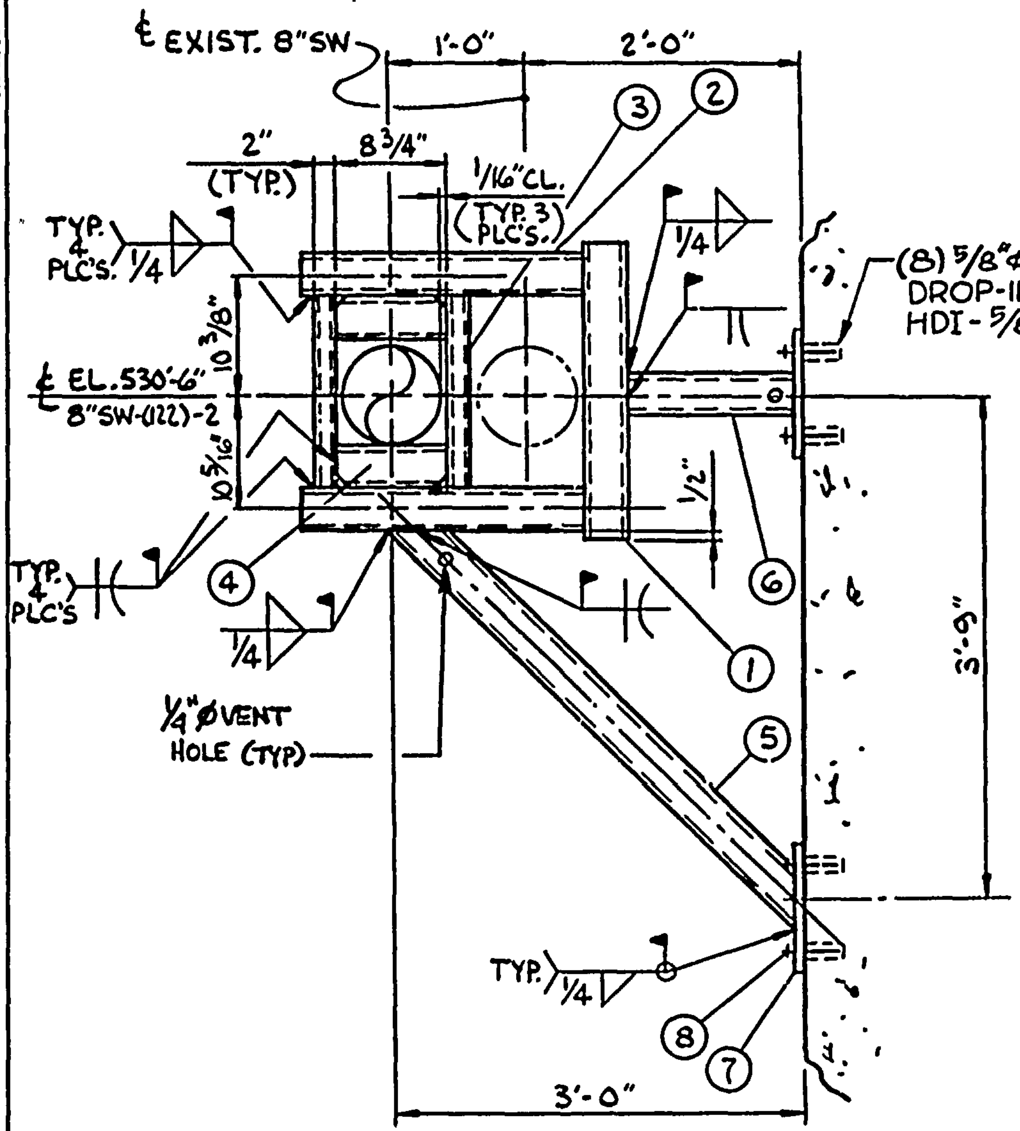
REVD H.R. Teague CHIEF DRAFTSMAN
APVD CHIEF MECH ENGINEER DATE 7/23/81

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
HANFORD #0.2

MARK NO. SW-950N

BURNS AND ROE, INC.
Engineers and Constructors
New Jersey • New York • Connecticut • California

W.O. 3808 | DWG. SW-950N | SHT. 1 OF 2 | REV 0



ELEVATION
LOOKING SOUTH

REV NO	REVISION	DATE	DWN	CHKD	APVD
0	RELEASE FOR FABRICATION	7/8/81			

DWN R. Williams	CHKD	SCALE NTS.	
SL/LDE		DATE 7/21/81	
ENGINEERING REVIEW			
MECH		CIVIL	
ELEC			
REVD CHIEF DRAFTSMAN		APVD CHIEF MECH ENGINEER	DATE 7/23/81

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
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New Jersey • New York • Connecticut • California

W.O.	DWG.	SHT.	REV
W.O.3808	DWG. SW-950	SHT. 2 OF 2	0

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

NUCLEAR PLANT 2

1994 ANNUAL REPORT

JANUARY 1 to DECEMBER 31, 1994

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Prepared by

Washington Public Power Supply System

and

Teledyne Brown Engineering Environmental Services

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1.0 EXECUTIVE SUMMARY

The Washington Public Power Supply System Radiological Environmental Monitoring Program activities conducted during 1994 are discussed in this report. The objective of the Radiological Environmental Monitoring Program (REMP) is to provide data for evaluating radiological impact of Plant 2 operations on the environment in the **Airborne, Direct Radiation, Waterborne, and Ingestion** pathways as specified by the Offsite Dose Calculation Manual (ODCM) for Plant 2. Plant 2 , a 3323 MWth (1150 MWe) boiling water reactor electrical generation plant, achieved initial criticality on January 19, 1984.

To accomplish the REMP objective of determining whether Plant 2 operations affected the environment, samples of air, water, milk, soil, sediment, fish and garden produce were collected and analyzed for radionuclides specific to plant operations throughout the year. Radiation levels were also monitored continuously during 1994 with thermoluminescent dosimeters (TLDs).

The samples were collected at preselected areas near the plant and at other locations which could be impacted by Plant 2 effluents. This information was compared to samples taken in areas that were unlikely to be affected by plant operations. The 1994 REMP data was also compared to data collected during previous years of plant operation and also compared to the data collected prior to initial plant operation.

Most of the results of samples collected by the REMP during 1994 were below detection levels. Some analyses, such as gross beta in air and water, were above the detection level for nearly all samples. This is due to the low detection limit for the gross beta analysis and also to the abundance of naturally occurring beta-emitting radionuclides in the environment. Other results above detection levels, such as cesium-137 in soil and sediment, reflect the effect of past Hanford activities or fallout from Chernobyl and past nuclear weapons testing.

The REMP analytical results and TLD results were demonstrated to be accurate through intercomparison programs which are provided as part of the quality assurance activities conducted during 1994. Such intercomparisons tested the performance of the Supply System monitoring program to other monitoring programs using known radioactive standards. The Supply System REMP performed well in the Environmental Measurements Laboratory (EML) and Environmental Protection Agency Intercomparison Studies conducted during 1994.

During 1994, data collected by the REMP remained consistent with the environmental data collected during the preoperational period and the prior operational years. Based on the data, no significant new trends or changes in the environmental levels around the plant were evident during 1994.

2.0 DEFINITIONS

Airborne Activity Sampling: Continuous sampling of air through the collection of particulates and radionuclides on filter media.

Periodic soil samples are collected for gamma isotopic analysis to provide information on deposition to the soil from airborne releases.

Alpha Particle (α): A charged particle emitted from the nucleus of an atom having a mass and charge equal in magnitude of a helium nucleus.

Becquerel (Bq): One disintegration per second. One picocurie (pCi) equals 0.037 becquerel.

Beta Particle (β): Charged particle emitted from the nucleus of an atom, with a mass and charge equal in magnitude to that of an electron.

Blank Sample: A sample of the same media as the field sample being analyzed but without the radionuclide(s) being measured. It enables correction for the inherent sample background.

Composite Sample: A series of single collected portions (aliquots) analyzed as one sample. The aliquots making up the sample are collected at time intervals that are very short compared to the composite period.

Control Station: A background sampling location, i.e., a location not likely to be affected by plant effluents due to its distance and/or direction from Plant 2.

Counting Error: An estimate of the two-sigma uncertainty associated with the sample results based respective count times.

$$+/- 2\sqrt{\left(\frac{Sample\ CPM}{Count\ Time} + \frac{Bkg\ Cpm}{Count\ Time}\right)}$$

Curie (Ci): 3.7×10^{10} disintegrations per second, or 2.22×10^{12} disintegrations per minute.

Direct Radiation Monitoring: The measurement of radiation dose at various distances from the plant is assessed through the use of thermoluminescent dosimeters and pressurized ionization chambers.

DOH: Washington State Department of Health.

EFSEC: Energy Facility Site Evaluation Council.

FFTF: U.S Department of Energy's Fast Flux Test Facility near Plant 2.

Flow Proportional Sampling: Sample collection volume or frequency determined as a function of the flow rate of the water being sampled.

Grab Sample: A single discrete sample drawn at one point in time.

Indicator Station: A sampling location that could be affected by plant effluents due to its proximity and/or direction from Plant 2.

Ingestion Pathway Monitoring: The ingestion pathway includes milk, soil, fish, garden produce. Also sampled (under special circumstances) are other media such as vegetation and animal products such as eggs and meat when additional information about particular radionuclides is needed.

Lower Limit of Detection (LLD): The smallest concentration of radioactive material in a sample that will yield a net count (above system background) that will be detected with 95% probability with a 5% probability of a false conclusion that a blank observation represents "real" signal.

$$LLD = \frac{4.66Sb}{(2.22 * Vol * Eff * Yield * e^{-\lambda t})}$$

where LLD is the "a priori" or 'before-the-fact' measurement and not "a posteriori" or 'after-the-fact' measurement.

Mean: The average, i.e., the sum of results divided by the number of results.

Microcurie: 3.7×10^{4} disintegrations per second, or 2.22×10^{6} disintegrations per minute.

Milliroentgen (mR): 1/1000 Roentgen; a unit of exposure to X- or gamma radiation.

NIST: National Institute of Standards and Technology.

NRC: U.S. Nuclear Regulatory Commission.

ODCM: Offsite Dose Calculation Manual, which contains the program requirements formerly contained in the Technical Specifications.

Picocurie (pCi): 1×10^{-12} Curie or 2.22 disintegrations per minute; one millionth of a microcurie.

REMP: Radiological Environmental Monitoring Program.

Range: The difference between the smallest and largest results.

Restricted Area: Any area to which access is controlled for purposes of protection of individuals from exposure to radiation and radioactive materials.

Results: The results of sample collection are discussed and interpreted by comparing them to similar measurements made during the preoperational and previous operational periods and to the detection capabilities associated with the current methods of analysis.

Roentgen: Unit of exposure to X- or gamma (γ) radiation in air.

Site Certification Agreement (SCA): The Plant 2 licensing agreement with the State of Washington.

Spike Sample: A sample containing a known concentration of the radionuclide(s) being measured.

Standard Deviation: A measure of the scatter of a set of observations (or samples) around their mean value. Indicated by (σ).

Standard Error of the Mean: An estimate of the uncertainty associated with the mean of observation (or sample) averages.

$$SE = \sqrt{\left(\frac{S^2}{n}\right)}$$

where S^2, the variance is

$$S_m^2 = \frac{1}{(n-1)} \sum^n (X_i - X)^2$$

SWTF: Sanitary Waste Treatment Facility; sanitary waste processing facility for Plant 2 and WNP-1 and WNP-4 sites.

TEDA: Triethylene diamine

TLD: A thermoluminescent dosimeter that contains a phosphor which stores energy from exposure to radiation and emits that energy in the form of light when heated.

3.0 INTRODUCTION

3.1 Site Description

The Washington Public Power Supply System's Nuclear Plant 2 is located in a sparsely populated shrub-steppe region within the Department of Energy's Hanford Site in southeastern Washington. The plant is located approximately three miles west of the Columbia River and is surrounded on all sides by uninhabited desert land. The nearest population centers are Richland, Kennewick and Pasco, which are 12 miles south, 21 miles southeast, and 18 miles southeast, respectively. The nearest privately-owned lands are located approximately four miles ENE of the plant, across the Columbia River. Given the prevailing wind directions, shown in the 1994 wind frequency distribution in Figure 3-1, the focus of REMP sampling is the farming region east of the river.

Because Plant 2 is located on the Hanford Site, other potential sources of radioactive materials are in close proximity to Plant 2. For this reason, sampling locations near the plant (near-plant locations) provide useful information for separating the potential environmental effects of Plant 2 from the effects of the other sources on the Hanford Site.

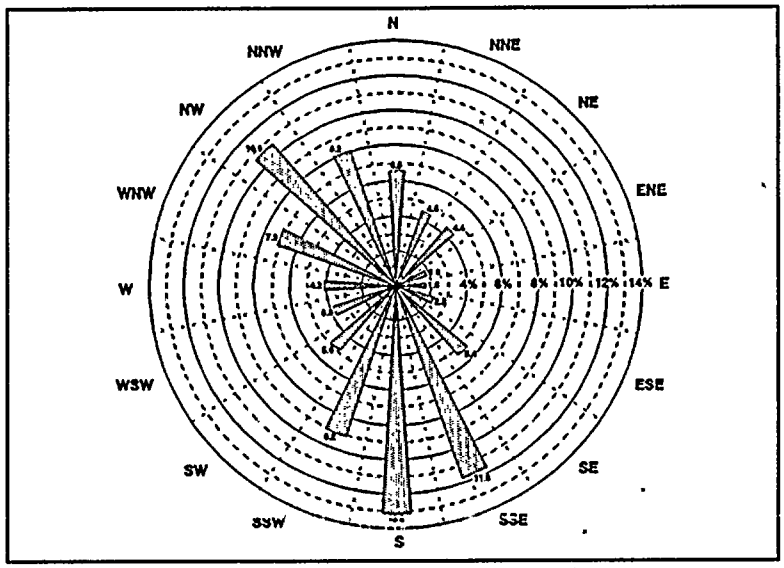

Figure 3-1 Average Wind Direction (percent) During 1994

3.2 Program Background

The REMP is designed to conform to the regulatory guidance of the Nuclear Regulatory Commission (NRC) as provided by Regulatory Guides 4.1[1] and 4.8[2], including the Radiological Assessment Branch Technical Position[3].

The quality assurance aspects of the program and the thermoluminescent dosimetry are conducted in accordance with Regulatory Guides 4.15[4] and 4.13.[5] The REMP also must adhere to the requirements of the Washington Energy Facility Site Evaluation Council[6], the Plant 2 Technical Specifications[7] and the Offsite Dose Calculation Manual (ODCM)[8]. These requirements cover not only the environmental sampling and sample analysis aspects of the program, but also the reporting and quality assurance requirements of the program.

The preoperational phase of the program, which lasted from March 1978 until January 1984, the date of initial criticality, provided a baseline of environmental data. Variability in the background levels of radioactivity due to differences in geologic composition, Chernobyl and nuclear weapons test fallout, meteorological conditions and seasonal changes is reflected in that preoperational data.

REMP environmental samples have always been analyzed by a contract analytical laboratory. Since June 1986, Teledyne Brown Engineering Environmental Services (formerly Teledyne Isotopes, Inc.) in Westwood, New Jersey has performed the analysis of REMP samples. The thermoluminescent dosimeters used in the REMP to assess the direct radiation are processed by the Supply System External Dosimetry Laboratory within the Health Physics Department.

3.3 Program Objectives

The REMP provides a mechanism for determining whether the levels of radioactivity in the plant environs are within established limits and for ensuring that the accumulation of radionuclides in the environment will not become significant as a result of plant operations.

While in-plant monitoring programs are used to ensure that 10CFR20[9] and 10CFR50[10] criteria for releases of radioactive effluents are met, the REMP provides supplemental verification that the concentrations of radionuclides in the environment are not greater than anticipated.

Any radiological effect of Plant 2 on the environment must be distinguished from the normal variation in background radiation levels and from the effects of other sources of radioactive effluents in the area.

The monitoring results obtained during each year of the plant's operation are compared to the preoperational data and to data from previous operating years, to determine whether a significant accumulation of plant-produced radionuclides has occurred in the environment. Quarterly averages of the results are also compared to the NRC non-routine reporting levels listed in the ODCM. In addition to evaluating the environmental concentrations against federal standards or limits, the REMP also compares the results to state standards.[11][12][13] The results are discussed and interpreted by comparing them to similar measurements made during the preoperational and previous operational periods and to the detection capabilities associated with the current methods of analysis. The quality assurance and quality control aspects of the program are also discussed in this report.

4.0 PROGRAM DESCRIPTION

The requirement for the Radiological Environmental Monitoring Program (REMP) is defined by the WNP-2 Offsite Dose Calculation Manual (ODCM). The sampling plan to meet ODCM requirements is presented as Table 4-1 in this report and provides a summary of the sample locations, collection frequency and types of analyses performed. The methods of sampling and sampling frequencies utilized in the program have been determined by such factors as the half-lives and major exposure pathways for the radionuclides potentially released from the plant to the surrounding environment.

4.1 Sample Locations

Eighty sample locations were included in the 1994 monitoring program. Seventy-three indicator and two control, i.e. background, locations were within 10 miles (16 kilometers) of Plant 2. Three additional control stations and two indicator stations were outside the 10-mile radius from the plant. Sample stations are listed in Table 4-2 by meteorological sector, sample media and approximate distance from the plant. The numbers and locations of sample stations are based not only on factors such as population distribution and meteorological conditions, but also on station accessibility, security throughout the year and the requirements of applicable regulations. Other factors, such as the need to monitor locations which potentially could be impacted by Plant 2 operations, influence the location of REMP sampling sites.

The REMP sampling locations listed in Tables 4-1 and 4-2 are shown in Figure 4-1. Figure 4-3 provides a more detailed map of sampling locations in the Sunnyside/Grandview area. Figure 4-4 shows the locations of the storm drain (Station 101), the Sanitary Waste Treatment Facility (Station 102) and the containerized storage area (Station 118), which are special interest stations.

4.2 Land Use Census

The land use census for areas within 5 miles of Plant 2 was performed in August. The objectives of the land use census are to identify the locations of the nearest milk animal, residence, and garden greater than 50 m^2 (500 ft^2) producing broadleaf vegetation and to determine whether any site located during the census has a calculated dose or dose commitment greater than the sites currently monitored for the same exposure pathway. If a new location with a higher dose commitment is found, routine sampling of that dose pathway would be initiated at that new site.

The results of the 1994 land use census within 5 miles of Plant 2 are given in Table 4-3. No significant changes from the 1993 land use census were observed. No milk animals are located within the 5-mile radius. The closest milk locations were at 7.2 miles ESE and 8.3 miles SE.

4.3 Sampling Methods

Environmental samples were collected according to the schedule in Table 4-1. All samples were collected by Supply System personnel. Documented procedures for sample collection and TLD analyses are in the Supply System's Health Physics Instruction (HPI) Manual. The sample analyses procedures are prepared and maintained by the analytical contractor and reviewed by the Supply System prior to implementation.

The following sections describe the sampling and preparation methods.

4.3.1 Direct Radiation

During 1994, thermoluminescent dosimeters (TLDs) were used to determine the direct radiation levels at fifty-six (56) monitoring locations listed in Table 4-1. No new TLD locations were added to the program this year, however, Station 55 which consists of an annual and quarterly TLD and is located near the Department of Energy's 300 Area was moved approximately 0.7 miles to the south to meet the ODCM requirement that the station be between 9,000 and 12,000 meters from the center of containment in that same sector. The control station TLD (background) is located at Station 9A in Sunnyside. The remaining TLDs served as indicator TLDs throughout the year.

Two sets of TLDs placed three feet above ground were employed at each location. One set of TLDs was exchanged on a quarterly basis (Quarterly TLDs) and the other exchanged on an annual basis (Annual TLDs). Exposure received by the field TLDs during transport to the TLD sites was monitored by a set of trip control dosimeters that accompanied the field dosimeters to and from the field locations. Another set of TLDs were used as building controls which were used to determine the exposure of the TLDs at the controlled storage location. The TLD exposure during transport to and from the field was determined by subtracting the difference between the building control results and the trip control results.

The environmental dosimeters were processed on a Teledyne Isotopes Model 9100 Automatic Reader. Following the initial processing, the field dosimeters were annealed and given a calibration exposure of 100 mR of cesium-137 gamma, in order to determine response (i.e, calibration) factors for each dosimeter. The calibration factors were then used to determine the total exposure received by each TLD.

The exposure values determined for calibration exposures, as well as the exposures of the QA dosimeters (processing control dosimeters) and audit dosimeters (spiked dosimeters), were based on the calculated field strength of the encapsulated cesium-137 source. The calculated field strength of the source was determined from National Institute of Standards and Technology (NIST)-traceable ionization chamber measurements made over a period of several years during the routine use and calibration of the source. Ionization chamber measurements made during TLD calibration were used to confirm the calculated exposure. If the calculated exposure and the ionization chamber reading differed by 5% or more, an investigation was performed to resolve the difference.

Three Reuter Stokes pressurized ionization chambers (PICs) provided additional capability for measuring direct radiation exposure. These units are no longer part of the routine monitoring program, but they are used in special monitoring situations and maintained as back-up monitoring systems.

4.3.2 Airborne Particulate/Iodine

Air particulate and air iodine (I-131) samples were obtained through the use of portable, low volume (1.5 cfm) constant flow-rate sampling units at each of twelve locations. The samples drawn at Station 9A (Figure 4-3) were considered control samples; the ones drawn at the other locations (Figure 4-1) were indicator samples. Air particulates were collected by drawing air through a 47mm diameter glass fiber filter. Air iodine was collected by drawing air through a 57mm diameter TEDA impregnated charcoal cartridge. The particulate air filter and charcoal cartridge were placed in tandem, particulate filter first, in a holder that attached to the air inlet of the sampler unit. The sampler units were placed in ventilated metal weatherproof housings mounted on elevated platforms at each air sample location. The filter media are changed weekly and shipped to the analytical contractor for analysis within one or two days of collection.

4.3.3 Water

There were nine sampling locations for water sampling: three for the evaluation of river/drinking water, one for plant discharge water, three for groundwater, one for the storm drain water, and one for sanitary waste water. One river/drinking water location, Station 26, was used for evaluation of the plant intake water, i.e., the river water taken upstream of the plant discharge point. This Station 26 sample can be considered a drinking water sample since the site draws its drinking water from the intake water. It is considered the river/drinking water control sample because of its upstream location. Two additional locations, Stations 28 and 29, were used to evaluate the water at the two nearest drinking water locations, the Department of Energy 300 Area and the Richland Water Treatment Plant. These two stations were considered indicator stations.

The ODCM requirement for a downstream water sample "near but beyond the mixing zone" was met by sampling water from Station 27, the plant discharge line to the Columbia River. This sample reflects the radioactivity present in the plant discharge prior to any river dilution, rather than the concentrations that would be found after dilution in the mixing zone. Water is drawn at this location because it was not feasible to perform flow-proportional composite sampling in the mixing zone area of the river downstream from the plant discharge point. The Station 27 sample is also considered an indicator sample.

Composite samplers are installed at the Columbia River pumphouse to monitor the cooling tower discharge line (Station 27). There are composite samplers at two drinking water locations (Stations 28 and 29), and the control location (Station 26). Samples collected are 25-ml aliquots of water at regular intervals of time or flow.

Non-routine analyses on the drinking water samples include strontium-90 and iodine-131 analysis. Strontium-90 analysis is required when the gross beta activity exceeds either 8 pCi/liter or ten times the mean of the previous three months' activity for a specific location. Iodine-131 analysis is required when the dose calculated for the consumption of water exceeds one millirem per year. Neither of these analyses were required during 1994.

Only three wells within the vicinity of Plant 2 are capable of supplying water. These are a deep well on the Plant 2 site (0.1 mile north of the Reactor Building) and two wells on the WNP-1 site (1.2 miles downgradient from Plant 2). Water from the Plant 2 well can be used as a backup source for drinking and fire protection. Water from the WNP-1 wells supplies the drinking and fire protection water for the WNP-1 site. Although none of these wells draw from the unconfined aquifer, they are considered indicator samples. Quarterly grab samples were taken from each of these wells. One gallon (3785 ml) was collected from each well for gamma analysis and 250 ml was drawn for tritium analysis.

Water samples were also collected from the storm drain (Station 101) for Plant 2, and at the Sanitary Waste Treatment Facility (SWTF; Station 102). In January 1994, a flume was installed at the storm drain outfall allowing flow-proportional composite sampling to be done using the automatic sampler in place there. The SWTF samples are grab samples collected monthly, quarterly and before discharge.

4.3.4 Soil

As required by the Site Certification Agreement, annual soil samples were taken at Stations 1, 7, 21 and 23. One sample was taken at the control location, Station 9A (Figure 4-3). Quarterly soil samples were collected at two special interest locations, Station 101 and Station 118, as shown in Figures 4-4.

Each sample was collected from an area of approximately one square foot to a depth of approximately one inch. Approximately two kilograms of soil were collected in each sample. Soil samples were shipped to the analytical contractor after collection and analyzed for gamma activity.

If the gamma isotopic analysis indicates that cesium levels in any of the indicator samples exceeds ten (10) times the level in the control sample, a strontium analysis is performed on the sample(s). No strontium analysis was required during 1994.

4.3.5 Sediment

Sediment samples were collected twice during 1994 from two sampling locations along the Columbia River. The upstream sediment sample (Station 33) was collected from a location approximately two miles upriver from the plant discharge. The downstream sample (Station 34) was collected approximately one mile downstream of the plant discharge. Each sample consisted of approximately two kilograms of the shallow surface sediment scooped from below the waterline. The samples were shipped to the analytical contractor.

Sediment samples were also taken from the storm drain (Station 101) outfall and pond and the SWTF (Station 102) north stabilization pond. Sediment sampling in these locations was performed in a manner similar to river sediment sampling. Special care was taken to prevent loss of the fine particulates in the sediment. In addition, formalin was added to the sanitary pond sediment prior to shipping, to inhibit gas formation within the sample container.

4.3.6 Fish

Fish sampling was performed in late September when the likelihood of obtaining anadromous species was high. Fish samples collected from the Columbia River (Station 30 in Figure 4-1) were indicator samples, whereas the fish collected on the Snake River (Stations 38 and 38A in Figure 4-2) were control samples.

Four separate fish samples, consisting of an anadromous species and three other species generally considered edible or potentially edible (such as carp, catfish and whitefish) were collected at each location. Most of the fish were collected using electro-shocking, but samples of the anadromous species were also collected from the Ringold hatchery on the Columbia River and at the Lyons Ferry Fish Hatchery on the Snake River. The fish were filleted to obtain one kilogram of edible flesh per sample. The fillets were placed in clean plastic bags and frozen until shipment to the analytical contractor. The Site Certification Agreement was changed to require only annual fish sampling, unless elevated radiation levels related to plant operations are observed in which case semi-annual sampling would resume.

4.3.7 Milk

Milk samples were collected monthly during January, February, March, October, November and December and semi-monthly during the remaining six months when the cows were likely to be grazing. One gallon of raw milk was collected from each sampling location. The milk samples were chilled thoroughly and shipped to the analytical contractor within a day of collection.

Routine samples were collected from three indicator locations (Stations 36, 62 and 64) across the Columbia River in Franklin County. Milk samples for Station 62 were only taken until March at which time milk production ceased at this farm.

Milk samples were also collected at one indicator station (Station 9B) and one control location (Station 96) in the Sunnyside/Grandview area (in Figure 4-3). Station 9B in Sunnyside continued to serve as an indicator station in 1994 because a portion of the feed for the cows at that location is hay from Franklin County north of Pasco. That factor makes it unsuitable for use as a control location.

4.3.8 Garden Produce

Samples of local garden produce were collected monthly from April to September when the produce was readily available. When possible, three types of produce samples, a root crop, fruit and a leafy vegetable, were collected at each location.

The indicator samples were collected from a region in a predominant downwind direction (Station 37 in Figure 4-2) where crops are irrigated with Columbia River water. The control samples were obtained from produce stands in the Sunnyside area (Station 9C in Figure 4-3), the direction least likely to be affected by plant effluents. Apples were collected in September from Station 91, the Rio Vista Farms orchard, which is irrigated with Columbia River water.

4.3.9 Vegetation

The annual sample of vegetation growing in the storm drain pond was collected in June. Cattails and grasses were the principal types of vegetation collected. Approximately two kilograms of sample were collected each time. Care was taken to avoid including the roots or soil from around the roots in the samples.

4.4 Analytical Procedures

The analytical procedures used for the 1994 REMP samples are described below. Teledyne Brown Engineering Environmental Services performed all routine analyses of REMP samples during 1994.

4.4.1 Gross Beta Activity on Particulate Filters

The particulate filters were counted in a gas flow-proportional counter after a delay of five or more days to allow for the radon-222 and radon-220 (thoron) daughter products to decay. An unused air particulate filter was counted as the blank with each weekly set of filters.

4.4.2 Measurement of Gamma Emitters

A shielded Ge(Li) detector system was coupled to a computer-based data acquisition system which performed pulse height and gamma energy analysis. The information collected about each peak was compared to a library of known peaks. Isotopic identification was performed as was the radioactivity calculation which used the appropriate fractional gamma ray abundance, half-life, detector efficiency, and net counts in the peak region.

Milk and Water

A 1-liter Marinelli beaker was filled with a representative aliquot of the sample. The sample was then counted for at least 1000 minutes (16.7 hours).

Foodstuff

As much of the edible portion of the sample as possible was loaded into a tared Marinelli beaker and weighed. The sample was then counted for at least 1000 minutes (16.7 hours).

Vegetation

As much sample as possible is placed in a 1-liter Marinelli beaker and counted for approximately 1000 minutes (16.7 hours). The sample is not dried prior to counting, so the results are given in terms of wet weight.

Soils and Sediments

A large quantity of the sample was dried at a temperature below 100°C. As much sample as possible was loaded into a tared 1-liter Marinelli beaker and weighed. The sample was then counted for at least 360 minutes (6 hours).

Charcoal Cartridges (Air Iodine)

Charcoal filters were counted up to five at a time, with one positioned on the face and up to four on the side of the calibrated Ge(Li) detector. The detection limit for a charcoal cartridge was uniquely determined for each filter and by using its position. In the event that iodine-131 would have been observed in the initial counting of a set, each charcoal cartridge in the set was then positioned separately on the face of the detector and counted.

Air Particulate Filters

Four air particulate filters for a quarterly composite from each field station were aligned one in front of another and counted for at least 360 minutes (6 hours).

4.4.3 Gross Beta Activity in Water

A one-liter aliquot of each sample was evaporated to a small volume and transferred to a stainless steel planchet. The sample was dried under heat lamps, cooled, then counted on an automatic beta proportional counter. The results were calculated using empirical self-absorption curves which enabled the correction of effective counting efficiency based on the sample residue mass.

4.4.4 Iodine-131 in Water

Two liters of sample were first equilibrated with a stable iodide carrier. A batch treatment with anion exchange resin was used to remove iodine from the sample. The iodine was then stripped from the resin with sodium hypochlorite solution, reduced with hydroxylamine hydrochloride, and extracted into carbon tetrachloride as free iodine. It was then back-extracted as iodide into sodium bisulfite solution and precipitated as palladium iodide. The precipitate was weighed for chemical yield and mounted on a nylon planchet for low-level beta counting. The chemical yield was corrected by measuring the stable iodide content of the water with a specific ion electrode. During 1994, this procedure was used only on intercomparison samples, since the doses calculated via ODCM methodology for the consumption of drinking water did not exceed one millirem per year.

4.4.5 Tritium in Water

The analysis of tritium in water is performed utilizing liquid scintillation. Liquid scintillation requires 10 milliliters of water mixed with 10 milliliters of liquid scintillation "cocktail." The mixture is then counted in an automatic liquid scintillation detector.

4.4.6 Strontium-89 and 90 in Water, Milk and Soil

During 1994, strontium analyses were not required for any routine REMP water, milk or soil samples. It was used for intercomparison water and sediment analyses. The techniques used to analyze for strontium in the various media are described below.

Water

Stable strontium carrier was added to one liter of sample and the volume is reduced by evaporation. Strontium is precipitated as $Sr(NO_3)_2$ using fuming (90%) nitric acid.

Milk

Stable strontium carrier is added to one liter of sample. The sample is then evaporated and ashed in a muffle furnace. The ash is dissolved and strontium precipitated as a phosphate. The sample is then redissolved and strontium precipitated as $Sr(NO_3)_2$ using fuming (90%) nitric acid.

Soil and Sediment

The sample is first dried under heat lamps and a 10-gram aliquot is taken. Stable strontium carrier is added and the sample is leached in hydrochloric acid. After the mixture is filtered, phosphates are then precipitated, collected by filtration, and dissolved in nitric acid. Strontium is precipitated as $Sr(NO_3)_2$ using fuming (90%) nitric acid. A barium chromate scavenge and an iron (ferric hydroxide) scavenge are then performed. Stable yttrium carrier is added and the sample is allowed to stand for five days or more for yttrium ingrowth. Yttrium is then precipitated as hydroxide, dissolved and reprecipitated as oxalate. The yttrium oxalate is mounted on a nylon planchet and counted in a low-level beta counter to infer strontium-90 activity. Strontium-89 activity is determined by precipitating $SrCO_3$ from the sample after yttrium separation. This precipitate is mounted on a nylon planchet and covered with an 80 mg/cm^2 aluminum absorber for low-level beta counting.

4.4.7 Iodine-131 in Milk

Two liters of sample are first equilibrated with stable iodide carrier. A batch treatment with anion exchange resin is used to remove iodine from the sample. The iodine is then stripped from the resin with sodium hypochlorite solution, reduced with hydroxylamine hydrochloride, and extracted into carbon tetrachloride as free iodine. It was then back-extracted as iodide into sodium bisulfite solution and precipitated as palladium iodide. The precipitate was weighed for chemical yield and mounted on a nylon planchet for low-level beta counting. The chemical yield iss corrected by measuring the stable iodide content of the milk with a specific ion electrode.

4.5 Data Analysis Methods

Since mid-1984, the results of the REMP analyses have been presented as net results calculated from the gross or total counts determined for each radionuclide minus the background counts of the counting or detection instrument. Consequently, for several sample types, the results range from negative to positive numbers. This manner of presenting environmental data prevents the bias and loss of individual results inherent in the use of "less than" (<) values, where the "less than" numbers can have a variety of meanings, such as "less than the lower limit of detection (LLD)." The net results for REMP samples are presented with an asterisk (*) in front, if the results are less than the LLD. A listing of the LLDs determined for each analysis is provided in Table 4-4 as a reference when reviewing the sample results.

Plots of the sample results versus time are used to represent the results for analyses such as gross beta on air particulate filters, where the results are normally above the lower limits of detection. In such cases, the indicator station results are plotted with the control station results for easy comparison. Other data analysis techniques, such as frequency distributions, are also used to represent the data and to determine whether trends that could be attributed to Plant 2 operations are evident. Thermoluminescent dosimeter (TLD) data is presented in terms of the net mR/day exposure rate. These results are determined from the total exposure (in mR) calculated for each TLD from its total thermoluminescent output minus the TLD background, minus any transit (or trip) exposure received during distribution and retrieval, and divided by the number of days the TLD was in the field. Circular plots, frequency distributions and graphs of TLD data by meteorological sector and distance from the plant are used to interpret trends in the results.

TLD data summaries include the term "standard error" along with "standard deviation." The standard error, which is the estimate of the precision of the mean, is used for the means of quarterly and annual data. The standard deviation is used for the TLD data involving a single dosimeter result that has been determined from the four reader areas of the TLD. Both terms provide an indicator of the uncertainty associated with the results.

TABLE 4-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM PLAN

	SAMPLE TYPE[a]	SAMPLE STATION [b] NUMBER	SAMPLING AND COLLECTION FREQUENCY[c]	TYPE AND FREQUENCY OF ANALYSIS
1.	**AIRBORNE**			
	Particulates and radioiodine (6/12)[d]	1, 4-9A, 21, 23, 40, 48, and 57	Continuous sampling; weekly collection	Particulate: Weekly gross beta[e]; gamma isotopic[f] of quarterly composite (by location)
				Iodine: Weekly gamma analysis.
	Soil[g](0/7)	9A, 1,7,21 and 23, 101, 118	Annually Quarterly or more often as needed.	Gamma isotopic[f]; strontium-90[h] Gamma isotopic
2.	**DIRECT RADIATION**			
	TLD[i](34/57)	1-9A, 10-25, 40-47, 49-51, 53-56, 71-86 (1S-16S)[j]	Quarterly, annually	Thermoluminescent output; quarterly and annual processing.
	PIC	Various locations, as needed [k]	Continuous recording, as needed	Exposure rate accumulated on mag card and in internal memory
3.	**WATERBORNE**			
	River/Drinking Water[l] (3/4)	26, 27, 28 and 29	Composite aliquots[m]; monthly collection	Gamma isotopic[f], gross beta, quarterly; tritium composite; strontium-90[n]; I-131[o]
	Storm Drain Water (1/1)	101	Composite aliquots[m], weekly collection; grab samples	Gamma isotopic[f], tritium, gross beta
	Sanitary Waste Treatment Facility Water (1/1)	102	Monthly, annually, pre-discharge and as needed.	Gamma isotopic[f], gross beta, gross alpha, strontium-90[n], tritium
	Ground Water (2/3)[p]	31, 32, and 52	Quarterly	Gamma isotopic[f]; tritium
	River Sediment (1/2)[q]	33 and 34	Semiannually	Gamma isotopic[f]
	Sanitary Waste Treatment Facility Sediment (1/1)	102	Monthly or more often as needed	Gamma Isotopic[f]

TABLE 4-1 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM PLAN

	SAMPLE TYPE[a]	SAMPLE STATION [b] NUMBER	SAMPLING AND COLLECTION FREQUENCY[c]	TYPE AND FREQUENCY OF ANALYSIS
4.	INGESTION			
	Milk[e] (4/4)	9B, 36, 62[g], 64 and 96[g]	Semi-monthly during grazing season, monthly at other times	Gamma isotopic[f]; iodine-131; strontium-90[g]
	Fish[a] (2/2)	30, 38 and 39	Annually [v]	Gamma isotopic[f]
	Garden Produce[w](1/3)	9C, 91[g] and 37	Monthly during growing season in the Riverview area of Pasco and a control near Grandview; annual collection at Station 91.	Gamma isotopic[f]
	Vegetation	101	annually	Gamma isotopic[f]

(a) The fraction in parentheses for each sample type indicates the ratio of ODCM-required sample locations to the total number of sample locations currently being monitored in the surveillance program. The SCA also requires certain numbers of sampling stations for each type of media.

(b) The underlined sample location designates a control station.

(c) Deviations are permitted if samples are unobtainable due to hazardous conditions, seasonal availability, malfunction of automatic sampling equipment, or other legitimate reasons. Such deviations are documented in Section 5

(d) The SCA requires nine or more air sampling stations.

(e) Particulate sample filters will be analyzed for gross beta after at least 24 to 48 hours to allow for the decay of radon daughter products. If gross beta activity is greater than 10 times the mean of the result for the control, Station 9A, gamma isotopic analysis shall be performed on the individual sample.

(f) Gamma isotopic means identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents of Plant 2.

(g) Soil samples are collected to satisfy the requirements of the Site Certification Agreement (SCA)[6] for Plant 2. The SCA requires that soil samples be collected at five air sampling locations.

(h) Strontium-90 analysis shall be performed on any indicator soil sample having cesium results greater than ten times the results for the control location.

(i) TLD refers to thermoluminescent dosimeter. For purposes of the REMP, a TLD is a phosphor card (31.75mm x 44.75mm x 0.4mm) with eight individual read-out areas (four main dosimeter areas and four back-up dosimeter areas) in each badge case. TLDs used in the REMP meet the requirements of Reg Guide 4.13[5] and ANSI N545-1975, except for specified energy-dependence response. Correlation factors are available for energy ranges with response outside of specified tolerances.

(j) TLD Stations 71-86 are special interest stations and are not included among the 34 routine TLD stations required by the ODCM Table 6.3.1.1-1 (3.12-1). Their alternate designations are 1S-16S. The SCA requires that 25 or more TLD stations are located within a 10-mile radius of the plant.

(k) Pressurized ion chambers (PICs) are not required as part of the routine monitoring program, but they are required by the SCA to be maintained as a supplemental or backup system. PICs were used routinely at various locations during 1994 to provide supplemental information.

(l) The term "river/drinking water", instead of "surface/drinking water", is used throughout this report because the surface water is taken from the Columbia River. Station 26, Plant 2 makeup water intake from the Columbia River is both an upstream surface, or river, water sample and the drinking water control sample location. Station 28 (300 Area) and Station 29 samples are drinking water samples. The Station 27 sample, which is drawn from the plant discharge line, is taken in place of a "downstream" water sample near but beyond the mixing zone. It reflects the radioactivity present in the plant discharge prior to any river dilution. The SCA requires two drinking water locations downstream from the plant discharge and requires sampling from the plant intake and discharge water. Station 101, the storm drain pond, and Station 102, the Sanitary Waste Treatment Facility, are represented individually because they are unique sampling locations requiring special attention.

(m) Composite (integrated grab) samples are collected with equipment which collects an aliquot at time intervals that are short relative to the compositing period.

(n) When the gross beta activity in drinking water exceeds 8 pCi/liter, a strontium-90 analysis is performed.

(o) When the dose calculated via ODCM methodology for consumption of water exceeds 1 mrem per year, iodine-131 analyses are performed on the drinking water samples.

(p) The SCA requires sampling from wells used for fire protection and as backup drinking water sources.

(q) The SCA requires sediment sample collection upstream and downstream of the plant discharge.

(r) Milk samples will be obtained from farms or individual milk animals which are located in the most prevalent wind directions from Plant 2. Routine milk samples are collected in areas of high dose potential instead of within 5 kilometers, due to the locations of milk animals. The SCA requires at least three milk locations within the 10-mile radius of the plant and one in a control location.

(s) Station 96 is the control station for milk samples because it was determined that the cows at Station 9B in Sunnyside were given feed grown in the Franklin County area across the Columbia River from Plant 2. Station 62 was removed as a milk location in March 1994.

TABLE 4-1 (Cont.)

(t) If cesium-134 or cesium-137 is measured in an individual milk sample in excess of 30 pCi/1, then the strontium-90 analysis will be performed..

(u) There are no commercially important species in the Hanford Reach of the Columbia River. Most recreationally important species in the area are anadromous (primarily salmonids), which ascend rivers from the sea for breeding. Four fish species will normally be collected by the electroshock technique in the vicinity of the plant discharge (Station 30) and from the Snake River (Station 38). If electroshocking produces insufficient anadromous fish samples from the Snake River, samples may be obtained from the fish trap at Ice Harbor Dam, Lyons Ferry Fish Hatchery, or other similar facility (Station 38A). If insufficient anadromous fish samples are produced through electroshocking on the Columbia River, samples may be obtained at the Ringold Fish Hatchery (Station 39).

(v) If an impact is indicated, sampling will be conducted semiannually.

(w) Garden produce will routinely be obtained from farms or gardens using Columbia River water for irrigation. One sample of a root crop, leafy vegetable, and a fruit is collected each sample period, if available. The variety of the produce obtained will be dependent on seasonal availability.

(x) Station 91 is an apple orchard irrigated with Columbia River water. The apple crop from Station 91 is sampled annually.

TABLE 4-2

REMP SAMPLE LOCATIONS BY SECTOR

SECTOR[a]		STATION[b] NUMBER	ESTIMATED DISTANCE[c] MILES	METERS	SAMPLE TYPE[d]
N	(1)	52	0.1	161	GW
		71(1S)	0.3	483	TLD
		47	0.5	805	TLD
		57	0.8	1201	AP/AI
		18	1.1	1770	TLD
		53	7.5	12068	TLD
NNE	(2)	72(2S)[e]	0.4	644	TLD
		2	1.8	2896	TLD
		54	6.5	10459	TLD
NE	(3)	73(3S)	0.5	805	TLD
		19	1.8	2896	TLD
		48	4.5	7241	AP/AI
		39	4.4	7084	FI
		46	5.0	8045	TLD
ENE	(4)	101	0.3	483	SDW/SE/SO/VE
		74(4s)	0.4	644	TLD
		21	1.5	2414	AP/AI/SO/TLD
		20	1.9	3057	TLD
		11	3.1	4988	TLD
		33	3.6	5792	SE
		45	4.3	6919	TLD
		44	5.8	9332	TLD
E	(5)	75(5S)	0.4	644	TLD
		22	2.1	3379	TLD
		10	3.1	4988	TLD
		26	3.2	5149	PW
		27	3.2	5149	DW
		30	3.3	5311	FI
		43	5.8	9332	TLD
ESE	(6)	76(6S)	0.4	644	TLD
		31	1.1	1770	GW
		32	1.2	1931	GW
		51	2.1	3379	TLD
		23	3.0	4827	AP/AI/TLD
		34	3.5	5632	SE
		91	4.4	7079	FR
		8	4.5	7241	AP/AI/TLD
		42	5.6	9010	TLD
		36[e]	7.2	11585	MI
		5	7.7	12389	AP/AI/TLD
		64	9.7	15610	MI
		38	26.5	42639	FI

TABLE 4-2 (Cont.)

REMP SAMPLE LOCATIONS BY SECTOR

SECTOR[a]		STATION[b] NUMBER	ESTIMATED DISTANCE[c] MILES	METERS	SAMPLE TYPE[d]
SE	(7)	102	0.3	483	SSW/SE
		77(7S)	0.5	805	TLD
		24	1.9	3057	TLD
		3	2.0	3218	TLD
		41	5.8	9332	TLD
		40	6.4	10298	AP/AI/TLD
		62	10.9	16730	MI
SSE	(8)	78(8S)	0.7	1126	TLD
		25	1.6	2574	TLD
		55[e]	5.5/6.2	8850/9976	TLD
		28	7.4	11907	PW
		4	9.3	14964	AI/AP/TLD
		29	11.0	17699	PW
		37[f]	16.0	25744	GP
S	(9)	118	0.3	483	SO
		79(9S)	0.7	1126	TLD
		1	1.3	2092	AP/AI/SO/TLD
		6	7.7	12389	AP/AI/TLD
SSW	(10)	80(10S)	0.8	1287	TLD
		50	1.2	1931	TLD
		56	7.0	11263	TLD
SW	(11)	81(11S)	0.7	1126	TLD
		13	1.4	2253	TLD
		96	36.0	49250	MI
WSW	(12)	82(12S)	0.5	805	TLD
		14	1.4	2253	TLD
		9A, 9B, 9C[f]	30.0	48270	AP/AI/MI/GP/TLD/SO
W	(13)	83(13S)	0.5	805	TLD
		15	1.4	2253	TLD
WNW	(14)	84(14S)	0.5	805	TLD
		16	1.4	2253	TLD
		7	2.7	4344	AP/AI/SO/TLD
NW	(15)	85(15S)	0.5	805	TLD
		49	1.2	1931	TLD
NNW	(16)	86(16S)	0.4	644	TLD
		17	1.2	1931	TLD
		12	3.1	9815	TLD

TABLE 4-2 (Cont.)

(a) The area in the vicinity of Plant 2 is separated into 16 separate sectors for reporting purposes. The 16 sectors cover 360 degrees in equal 22.5 degree sections, beginning with Sector 1 (N) at 348.75 to 11.25 degrees and continuing clockwise through Sector 16 (NNW).

(b) The alternate designations for TLD Stations 71-86 are given in parentheses, i.e., 1S-16S.

(c) Distances are estimated from map positions for each location as a radial distance from Plant 2 containment.

(d) Sample Type Key:

AI	- Air Iodine	AP	- Air Particulate
DW	- Discharge Water	FI	- Fish
FR	- Fruit	GP	- Garden Produce
GW	- Ground Water	MI	- Milk
PW	- Surface (River)/Drinking Water	SDW	- Storm Drain Water
SE	- Sediment	SO	- Soil
SWW	- Sanitary Waste Water	TLD	- Thermoluminescent Dosimeter
VE	- Vegetation		

Station 9 designates the Sunnyside-Grandview control area. It is actually three separate stations (Stations 9A for TLD, AI/AP and SO, 9B for milk, and 9C for GP) within a few miles of each other and all within 30-35 miles of Plant 2. Station 96, which is the control station for milk, is also located within the control area. It is 36 miles from Plant 2. Station 9B, which was the control location for milk until 1986, is now an indicator milk location.

(e) TLD station 55 was moved from its former location to its present location to meet the ODCM requirement that the station to be between 9,000 meters and 12,000 meters from center of containment.

(f) Duplicate samples, i.e., samples drawn at the same time as the routine samples and submitted for analysis as a quality assurance check, are collected at this location. The station designation for the duplicate of Station 27 is Station 72 for second and fourth quarters and 92 for first and third quarters . The station designation for the duplicate of Station 36 is Station 37.

TABLE 4-3

1994 FIVE MILE LAND USE CENSUS RESULTS

SECTOR[a]	NEAREST RESIDENT[b]	GARDEN (>50M^2)	DAIRY[c] ANIMALS	LIVESTOCK
NE	4.3	none	none	4.8
ENE	4.1	4.1[d]	none	none
E	4.5	none	none	none
ESE	4.1	none	none	none
SE	none	none	none	none

(a) Eleven of the sixteen meteorological sectors within the five-mile radius of Plant 2 are on the federally-owned Hanford Site; the remaining land is comprised of 4.5 sq. miles of privately-owned farm land. Only those sectors containing points of interest are presented here.

(b) In miles. These are estimated distances.

(c) The closest dairy animal locations are at 8.3 and 10.9 miles SE and 7.2 and 9.7 miles ESE. The dairy at 8.3 miles SE is not used for milk sample collection due to the owner's reluctance to participate in the sampling program.

(d) Small garden with broadleaf; samples were not available due to the small amounts grown.

TABLE 4-4

COMPARISON OF TELEDYNE NOMINAL LOWER LIMITS OF DETECTION WITH BRANCH TECHNICAL POSITION[3] REQUIREMENTS

MEDIA (UNITS)	ANALYSIS	TELEDYNE LLDs	BTP REQUIRED LLDs
Air	Gross Beta	0.003	0.01
(pCi/m^3)	Gamma Spectrometry		
	Cs-134	0.001	0.05
	Cs-137	0.001	0.06
	I-131	0.01	0.07
Water:	Gross Beta	4	4
(pCi/l)	Tritium	100-200	2000
	I-131	1	1
	Sr-90	1	---
	Gamma Spectrometry		
	Mn-54	10	15
	Fe-59	20	30
	Co-58	10	15
	Co-60	10	15
	Zn-65	20	30
	Zr-95	20	30
	Nb-95	10	15
	Cs-134	10	15
	Cs-137	10	18
	Ba-140	20	60
	La-140	10	15
Soil/Sediment:	Gamma Spectrometry		
(pCi/kg dry)	Co-57	120	---
	Co-60	30	---
	Zn-65	100	---
	Cs-134	30	150
	Cs-137	40	180
	Sr-90	10	---
Fish:	Gamma Spectrometry		
(pCi/kg wet)	Mn-54	20	130
	Fe-59	30	260
	Co-58	20	130
	Co-60	20	130
	Zn-65	30	260
	Cs-134	20	130
	Cs-137	20	150
Milk:	I-131	0.5	1
(pCi/l)	Gamma Spectrometry		
	Cs-134	10	15
	Cs-137	10	18
	Ba-140	20	60
	La-140	10	15
	Sr-90	1	---
Garden Produce:	Gamma Spectrometry		
(pCi/kg wet)	Cs-134	20	60
	Cs-137	20	80
	I-131	30	60

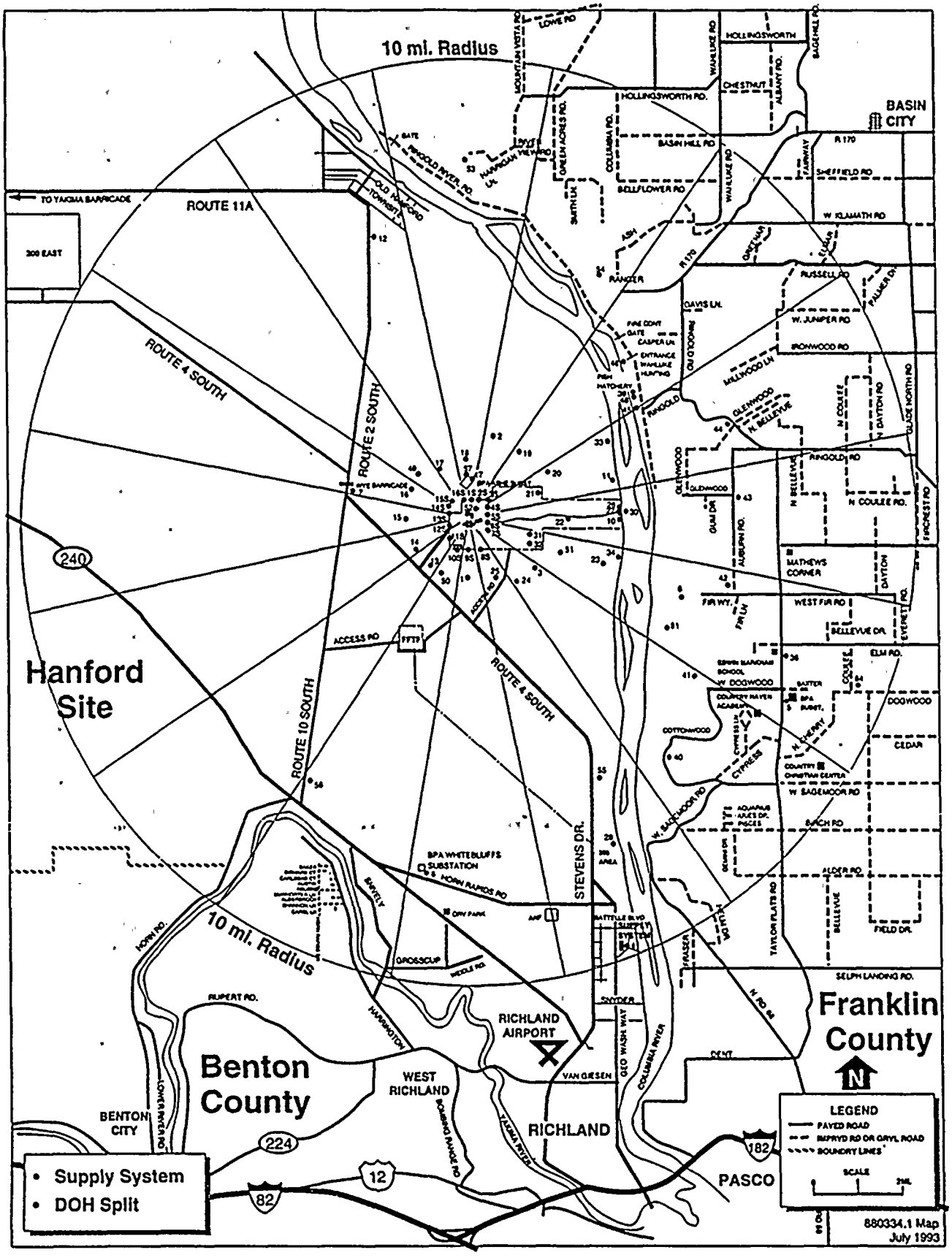

FIGURE 4-1 REMP SAMPLING LOCATIONS WITHIN THE 10-MILE RADIUS

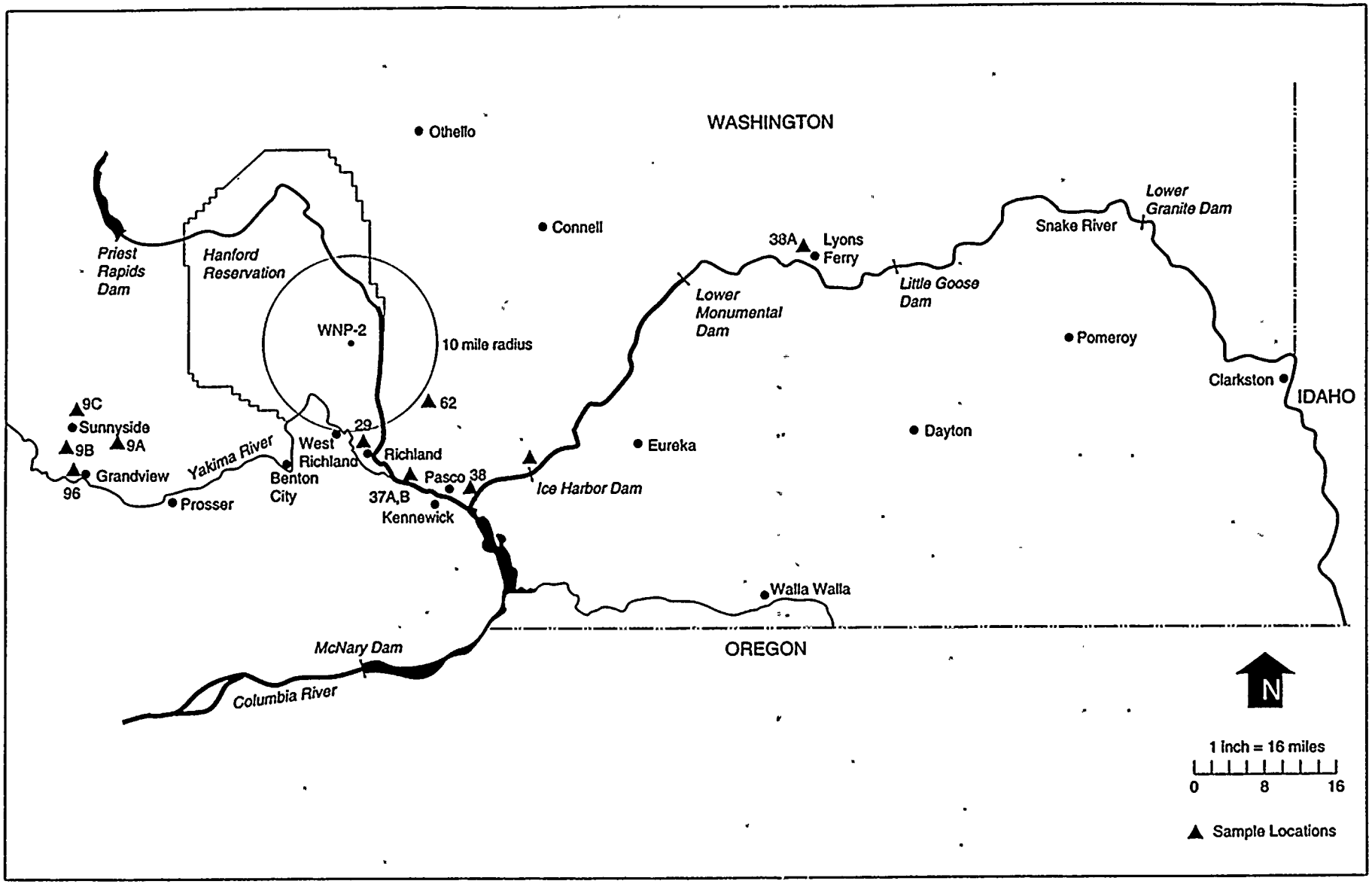

FIGURE 4-2 REMP SAMPLING LOCATIONS OUTSIDE THE 10-MILE RADIUS

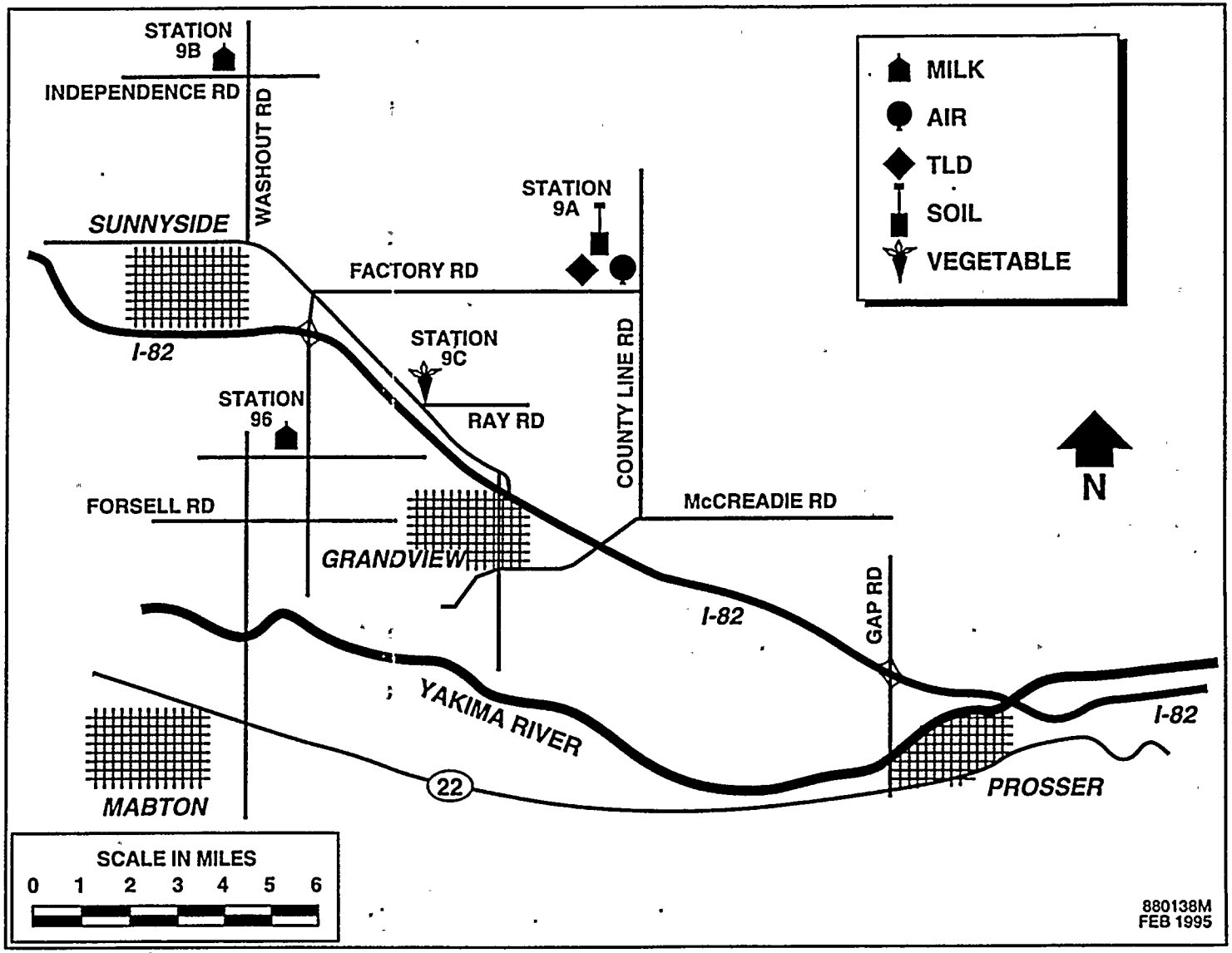

FIGURE 4-3 REMP SAMPLING LOCATIONS SUNNYSIDE/GRANDVIEW AREA

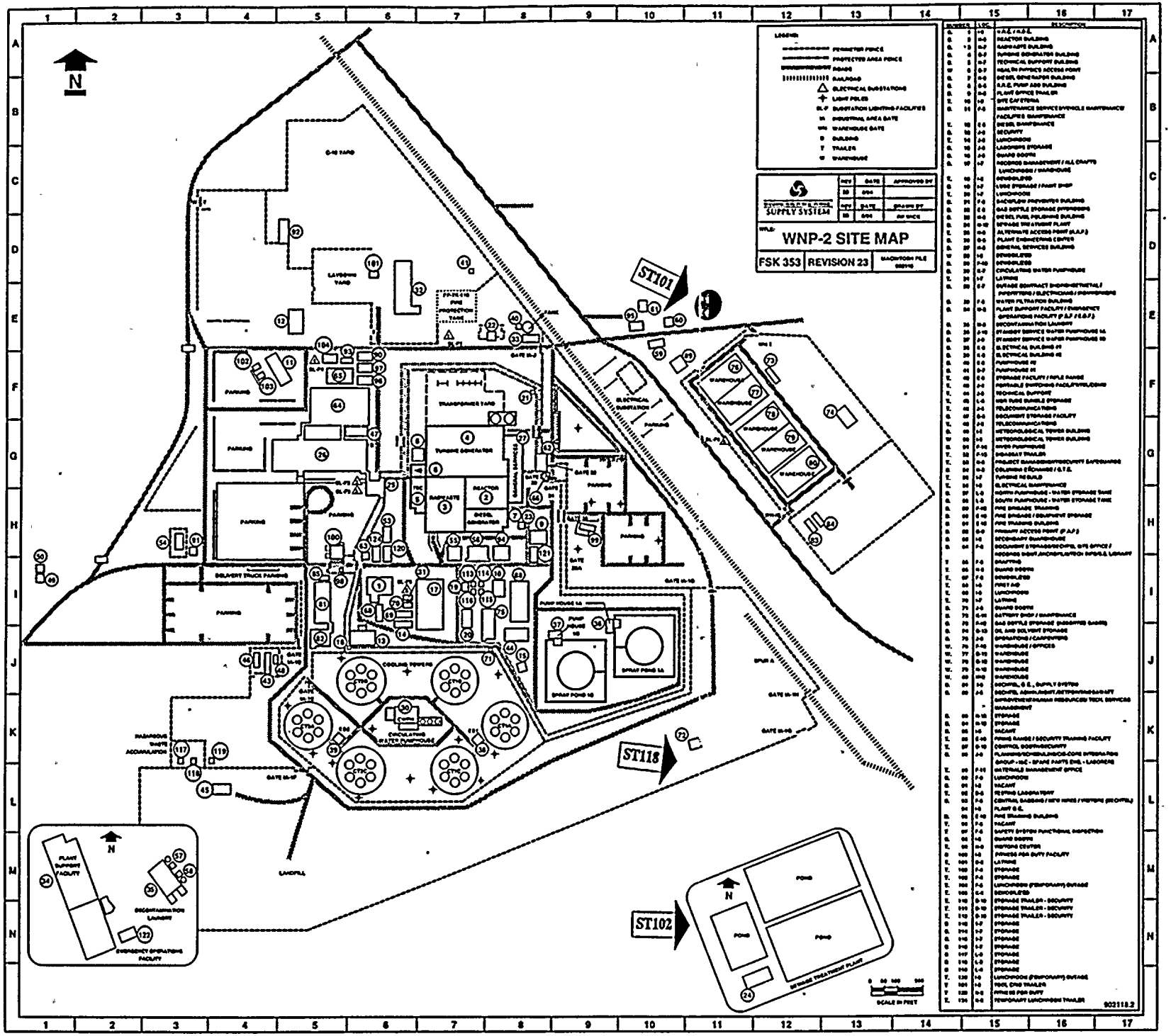

FIGURE 4-4 REMP NEAR PLANT SAMPLING LOCATIONS

5.0 RESULTS AND DISCUSSION

During 1994, the analyses of REMP samples were performed by Teledyne Brown Engineering Environmental Services in Westwood, New Jersey. The thermoluminescent dosimeters were processed by the Supply System External Dosimetry Laboratory. Table 5-1 presents the means and ranges of selected 1994 results for each type of sample collected and Table 5-3 provides a summary of detectable results. The means and ranges of the preoperational and the previous operational data from 1984 to 1993 are also included in the table for comparison. The data tables of 1994 results comprise a separate volume that is available to interested parties.

The data for the preoperational period and the first six months of 1984 included "less than" (<) designations for results below the actual LLD, the contractual LLD, or the two-sigma error, depending upon the convention employed by the analytical contractor. Consequently, the data averages using "less than" values are biased high. The use of the "less than" values was discontinued in mid-1984. Since then, REMP data have been reported as net (total results minus the detector counting background).

Since the primary focus of the REMP is to determine whether Plant 2 operations had an impact on the environment, the 1994 results are compared in this report to the results during the preoperational period and the results obtained during the previous years of Plant 2 operation. They are also compared to state and federal regulatory limits. Because of the use of "less than" values, rather than net results, during the preoperational period and during the first year of operation, and because of the impact of the 1986 Chernobyl accident on environmental radiation levels, the interpretation of the 1994 measurements relative to previous measurements must bear this in mind. Some of the parameters considered in the evaluations discussed in this report are the means, ranges and standard deviations or standard errors of the results. Comparative plots and frequency distributions of the data are some of the tools that have been employed in the interpretation of the 1994 REMP data.

The 1994 analytical results for the REMP sampling locations established since the preoperational period are very similar to the results reported for previous years. The 1994 annual and quarterly TLD results were also very much like those observed previously. No significant trends indicating an environmental impact or unexpected change in the environmental concentrations or exposure rates at REMP monitoring stations were observed.

5.1 Direct Radiation

Summaries of the environmental radiation exposure rates, determined by thermoluminescent dosimeters (TLDs) are presented in Tables 5-4 and 5-5, and 5-6.

Figure 5-1 presents a circular plot of the mean 1994 quarterly TLD results for each of the sixteen meteorological sectors at the site boundary ("S" stations). The chart also includes preoperational and previous operational periods.

The relationship of the mean 1994 results to the results for the preoperational and previous operational periods is very similar for each sector. This indicates that there were no significant directional effects observed in the 1994 TLD results.

The increase in the mean 1994 TLD results over the means of the preoperational and previous operational periods is due to the effect of averaging only the four quarters of 1994 data, versus averaging numerous quarters for the other two sets of results.

The shift to the north is a result of those sector TLDs being physically closer to the plant than the rest of the near-plant TLDs. Compare the data presented in Figure 5-1 with that of Figure 5-2, where the TLDs are more evenly placed from the plant.

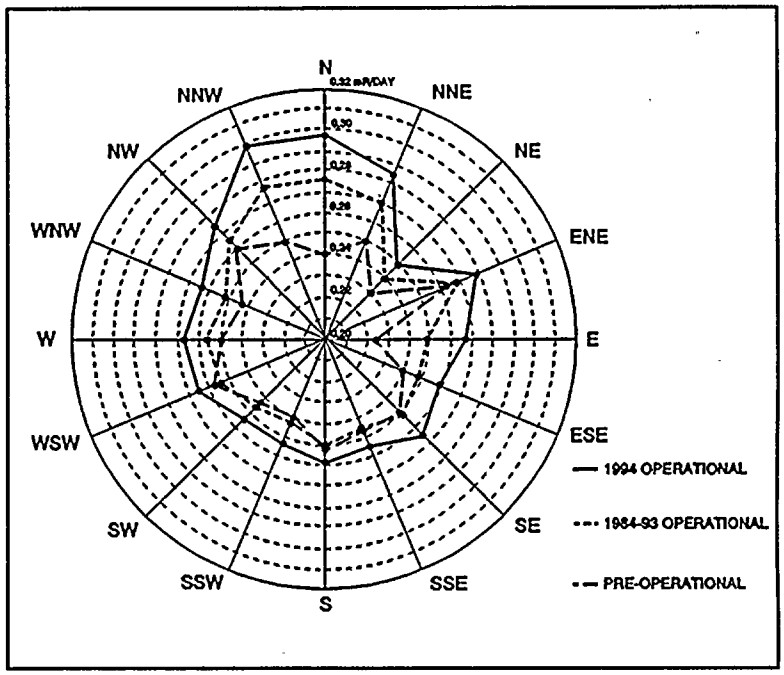

Figure 5-1 Sector Quarterly TLDs - Annual Mean by Sector

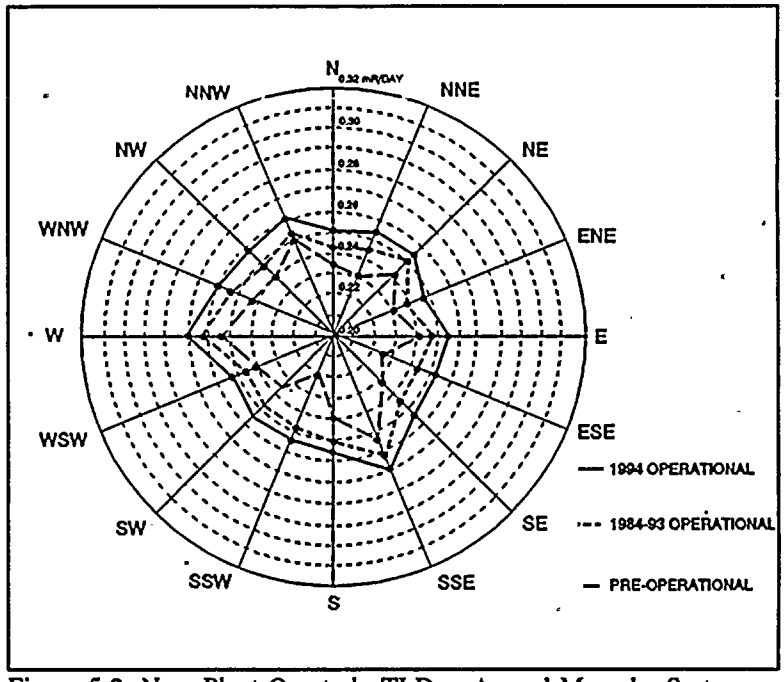

Figure 5-2 Near-Plant Quarterly TLDs - Annual Mean by Sector

For the remote TLDs, Station 46 in the Wahluke Reserve (NE sector) remained the location with the highest mean exposure rate, as shown in Figure 5-3. This is consistent with the mean exposure rates determined for that station in prior years.

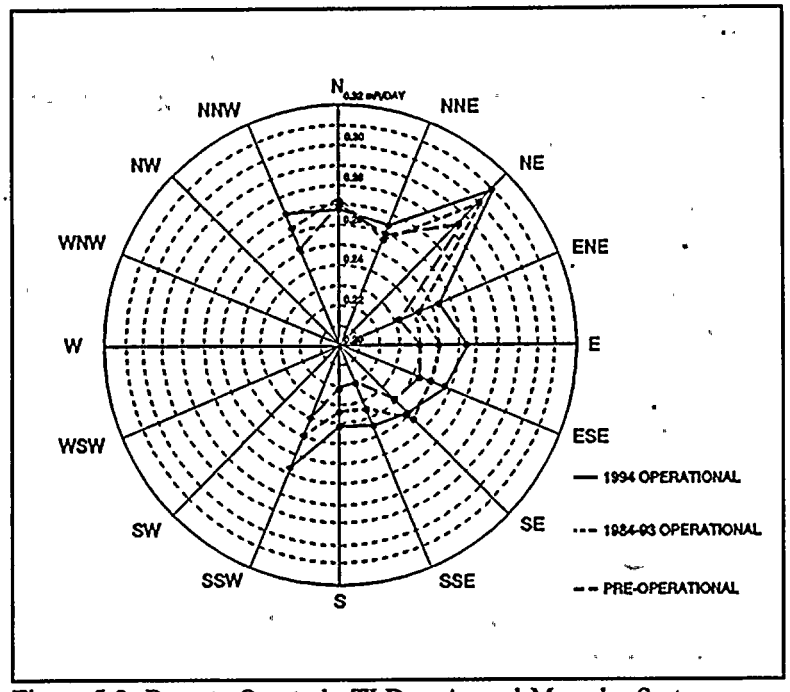

Figure 5-3 Remote Quarterly TLDs - Annual Mean by Sector

Since the preoperational measurement phase, the results for this location have exceeded the results for all other locations. Variations in the ambient background due to differences in the soil and underlying rock composition account for such local differences in Station 46 TLD results.

Frequency distribution plots of the 1994 quarterly TLD results are presented in Figure 5-4. The plots are very similar from quarter to quarter, with 0.26 mR/day being the most frequent result and with the Station 46 results being upscale and separate from the main distribution. The frequency distributions for the previous operational TLD results are shown in Figure 5-5. The distributions agree well.

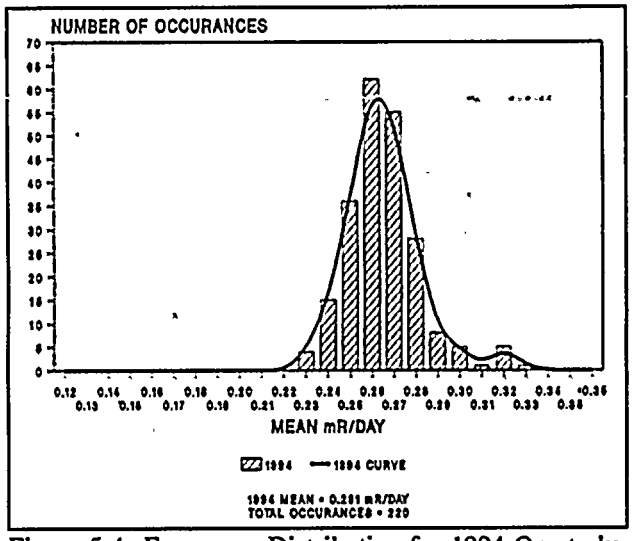

Figure 5-4 Frequency Distribution for 1994 Quarterly TLDs

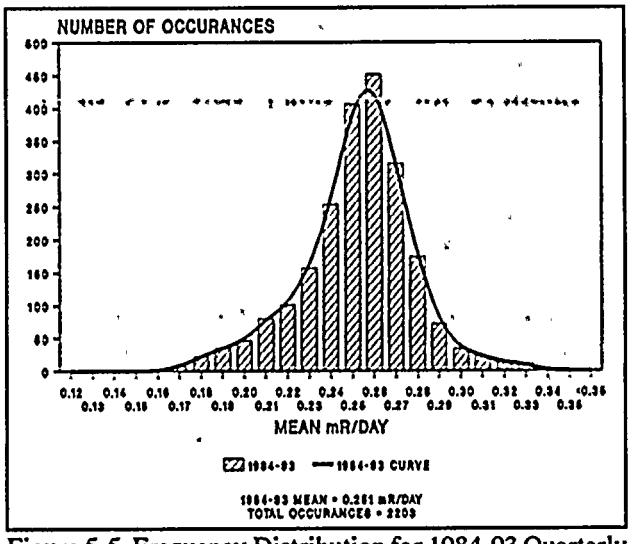

Figure 5-5 Frequency Distribution for 1984-93 Quarterly TLDs

5.2 Airborne Particulate/Iodine

The 1994 mean weekly gross beta on particulate filter results for selected indicator stations near Plant 2 are plotted in Figure 5-6. The gross beta in air results for 1994 were within the ranges observed during the preoperational period and during previous operational periods, as shown in Table 5-1. In Figure 5-7, the similarity between results from near-plant locations and those from remote locations can be seen. The control location (Station 9A) results follow a very similar pattern to the remote and near-plant indicator locations. As observed previously, gross beta levels increased during periods of inversion occurring in the fall and winter months. In fact, the gross beta results plotted over a period of several years show a cyclic pattern of fall and winter increases. The increase, which was evident in the results of all the air sampling locations, is due to an increase in radon and radon daughter concentrations during the inversions.

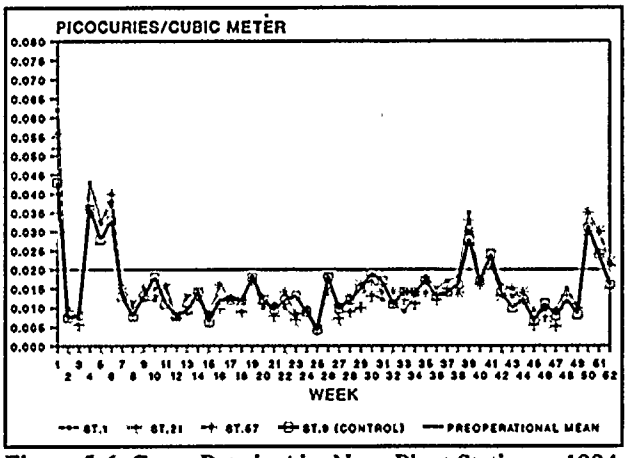

Figure 5-6 Gross Beta in Air, Near-Plant Stations - 1994

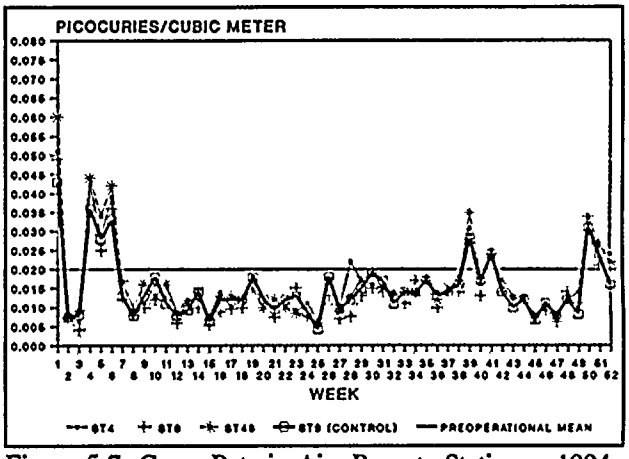

Figure 5-7 Gross Beta in Air, Remote Stations - 1994

The quarterly gamma analyses of the particulate filter composites indicated only the presence of two naturally-occurring radionuclides, beryllium-7 and potassium-40, at levels above detection limits at indicator locations and the control location. All iodine-131 in air results for 1994 were less than 0.02 picocuries/cubic meter (pCi/m^3) LLD.

No evidence of any impact of plant operations on the environment was apparent in the particulate filter and charcoal cartridge results for 1994.

5.3 Water

All river/drinking water results for gross beta were within the ranges normally observed and less than 8 picocuries/liter (pCi/l), the level at which a strontium analysis is performed to verify compliance with the Washington State drinking water standard for strontium-90*. The 1994 gross beta concentrations in river/drinking water, relative to the state annual average concentration limit[11], are presented in Figure 5-8. The mean gross beta results in discharge water, for 1994 are presented in Figure 5-9. The 1994 average results compare well to the averages from previous periods.

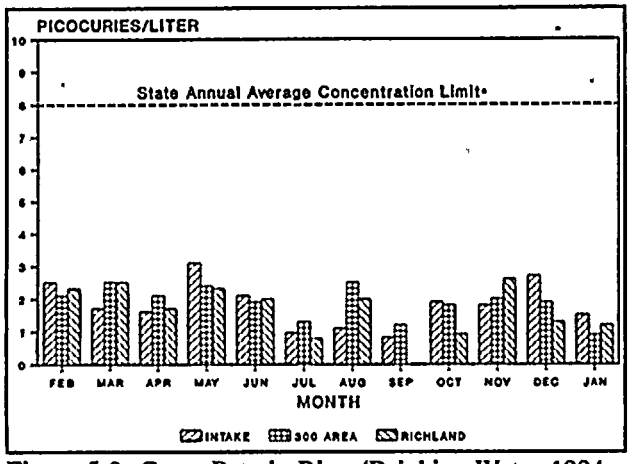

Figure 5-8 Gross Beta in River/Drinking Water-1994

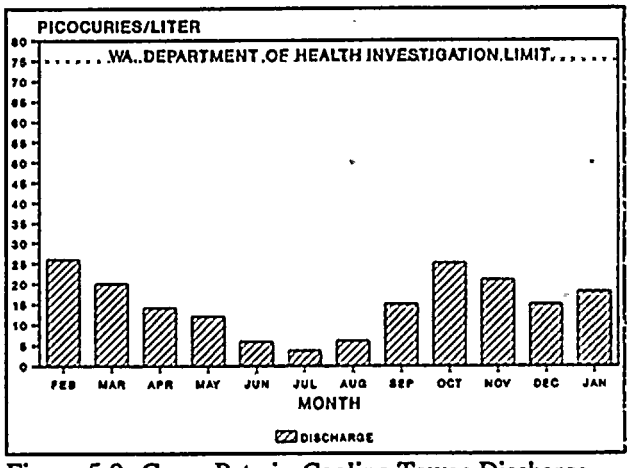

Figure 5-9 Gross Beta in Cooling Tower Discharge Water-1994

The gross beta levels in the discharge sample reflect the concentrations of naturally-occurring radionuclides, principally potassium-40, and any radionuclides from upstream sources of past Hanford activities present in the makeup water, in addition to radionuclides from Plant 2 discharges. The discharge sample results are representative of the radioactivity present in plant discharges before any mixing with river water occurs.

The 1994 tritium levels in the river/drinking water and groundwater were comparable with results obtained for prior years. Tritium levels in the discharge water were higher than the levels observed for the river/drinking water samples because of plant releases and because discharge water samples are taken prior to the water reaching the river and becoming diluted. As shown in Figure 5-10, the concentration of tritium was lower than the mean levels observed for the 1992 and 1993 periods. This reduction is due to an overall reduction in the volume of the radwaste discharges and the finding that a corrosion inhibitor used in Plant 2 had been introducing small amounts of boron into the primary system, which helped to increase tritium levels.

Tritium concentrations in the discharge water for 1994 ranged from 500 to 3500 pCi/l, which is low when compared to the NRC reporting level of 20,000 pCi/l for a quarterly average concentration in drinking water.

*Strontium-90 is assumed to account for the gross beta result.

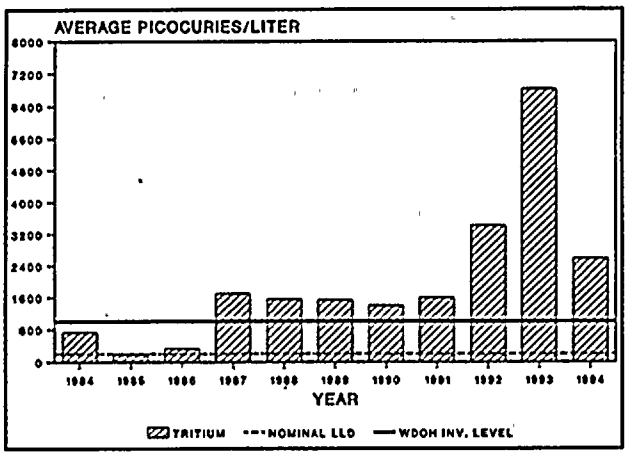

Figure 5-10 Tritium in Discharge Water 1984 - 1994

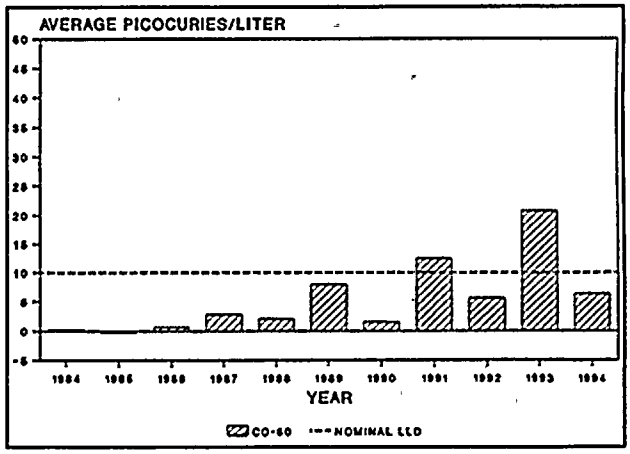

Figure 5-11 Cobalt-60 in Discharge Water 1984 - 1994

For gamma in discharge water, only cobalt-60, cesium-137 and potassium-40, a natural occuring radionuclide, were detected in samples during 1994. Figures 5-11, 5-12, and 5-13 show the annual averages for cobalt-60, zinc-65 and cesium-137 from 1984 to 1994. The detectable cobalt-60 results ranged from 4.6 to 17.5 pCi/l, the detectable cesium-137 result was 5.9 pCi/l, and the potassium-40 result was 46.8 pCi/l. Although above detection levels, these results were low and did not exceed any reporting levels.

There were no detectable nuclides in either the river/drinking water or the groundwater in samples taken during 1994.

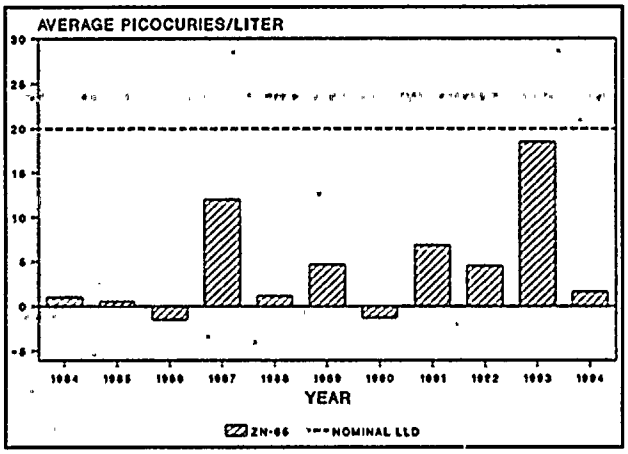

Figure 5-12 Zinc-65 in Discharge Water 1984 - 1994

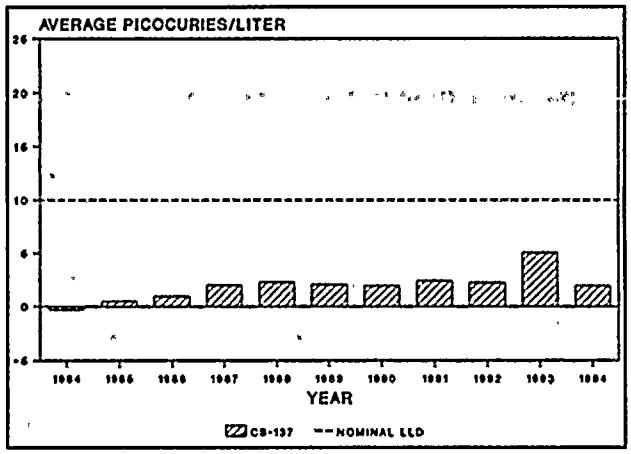

Figure 5-13 Cesium-137 in Discharge Water 1984 - 1994

5.4 Soil

Gamma spectrometry performed on soil samples in 1994 indicated a range of cesium-137 from 21.9 picocuries/kilogram (pCi/kg) to 263 pCi/kg at the indicator stations. As shown in Table 5-1, and presented in Figures 5-14 and 5-15, the cesium-137 levels in the soil samples were well within the range observed during preoperational and previous operational sampling. The gamma spectrometry results for the soil samples did not indicate any impact from Plant 2 operations on the environment.

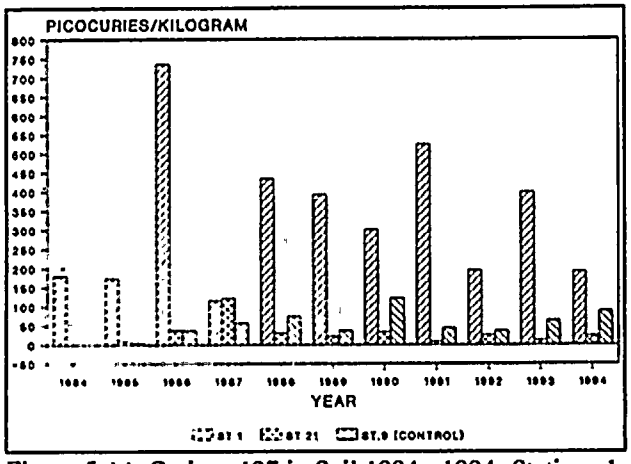

Figure 5-14 Cesium-137 in Soil 1984 - 1994, Stations 1, 21 and 9

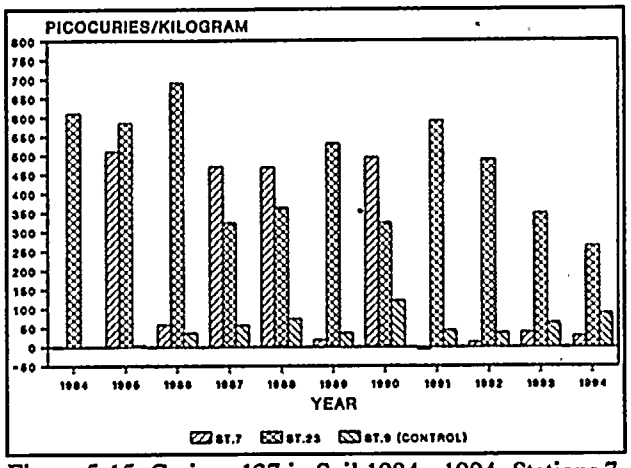

Figure 5-15 Cesium-137 in Soil 1984 - 1994, Stations 7, 23 and 9

No strontium analysis was required in 1994. Aside from cesium-137, the only radionuclides detected in the samples were potassium-40, radium-226 and thorium-228. These are part of the natural radioactivity typically found in soils.

No indication of impact of Plant 2 operations on the environment was evident in these results.

5.5 River Sediment

The results of gamma spectrometry of river sediment indicated that aside from the naturally-occurring radionuclides (potassium-40, radium-226 and thorium-228), only cobalt-60 and cesium-137 were detected downstream of the plant (Station 34). Cesium-137 was also detected in the control location (Station 33) sample. The cesium-137 concentrations upstream from the plant discharge were 76.7 and 92.0 pCi/kg dry weight; the concentrations downstream from the discharge were 225 and 235 pCi/kg dry weight. Downstream cobalt-60 concentrations were 18.1 and 37.4 pCi/kg dry weight. These are consistent with the concentrations observed previously.

Cesium-137 has been detected in preoperational samples and in samples taken since plant operation began. It has also been previously identified as a component of the Columbia River sediment originating from the operation of the old Hanford Reservation reactors.[16]

5.6 Fish

The gamma spectrometry results of fish samples collected in the vicinity of the Plant 2 discharge and at the control location on the Snake River were below detection limits, except for potassium-40, a naturally-occurring radionuclide. The cesium-137 levels for the fish taken from the Columbia River were low and within the range observed during the preoperational and previous operational periods and shown in Figure 5-16.

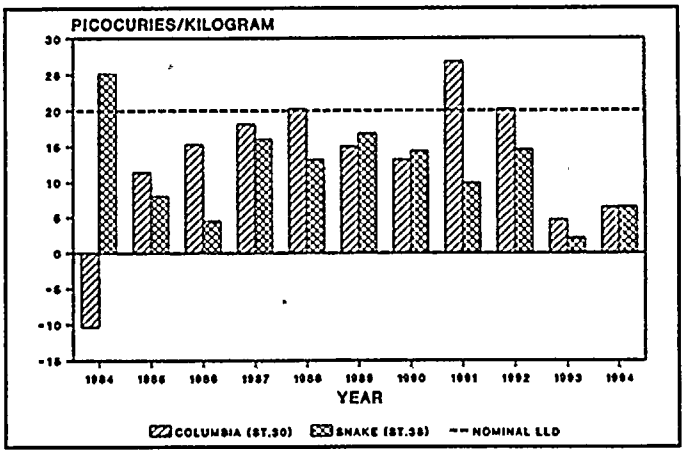

Figure 5-16 Cs-137 in All Fish 1984 - 1994

The cesium-137 results remained at the low levels observed in 1993.

5.7 Milk

All the results of iodine-131 analyses of milk samples collected during 1994 were less than detection limits. All milk sample results for the indicator and control locations were less than the detection limits, except for potassium-40, which is naturally-occurring.

5.8 Garden Produce

The gamma isotopic analysis results for all root, fruit and leafy vegetables collected in 1994 were below detection limits other than potassium-40, which occurs naturally.

5.9 Special Interest Stations

None of the special interest stations, the storm drain pond, the Sanitary Waste Treatment Facility (SWTF), containerized storage area, were a part of the routine sampling program for the REMP until 1992. Until incorporated into the REMP, the sediment samples collected during previous years at the storm drain and SWTF were analyzed inhouse at the Support Services radiochemical laboratory. The storm drain and SWTF sediment samples were analyzed wet, so the results were in terms of wet weight instead of the dry weight concentrations determined by Teledyne. Consequently, direct comparison of the wet sample results with the dried sample results is difficult since the percent solids can vary from sample to sample.

5.9.1 Storm Drain Pond (Station 101)

The storm drain pond is a drain field designed to collect site effluents from several sources which include the plant building roof drains, the Service Building and the Diesel Generator Building floor drains, air handling unit drains, backwash from make up water treatment, and Turbine Building nonradioactive floor drains. The storm drain pond is located within the Plant 2 restricted area approximately 1500 feet northeast of Plant 2. Water is conveyed to the pond via a 18-inch diameter pipe which discharges into a 300-foot long earthen channel that leads to a 100-foot diameter pond. The pond is a shallow, unlined percolation/evaporation basin.

There is some soil contamination in the pond as a result of previous plant operations relating to the Turbine Building sumps and the discharge of low levels of radioactive materials from the sumps. This has necessitated that the pond be posted as a radioactive materials storage area. The initiating problem is described in detail in the Radiological Environmental Monitoring Program 1992 Annual Report.

REMP personnel collected water, sediment and vegetation samples at the outfall during 1994. Additional monthly water and sediment samples were taken from the pond area beginning in July of 1994. Flow proportional composite water samples were collected weekly from the outfall and sediment samples were collected weekly until August, when sampling was changed to a monthly schedule. Vegetation was sampled annually.

Tritium was the predominate isotope detected during 1994. Figure 5-17 shows the monthly average for 1993 versus the 1994 monthly average. Sample results for 1994 indicate the measures taken by the plant have resulted in significant curtailment of the release of tritium to the pond.

The range for positive tritium results at the outfall was from 150 pCi/l to 8800 pCi/l. At the pond, the range for positive results was 160 pCi/l to 820 pCi/l. Gross beta activity at the outfall averaged 4.7 pCi/l with a range of 0.25 to 21.0 pCi/l. Gross beta at the pond ranged from 1.8 pCi/l to 14 pCi/l and averaged 5.6 pCi/l.

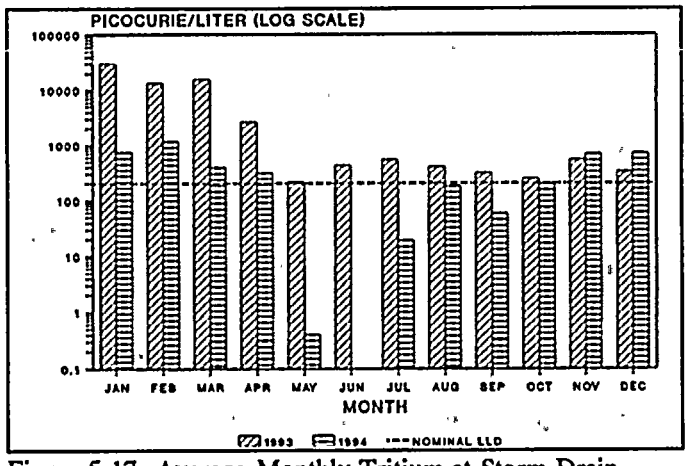

Figure 5-17 Average Monthly Tritium at Storm Drain Outfall - 1993-94

5.9.2 Sanitary Waste Treatment Facility (Station 102)

The Sanitary Waste Treatment Facility (SWTF), located approximately 0.3 mile south of Plant 2, processes the sanitary waste from Plant 2, the WNP-1 and WNP-4 sites and the Plant Support Facility (PSF). In April 1991, a sewer pipe was installed from the Department of Energy's Fast Flux Test Facility (FFTF) to the SWTF. The effluent pipe was to be isolated at the FFTF source to prevent flow of wastes until agreements for processing the wastes were finalized. The monitoring results related to an inadvertent discharge of FFTF waste in 1992 are included in the 1992 Annual REMP report. Discharge standards and monitoring requirements for the SWTF are established in EFSEC Resolution No. 259[17]. Until April 1992, the SWTF sediment was sampled semiannually and analyzed in the Support Services radiation laboratory and the radionuclide concentrations were given in terms of wet weight.

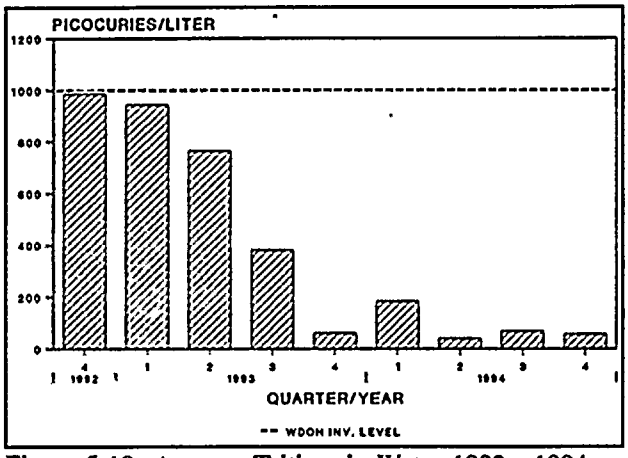

Figure 5-18 Average Tritium in Water 1992 - 1994, ST102C

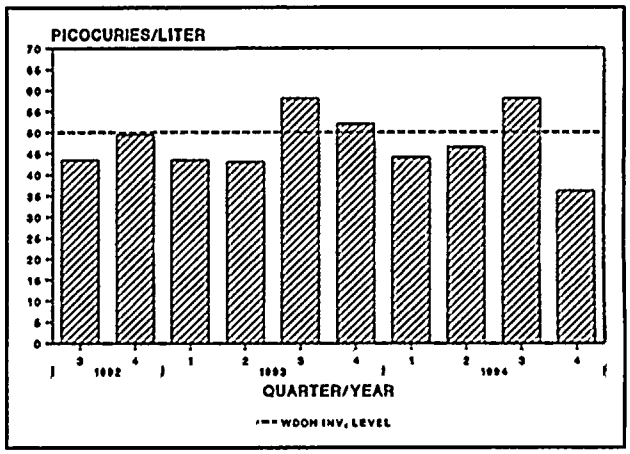

Figure 5-19 Average Gross Beta in Water 1992 - 1994, ST102C

The average quarterly tritium and gross beta results for water samples taken in the south stabilization pond prior to discharge (ST102C) for 1992 through 1994 are presented in Figure 5-18 and Figure 5-19. The pond had indicated gross beta levels at or above the 50 pCi/l EPA drinking water limit in several samples. An investigation into the source of gross beta indicated potassium-40, a natural isotope, was the major contributor. Other contributors to the beta appear to be natural isotopes and no fission or activation products were detected that would indicate Plant 2 as a source.

Gamma analysis of sediment collected from the north pond reveals detectable cobalt-60 and cesium-137 in addition to the naturally occuring radionuclide potassium-40, radium-226 and thorium-228. The range for the cobalt-60 during 1994 was 167 pCi/kg dry weight to 417 pCi/kg dry weight. Cesium-137 ranges were 106 pCi/kg dry weight to 218 pCi/kg dry weight. Both these are within ranges observed since 1992.

5.9.3 Containerized Storage Area (Station 118)

Station 118, consists of twenty-nine large metal storage containers holding the low-pressure turbine rotor parts removed from the plant during the 1992 maintenance outage. Soil samples and ionization chamber readings were taken at Station 118. Beginning in September 1994, samples from different areas were composited and sent to Teledyne Brown for analysis

Soil samples taken at Station 118 before and after storage of the low pressure turbine rotor parts contained no detectable radioactivity except that from naturally-occurring radionuclides, such as potassium-40 and radium-226.

5.10 1994 Sample Deviations

Air sampler outages made up the majority of sample deviations for 1994. Problems ranged from pump failure to power outages. Sampler problems at ST101 account for the majority of deviation listed for water samples. Deviations are shown in Table 5-2.

TABLE 5-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM COMPARATIVE SUMMARY

MEDIA/ ANALYSIS	PREOPERATIONAL[a] MEAN	(RANGE)	PREVIOUS OPERATIONAL[b][c] MEAN	(RANGE)	1994[d] MEAN	(RANGE)
Air: pCi/m³						
Gross Beta	<0.02	(<0.003 - 0.130)	0.02	(0.00 - 0.74)	0.02	(0.00 - 0.06)
I-131[e]	<0.05	(<0.01 - 0.11)	0.00	(-0.07 - 0.82)	0.00	(-0.02 - 0.01)
Gamma						
Cs-134	<0.01	(<0.001 - 0.040)	0.0004	(-0.0021 - 0.0149)	0.0000	(-0.0002 - 0.0003)
Cs-137	<0.01	(<0.001 - 0.040)	0.0008	(-0.0011 - 0.0356)	0.0000	(-0.0003 - 0.0003)
Ru-103	Not Reported		0.0005	(-0.0008 - 0.0194)	0.0000	(-0.0005 - 0.0005)
River/Drinking Water: pCi/l						
Gross Beta	<3	(<1 - <6)	2	(-0.2 - 9.1)	1.8	(0.0 - 2.6)
Gamma						
Cs-134	<3.8	(<1 - <12)	0.3	(-5.4 - 5.2)	0	(-1.9 - 2.2)
Cs-137	<4.1	(<1 - <13)	1	(-5.7 - 6.2)	0.7	(-3.1 - 3.4)
Co-58	<5.1	(<1 - <25)	-0.1	(-3.3 - 2.9)	-0.1	(-1.7 - 0.9)
Co-60	<4.7	(<1 - <13)	0.9	(-4.9 - 7.1)	0.4	(-4.5 - 3.2)
Fe-59	<13.3	(<2 - <93)	0.7	(-8.9 - 6.9)	0.4	(-4.5 - 4.3)
Zn-65	<8.3	(<2 - <27)	-1.4	(-16.2 - 8.2)	0.4	(-5.2 - 5.8)
H-3	<481.7	(220 - <820)	130.9	(-500 - 596)	101.3	(9.5 - 220)
Sr-90	<2		0.4	(0.3 - 0.7)	Analysis Not Performed	
Groundwater: pCi/l						
Gamma						
Cs-134	<4	(<1 - <12)	0.4	(-4.1 - 5.4)	0.4	(-1.1 - 2.4)
Cs-137	<3.8	(0.8 - <8)	1.1	(-3.1 - 4.9)	0.8	(-4.1 - 4.1)
Co-58	<4.7	(<1 - <12)	-0.3	(-3.3 - 1.9)	-0.7	(-3.3 - 1.3)
Co-60	<4.1	(0.1 - <9)	1.1	(-2.4 - 8.4)	-0.1	(-2.3 - 1.2)
Fe-59	<11.6	(<2 - <33)	0.7	(-4.5 - 5.7)	1.1	(-0.8 - 3.8)
Zn-65	<8.6	(<2 - 17)	-1.3	(-46.8 - 15)	1.3	(-2.4 - 4.1)
H-3	<467.8	(<10 - 2600)	35.1	(-516 - 470)	4.7	(-77 - 160)
Sr-90	<0.4	(<0.1 - 0.7)	Analysis Not Performed		Analysis Not Performed	

(a) All stations, all years.
(b) Indicator stations only for the years 1984 to 1993. Some of the data means and ranges are biased high due to Chernobyl in 1986.
(c) The data used for these averages does not include the "less than" values reported in 1984.
(d) Indicator stations only.
(e) Charcoal cartridge results.

TABLE 5-1 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM COMPARATIVE SUMMARY

MEDIA/ ANALYSIS	PREOPERATIONAL[a] MEAN	(RANGE)	PREVIOUS OPERATIONAL[b,c] MEAN	(RANGE)	1994[d] MEAN	(RANGE)
Discharge Water: pCi/l						
Gross Beta	<2.8	(<1.9 - 4)	17.9	(0.6 - 56)	15.1	(3.7 - 26)
Gamma						
Cs-134	<3.7	(<1 - <8)	0.7	(-3.9 - 10.1)	0.3	(-1.4 - 2.9)
Cs-137	<4.7	(<1 - 16)	2	(-5.3 - 23.1)	1.9	(0.0 - 5.9)
Co-58	<1.4	(1 - 13)	0.0	(-2.6 - 4.6)	-0.3	(-1.4 - 1.2)
Co-60	<5.0	(<1.9 - <13)	5.9	(-8.7 - 57.6)	6.4	(1.1 - 17.5)
Fe-59	<11.9	(<3 - <38)	0.8	(-4.1 - 13)	0.9	(-2 - 3.6)
Zn-65	<8.6	(<2 - 27)	3.2	(-8.2 - 86.7)	1.6	(-5.4 - 5.4)
H-3	<420	(<80 - 700)	1993	(55 - 12000)	2585	(540 - 3500)
Sr-90	<3		0.8	(0.5 - 1.1)	Analysis Not Performed	
Storm Drain Water: pCi/l						
Gross Beta	Analysis Not Performed		38	(1.6 - 1100)	4.8	(0.3 - 21)
Gamma	Analysis Not Performed					
Cs-134			0.0	(-9.6 - 8.1)	0.3	(-6.2 - 2.6)
Cs-137			1.5	(-11 - 252)	1.7	(-3.2 - 10.5)
Co-58			-0.5	(-7.6 - 3.4)	-0.4	(-4.5 - 2.6)
Co-60			1.1	(-4.2 - 125)	0.5	(-2.1 - 6.7)
Fe-59			0.8	(-14 - 9.9)	0.4	(-3.9 - 4.4)
Zn-65			0.9	(-13 - 53)	0.2	(-8.3 - 12)
Mn-54			0.7	(-3.2 - 6.7)	0.6	(-6.2 - 2.5)
I-131			-0.2	(-17 - 21.1)	0.0	(-4 - 3.1)
Ce-141			0.3	(-19 - 707)	-9.1	(-441 - 5.1)
Sb-124			11.5		Analysis Not Performed	
Sb-125			20.8		Analysis Not Performed	
I-131[e]			0.4	(-0.2 - 8.3)	Analysis Not Performed	
H-3	Analysis Not Performed		7360	(-170 - 270000)	573	(-160 - 8800)
Sr-89	Analysis Not Performed		0.9	(-0.1 - 1.8)	Analysis Not Performed	
Sr-90	Analysis Not Performed		0.4	(-0.1 - 0.9)	Analysis Not Performed	
Sanitary Waste Water: pCi/l						
Gross Alpha	Analysis Not Performed		0.3	(-0.4 - 1.5)	0.4	(-0.7 - 1.6)
Gross Beta	Analysis Not Performed		49	(35 - 61)	38.3	(13 - 60)
Cs-134			0.1	(-4.9 - 2.9)	0.3	(-2.6 - 4.9)
Cs-137			0.6	(-5.1 - 4.2)	1.5	(-2 - 4.2)
Co-58			-0.3	(-2.7 - 1.8)	-0.2	(-1.8 - 1.2)
Co-60			0.6	(-1.7 - 4)	0.1	(-12.9 - 3.1)
H-3	Analyses Not Performed		477	(-110 - 1700)	56	(-120 - 260)

(a) All stations, all years.
(b) Indicator stations only for the years 1984 to 1993. Some of the data means and ranges are biased high due to Chernobyl in 1986
(c) The data used for these averages does not include the "less than" values reported in 1984.
(d) Indicator stations only.
(e) Resin method

TABLE 5-1 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM COMPARATIVE SUMMARY

MEDIA/ ANALYSIS	PREOPERATIONAL[a] MEAN	(RANGE)	PREVIOUS OPERATIONAL[b][c] MEAN	(RANGE)	1994[d] MEAN	(RANGE)
River Sediment: pCi/kg (dry)						
Gamma						
Cs-134	<112.5	(<50 - <150)	51.7	(7 - 172)	41.4	(28.7 - 54)
Cs-137	<287	(<50.0 - <560.0)	343.8	(153 - 1890)	229.6	(224.6 - 234.6)
Co-60	<254.6	(130 - 610)	42.7	(11 - 129)	27.7	(18.1 - 37.4)
Co-57	Not Reported		27.9	(-11.6 - 54)	6.9	(5.1 - 8.7)
Eu-152	Not Reported		122.8	(5.6 - 279)	135	(134 - 136)
Storm Drain Sediment: pCi/kg (dry)						
Gamma:	Analysis Not Performed[e]					
Cs-134			77.9	(4.1 - 1140)	39.7	(11.9 - 82.9)
Cs-137			193.9	(-3.6 - 2900)	122.5	(16.3 - 286.1)
Co-58			-0.3	(-27.0 - 58)	-3.7	(-10.4 - 4.8)
Co-60			1002.8	(-6.4 - 25400)	279.2	(69.7 - 868.2)
Fe-59			2	(-55 - 280)	-5.6	(-49.1 - 8.6)
Zn-65			180	(-25 - 4650)	22.2	(-2.1 - 64.2)
Mn-54			32.3	(-9.6 - 670)	6.1	(-2.8 - 18)
Ce-141			56.1	(-29 - 3740)	4	(-13.2 - 19.2)
Sanitary Waste Sediment: pCi/kg (dry)						
Gamma:	Analysis Not Performed[e]					
Cs-134			25.8	(-15.6 - 55.2)	26.2	(0.0 - 40.3)
Cs-137			143.9	(0.0 - 255)	157.8	(106.1 - 218.3)
Co-60			242.2	(-3.4 - 728)	263.3	(166.6 - 417)
Zn-65			3.4	(-106 - 77.4)	26.0	(10.6 - 47.5)
Mn-54			3.7	(-26 - 32.1)	7.2	(-13.3 - 19.2)
Sr-90	Analysis Not Performed		83.4	(26 - 130)	Analysis Not Performed	
Soil: pCi/kg (dry)						
Gamma						
Cs-134	<65.3	(<20 - <150)	27.1	(1 - 53.2)	21.9	(19.7 - 25.7)
Cs-137	364.3	(<20.0 - <1880.0)	280.4	(-7.3 - 735)	125.7	(21.9 - 262.5)
Sr-90	Analysis Not Performed		178.8	(0.2 - 455)	Analysis Not Performed	

(a) All stations all years.
(b) Indicator stations only for the years 1984 to 1993. Some of the data means and ranges are biased high due to Chernobyl in 1986
(c) The data used for these averages does not include the "less the" values reported in 1984.
(d) Indicator stations only.
(e) Prior to February 1992, these samples were analyzed as wet weight. These numbers are for the samples analyzed as dry weight.

TABLE 5-1 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM COMPARATIVE SUMMARY

MEDIA/ ANALYSIS	PREOPERATIONAL[a] MEAN	(RANGE)	PREVIOUS OPERATIONAL[b][c] MEAN	(RANGE)	1994[d] MEAN	(RANGE)
ST 118 Soil: pCi/kg (dry)						
Gamma	Analysis Not Performed					
Cs-134			22.4	(-2.9 - 45.6)	24.4	(19.1 - 31)
Cs-137			14.7	(-8.2 - 47.6)	14.4	(3.6 - 27.8)
Storm Drain Soil: pCi/kg (dry)						
Gamma	Analysis Not Performed					
Cs-134			19.6	(-1.4 - 38)	24.1	(20.1 - 31.4)
Cs-137			51	(24.6 - 77.3)	30	(12.5 - 45)
Sr-90	Analysis Not Performed		Analysis Not Performed		Analysis Not Performed	
Milk: pCi/l						
Gamma						
Cs-134	<3.7	(<0.9 - <14)	0.8	(-7.4 - 22.6)	0.0	(-8.7 - 3)
Cs-137	<3.8	(<1 - <12)	2.5	(-7.4 - 47.3)	0.9	(-3.8 - 2.7)
Ba-140	<72.1	(<6 - <2000)	0.2	(-44.3 - 55)	0.0	(-6.4 - 8.6)
La-140	<33.3	(<5 - 1000)	-0.4	(-24.2 - 9.7)	0.1	(-3.2 - 5.7)
I-131[e]	<0.5	(<0.1 - <1)	0.9	(-0.8 - 143.6)	0.0	(-0.2 - 0.2)
Sr-90	Analysis Not Performed		1.9	(1.3 - 3.9)	Analysis Not Performed	
Fish: pCi/kg (wet)						
Gamma						
Cs-134	<61.2	(<6 - <130)	2	(-20.4 - 24)	-2.3	(-7.5 - 2.3)
Cs-137	<88.8	(<10 - <130)	15.2	(-35.1 - 57)	6.4	(-10 - 14.2)
Co-58	<87.7	(<9 - <130)	0.7	(-16.8 - 25.8)	-0.6	(-7.2 - 4.9)
Co-60	<80.6	(<9 - <130)	1.7	(-18.4 - 21)	-0.6	(-3.4 - 1.8)
Fe-59	<130	(<30 - <260)	-0.3	(-34.2 - 30)	2.9	(-7.2 - 10)
Mn-54	<88.3	(<8 - <130)	1.3	(-20 - 30.9)	2.8	(1.4 - 4.8)
Produce: pCi/kg (wet)						
Gamma						
Cs-134	<49.1	(<10 - <140)	1	(-24.8 - 19.8)	-1.1	(-8.3 - 2.5)
Cs-137	<69.8	(<10 - <140)	3.6	(-9.8 - 20.9)	1.7	(-0.8 - 4.3)
I-131	<105.6	(<10 - <1000)	-0.3	(-26 - 59)	-0.9	(-13.3 - 2.3)

(a) All stations, all years.
(b) Indicator stations only for the years 1984 to 1993. Some of the data means and ranges are biased high due to Chernobyl in 1986.
(c) The data used for these averages does not include the "less than" values reported in 1984.
(d) Indicator stations only.
(e) Resin method.

TABLE 5-1 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM COMPARATIVE SUMMARY

MEDIA/ ANALYSIS	PREOPERATIONAL[a] MEAN	(RANGE)	PREVIOUS OPERATIONAL[b][c] MEAN	(RANGE)	1994[d] MEAN	(RANGE)
Storm Drain Vegetation[e] pCi/kg (wet)						
Gamma	Analysis Not Performed					
Mn-54			14.7	(-2 - 32.2)	-0.7	
Co-60			23.8	(-3.7 - 48.2)	-1.9	
Zn-65			34.6	(4.1 - 57.4)	-4.3	
Cs-134			9.1	(-6.5 - 45.8)	-2	
Cs-137			29.9	(3.9 - 93.5)	10.6	(10.6 - 10.6)
TLD: mR/day						
Quarterly	0.24	(0.11 - 0.32)	0.25	(0.16 - 0.35)	0.26	(0.23 - 0.32)
Annual	0.23	(0.20 - 0.31)	0.23	(0.18 - 0.32)	0.23	(0.20 - 0.28)

(a) All stations, all years.
(b) Indicator stations only for the years 1984 to 1993. Some of the data means and ranges are biased high due to Chernobyl in 1986.
(c) The data used for these averages does not include the "less than" values reported in 1984.
(d) Indicator Stations only.
(e) Routine samples from the outfall only.

TABLE 5-2

1994 SAMPLE DEVIATIONS

SAMPLE MEDIA	DATE	LOCATION	PROBLEM
Air Particulate/Iodine	02/07 - 02/14	Station 40	Unit Failure, Reduced hours
	02/28 - 03/07	Station 4	Unit Failure, Reduced hours
	05/02 - 05/09	Station 7	Power Outage, Reduced hours
	05/16 - 05/23	Station 48	Power Outage, Reduced hours
	06/06 - 06/13	Station 48	Pump Failure, Reduced hours
	06/13 - 06/20	Station 8	Power Outage, Reduced hours
	07/05 - 07/11	Station 4	Pump Failure, Reduced hours
	07/18 - 07/25	Station 7	Pump Failure, Reduced hours
	08/15 - 08/22	Station 40	Power Outage, Reduced Hours
	08/22 - 08/29	Station 5	Pump Failure, Acceptable Hours
	08/22 - 08/29	Station 23	Pump Failure, Reduced hours
	08/22 - 08/29	Station 40	Power Outage, Reduced Hours
	09/12 - 09/19	Station 5	Pump Failure, Reduced Hours
	09/12 - 09/19	Station 40	Pump Failure, Reduced Hours
	10/17 - 10/24	Station 5	Pump Failure, Reduced Hours
	10/31 - 11/07	Station 5	Pump Failure, Reduced Hours
	11/07 - 11/14	Station 40	Power Outage, Reduced Hours
	11/14 - 11/21	Station 40	Power Outage, Reduced Hours
	11/21 - 11/28	Station 40	Power Outage, Reduced Hours
	11/21 - 11/28	Station 57	Pump Failure, Reduced Hours
	12/19 - 12/27	Station 40	Pump Failure, Reduced Hours
Water	01/06 - 02/02	Station 27	Maintenance Being Performed, unit in timed mode.
	01/19 - 01/26	ST 101	Battery died, no sample.
	03/24 - 03/31	ST 101	Collection bottles capped, no individual samples collected.
	04/25 - 04/27	ST101	Sampler in for calibration, grab samples collected.
	05/11 - 06/21	Station 27	Timed Mode for Plant Outage Work.

TABLE 5-2 (Cont.)

1994 SAMPLE DEVIATIONS

SAMPLE MEDIA	DATE	LOCATION	PROBLEM
Water (cont.)	06/14 - 06/20	ST101	Intake tubing cracked, no samples.
	06/21 - 06/28	Station 27	Out of service for repair.
	07/12 - 08/01	ST101	Sample volume low, samples acceptable
	08/18 - 08/26	ST101	Sample volume calibration lost, sampler base flooded. No individual samples.
	09/12 - 09/16	ST101	Sampler in pause mode, no samples collected.
	10/09 - 10/19	ST101	Sample volume calibration lost, sampler base flooded. No individual samples.
	10/25 - 10/27	ST101	Sampler in pause mode, no samples collected.
	10/29 - 11/10	Station 26	Pump failure, grab samples taken; normal composite sample collected.
	11/23 -11/28	ST101	Sample in manual mode, no samples collected.
	11/17 - 11/30	ST101	24 samples missed due to intake line freezing.
	12/13 - 12/16	ST101	Sampler brought in for calibration, grab sample taken 12/14.
Soil	12/94	Station 118	Sample not collected

TABLE 5-3

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

WASHINGTON PUBLIC POWER SUPPLY SYSTEM WNP-2 DOCKET NO. 50-397
HANFORD WASHINGTON JANUARY 1 to DECEMBER 31, 1994

Medium Or Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Ratio) [a] (Range)	Location With Highest Mean Name Distance and Direction	Mean Ratio [a] (Range)	Control Location MEAN (RATIO) [a] (RANGE)	Number of Nonroutine Reported Measurements
Air Particulates (pCi/m^3)	Gross Beta 621	0.003	0.016(567/569) (0.004-0.063)	48 4.5 mi NE	0.017(52/52) (0.006-0.060)	0.015(52/52) (0.004-0.043)	0
	Gamma (Quarterly) 48						
	Be-7	0.01	0.130(44/44) (0.08-0.214)	48 4.5 mi NE	0.136(4/4) (0.093-0.192)	0.1274(4/4) (0.093-0.176)	0
	K-40	0.01	0.006(7/44) (0.005-0.007)	9A 30.0 mi WSW	0.017(2/4) (0.007-0.026)	0.017(2/4) (0.007-0.026)	0
Air Iodine (pCi/m^3)	I-131 621	0.01	-(0/569)			-(0/52)	0
Soil (pCi/kg dry)	Gamma 5						
	K-40	700	12800(4/4) (11500-13600)	7 2.7 mi WNW	13600(1/1)	11700(1/1)	0
	Cs-137	40	126(4/4) (21.9-263)	23 1.3 mi S	263(1/1)	87.9(1/1)	0
	Ra-226	400	733(4/4) (621-887)	01 1.3 mi S	887(1/1)	810(1/1)	0
	Th-228	50	584(4/4) (418-696)	23 1.3 mi S	696(1/1)	529(1/1)	0

(a) The ratio of positive results above the LLD to the number of samples analyzed for the parameter of interest.

TABLE 5-3 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

WASHINGTON PUBLIC POWER SUPPLY SYSTEM WNP-2 DOCKET NO. 50-397
HANFORD WASHINGTON JANUARY 1 to DECEMBER 31, 1994

Medium Or Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analyses Performed	Lower Limit of Detection (LLD)		All Indicator Locations Mean (Ratio) [a] (Range)	Location With Highest Mean Name Distance and Direction	Mean Ratio[a] (Range)	Control Location MEAN (RATIO) [a] (RANGE)	Number of Nonroutine Reported Measurements
Water (River/Drinking) (pCi/liter)	Gross Beta	37	4	2.04(19/24) (1.2-2.9)	29	2.02(9/12) (1.2-2.9)	1.95(10/13) (1.1-3.1)	0
	Tritium	12	200	193(3/8) (170-220)	28 7.4 mi SSE	205(2/4) (190-220)	-(0/4) -	0
	Gamma	36						
	K-40		200	-(0/24)			-(0/12) -	0
Water (Discharge) (pCi/liter)	Gross Beta	12	12	15.1(12/12) (3.7-26.0)	27 3.2 mi E	15.1(12/12) (3.7-26.0)	-(0/0) -	0
	Tritium	4	200	2575(4/4) (500-3500)	27 3.2 mi E	2575(4/4) (500-3500)	-(0/0) -	0
	Gamma	12						
	K-40		10	46.8(1/12) -	27 3.2 mi E	46.8(1/12) -	-(0/0) -	0
	Co-60		10	9.67(6/12) (4.63-17.5)	27 3.2 mi E	9.67(6/12) (4.63-17.5)	-(0/0) -	0
	Cs-137		10	5.86(1/12) -	27 3.2 mi E	5.86(1/12) -	-(0/0) -	0

(a) The ratio of positive results above the LLD to the number of samples analyzed for the parameter of interest.

TABLE 5-3 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

WASHINGTON PUBLIC POWER SUPPLY SYSTEM WNP-2 DOCKET NO. 50-397
HANFORD WASHINGTON JANUARY 1 to DECEMBER 31, 1994

Medium Or Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Ratio) [a] (Range)	Location With Highest Mean Name Distance and Direction	Mean Ratio [a] (Range)	Control Location MEAN (RATIO) [a] (RANGE)	Number of Nonroutine Reported Measurements
Water (Ground) (pCi/liter)	Tritium 12	200	160(1/12)	52 0.1 mi N	160(1/4)	None	0
	Gamma 12						
	K-40		-(0/12)				0
Sediment (pCi/kg dry)	Gamma 4						
	K-40	700	15300(2/2) (14100-16500)	34 3.5 mi ESE	(15300(2/2) (14100-16500)	14400(2/2) (14200-14600)	0
	Co-60	30	27.8(2/2) (18.1-37.4)	34 3.5 mi ESE	27.8(2/2) (18.1-37.4)	-(0/2)	0
	Cs-137	40	230(2/2) (225-235)	34 3.5 mi ESE	230(2/2) (225-235)	84.4(2/2) (76.7-92.0)	0
	Ra-226	400	1310(2/2) (1020-1600)	33 3.6 mi ENE	1375(2/2) (1310-1440)	1375(2/2) (1310-1440)	0
	Th-228	50	921(2/2) (692-1150)	33 3.6 mi ENE	1064(2/2) (988-1140)	1064(2/2) (988-1140)	0

(a) The ratio of positive results above the LLD to the number of samples analyzed for the parameter of interest.

TABLE 5-3 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

WASHINGTON PUBLIC POWER SUPPLY SYSTEM WNP-2 DOCKET NO. 50-397
HANFORD WASHINGTON JANUARY 1 to DECEMBER 31, 1994

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD)	ALL INDICATOR LOCATIONS MEAN (RATIO) [a] (RANGE)	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	MEAN (RATIO)[a] (RANGE)	CONTROL LOCATION MEAN (RATIO) [a] (RANGE)	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
Fish (pCi/kg wet)	Gamma 8						
	K-40	1000	3088(4/4) (2470-3920)	38 27 mi ESE	3213(4/4) (2970-3640)	3213(4/4) (2970-3640)	0
Milk (pCi/liter)	I-131 75	1	-(0/57)			-(0/18)	0
	Gamma 75						
	K-40 75	200	1369(57/57) (1180-1650)	36 7.2 mi ESE	1409(18/18) (1250-1520)	1398(18/18) (1190-1500)	0
Roots (pCi/kg wet)	Gamma 7		-(0/4)	N/A		-(0/3)	0
Fruits (pCi/kg wet)	Gamma 9		-(0/5)			-(0/4)	0
Vegetables (pCi/kg wet)	Gamma 11						
	Th-228 11		-(0/5)			-(0/6)	0

(a) The ratio of positive results above the LLD to the number of samples analyzed for the parameter of interest.

TABLE 5-3 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

WASHINGTON PUBLIC POWER SUPPLY SYSTEM WNP-2 DOCKET NO. 50-397
HANFORD WASHINGTON JANUARY 1 to DECEMBER 31, 1994

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED		LOWER LIMIT OF DETECTION (LLD)	ALL INDICATOR LOCATIONS MEAN (RATIO) [a] (RANGE)	LOCATION WITH HIGHEST MEAN NAME DISTANCE AND DIRECTION	MEAN (RATIO)[a] (RANGE)	CONTROL LOCATION MEAN (RATIO) [a] (RANGE)	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
Direct Radiation Quarterly TLD's (mR/day)	TLD	224	-	0.26(220/220) (0.23-0.32)	46 5.0 mi NE	0.31(4/4) (0.30-0.32)	0.24(4/4) (0.23-0.25)	0
Direct Radiation Annual TLD's (mR/day)	TLD	56	-	0.23(55/55) (0.20-0.28)	46 5.0 mi NE	0.28(1/1) -	0.21(1/1) -	0
Storm Drain Water Station 101 (pCi/liter)	Gr-Beta	44		5.93(30/44) (2.90-21.0)	101 0.3 mi ENE	5.93(30/44) (2.90-21.0)	-(0/0)	0
	Tritium	56	200	1023(31/56) (150-3800)	101 0.3 mi ENE	1023(31/56) (150-8800)	-(0/0	0
	Gamma	56						
	K-40		200	72.1(6/56) (50.6-105)	101 0.3 mi ENE	72.1(6/56) (50.6-105)	-(0/0)	0
	Cs-137		10	10.3(1/56) -	101 0.3 mi ENE	10.3(1/56) -	-(0/0)	0
	Th-228		10	15.5(1/56) -	101 0.3 mi ENE	15.5(1/56) -	-(0/0)	0
Storm Drain Water Station 101E (pCi/liter)	Gr-Beta	5		5.56(5/5) (1.8-14.0)	101 0.3 mi ENE	5.56(5/5) (1.8-14.0)	-(0/0)	0
	Tritium	5	200	537(3/5) (160-320)	101 0.3 mi ENE	537(3/5) (160-820)	-(0/0)	0
	Gamma	5		-(0/5)			-(0/0)	0

(a) The ratio of positive results above the LLD to the number of samples analyzed for the parameter of interest.

TABLE 5-3 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

WASHINGTON PUBLIC POWER SUPPLY SYSTEM WNP-2 DOCKET NO. 50-397
HANFORD WASHINGTON JANUARY 1 to DECEMBER 31, 1994

Medium Or Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Ratio) [a] (Range)	Location With Highest Mean Name Distance and Direction	Mean Ratio[a] (Range)	Control Location MEAN (RATIO) [a] (RANGE)	Number of Nonroutine Reported Measurements
Storm Drain Sediment Station 101-Outfall (pCi/kg)	Gamma 36						
	K-40	700	9070(36/36) (1890-13900)	101 0.3 mi ENE	9070(36/36) (1890-13900)	-(0/0)	0
	Mn-54	40	15.4(2/36) (12.7-18.0)	101 0.3 mi ENE	15.4(2/36) (12.7-18.0)	-(0/0)	0
	Co-60	30	286(36/36) (133-868)	101 0.3 mi ENE	286(36/36) (133-868)	-(0/0)	0
	Cs-134	30	49.7(23/36) (23.7-82.9)	101 0.3 mi ENE	49.7(23/36) (23.7-82.9)	-(0/0)	0
	Cs-137	40	133(36/36) (25.5-286)	101 0.3 mi ENE	133(36/36) (25.5-286)	-(0/0)	0
	Ra-226	400	861(36/36) (524-1260)	101 0.3 mi ENE	861(36/36) (524-1260)	-(0/0)	0
	Th-228	50	446(36/36) (310-793)	101 0.3 mi ENE	446(36/36) (310-793)	-(0/0)	0

(a) The ratio of positive results above the LLD to the number of samples analyzed for the parameter of interest.

TABLE 5-3 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

WASHINGTON PUBLIC POWER SUPPLY SYSTEM WNP-2 DOCKET NO. 50-397
HANFORD WASHINGTON JANUARY 1 to DECEMBER 31, 1994

Medium Or Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Ratio) [a] (Range)	Location With Highest Mean Name Distance and Direction	Mean Ratio [a] (Range)	Control Location MEAN (RATIO) [a] (RANGE)	Number of Nonroutine Reported Measurements
Storm Drain Sediment Station 101C-Pond (pCi/kg)	Gamma	5					
	K-40	700	14920(5/5) (13500-16700)	101 0.3 mi ENE	14920(5/5) (13500-16700)	-(0/0)	0
	Co-60	30	232(5/5) (69.7-504)	101 0.3 mi ENE	232(5/5) (69.7-504)	-(0/0)	0
	Cs-137	40	65.4(3/5) (42.8-107)	101 0.3 mi ENE	65.4(3/5) (42.8-107)	-(0/0)	0
	Ra-226	400	1306(5/5) (1140-1500)	101 0.3 mi ENE	1306(5/5) (1140-1500)	-(0/0)	0
	Th-228	50	678(5/5) (582-783)	101 0.3 mi ENE	678(5/5) (582-783)	-(0/0)	0
Storm Drain Soil (pCi/kg)	Gamma	8					
	K-40	700	15250(8/8) (13800-17300)	101 0.3 mi ENE	15250(8/8) (13800-17300)	-(0/0)	0
	Cs-137	40	36.4(7/8) (22.1-45.0)	101 0.3 mi ENE	36.4(7/8) (22.1-45.0)	-(0/0)	0
	Ra-226	400	785(8/8) (595-923)	101 0.3 mi ENE	785(8/8) (595-923)	-(0/0)	0
	Th-228	50	503(8/8) (411-553)	101 0.3 mi ENE	503(8/8) (411-553)	-(0/0)	0

(a) The ratio of positive results above the LLD to the number of samples analyzed for the parameter of interest.

TABLE 5-3 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

WASHINGTON PUBLIC POWER SUPPLY SYSTEM WNP-2 DOCKET NO. 50-397
HANFORD WASHINGTON JANUARY 1 to DECEMBER 31, 1994

Medium Or Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Ratio) [a] (Range)	Location With Highest Mean Name Distance and Direction	Location With Highest Mean Mean Ratio [a] (Range)	Control Location MEAN (RATIO) [a] (RANGE)	Number of Nonroutine Reported Measurements
Storm Drain Vegetation (pCi/kg wet)	Gamma	1					
	Be-7		583(1/1)	101 0.3 mi ENE	583(1/1)	-(0/0)	0
	K-40		3180(1/1)	101 0.3 mi ENE	3180(1/1)	-(0/0)	0
Sanitary Waste Treatment Facility Water (pCi/l)	Gross Alpha	10 3	-(0/10)			-(0/0)	0
	Gross Beta	31 1	38.3(31/31) (13-60)	102C 0.3 mi ENE	38.3(31/31) (13-60)	-(0/0)	0
	Tritium	37 200	195(4/37) (140-260)	102C 0.3 mi ENE	195(4/37) (140-260)	-(0/0)	0
	Gamma	37					
	K-40		73.9(5/37) (44.9-116)	102C 0.3 mi ENE	73.9(5/37) (44.9-116)	-(0/0)	0
Sanitary Waste Treatment Facility Sediment (pCi/kg)	Gamma	8					
	K-40	700	8760(8/8) (6040-15000)	102 0.3 mi ENE	8760(8/8) (6040-15000)	-(0/0)	0
	Co-60	30	264(8/8) (167-417)	102 0.3 mi ENE	(264(8/8) (167-417)	-(0/0)	0
	Cs-137	40	158(8/8) (106-218)	102 0.3 mi ENE	158(8/8) (106-218)	-(0/0)	0
	Ra-226	400	1336(8/8) (842-1700)	102 0.3 mi ENE	1336(8/8) (842-1700)	-(0/0)	0
	Th-228	50	489(8/8)	102 0.3 mi ENE	489(8/8)	-(0/0)	0

(a) The ratio of positive results above the LLD to the number of samples analyzed for the parameter of interest.

TABLE 5-3 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

WASHINGTON PUBLIC POWER SUPPLY SYSTEM WNP-2 DOCKET NO. 50-397
HANFORD WASHINGTON JANUARY 1 to DECEMBER 31, 1994

Medium Or Pathway Sampled (Unit of Measurement)	Analysis and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Ratio) [a] (Range)	Location With Highest Mean Name Distance and Direction	Mean Ratio [a] (Range)	Control Location MEAN (RATIO) [a] (RANGE)	Number of Nonroutine Reported Measurements
Station 118 Soil (pCi/kg dry)							
	Gamma 15						
	K-40	700	12813(15/15) (11700-14400)	118 0.3 mi S	12813(15/15) (11700-14400)	-(0/0)	0
	Cs-137	40	17.3(8/15 (12.4-27.8)	118 0.3 mi S	17.3(8/15) (12.4-27.8)	-(0/0)	0
	Ra-226	700	790(15/15) (622-922)	118 0.3 mi S	790(15/15) (622-922)	-(0/0)	0
	Th-228	50	522(15/15) (441-662)	118 0.3 mi S	522(15/15) (441-662)	-(0/0)	0

(a) The ratio of positive results above the LLD to the number of samples analyzed for the parameter of interest.

TABLE 5-4

MEAN QUARTERLY TLD DATA SUMMARY FOR THE PREOPERATIONAL AND OPERATIONAL PERIODS

Results in mR/day

	PREOPERATIONAL		1984 - 1993 OPERATIONAL		1994 OPERATIONAL	
STATION	MEAN[a]	STANDARD ERROR	MEAN	STANDARD ERROR	MEAN	STANDARD ERROR
1	0.24	0.02	0.25	0.01	0.26	0.01
2	0.23	0.02	0.25	0.01	0.25	0.01
3	0.22	0.01	0.24	0.01	0.25	0.01
4	0.22	0.02	0.23	0.01	0.24	0.01
5	0.23	0.01	0.23	0.01	0.24	0.01
6	0.22	0.01	0.23	0.01	0.24	0.01
7	0.23	0.01	0.24	0.01	0.26	0.00
8	0.26	0.01	0.27	0.01	0.28	0.01
9	0.22	0.01	0.23	0.01	0.24	0.01
10	0.23	0.01	0.24	0.01	0.25	0.01
11	0.24	0.01	0.24	0.01	0.26	0.01
12	0.25	0.01	0.26	0.01	0.27	0.01
13	0.24	0.01	0.25	0.01	0.26	0.01
14	0.24	0.02	0.25	0.01	0.25	0.01
15	0.25	0.01	0.26	0.01	0.27	0.01
16	0.24	0.01	0.25	0.01	0.26	0.01
17	0.25	0.01	0.25	0.01	0.26	0.01
18	0.24	0.01	0.25	0.01	0.26	0.01
19	0.24	0.01	0.25	0.01	0.25	0.01
20	0.24	0.01	0.25	0.01	0.26	0.00
21	0.23	0.01	0.23	0.01	0.24	0.01
22	0.24	0.01	0.25	0.01	0.26	0.01
23	0.24	0.01	0.24	0.01	0.25	0.01
24	0.24	0.01	0.25	0.01	0.26	0.01
25	0.25	0.01	0.26	0.01	0.27	0.01
40	0.22	0.01	0.23	0.01	0.23	0.00
41	0.26	0.02	0.26	0.01	0.27	0.01
42	0.25	0.01	0.25	0.01	0.26	0.01
43	0.25	0.01	0.26	0.01	0.27	0.01
44	0.23	0.01	0.24	0.01	0.25	0.01
45	0.23	0.01	0.24	0.01	0.25	0.01
46	0.28	0.02	0.30	0.01	0.31	0.01
47	0.22	0.02	0.23	0.01	0.24	0.01
49	0.24	0.00	0.25	0.01	0.26	0.01
50	0.22	0.00	0.25	0.01	0.25	0.01
51	0.23	0.01	0.24	0.01	0.25	0.01

(a) This preoperational mean is for the 1982-1983 data only.

TABLE 5-4 (Cont.)

MEAN QUARTERLY TLD DATA SUMMARY FOR THE PREOPERATIONAL AND OPERATIONAL PERIODS

Results in mR/day

	PREOPERATIONAL		1984 - 1993 OPERATIONAL		1994 OPERATIONAL	
STATION	MEAN[a]	STANDARD ERROR	MEAN	STANDARD ERROR	MEAN	STANDARD ERROR
53	0.27	0.00	0.27	0.01	0.27	0.02
54	0.26	0.00	0.26	0.01	0.26	0.01
55	0.23	0.00	0.24	0.01	0.25	0.01
56	0.24	0.00	0.25	0.01	0.27	0.01
61	(b)		0.27	0.01	(b)	
71(1S)	0.24	0.02	0.28	0.01	0.30	0.02
72(2S)	0.25	0.01	0.27	0.01	0.28	0.01
73(3S)	0.23	0.01	0.24	0.01	0.25	0.01
74(4S)	0.26	0.01	0.27	0.01	0.28	0.01
75(5S)	0.22	0.02	0.25	0.01	0.27	0.01
76(6S)	0.24	0.01	0.25	0.01	0.26	0.01
77(7S)	0.25	0.01	0.25	0.01	0.27	0.00
78(8S)	0.25	0.01	0.25	0.01	0.25	0.01
79(9S)	0.25	0.01	0.25	0.01	0.26	0.01
80(10S)	0.24	0.01	0.24	0.01	0.25	0.01
81(11S)	0.24	0.02	0.25	0.01	0.26	0.01
82(12S)	0.25	0.02	0.25	0.01	0.27	0.01
83(13S)	0.25	0.01	0.26	0.01	0.27	0.01
84(14S)	0.24	0.01	0.25	0.01	0.26	0.01
85(15S)	0.26	0.01	0.26	0.01	0.27	0.01
86(16S)	0.25	0.01	0.28	0.01	0.30	0.02
All	0.24	0.00	0.25	0.01	0.26	0.00

(a) This preoperational mean is for 1982-1983 data only.
(b) Station 61 was added in 1989 and discontinued in 1992.

TABLE 5-5

ANNUAL TLD DATA SUMMARY FOR THE PREOPERATIONAL AND OPERATIONAL PERIODS

Results in mR/day

	PREOPERATIONAL		1984 - 1993 OPERATIONAL		1994 OPERATIONAL	
STATION	MEAN(a)	STANDARD ERROR	MEAN	STANDARD ERROR	MEAN	STANDARD DEVIATION(2σ)
1	0.23	0.04	0.24	0.01	0.23	0.01
2	0.22	0.04	0.23	0.01	0.23	0.01
3	0.21	0.04	0.22	0.01	0.22	0.01
4	0.22	0.06	0.21	0.01	0.22	0.00
5	0.22	0.04	0.21	0.02	0.21	0.01
6	0.21	0.04	0.21	0.02	0.22	0.01
7	0.22	0.02	0.23(b)	0.01	0.23	0.01
8	0.25	0.04	0.25(b)	0.02	0.26	0.01
9	0.20	0.02	0.21	0.02	0.21	0.01
10	0.22	0.04	0.22	0.02	0.22	0.01
11	0.22	0.04	0.23	0.02	0.23	0.01
12	0.24	0.04	0.24	0.02	0.25	0.01
13	0.22	0.04	0.23	0.01	0.23	0.01
14	0.22	0.04	0.22	0.02	0.23	0.01
15	0.23	0.06	0.24	0.02	0.24	0.01
16	0.23	0.04	0.23	0.02	0.24	0.01
17	0.23	0.02	0.24(b)	0.02	0.23	0.01
18	0.25	0.02	0.23	0.02	0.24	0.01
19	0.22	0.04	0.23	0.01	0.23	0.01
20	0.23	0.04	0.23	0.02	0.23	0.01
21	0.23	0.02	0.21	0.02	0.21	0.01
22	0.22	0.02	0.23	0.02	0.23	0.01
23	0.24	0.02	0.23	0.02	0.23	0.01
24	0.22	0.02	0.23	0.02	0.23	0.01
25	0.24	0.02	0.25	0.02	0.24	0.01
40	0.21(c)	0.02	0.22	0.02	0.20	0.01
41	0.26(c)	0.04	0.24	0.02	0.23	0.01
42	0.24(c)	0.02	0.23	0.02	0.25	0.01
43	0.24(c)	0.02	0.24	0.02	0.25	0.01
44	0.24	0.02	0.22	0.02	0.22	0.01
45	0.24	0.01	0.23	0.02	0.23	0.01
46	0.29	0.01	0.28	0.02	0.28	0.01
47	0.22(c)	0.03	0.22	0.02	0.22	0.00
49	(d)		0.23	0.01	0.23	0.01

(a) This preoperational mean is for 1982 - 1983 data only.
(b) 1985 TLD missing.
(c) There was only one annual exchange during the preoperational period.
(d) Stations 49-56 were first monitored during Fourth Quarter 1983. Station 61 was added in 1989 and discontinued in 1992.

TABLE 5-5 (Cont.)

ANNUAL TLD DATA SUMMARY FOR THE PREOPERATIONAL AND OPERATIONAL PERIODS

Results in mR/day

	PREOPERATIONAL		1984 - 1993 OPERATIONAL		1994 OPERATIONAL	
STATION	MEAN[a]	STANDARD ERROR	MEAN	STANDARD ERROR	MEAN	STANDARD DEVIATION(2σ)
50	(d)		0.23	0.02	0.22	0.00
51	(d)		0.22	0.02	0.23	0.01
53	(d)		0.25	0.02	0.25	0.01
54	(d)		0.24	0.02	0.24	0.01
55	(d)		0.23	0.02	0.22	0.01
56	(d)		0.23	0.02	0.23	0.01
61	(d)		0.26[d]	0.02	(e)	
71	0.24[c]	0.02	0.26	0.02	0.27	0.01
72	0.25[c]	0.02	0.25	0.02	0.27	0.01
73	0.23[c]	0.01	0.22	0.02	0.23	0.01
74	0.24[c]	0.01	0.25	0.02	0.25	0.01
75	0.24[c]	0.01	0.23	0.02	0.24	0.01
76	0.24[c]	0.02	0.23	0.02	0.23	0.01
77	0.25[c]	0.02	0.23	0.02	0.23	0.01
78	0.25[c]	0.04	0.23	0.02	0.22	0.01
79	0.25[c]	0.02	0.23	0.02	0.23	0.01
80	0.23[c]	0.05	0.22	0.02	0.22	0.00
81	0.23[c]	0.02	0.23	0.02	0.23	0.01
82	0.25[c]	0.03	0.24	0.01	0.24	0.01
83	0.25[c]	0.02	0.24	0.02	0.25	0.01
84	0.23[c]	0.02	0.23	0.02	0.24	0.01
85	0.26[c]	0.02	0.25	0.02	0.25	0.01
86	0.24	0.02	0.26	0.02	0.27	0.01
All	0.23	0.02	0.23	0.00	0.23	0.03

(a) This preoperational mean is for 1982 - 1983 data only.
(b) 1985 TLD missing.
(c) There was only one annual exchange during the preoperational period.
(d) Stations 49-56 were first monitored during Fourth Quarter 1983. Station 61 was added in 1989.
(e) Station 61 discontinued on June 29, 1992

TABLE 5-6

1994 MEAN QUARTERLY VERSUS ANNUAL TLD DATA

Results in mR/day

	QUARTERLY TLDs		ANNUAL TLDs	
STATION	MEAN[a]	STANDARD ERROR	MEAN[b]	STANDARD DEVIATION(2σ)
1	0.26	0.01	0.23	0.01
2	0.25	0.01	0.23	0.01
3	0.25	0.01	0.22	0.01
4	0.24	0.01	0.22	0.00
5	0.24	0.01	0.21	0.01
6	0.24	0.01	0.22	0.01
7	0.26	0.00	0.23	0.01
8	0.28	0.01	0.26	0.01
9	0.24	0.01	0.21	0.01
10	0.25	0.01	0.22	0.01
11	0.26	0.01	0.23	0.01
12	0.27	0.01	0.25	0.01
13	0.26	0.01	0.23	0.01
14	0.25	0.01	0.23	0.01
15	0.27	0.01	0.24	0.01
16	0.26	0.01	0.24	0.01
17	0.26	0.01	0.23	0.01
18	0.26	0.01	0.24	0.01
19	0.25	0.01	0.23	0.01
20	0.25	0.00	0.23	0.01
21	0.24	0.01	0.21	0.01
22	0.26	0.01	0.23	0.01
23	0.25	0.01	0.23	0.01
24	0.26	0.01	0.23	0.01
25	0.27	0.01	0.24	0.01
40	0.23	0.00	0.20	0.01
41	0.27	0.01	0.23	0.01
42	0.26	0.01	0.25	0.01
43	0.27	0.01	0.25	0.01
44	0.25	0.01	0.22	0.01
45	0.25	0.01	0.23	0.01
46	0.31	0.01	0.28	0.01
47	0.24	0.01	0.22	0.00
49	0.26	0.01	0.23	0.01
50	0.25	0.01	0.22	0.00

(a) Mean of the quarterly results.
(b) Mean of four readout areas on each TLD.
(c) TLD missing.

TABLE 5-6 (Cont.)

1994 MEAN QUARTERLY VERSUS ANNUAL TLD DATA
Results in mR/day

	QUARTERLY TLDS		ANNUAL TLDS	
STATION	MEAN[a]	STANDARD ERROR	MEAN[b]	STANDARD DEVIATION(2σ)
51	0.25	0.01	0.23	0.01
53	0.27	0.02	0.25	0.01
54	0.26	0.01	0.24	0.01
55	0.25	0.01	0.22	0.01
56	0.27	0.01	0.23	0.01
61	(c)		(c)	0.01
71 (1S)	0.30	0.02	0.27	0.01
72 (2S)	0.28	0.01	0.27	0.01
73 (3S)	0.25	0.01	0.23	0.01
74 (4S)	0.28	0.01	0.25	0.01
75 (5S)	0.27	0.01	0.24	0.01
76 (6S)	0.26	0.01	0.23	0.01
77 (7S)	0.27	0.00	0.23	0.01
78 (8S)	0.25	0.01	0.22	0.01
79 (9S)	0.26	0.01	0.23	0.01
80 (10S)	0.25	0.01	0.22	0.00
81 (11S)	0.26	0.01	0.23	0.01
82 (12S)	0.27	0.01	0.24	0.01
83 (13S)	0.27	0.01	0.25	0.01
84 (14S)	0.26	0.01	0.24	0.01
85 (15S)	0.27	0.01	0.25	0.01
86 (16S)	0.30	0.02	0.27	0.01

(a) Mean of the quarterly mean results.
(b) Mean of four readout areas on each TLD.
(c) Station 61 was discontinued on June 29, 1992.

6.0 QUALITY ASSURANCE AND QUALITY CONTROL

The REMP is designed to meet the quality assurance and quality control criteria of Regulatory Guide 4.15[4]. To accomplish this, the REMP requires that its analytical contractors meet these criteria also. In-depth audits are performed of the REMP records and activities and the records and activities of its support organizations at least annually by the Supply System Quality Assurance group.

Quality assurance and technical audits of the analytical contractor (Teledyne Brown Engineering) are also conducted annually to verify their compliance to regulatory and contractual requirements. The adequacy of their quality assurance program is also assessed during the audits.

Intercomparison programs, which involve the comparison of Supply System analytical results for samples containing known concentrations of various radionuclides with the known values and with the results reported by other monitoring programs, are also a major component of the quality assurance activities of the REMP. The program participates in the Environmental Protection Agency (EPA) and Environmental Measurements Laboratory (EML) intercomparison programs. It also participates in local and regional intercomparison studies. The following sections summarize the quality assurance and quality control aspects of the TLD and analytical components of the REMP.

6.1 Quality Control For the Supply System Environmental TLD Program

The Quality Control Program includes the preparation, processing and evaluation of environmental TLDs. QA dosimeters, which are annealed just prior to being given a known exposure to cesium-137 gamma radiation and processed among the field dosimeters, serve as indicators that the readout, calibration and evaluation of the field dosimeters were properly performed. The number of QA dosimeters used during each processing is generally 10% of the number of field dosimeters. Since 1987, the same QA dosimeters have been used repeatedly throughout the year in order to track their sensitivity and to provide consistency from run to run.

If the mean QA dosimeter results are greater than $\pm$ 5% (or 5 mR) of the given exposure, an investigation into the source of the discrepancy is initiated. Evaluation of the 1994 QA dosimeter results indicated only small biases for the four quarters.

Control dosimeters (trip controls) are used for each set of field dosimeters to monitor the contribution of the exposure received by the field TLDs while in transit. The radiation background in the storage area is also monitored by a separate set of control dosimeters (building controls). If the trip control results are significantly greater than the building control results, the difference between the two is subtracted from the field dosimeters.

Spiked dosimeters, which are exposed to known levels of radiation below the 100 mR given to the QA dosimeters, were processed with the field dosimeters during each run to verify the accuracy of the environmental TLD evaluations. All results were within $\pm$5% of the given exposure and are provided in Table 6-1.

During each environmental TLD processing, individual calibration factors are determined for each TLD by exposing the TLDs to 100 mR from an encapsulated cesium-137 source. The calibration exposure is determined from the exposure duration and the assessed source strength at 55 centimeters. As a quality control check for each calibration exposure, an NIST-traceable ionization chamber is also used to determine the calibration exposure. If the ionization chamber measurement does not agree with the calibration exposure to within $\pm$ 5% of the calculated value, an investigation is performed into the discrepancy and the TLD calibration is repeated, if necessary.

6.2 Quality Control For the Analytical Program

Quality control for the analytical program involves two components: the quality control activities performed by the Supply System and the quality control program of the analytical contractor, Teledyne Brown Engineering. Both of these components are described in the following sections.

6.2.1 Supply System Quality Control Activities

The Supply System has participated in the U.S. Department of Energy's Environmental Measurements Laboratory (EML) Quality Assessment Program since 1987. In general, the Teledyne Brown results agreed with the EML values as seen in Table 6-2.

In addition to participating in the EML Intercomparison Program, the Supply System participates in the Environmental Radiation Quality Assurance Task Force of the Pacific Northwest (QATF) intercomparison program. The results of the 1994 QATF intercomparison are listed in Table 6-3.

Duplicate samples were also submitted to Teledyne Brown for analysis during 1994. These duplicates consisted of two sets of milk samples and one set of air filters from EML. The milk duplicates were marked Station 37 and were submitted for analysis at the same time as the milk samples from Station 36.

6.2.2 Teledyne Brown Engineering Quality Control Program

The goal of the quality control program at Teledyne Brown Engineering is to produce analytical results which are accurate, precise and supported by adequate documentation. The program is based on the requirements of 10CFR50, Appendix B, Regulatory Guide 4.15 and the implemented program, as described in Teledyne's Quality Assurance Manual IWL-0032-395 and Quality Control Manual IWL-0032-365.

All measuring equipment is calibrated for efficiency at least annually using standard reference material traceable to the National Institute of Standards and Technology (NIST). For alpha and beta counting, check sources are prepared and counted every day the counter is in use. Control charts are maintained with three-sigma limits specified. Backgrounds are usually measured at least once per week.

The efficiency of the gamma spectrometers is determined annually with a NIST-traceable standard reference material selected to cover the energy range of the nuclides to be monitored and to include all of the geometries measured. Backgrounds are determined every other week and check sources are counted weekly. The energy resolution and efficiency are plotted at two energy levels (125.1 and 1274.4 KeV) on charts and held within three-sigma control limits.

The efficiency of the tritium liquid scintillations was determined at least annually by counting a NIST-traceable standard which had been diluted in a known amount of distilled water so that the activity level loaded into the counter is sufficient to provide good counting statistics. If the efficiency measurement does not agree within two standard deviations of the average of the previous six measurements, corrective action is taken. The background of each counter is measured for each batch of samples. A control chart is maintained for the background and check source measurements as a stability check.

Control of sample identity is maintained by the assignment of a unique five-digit number which is maintained throughout the sample's history from sample receipt, log-in number assignment, and designation of analysis to reporting the final analytical result. Besides ensuring sample accountability, Teledyne procedures also ensure the maintenance of sample integrity by controlling sample storage and taking steps to prevent contamination of samples.

Results are reviewed for reasonableness before being entered into the data system. Any results which are suspect, i.e., which are higher or lower than results in the past, are returned to the laboratory for recount. If a longer count, decay check, recount on another system or recalculation does not give acceptable results based on experience, a new aliquot is analyzed. The complete information about the sample is contained on the worksheets accompanying the sample results.

Teledyne Brown also participates in the EPA intercomparison program. Table 6-4 presents the results of the 1994 intercomparison as reported to the Supply System. Footnotes in the table refer to investigations of problems encountered in a few cases and the steps taken by Teledyne Brown to prevent reoccurrence.

Iodine-131 Cartridges

One blank charcoal cartridge was analyzed on a weekly basis with each set of cartridges, for a total of fifty-two blanks. The average activity was of the blanks was -3.2 ± 8.4 E-01 total pCi. Activities were calculated without considering detection limits.

Gross-Beta - Filters

One blank filter was measured with each set of filters analyzed. Fifty-two blanks were counted. The average activity of the blanks in total pCi was 1.1 ± 0.2 E+00.

I-131 - Milk

A blank milk was analyzed with each group of samples analyzed. The results showed that there was no contamination in the laboratory or counting area. Eighteen blank samples were counted in 1994 with an average activity of 1.6 ± 5.5 E-02 pCi/liter without considering detection limits. An additional 52 blanks were analyzed as part of the Teledyne Brown Engineering Quality Assurance program. The average result for blanks in 1994 was 1.6 ± 6.2 E-02 pCi/liter.

Sr-90 - Milk and Water

Blank water samples were analyzed on a weekly basis. The average activity of the fifty-two samples in 1994 was 5.8 ± 20.0 E-02 pCi/liter. Fifty-two spiked water samples were analyzed with an average value of 3.7 ± 0.2 E+01 pCi/l versus a spike value of 3.8 ± 0.6 E+01 pCi/l. A total of twenty-four spiked milk samples were analyzed in 1994. The average value of the samples was 3.8 ± 0.3 E+01 pCi/liter compared to a spike value of 3.8 ± 0.6 E+01 pCi/l. Twenty-four blank milk samples were analyzed with an average activity of 1.0 ± 0.3 E+00 pCi/liter of Sr-90, which is the natural content of milk.

Gross Beta - Water

Fifty-two blanks were prepared from distilled water. The average result was 2.9 ± 1.5 E-01 without considering detection limits. In 1994, fifty-two spike samples were also analyzed with an average result of 2.1 ± 0.2 E+01 pCi/liter. The spike level was 2.2 ± 0.5 E+01 pCi/l. No contamination was indicated and the background level was low and stable.

Tritium in Water

Fifty-two blank samples were analyzed by liquid scintillation. The average result, without considering detection levels, was -1.1 ± 35.0 E+00 pCi/l. Fifty-two spiked samples with a level of 1.3 ± 0.2 E+03 pCi/l were analyzed. The average result was 1.4 ±01 E+03 pCi/l.

Gamma Spectroscopy

A blank water sample was analyzed on a weekly basis in the gamma spectroscopy laboratory. All nuclides were below the normal level of detection. Weekly spike samples were analyzed using the Cs-137 peak at 662 KeV. The spike value was 2.2 ± 0.3 E+04 pCi/l and the average result of the fifty-two spike samples was 2.2 ± 0.03 E+04 pCi/l.

TABLE 6-1

1994 ENVIRONMENTAL SPIKED DOSIMETER RESULTS

DISTRIBUTION PERIOD	GIVEN EXPOSURE (mR)	REPORTED EXPOSURE (mR)	BIAS (%)
First Quarter	30.0	30.6	2.0
		30.6	2.0
		30.3	1.0
Second Quarter	25.0	25.4	1.6
	27.0	27.2	0.7
	29.0	29.6	2.0
Third Quarter	29.0	29.5	1.7
		28.6	-1.4
		28.6	-1.4
Fourth Quarter	26.0	26.4	1.5
		27.2	4.4
		26.5	1.9
Annual	80.0	81.0	1.2
		78.2	-2.3
		84.1	4.9

TABLE 6-2

1994 ENVIRONMENTAL MEASUREMENTS LABORATORY (EML)
QUALITY ASSESSMENT PROGRAM RESULTS

DATE	SAMPLE TYPE	NUCLIDE	REPORTED RESULT	PERCENT ERROR	EML VALUE	RATIO REPORTED/EML
03/94	Air (Bq/filter)[1]	Mn-54	2.77E+01	2	3.35E+01	0.83
		Co-57	8.61E+00	2	1.25E+01	0.69
		Co-60	5.92E+01	2	7.02E+01	0.84
		Sb-125	2.14E+01	5	2.33E+01	0.92
		Cs-137	3.48E+01	2	4.00E+01	0.87
		Ce-144	8.38E+01	2	1.28E+02	0.65
03/94	Soil (Bq/kg)	K-40	3.54E+02	5	3.37E+02	1.05
		Sr-90	1.20E+01	21	8.79E+00	1.37
		Cs-137	1.61E+02	2	1.41E+02	1.14
03/94	Vegetation (Bq/kg)	K-40	1.01E+03	3	9.23E+02	1.09
		Co-60	4.03E+01	5	3.40E+01	1.19
		Cs-137	5.31E+02	1	4.61E+02	1.15
03/94	Water (Bq/l)	H-3	1.90E+02	3	1.87E+02	1.02
		Mn-54	9.08E+01	3	9.82E+01	0.92
		Co-60	1.01E+02	3	1.01E+02	1.00
		Sr-90	3.30E+01	3	2.86E+01	1.15
		Cs-134	1.49E+02	2	1.54E+02	0.97
		Cs-137	1.00E+02	2	9.37E+01	1.07
09/94	Soil (Bq/kg)	K-40	3.91E+02	10	4.28E+02	0.91
		Sr-90	2.80E+00	29	3.30E+00	0.85
		Cs-137	2.96E+02	10	2.80E+02	1.06
09/94	Vegetation (Bq/kg)	K-40	7.71E+02	10	8.08E+02	0.95
		Sr-90	5.20E+02	7	5.35E+02	0.97
		Co-60	1.22E+01	22	1.07E+01	1.14
09/94	Water (Bq/l)	H-3	1.10E+02	7	1.13E+02	0.97
		Mn-54	9.83E+01	10	1.08E+02	0.91
		Co-60	3.38E+02	10	3.17E+02	1.07
		Sr-90	8.50E+01	4	6.86E+01	1.24
		Cs-137	5.08E+01	10	4.66E+01	1.09

[1] Bq = becquerel; the EML results are reported in becquerels instead of picocuries. One picocurie equals 0.037 becquerel.

TABLE 6-3

1994 ENVIRONMENTAL RADIATION QUALITY ASSURANCE TASK FORCE
OF THE PACIFIC NORTHWEST INTERCOMPARISON RESULTS

SAMPLE/ NUCLIDE	WA	OR	PNL	WHC	SS	ID	USE
Reference Sediment (pCi/g dry)							
Sr-90	282 ± 4	—	108 ± 1.3	241 ± 2.4	240 ± 10	—	239 ± 4.1
	267 ± 4	—	117 ± 1.3	239 ± 2.4	240 ± 10	220 ± 20	240 ± 3.5
	269 ± 4	—	109 ± 1.3	—	240 ± 10	—	—
Cs-137	85.9 ± 0.3	83.2 ± 1.2	85.1 ± 0.7	87.5 ± 0.5	85.6 ± 8.6	78.7 ± 7.1	103.7 ± 0.2
	84.1 ± 0.3	—	82.5 ± 0.7	87.0 ± 0.5	86.2 ± 8.6	—	100.2 ± 0.3
	85.3 ± 0.3	—	73.1 ± 0.7	—	84.1 ± 8.4	—	—
Hanford Groundwater 100-N-56 (pCi/l)							
H-3	11800 ± 300	10200 ± 200	11100 ± 325	7791 ± 78	11000 ± 1000	11710 ± 340	11951 ± 320
	11300 ± 300	—	11100 ± 326	8287 ± 83	11000 ± 1000	11990 ± 350	11595 ± 316
	11300 ± 300	—	10800 ± 321	8712 ± 87	12000 ± 1000	11800 ± 350	11719 ± 317
Sr-90	232 ± 13	—	329 ± 4.5	212 ± 9.3	230 ± 10	240 ± 20	197.3 ± 4.2
	235 ± 13	—	243 ± 4.6	207 ± 6.8	240 ± 10	—	221.4 ± 4.8
	242 ± 14	—	243 ± 4.4	204 ± 6.3	230 ± 10	—	199.7 ± 4.5
Co-60	2.41 ± 0.87	12.8 ± 0.4	-3.25 ± 8.61	5.9 ± 1.9	<1.9 ± 1.3	2.3 ± 0.96	2.6 ± 0.8
	2.36 ± 1.16	13.0 ± 0.4	-5.57 ± 9.10	5.5 ± 2.3	<1.3 ± 1.8	1.2 ± 0.94	2.9 ± 0.9
	1.66 ± 0.81	—	1.24 ± 7.57	7.7 ± 2.5	<2.0 ± 2.7	1.3 ± 84.0	2.7 ± 1.2

WA = Washington State Department of Health
PNL = Battelle Pacific Northwest Laboratory
WHC = Westinghouse Hanford Company
USE = US Ecology
OR = State of Oregon Health Divison
SS = Washington Public Power Supply System
ID = Idaho State University

TABLE 6-3 (Cont.)

1994 ENVIRONMENTAL RADIATION QUALITY ASSURANCE TASK FORCE
OF THE PACIFIC NORTHWEST INTERCOMPARISON RESULTS

SAMPLE/ NUCLIDE	WA	OR	PNL	WHC	SS	ID	USE
Hanford Groundwater 399-1-16A (pCi/l)							
H-3	10600 ± 200	10200 ± 200	10300 ± 313	9878 ± 99	10000 ± 1000	10790 ± 340	10588 ± 303
	10700 ± 200	—	10100 ± 312	8861 ± 89	10000 ± 1000	10770 ± 340	10772 ± 305
	10400 ± 200	—	10200 ± 313	10732 ± 107	10000 ± 1000	11210 ± 340	10815 ± 306
U-234	58.7 ± 1.4	—	68.2 ± 1.1	—	67 ± 8	62 ± 14	66.9 ± 0.8
	58.1 ± 1.3	—	76.5 ± 1.5	—	67 ± 6	—	65.3 ± 0.8
	58.7 ± 1.3	—	75.5 ± 1.2	—	66 ± 8	—	66.9 ± 0.8
U-235	2.9 ± 0.3	—	4.21 ± 0.49	—	2.7 ± 0.9	2.7 ± 1.8	3.5 ± 0.2
	3.3 ± 0.3	—	1.53 ± 0.26	—	3.0 ± 0.8	—	3.7 ± 0.2
	3.3 ± 0.3	—	1.69 ± 0.17	—	2.6 ± 0.9	—	3.6 ± 0.2
U-238	49.1 ± 1.3	—	56.9 ± 1.0	—	52 ± 6	53 ± 12	54.9 ± 0.7
	46.3 ± 1.2	—	57.6 ± 1.3	—	54 ± 5	—	53.1 ± 0.7
	58.7 ± 1.3	—	58.8 ± 1.0	—	51 ± 6	—	55.1 ± 0.7
Total U	114 ± 12	—	93.1 ± 27.2	178 ± 8.9	122 ± 10	120 ± 40	125.3 ± 1.7
	111 ± 2	—	92.3 ± 26.9	177 ± 8.9	124 ± 7.9	—	122.1 ± 1.7
	115 ± 2	—	97.8 ± 28.6	177 ± 8.9	120 ± 10	—	125.6 ± 1.7

WA = Washington State Department of Health
PNL = Battelle Pacific Northwest Laboratory
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USE = US Ecology
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SS = Washington Public Power Supply System
ID = Idaho State University

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TABLE 6-4

1994 EPA INTERCOMPARISON PROGRAM RESULTS

ISOTOPE	COLLECTION DATE	TI RESULTS (a)	EPA RESULTS (b)	OTHER LABS (c)	
		MEDIUM - WATER (pCi/liter)			
Sr-89	01/14/94	24.00 ± 1.00	25.0 ± 5.0	23.74 ± 4.01	
Sr-90	"	15.67 ± 1.53	15.0 ± 5.0	14.59 ± 2.17	
Sr-89	04/19/94	19.00 ± 1.00	20.0 ± 5.0	18.49 ± 3.69	
Sr-90	"	13.00 ± 0.00	14.0 ± 5.0	14.13 ± 2.14	
Sr-89	07/15/94	26.00 ± 1.73	30.0 ± 5.0	28.84 ± 6.06	
Sr-90	"	19.00 ± 0.00	20.0 ± 5.0	18.80 ± 2.80	
Gr-Beta	01/28/94	72.33 ± 3.79	62.0 ± 10.0	56.14 ± 14.15	(d)
Gr-Beta	04/19/94	102.67 ± 6.43	117.0 ± 18.0	106.86 ± 15.47	
Gr-Beta	07/22/94	16.00 ± 0.00	10.0 ± 5.0	14.91 ± 3.74	(e)
Gr-Beta	10/28/94	25.33 ± 1.53	23.0 ± 5.0	27.16 ± 5.23	
I-131	02/04/94	110.33 ± 0.00	119.0 ± 12.0	120.99 ± 10.18	
Ra-226	02/11/94	21.00 ± 1.00	19.9 ± 3.0	19.39 ± 3.51	
Ra-228	"	15.67 ± 1.53	14.7 ± 3.7	14.09 ± 3.07	
Co-60	04/19/94	23.67 ± 3.21	20.0 ± 5.0	20.12 ± 1.83	
Cs-134	"	34.00 ± 1.73	34.0 ± 5.0	31.45 ± 2.72	
Cs-137	"	34.00 ± 2.65	29.0 ± 5.0	31.17 ± 2.40	
Ra-226	"	15.67 ± 1.53	20.0 ± 3.0	19.72 ± 4.23	(f)
Ra-228	"	15.33 ± 0.58	20.1 ± 5.0	20.07 ± 3.58	
Co-60	06/10/94	43.00 ± 2.00	50.0 ± 5.0	49.77 ± 3.82	(g)
Zn-65	"	13.33 ± 0.58	134.0 ± 13.0	140.62 ± 9.59	(h)
Ru-106	"	201.33 ± 9.29	252.0 ± 25.0	216.56 ± 28.52	(i)
Cs-134	"	29.33 ± 3.79	40.0 ± 5.0	36.99 ± 3.14	(j)
Cs-137	"	49.67 ± 1.53	49.0 ± 5.0	52.38 ± 3.61	
Ba-133	"	85.00 ± 3.00	98.0 ± 10.0	86.46 ± 8.31	(k)
Ra-226	06/17/94	15.33 ± 0.58	15.0 ± 2.3	14.95 ± 1.49	
Ra-228	"	16.33 ± 1.53	15.4 ± 3.9	15.39 ± 2.84	
Ra-226	09/16/94	10.67 ± 0.58	10.0 ± 1.5	9.92 ± 1.31	
Ra-228	"	9.70 ± 0.52	10.2 ± 2.6	10.47 ± 1.87	
I-131	10/07/94	71.00 ± 3.00	79.0 ± 8.0	79.89 ± 6.79	
Co-60	11/04/94	52.00 ± 0.00	59.0 ± 5.0	58.87 ± 4.59	(l)
Zn-65	"	81.33 ± 7.02	100.0 ± 10.0	104.68 ± 7.95	(l)
Cs-134	"	19.67 ± 2.52	24.0 ± 5.0	22.95 ± 2.27	
Cs-137	"	54.33 ± 2.31	49.0 ± 5.0	51.92 ± 3.61	
Ba-133	"	58.33 ± 2.89	73.0 ± 7.0	70.81 ± 6.13	(l)
H-3	03/04/94	4833.33 ± 152.75	4936.0 ± 494.0	4844.97 ± 477.67	
H-3	08/05/94	9700.00 ± 100.04	9951.0 ± 995.0	9651.86 ± 696.62	
		MEDIUM - AIR FILTERS (pCi/F)			
Gr-Beta	08/26/94	59.33 ± 3.21	56.0 ± 10.0	59.08 ± 7.23	
Sr-90	"	18.00 ± 1.00	20.0 ± 5.0	19.57 ± 2.76	
Cs-137	"	17.00 ± 1.73	15.0 ± 5.0	16.59 ± 2.42	
		MEDIUM - MILK (pCi/liter)			
Sr-89	09/30/94	24.33 ± 2.52	25.0 ± 5.0	22.19 ± 5.11	
Sr-90	"	17.67 ± 1.53	15.00 ± 5.0	15.15 ± 2.48	
I-131	"	81.67 ± 5.86	75.0 ± 8.0	74.89 ± 5.58	
Cs-137	"	70.33 ± 4.62	59.0 ± 5.0	62.39 ± 3.72	(m)
K	"	1740.00 ± 153.95	1715.0 ± 86.0	1700.90 ± 109.00	

Footnotes:

(a) Teledyne Results - Average ± one sigma. Units are pCi/liter for water and milk except for potassium (K) which is in mg/liter. Units are total pCi for air particulate filters.

(b) EPA Results - Expected laboratory precision (1 σ). Units are pCi/l for water, and milk except that potassium is in mg/l. Units are total pCi for air particulate filters.

(c) Average concentration plus or minus one sigma, based on range of values encountered.

(d) There appears to be variation in self-absorption matrix. The EPA confirms that the composition of their tap water from Lake Mead, varies seasonally which can cause variation in alpha, beta results. Results are within $\pm 3\ \sigma$ control limits.

(e) EPA results for gross beta in water were corrected for 20% crosstalk into the beta channel from the Th-230 alpha spike. Measurements show that the crosstalk can be much higher (37% for Tennelec Counter #3 and 54% for Gamma Products Counter #1). The normalized deviation from the grand average was only 0.38.

(f) No specific or apparent reason found. Data sheets verified and detector efficiencies calibrated. Teledyne will check future samples to see if a pattern develops.

(g) A second aliquot was analyzed, paying particular attention to volume aliquoted. The result, 52 pCi/l, was in good agreement with the EPA. The three original results, each counted on a different detector, showed good precision. The measurement of Co-60 has not been a problem.

(h) The average value of three analyses on the "Report of Analysis" was 133 pCi/l which is in good agreement with the EPA. Apparently, incorrect results were entered into the EPA computer.

(i) EPA was experiencing problems with the Ruthenium-106 used in Performance Evaluation Studies.

(j) The first aliquot, prepared according to EPA dilution instructions was counted on four detectors in the 1-liter Marinelli geometry with Cs-134 results (based on the 796-KeV peak) in pCi/l of 32.0, 25.1. 31.7, and 30.8. The 31.7 result was not reported. Had that been reported instead of 25.1, the average would have been 31.5 and the normalized deviation would have been -2.94 instead of -3.70. A second aliquot was prepared and a single measurement was made with the result of 31.1 pCi/l. An undiluted aliquot was measured in a 150-ml geometry with the result of 33.5 pCi/l. That result is comparable with the Marinelli results. Thus, sample preparation (dilution, volume determination, maintaining correct pH. etc.). sample geometry. or detector efficiency do not seem to be the cause of the low results.

(k) There is no apparent reason for the low result, however the average value, 85 pCi/l is in good agreement to the grand average (86.46).

(l) The results are being investigated.

(m) The milk sample was counted four times. The reported Cs-137 values were based on one aliquot of 1 liter volume and an aliquot of 0.865 liter counted two times. It is suspected that the 0.865 liter volume was incorrectly determined. If 1 liter (the usual volume for counting milk samples) is used in the calculation, the average of three results equals 63.6 pCi/l which gives a normalized deviation to the known of 1.59. The fourth count (a 1-liter aliquot) had a Cs-137 equal to 64.2 pCi/l which is in good agreement with the average of the other three.

7.0 REFERENCES

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2. U.S. Nuclear Regulatory Commission, "Environmental Technical Specifications For Nuclear Power Plants", Regulatory Guide 4.8, December 1975.

3. U.S. Nuclear Regulatory Commission, "An Acceptable Radiological Environmental Monitoring Program", Assessment Branch Technical Position Revision 1, November 1979.

4. U.S. Nuclear Regulatory Commission, "Quality Assurance For Radiological Environmental Monitoring Program (Normal Operations), Effluent Streams and the Environment", Regulatory Guide 4.15, Revision 1, February 1979.

5. U.S. Nuclear Regulatory Commission, "Performance, Testing and Procedural Specifications For Thermoluminescence Dosimetry-Environmental Applications", Regulatory Guide 4.13, Revision 1, July 1977.

6. Energy Facility Site Evaluation Council, Resolution No. 260, January 1992.

7. Washington Public Power Supply System Nuclear Plant No. 2, Operating License NSF-21, Technical Specifications 3/4.12.1, Table 3.13.1.

8. WNP-2 Offsite Dose Calculation Manual (ODCM).

9. Code of Federal Regulations, Title 10 Part 20, "Standards For Protection Against Radiation".

10. Code of Federal Regulations, Title 10 Part 50, "Domestic Licensing of Production and Utilization Facilities".

11. Washington Administrative Code 246-290, "Group A Public Water Systems".

12. Washington Administrative Code 173-200, "Water Quality Standards for Ground Water of the State of Washington".

13. Washington Administrative Code 173-201A, "Water Quality Standards for Surface Waters of the State of Washington".

14. "Teledyne Isotopes TLD System For Personnel and Environmental Monitoring", Teledyne Isotopes, Westwood, New Jersey, February 2, 1981.

15. Washington Public Power Supply System, Radiological Environmental Monitoring Program Annual Report Plant 2, 1985, April 1986.

16. Robertson, D. E., and J. J. Fix, Association of Hanford Origin Radionuclides With Columbia River Sediment, BNWL-2305, August 1977.

17. Energy Facility Site Evaluation Council, Resolution 259, amended November 1994.

8.0 1993 REMP REPORT ERRATA

Corrections to errors found in the 1993 Radiological Environmental Monitoring Program Annual Report are listed below. Corrections to 1993 annual TLD results listed in Tables 5-5 and 5-6 are included in Tables 8-1 and 8-2.

Page 4-16, Table 4-2: SE sector, Station 40 sample types should be AP/AI/TLD.

Page 4-16, Table 4-2: SW sector, Station 96 sample type should be MI, not TLD.

Page 5-3, Figure 5-5: Caption should be TLD Frequency Distribution 1984-1992.

Page 5-13, Table 5-1: Storm Drain Water - Previous Operational Cs-134 range should be (-4.8 - 4.8).

Page 5-13, Table 5-1: Storm Drain Water - Previous Operational H-3 mean should be 12486.9 pCi/l.

Page 5-13, Table 5-1: Storm Drain Water - 1993 H-3 mean should be 5650.5 pCi/l.

Page 5-13, Table 5-1: Sanitary Waste Water - Previous Operational H-3 average should be 736.5 pCi/l.

Page 5-13, Table 5-1: Sanitary Waste Water - 1993 H-3 mean should be 317.2 pCi/l.

Page 5-14, Table 5-1: Storm Drain Sediment - Previous Operational Fe-59 mean and range should be 5.7 (-55.0 - 280.0) pCi/kg.

Page 5-14, Table 5-1: Sanitary Waste Sediment - Previous Operational Cs-137 mean should be 128.2 pCi/kg.

Page 5-14, Table 5-1: Sanitary Waste Sediment - Previous Operational Co-60 mean should be 170.7 pCi/kg.

Page 5-14, Table 5-1: Sanitary Waste Sediment - Previous Operational Zn-65 range should be (-65.0 - 69.0) pCi/kg.

Page 5-14, Table 5-1: Sanitary Waste Sediment - Previous Operational Mn-54 mean and range should be 6.2 (-26.0 - 32.1) pCi/kg.

Table A-2.1, Gross Beta on Air Particulate Filters: The exponent for the overall uncertainty starting 930927 to 931004 and ending at 931220 to 931227 for all stations should be E-03, not E-01.

Page 5-3, Figure 5-3: Chart incorrect, correct chart shown.

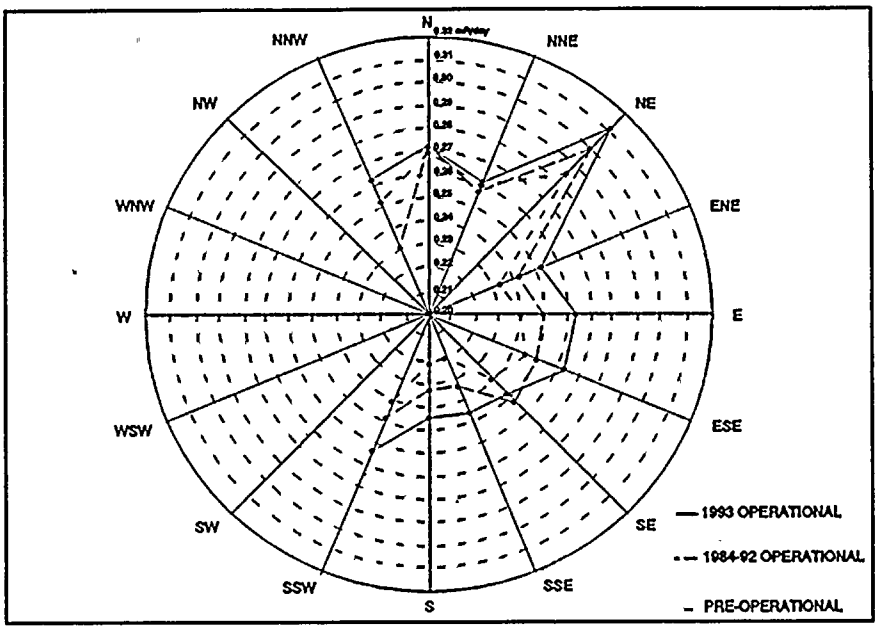

Figure 5-3 Remote TLDs

Page 5-6, Figure 5-12: Chart incorrect, correct chart shown.

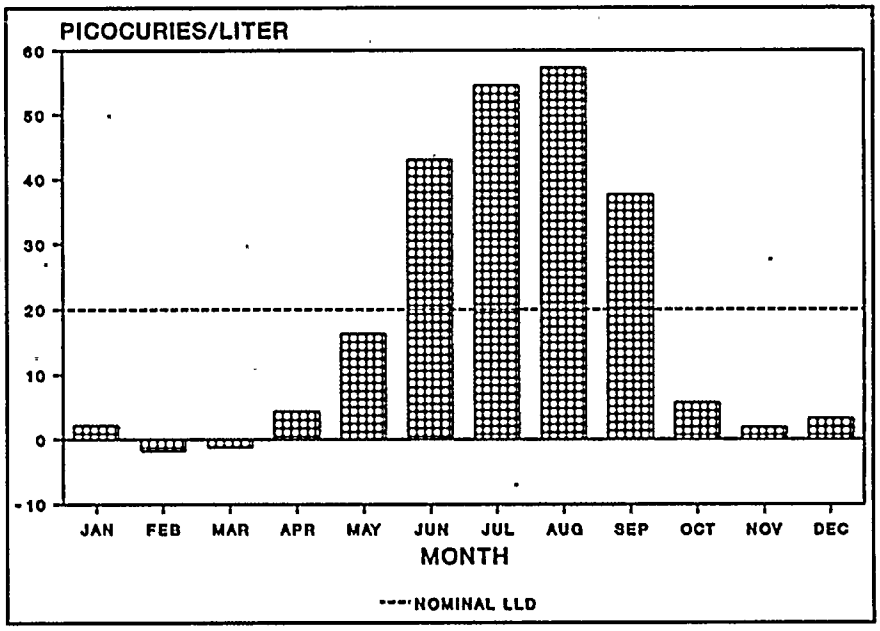

Figure 5-12 Zn-65 in Discharge Water - 1993

TABLE 8-1

ANNUAL TLD DATA SUMMARY FOR THE PREOPERATIONAL
AND OPERATIONAL PERIODS - CORRECTIONS FOR 1993 ANNUAL REPORT

Results in mR/day

	PREOPERATIONAL		1984 - 1992 OPERATIONAL		1993 OPERATIONAL	
STATION	MEAN(a)	STANDARD ERROR	MEAN	STANDARD ERROR	MEAN	STANDARD DEVIATION(2σ)
1	0.23	0.04	0.23	0.02	0.25	0.02
2	0.22	0.04	0.23	0.02	0.24	0.01
3	0.21	0.04	0.22	0.02	0.23	0.01
4	0.22	0.06	0.20	0.02	0.22	0.01
5	0.22	0.04	0.21	0.02	0.22	0.01
6	0.21	0.04	0.21	0.02	0.22	0.01
7	0.22	0.02	0.23(b)	0.01	0.24	0.01
8	0.25	0.04	0.25(b)	0.02	0.26	0.01
9	0.20	0.02	0.21	0.02	0.22	0.00
10	0.22	0.04	0.22	0.02	0.23	0.01
11	0.22	0.04	0.22	0.02	0.24	0.01
12	0.24	0.04	0.24	0.02	0.25	0.01
13	0.22	0.04	0.23	0.01	0.24	0.01
14	0.22	0.04	0.22	0.02	0.24	0.01
15	0.23	0.06	0.24	0.02	0.26	0.01
16	0.23	0.04	0.23	0.02	0.24	0.01
17	0.23	0.02	0.23(b)	0.02	0.25	0.01
18	0.25	0.02	0.23	0.02	0.24	0.01
19	0.22	0.04	0.23	0.01	0.22	0.00
20	0.23	0.04	0.23	0.02	0.24	0.01
21	0.23	0.02	0.21	0.02	0.23	0.01
22	0.22	0.02	0.23	0.02	0.24	0.01
23	0.24	0.02	0.22	0.02	0.23	0.01
24	0.22	0.02	0.23	0.02	0.24	0.01
25	0.24	0.02	0.24	0.02	0.26	0.00
40	0.21(c)	0.02	0.22	0.02	0.21	0.00
41	0.26(c)	0.04	0.24	0.02	0.25	0.01
42	0.24(c)	0.02	0.23	0.02	0.24	0.00
43	0.24(c)	0.02	0.24	0.02	0.26	0.00
44	0.24	0.02	0.22	0.02	0.24	0.01
45	0.24	0.01	0.22	0.02	0.24	0.01
46	0.29	0.01	0.28	0.02	0.29	0.01
47	0.22(c)	0.03	0.21	0.02	0.24	0.01
49	(d)		0.22	0.01	0.24	0.01

(a) This preoperational mean is for 1982 - 1983 data only.
(b) 1985 TLD missing.
(c) There was only one annual exchange during the preoperational period.
(d) Stations 49-56 were first monitored during Fourth Quarter 1983. Station 61 was added in 1989 and discontinued in 1992.

TABLE 8-1 (Cont.)

ANNUAL TLD DATA SUMMARY FOR THE PREOPERATIONAL AND OPERATIONAL PERIODS - CORRECTIONS FOR 1993 ANNUAL REPORT

Results in mR/day

	PREOPERATIONAL		1984 - 1992 OPERATIONAL		1993 OPERATIONAL	
STATION	MEAN[a]	STANDARD ERROR	MEAN	STANDARD ERROR	MEAN	STANDARD DEVIATION(2σ)
50	(d)		0.23	0.02	0.24	0.01
51	(d)		0.22	0.02	0.24	0.01
53	(d)		0.25	0.02	0.25	0.01
54	(d)		0.24	0.02	0.25	0.01
55	(d)		0.22	0.02	0.24	0.01
56	(d)		0.23	0.02	0.24	0.01
61	(d)		0.27[d]	0.02	(e)	
71	0.24[c]	0.02	0.25	0.02	0.28	0.00
72	0.25[c]	0.02	0.25	0.02	0.27	0.00
73	0.23[c]	0.01	0.22	0.02	0.23	0.01
74	0.24[c]	0.01	0.24	0.02	0.26	0.01
75	0.24[c]	0.01	0.23	0.02	0.25	0.00
76	0.24[c]	0.02	0.23	0.02	0.25	0.01
77	0.25[c]	0.02	0.23	0.02	0.25	0.00
78	0.25[c]	0.04	0.23	0.02	0.24	0.00
79	0.25[c]	0.02	0.23	0.02	0.24	0.01
80	0.23[c]	0.05	0.22	0.02	0.24	0.01
81	0.23[c]	0.02	0.23	0.02	0.24	0.01
82	0.25[c]	0.03	0.24	0.01	0.25	0.01
83	0.25[c]	0.02	0.24	0.02	0.26	0.02
84	0.23[c]	0.02	0.23	0.02	0.25	0.01
85	0.26[c]	0.02	0.24	0.02	0.26	0.00
86	0.24	0.02	0.26	0.02	0.28	0.01
All	0.23	0.02	0.23	0.01	0.24	0.01

(a) This preoperational mean is for 1982 - 1983 data only.
(b) 1985 TLD missing.
(c) There was only one annual exchange during the preoperational period.
(d) Stations 49-56 were first monitored during Fourth Quarter 1983. Station 61 was added in 1989.
(e) Station 61 discontinued on June 29, 1992

TABLE 8-2

1993 MEAN QUARTERLY VERSUS ANNUAL TLD DATA - CORRECTIONS FOR 1993 ANNUAL REPORT

Results in mR/day

	QUARTERLY TLDs		ANNUAL TLDs	
STATION	MEAN[a]	STANDARD ERROR	MEAN[b]	STANDARD DEVIATION(2σ)
1	0.26	0.01	0.25	0.02
2	0.26	0.01	0.24	0.01
3	0.24	0.01	0.23	0.01
4	0.24	0.01	0.22	0.01
5	0.24	0.01	0.22	0.01
6	0.24	0.01	0.22	0.01
7	0.25	0.01	0.24	0.01
8	0.28	0.01	0.26	0.01
9	0.24	0.01	0.22	0.00
10	0.25	0.01	0.23	0.01
11	0.25	0.00	0.24	0.01
12	0.27	0.01	0.25	0.01
13	0.26	0.01	0.24	0.01
14	0.25	0.00	0.24	0.01
15	0.27	0.01	0.26	0.01
16	0.26	0.01	0.24	0.01
17	0.26	0.01	0.25	0.01
18	0.26	0.01	0.24	0.01
19	0.25	0.01	0.22	0.00
20	0.25	0.01	0.24	0.01
21	0.23	0.01	0.23	0.01
22	0.25	0.01	0.24	0.01
23	0.25	0.01	0.23	0.01
24	0.26	0.01	0.24	0.01
25	0.27	0.01	0.26	0.00
40	0.23	0.01	0.21	0.00
41	0.27	0.01	0.25	0.01
42	0.26	0.01	0.24	0.00
43	0.27	0.01	0.26	0.00
44	0.25	0.01	0.24	0.01
45	0.25	0.01	0.24	0.01
46	0.31	0.01	0.29	0.01
47	0.24	0.01	0.24	0.01
49	0.26	0.01	0.24	0.01
50	0.25	0.01	0.24	0.01

(a) Mean of the quarterly results.
(b) Mean of four readout areas on each TLD.

TABLE 8-2 (Cont.)

1993 MEAN QUARTERLY VERSUS ANNUAL TLD DATA -
CORRECTIONS FOR 1993 ANNUAL REPORT
Results in mR/day

	QUARTERLY TLDS		ANNUAL TLDS	
STATION	MEAN[a]	STANDARD ERROR	MEAN[b]	STANDARD DEVIATION(2σ)
51	0.25	0.01	0.24	0.01
53	0.29	0.02	0.25	0.01
54	0.26	0.01	0.25	0.01
55	0.25	0.01	0.24	0.01
56	0.26	0.01	0.24	0.01
61	(c)		(c)	
71 (1S)	0.29	0.02	0.28	0.00
72 (2S)	0.28	0.01	0.27	0.00
73 (3S)	0.25	0.01	0.23	0.01
74 (4S)	0.28	0.01	0.26	0.01
75 (5S)	0.26	0.02	0.25	0.00
76 (6S)	0.25	0.01	0.25	0.01
77 (7S)	0.26	0.01	0.25	0.00
78 (8S)	0.25	0.01	0.24	0.00
79 (9S)	0.26	0.01	0.24	0.01
80 (10S)	0.25	0.01	0.24	0.01
81 (11S)	0.25	0.01	0.24	0.01
82 (12S)	0.26	0.01	0.25	0.01
83 (13S)	0.27	0.01	0.26	0.02
84 (14S)	0.26	0.01	0.25	0.01
85 (15S)	0.27	0.01	0.26	0.00
86 (16S)	0.29	0.02	0.28	0.01

(a) Mean of the quarterly mean results.
(b) Mean of four readout areas on each TLD.
(c) Station 61 was discontinued on June 29, 1992.