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ILLINOIS POWER COMPANY



CLINTON POWER STATION, R.R. #3, BOX 228, CLINTON, IL 61727

April 25, 1985

Docket No. 50-461

Mr. James G. Keppler  
Regional Administrator  
Region III  
U. S. Nuclear Regulatory Commission  
799 Roosevelt Road  
Glen Ellyn, Illinois 60137  
Attention: Mr. Ron Paul

Subject: Investigation of Unauthorized Personnel in a Restricted Area

Dear Mr. Keppler:

Attached is an investigation report conducted by the CPS Radiation Protection Department concerning a radiography incident involving unauthorized personnel access into a restricted area (Drywell). This report was requested by Mr. Ron Paul, Region III NRC inspector.

As discussed in the attached report, the root causes of this incident have been identified and corrective actions have been implemented to prevent recurrence of such incidents.

If you have any questions on this matter, please contact me.

Sincerely yours,

A handwritten signature in cursive script that reads 'W. Connell'.

W. Connell  
~~Manager~~ - Quality Assurance

TLR/lis

Attachment

cc: B. L. Siegel, NRC Clinton Licensing Project Manager  
Illinois Department of Nuclear Safety  
NRC Resident Office  
Director, Office of I & E, USNRC

8505060345 850425  
PDR ADOCK 05000461  
S PDR

IEC 6/11

## Investigation of Unauthorized Personnel in Restricted Area

While performing radiography on joint number 1RR1055-17 and 18 (Traveler number RR-1005) at the 730' elevation of the Drywell (AZ 140°), Baldwin Associates (BA) personnel Ron Olson and William (Bill) Davis were observed descending a ladder into the radiological controlled area from the 755' elevation. US Testing personnel, Ray Paxton and Lenard Brinks, immediately secured the shot and made required notifications. The shot was first exposed at approximately 0110 on January 5, 1985 and secured at approximately 0112 the same date.

D. W. Hillyer (Plant Staff), R. Baldwin (IP QA) and J. Grimm (US Testing RPS) reported to the site at 0230 to investigate the occurrence. US Testing phone lines were not functioning and D. Spencer (BA Safety), F. Christenson (US NRC) and R. F. Haight (Plant Staff) were notified from the Main Control Room at 0310.

Interviews with both BA employees and US Testing personnel verified that the area was not properly searched and controlled. Preliminary estimates of 10 mRem exposure for R. Olson and W. Davis were indicated based on a survey taken by R. Paxton (UST). Immediate disciplinary action was taken against lead radiographer Lenard Brinks (Level II Radiographer) and Gary Chandler (assistant radiographer) who had performed the search on the 755' elevation Drywell. The area was walked down by D. W. Hillyer and J. Grimm and condition report 1-85-01-018 was initiated and submitted to the Operations Shift Supervisor J. Owens.

On January 6, 1985, the same source was used to recreate the shot and surveys were taken by Illinois Power Co. personnel, D. Caswell and D. Seiller (Rad Chem Technicians). (See attachment 8). Surveys were taken with calibrated ion chambers which were response checked prior to use. Based on a timed exposure of two minutes, and using the highest observed radiation level of 600 mr/hr, the assigned personnel exposure is 20 mrem for each BA employee.

R. Paul (US NRC inspector) and D. W. Hillyer conducted interviews with both BA employees as well as US Testing personnel Brinks and Chandler. Both BA employees were briefed regarding levels of exposure and the biological significance of such exposure by both R. Paul and D. W. Hillyer. All individuals were provided opportunities to ask questions and were advised to see D. W. Hillyer at any time should they have any questions.

The work area was walked down by R. Paul and D. W. Hillyer and announcements with the Gaitronics system and bullhorns were made in the area. Gaitronics announcements were not audible. Bullhorn announcements were clearly audible. A formal critique was held on January 10, 1985 to identify root causes.

Meeting January 10, 1985 1700 hours - 1846.

Attendees.

D. W. Hillyer	-	Supervisor - Radiological Operations (panel member)
J. A. Grimm	-	US Testing Co. Radiation Protection Officer
B. Moss	-	US Testing Co. Project Manager
M. Jubran	-	Baldwin Associates, Civil/Structural
R. Olson	-	Baldwin Associates - Surveyor
B. Davis	-	Baldwin Associates - Laborer
R. F. Haight	-	Supervisor - Radiation Protection (panel member)
L. Brinks	-	US Testing Co. Level II Radiographer
R. Melton	-	US Testing Co. Assistant Radiographer
R. Paxton	-	US Testing Co. Level II Radiographer
R. Irvin	-	US Testing Co. 3rd Shift Senior Supervisor
M. Porter	-	US Testing Co. 3rd Shift Field Supervisor
F. L. Wolking	-	Supervisor - Radiological Assessment
D. Kahn	-	Supervisor - Radiological Engineering
R. Paul	-	US NRC (panel member)

Summary of investigation

R. Olson and B. Davis reported for work at 1600 and were given a list of hangers to inspect by M. Jubran. (See attachment 2, Layout request) The hanger inspected in the Drywell was at azimuth 196°30', 755' elevation Drywell and was worked under traveler E27-1607 WCP-1B. At approximately 0030, R. Olson and B. Davis entered the Drywell through the personnel airlock on the 737' elevation, turned to their right and traveled about 180° inside the drywell to a wooden ladder (see number 1 on attachment 3 for location). They ascended this ladder to the 755' elevation and proceeded to the hanger at azimuth 196°30'. As their flashlight was not working, both individuals moved approximately seven feet closer to the Reactor Vessel Bioshield to repair the flashlight under a droplight. When the flashlight was repaired, the workers resumed work on the hanger. They heard other personnel say words to the effect "ready to shoot" and thought this might refer to radiography. They proceeded to the ladder immediately south of the equipment access hatch and descended (see number 3 on attachment 3).

The following points were established through questions from the panel:

While on the staging, both BA employees noticed three individuals wearing white hats descending the stairway. No significance was associated with this.

Supervisor M. Jubran had not received any notification as to radiography locations or times nor had he or the other two workers noticed the postings in the Radwaste Building or brass alleyway. The shift hours for BA were 1630 to 0230. Posting was established at 0030.

Both R. Olson and B. Davis stated that they had not heard any bullhorn or Gaitronics announcements. When entering the Drywell, they had not noticed any US Testing personnel, nor were any posted areas or flashing lights observed.

The surveyors did not notify M. Jubran that they were involved in an incident involving radiography until January 6, 1985.

When leaving the site, the surveyors noticed the posting in the RW Building and brass alley for the first time that day.

Radiographers reported to site at approximately 2330 to radiograph elbow at azimuth 140° on the 730' elevation in the drywell. Notice of operations was completed and routed for signatures at 0001 through 0030 (see attachment 4). Signatories include Security, IP Operations and the BA General Superintendent. This notice was posted at the brass alley and RW building N/W corner at approximately 0030. US Testing personnel were at the Drywell at approximately 0030. The following individuals were assigned:

Ray Irvin	- 3rd Shift Senior Supervisor
Mike Porter	- 3rd Shift Field Supervisor
Ray Paxton	- Level II Radiographer
Lenard Brinks	- Level II Radiographer (Lead Radiographer)
Grant Cavins	- Level I Radiographer
Bill Norton	- Assistant Radiographer
Rich Melton	- Assistant Radiographer
Gary Chandler	- Assistant Radiographer Trainee

R. Irvin was stationed at the equipment access hatch to prevent personnel from entering the drywell. L. Brinks and R. Paxton set up shot at the elbow and posted the high radiation area posting at two locations (see attachment 3). Handrails provided natural barriers for the remainder of the high radiation area boundary. M. Porter was inside the personnel airlock on the 737' elevation, but was not specifically controlling the area to prevent personnel from entering. R. Melton used the bullhorn and searched the 712' elevation and then the 737' elevation travelling in a counter clockwise direction. Approximately 5 announcements were made on each elevation. As he finished the 737' elevation, three QA individuals entered the drywell and began ascending the stairway between the equipment access hatch and the personnel airlock. R. Irvin took the bullhorn from R. Melton and used it to attract the attention of the QA personnel. The bullhorn was not used by any other personnel. Norton went up to the 828' elevation of containment and checked the reactor vessel cavity to ensure the hatches to the drywell were shut and no personnel were in the cavity. Norton then descended to the 737' elevation and entered the drywell. After the QA inspectors left the drywell, Norton ascended to the 782' elevation of the drywell, searched 360° and returned to the 737' elevation. G. Chandler had climbed the wooden ladder between the equipment hatch and the personnel airlock to the 755' elevation. After walking the staging on the 755' elevation, he searched inside the reactor vessel bioshield and the 762' elevation before returning to the 737' elevation. The radiation area postings were placed at the equipment access hatch and the personnel access hatch at approximately 0103. IP security and Operations were notified at 0103 that radiography operations were about to commence. An announcement was made on the Gaitronics and the bullhorn at the equipment access hatch that radiography operations would begin in five minutes.



The camera was assembled by G. Cavins at approximately 0045. A 76 Ci Ir<sup>192</sup> source was used (Source number 6487) with camera number 2270. After the searchers had finished, R. Irvin informed R. Paxton and L. Brinks that the signs were up and to begin the shot. The first shot was cranked out between 0110 and 0112. The shot was timed by L. Brinks using a stopwatch. G. Cavins was stationed between the staircase and the personnel airlock and noticed the BA employees starting to descend the ladder from the 755' staging. He yelled to Brinks to retract the source. Brinks pressed the stopwatch and R. Paxton retracted the source. The indicated time on the stopwatch was two minutes. R. Irvin talked to the surveyors to determine where they were. R. Irvin directed R. Paxton to survey the work area near the hanger and the staging where the BA employees were. L. Brinks re-exposed source. Using a Victoreen 492 (GM tube) Number 1795, R. Paxton observed 100 mr/hr at the hanger. While walking toward the ladder, the radiation level increased to 300 mr/hr and back to 200 mr/hr at the top of the ladder. The radiation levels halfway down the ladder were 500 mr/hr. Paxton observed 2 mr on his dosimeter. The source was exposed for less than one minute. M. Porter and R. Irvin escorted surveyors to US Testing trailer and notified D. W. Hillyer, J. Grimm and R. Baldwin.

The following points were established through questions by the panel:

There may have been up to ten minutes between the last use of the bullhorn to evacuate the drywell and when the drywell accesses were posted.

The Drywell was busy, with high noise levels due to fans and equipment. Gaitronics announcements could not be heard on the staging as verified by D. W. Hillyer and R. Paul. Bullhorn announcements were clearly audible at the hanger when announcements were made directly below on the 737' elevation.

US Testing personnel have no formal process for assigning search patterns and responsibilities. Search patterns are established by the assistant radiographers and trainees doing the search.

With two other supervisors controlling worker activities, the lead radiographer was not sure how his responsibilities were defined.

The lead radiographer was not aware that he was the assigned lead radiographer when the shot was performed.

US Testing search patterns were interrupted by entrance of the QA inspectors. Normal search patterns were not resumed.

US Testing supervisory personnel establish radiation boundaries based on calculations (inverse square).

US Testing anticipated performing approximately 3 shots per hour after the first shot. The first shot was expected to take 1 hour.

US Testing survey results were 100 mr/hr at the hanger. IP survey results were 400 mr/hr at the hanger. US Testing supplied instrument No. 1795 to Illinois Power Company for evaluation to known sources. IP evaluation of US Testing meter No. 1795 indicated a response below the 10% calibration range to known radiation levels. In addition, No. 1795 is a gieger-mueller instrument which slightly overresponds to  $\text{Ir}^{192}$ . (see Attachment 13). The true dose rate would therefore be slightly less than the measured 100 mr/hr. IP instruments were evaluated and performed within calibration standards. The R0-2As utilized are ionization chambers and respond equally to the calibration standard and  $\text{Ir}^{192}$ . Other possible reasons for differences in measured dose rate would be a different position of the source during the recreation of the incident or slightly different surveyor locations. (see Attachment 14). Dose assignment to personnel is based on the highest observed readings from the Illinois Power Company survey.

US Testing instruments are calibrated every 90 days. The last calibration date was December 7, 1984. A battery check is performed daily. US Testing procedures do not require a response check prior to use. Instrument No. 1795 was not response checked prior to use.

## Action Items

US Testing to supply copies of calculations used to establish boundaries to Supervisor - Radiological Operations. These copies to be forwarded to R. Paul. (completed January 18, 1985) Attachment 10

US Testing to supply copies of calibration Data Sheets and Calibration Log to the Supervisor - Radiation Protection. These copies to be forwarded to R. Paul. (completed January 18, 1985) Attachment 11

US Testing to supply a copy of the pocket dosimeter record for R. Paxton. Copy to be submitted to Supervisor - Radiological Operations and forwarded to R. Paul. (completed January 18, 1985) Attachment 12

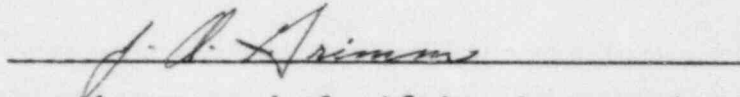
## Root causes and Corrective Actions

- 1) Baldwin Associates (BA) is not effectively distributing notice of radiography operations to all supervisors and trades. In addition, each supervisor is not aware of his immediate responsibility as the supervisor to control work in areas where radiography is planned.

### Recommended Corrective Action:

US Testing to prepare and distribute a Preliminary Notice of Radiation Operations to BA and Project Management. The Preliminary Notice of Radiation Operations shall clearly state no work to be scheduled in identified areas when radiography is scheduled. (completed 1/24/85) Attachment 15. BA to identify additional list of supervisors to be trained. (completed 1/21/85) Attachment 16. Plant Staff to provide training. (completed 2/13, 2/15, 2/27/85) Attachment 17A, 17B, 17C.

Concurrence



- 2) US Testing procedures need clarifying instructions for clearing areas prior to radiography operations. US Testing search patterns were interrupted by personnel entering the controlled areas. Search patterns were not resumed. US Testing search practices allowed personnel to enter the controlled area after evacuation of the Drywell had started.

### Recommended Corrective Action:

US Testing Co. to review procedures to determine if the following steps are adequately outlined:

- require physical search in all areas
- require frequent use of the bullhorn in all areas being evacuated
- establish formal search patterns for the drywell
- require the use of a bullhorn by all assigned searchers in the drywell
- establish methods to ensure completion of assigned search areas for lead radiographer review
- require a copy of notification of radiography be submitted to RP
- require RP signature approval for Radiography to commence in the Drywell

Following the review, initiate a procedural revision if necessary. Illinois Power Company Radiation Protection Department to review US Testing Co. procedure revision and subsequent revisions. (procedure revision to incorporate review deficiencies and obtain Illinois Power Company Radiation Protection Department concurrence completed 2/27/85) Attachment 18.

US Testing to establish procedural methods and training to ensure completion of assigned search areas. (completed 2/27/85) Attachment 18. (completed 2/22, 2/27, 2/28/85) Attachment 19A, 19B, 19C.

US Testing to develop control measures to ensure that personnel do not enter any area after evacuation of that area has started. This would include stationing personnel at entrances to prevent unauthorized entry. (completed 2/27/85) Attachment 18

Concurrence *J. D. Simon*

- 3) US Testing personnel were given a time limit to perform shots. Radiographers identified a feeling of urgency due to time constraints. This pressure may have contributed to a less than thorough search being performed.

Recommended Corrective Action:

US Testing Co. to provide specific training for all radiographers to stress the importance of doing a thorough, complete search regardless of time constraints. (completed 2/22, 2/27, 2/28/85) Attachment 19A, 19B, 19C

Concurrence *J. D. Simon*

- 4) The number of field instructions given by US Testing supervisors contributed to the lead radiographer not assuming all responsibility.

Recommended Corrective Action:

US Testing to provide special training or instructions to identify field responsibilities. (completed 2/27/85) Attachment 18.

Concurrence *J. D. Simon*

Prepared By: *D. W. Millyen* 4/18/85

D. W. Millyen, Supervisor - Radiological Operations



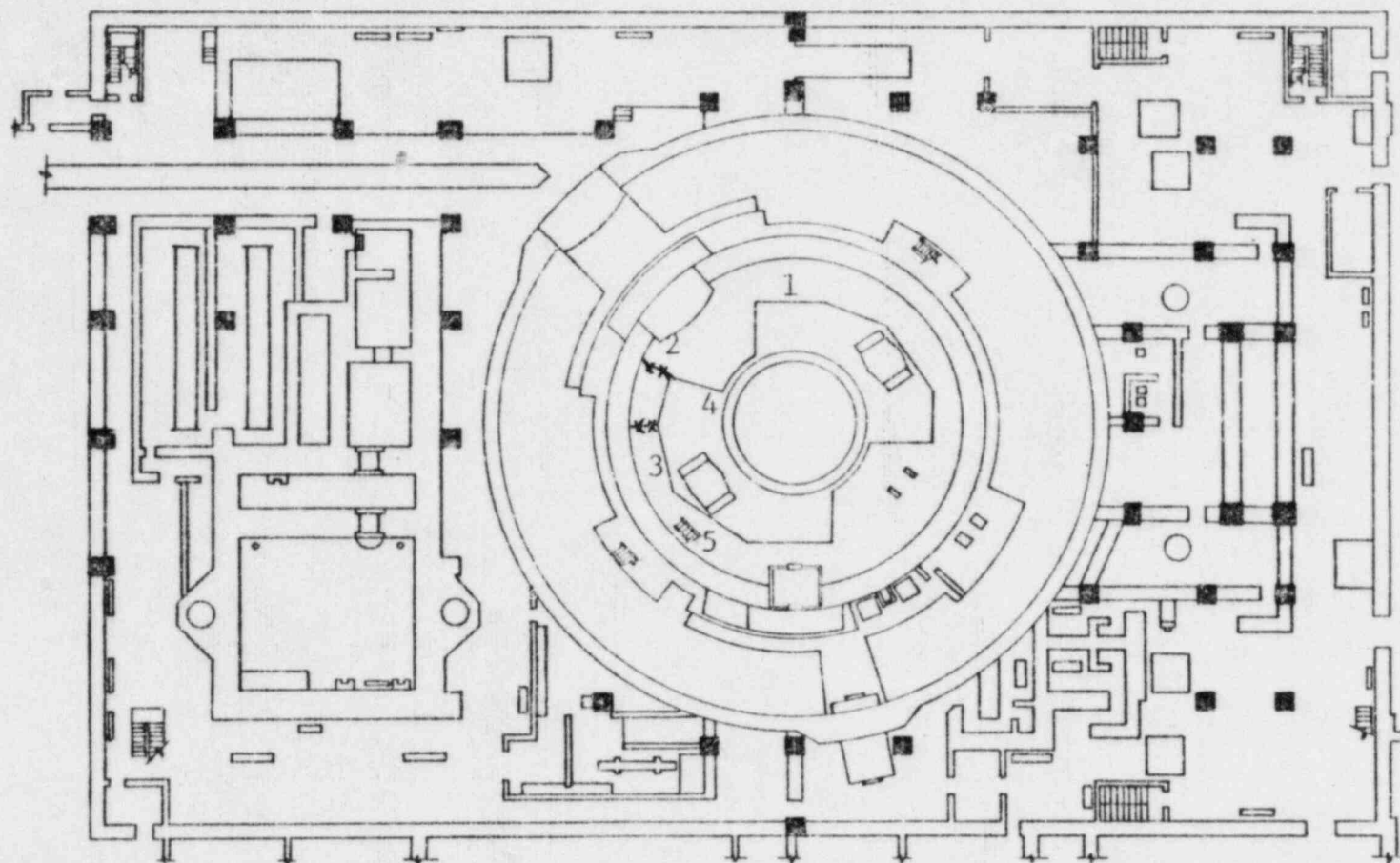
Attendance - January 10, 1985 1700 hours

D. W. Hillyer	- Supervisor - Radiological Operations
J. A. Grimm	- UST Co. R.P.O.
B. Moss	- U.S.T. PROJ. MGR.
M. Jubran	- BA C/S
Ron Olson	Surveyor
B. Davis	Lidhok
R. F. Haight	Supervisor Rail Protection
L. Brinks	LV. II RADIOGRAPHER
R. Meltan	Asst. Radiographer
R. Taylor	LV. II Radiographer
Ray He	U.S.T. 3 <sup>rd</sup> shift Senior Supervisor
Michael Porter	U.S.T. 3 <sup>rd</sup> shift Field Supervisor
F.L. Wolking	Supervisor - Rad. Assessment
D. Kahn	Supervisor - Rad. Engineering
R. Paul	US WRC

## Lavau's Request

LOCATION - *unmarked*

## CLINTON POWER STATION



- 1 Wooden ladder BA personnel ascended to 755' from 737'
- 2 Hanger location
- 3 Wooden ladder BA personnel descended to 737' from 755'
- 4 Source location in the 730' elevation
- 5 Location of perimeter guard (G. Chandler)
- 6 High Radiation Boundary x x









UNITED STATES TESTING COMPANY, INC.

Date: 1/5/85

1.P. OPERATIONS AND SECURITY NOTIFICATION LOG

[illegible]



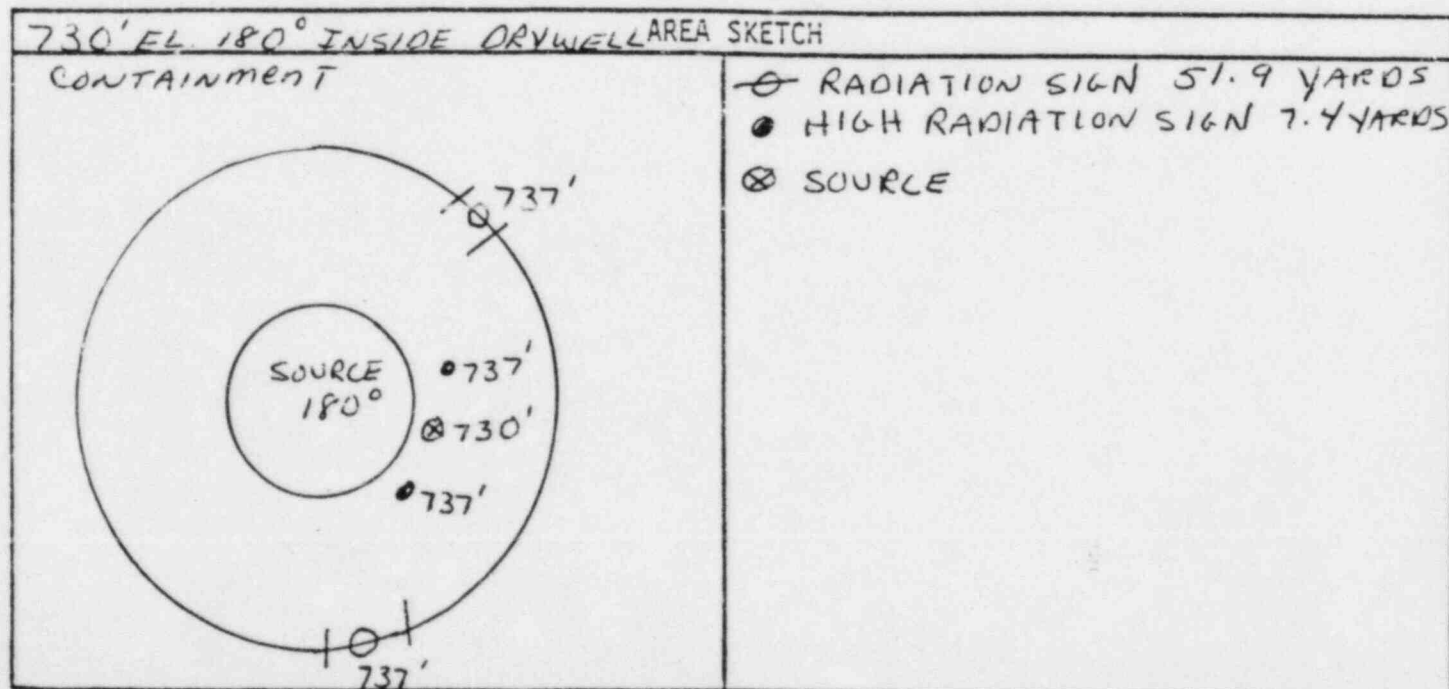
UNITED STATES TESTING COMPANY, INC.

Attachment 6

USTE-RTC-1.5 Rev. 1

RADIATION REPORT FORMDATE: 1-5-85Corresponds to RT Report No: RR-1005

Clinton Power Station

Unit No. 1No. of Exposures 1 Original 0 Rex.Source Model No./Serial No. 424-9 / 6487Survey Meter Model No./Serial No. 492 / 1795-4456Radiation Level Source Before Unlocking 42 mr/hrAfter Locking 42 mr/hrRadiographer L. BRINKSAsst. Radiographer Ray PaxtonDosimeter No. 2327 Reading 0 mrDosimeter No. 8992-C Reading 2 mrFilm Badge No. 00142Film Badge No. 00144Contractor Personnel informed of Testing: PATRICKMrem in any one hour at barricades 42Report Filed By: L. Brinks



## UNITED STATES TESTING COMPANY, INC.

## RESTRICTED VOLUME RADIUS &amp; SURVEY METER READING WORKSHEET

6487

Joint & Trav.# & Location	Name Radiographer Init. of Assigned Perim. Guard	Ci	N	Sec	Shots	R (Yards)	R High (Yards)	S (Mr/Hr)
Trav # RR-1005 Joint # IRR-1005-17 730' Cont. In. Dywell A2 140°	<u>Brinks, Porter</u> <u>OK</u> 12.1" S.O.D.	76	1	720 FIN	3	51.9	7.4	9.7

COMMENTS:

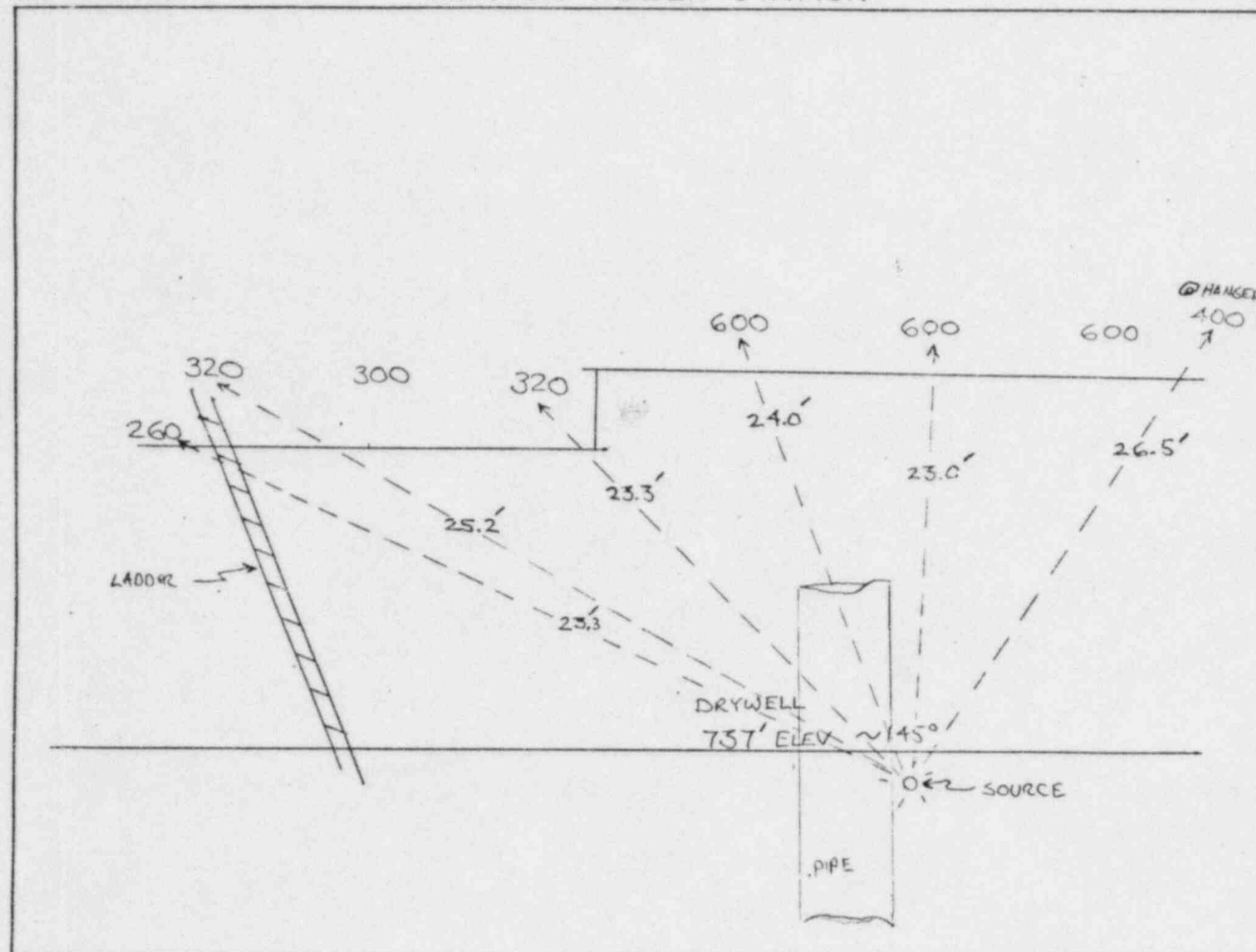
Supvr. Signature

Date

1/5/85

CPS No. ORP 7100 00 F 001  
N102-114 (1/83) (REV. 1)

## CLINTON POWER STATION



SUPPLEMENTAL *AKA*  
BIOLOGICAL SURVEY SHEET

Date 1-6-85 Performed by CASWELL/SEIGLER  
Time 0905 Reactor Power N/A  
Instrument Type R02 #1507, 1564  
Serial No 1564/1507 Cal Date 7-6-85  
Reviewed by W.A.S.


[illegible]

Remarks: 260 <sup>mm</sup> <sub>hg</sub> READING TAKEN AT  
FLOOR LEVEL, ALL OTHER READINGS  
TAKEN AT WAIST LEVEL.

NOTES:

- 1 Gen. Area Dose Rates in mr/hr  
2 Contact Rad levels denoted by \*  
3 Smears circled at location taken  
4. --- DENOTES RADIAL DISTANCE



TO: Dave Hillyer  
FROM: Mark Dodds   
DATE: January 10, 1985  
SUBJECT: Survey Instrument Operability

Per your request, the two R0-2 ion chambers used in the dose assessment, performed January 6, 1985, have been checked for correct operability. The response check and calibrations were performed by M. Reandean and M. Puckett.

The R0-2s were exposed to fields of approximately 100, 400, and 600 mR/hr in the gamma calibrator. The 100 and 400 mR/hr fields were determined from a SOURCE INTENSITY MEASUREMENT DATA FORM. The 600 mR/hr field was determined using the graphs supplied by J. L. Shepherd. The following are the results of that exposure:

	True Dose Rate	Indicated Dose Rate
#1507	100	100
	409	390
	600	600
#1564	100	100
	409	400
	600	600

After performing the above response check, each instrument was calibrated. The AS FOUND and linearity data were within tolerance. I have attached the calibration data sheets for the calibration's of January 6, 1985 and today.

Based on the two operability checks performed today, the two R0-2s used on January 6, 1985, were operating properly.

If you have any further questions on this matter, please feel free to ask.

MSD:dd

RO-2 (A) CALIBRATION DATA SHEET

Source ID 9042

D<sub>c</sub> update due 10-19-85

Serial No. 1507

Source ID N/A

D<sub>c</sub> update due N/A

CALIBRATION

RANGE	DESIRED DOSE RATE	TRUE DOSE RATE (D <sub>c</sub> )	AS FOUND (D <sub>c</sub> ±10%)	AS LEFT (D <sub>c</sub> ±3%)	DESIRED DOSE RATE	TRUE DOSE RATE (D <sub>c</sub> )	LINEARITY (D <sub>c</sub> ±10%)
50 R/h	40 R/h	N/A	N/A	N/A	10 R/h	N/A	N/A
5 R/h	4 R/h	4.11	4.0	4.0	1 R/h	1.02	1.05
500mR/h	400mR/h	409	410	410	100mR/h	100	100
50mR/h	40mR/h	41.5	39	41	10mR/h	10.4	10.5
5mR/h	4mR/h	4.1	3.8	4.2	1mR/h	1.1	1.05
RANGE	DESIRED DOSE RATE	TRUE DOSE RATE (D <sub>c</sub> )	AS FOUND (D <sub>c</sub> ±10%)	OBSERVED DOSE RATE	CORRECTION FACTOR (CF)		
500mR/h	234mrad/h	N/A	N/A	N/A	N/A		

Remarks: Not calibrated for beta.

Calibrated By: Don I. Cull  
Reviewed By: W. J. [Signature]

Date 1-6-85  
Date 1/6/85

RO-2 (A) CALIBRATION DATA SHEET

Source ID 9042

D<sub>t</sub> update due 10-19-85

Serial No. 1564

Source ID N/A

D<sub>t</sub> update due N/A

CALIBRATION

RANGE	DESIRED DOSE RATE	TRUE DOSE RATE (D <sub>t</sub> )	AS FOUND (D <sub>t</sub> ±10%)	AS LEFT (D <sub>t</sub> ±3%)	DESIRED DOSE RATE	TRUE DOSE RATE (D <sub>t</sub> )	LINEARITY (D <sub>t</sub> ±10%)
50 R/h	40 R/h	N/A	N/A	N/A	10 R/h	N/A	N/A
5 R/h	4 R/h	4.11	4.2	4.2	1 R/h	1.02	1.1
500mR/h	400mR/h	409	* 460	410	100mR/h	100	100
50mR/h	40mR/h	41.5	44	42	10mR/h	10.4	11
5mR/h	4mR/h	4.1	4.5	4.1	1mR/h	1.1	1.1
RANGE	DESIRED DOSE RATE	TRUE DOSE RATE (D <sub>t</sub> )	AS FOUND (D <sub>t</sub> ±10%)	OBSERVED DOSE RATE	CORRECTION FACTOR (CF)		
500mR/h	234mrad/h	N/A	N/A	N/A	N/A		

Remarks: \* As Found Data does not meet acceptance criteria. Instrument has not been previously used for quantitative data. Instrument was used for training only prior to this calibration.  
Not calibrated for beta.

Calibrated By: Dan J. Cault  
Reviewed By: MEB

Date 1-6-85  
Date 1/6/85

RO-2 (A) CALIBRATION DATA SHEET

Source ID 9042

D<sub>t</sub> update due 10-17-85 Serial No. 1507

Source ID NA

D<sub>t</sub> update due NA

CALIBRATION

RANGE	DESIRED DOSE RATE	TRUE DOSE RATE(D <sub>t</sub> )	AS FOUND (D <sub>t</sub> ±10%)	AS LEFT (D <sub>t</sub> ±3%)	DESIRED DOSE RATE	TRUE DOSE RATE (D <sub>t</sub> )	LINEARITY (D <sub>t</sub> ±10%)
50 R/h	40 R/h	NA	NA	NA	10 R/h	NA	NA
5 R/h	4 R/h	4.11	4.1	4.1	1 R/h	1.02	1.05
500mR/h	400mR/h	409	395	410	100mR/h	100	100
50mR/h	40mR/h	41.5	41	41.5	10mR/h	10.4	10.5
5mR/h	4mR/h	4.1	4.1	4.1	1mR/h	1.1	1.0
RANGE	DESIRED DOSE RATE	TRUE DOSE RATE(D <sub>t</sub> )	AS FOUND (D <sub>t</sub> ±10%)	OBSERVED DOSE RATE	CORRECTION FACTOR (CF)		
500mR/h	234mrad/h	NA	NA	NA	NA		

Remarks:

NOT CALIBRATED FOR BETA

Calibrated By:

Reviewed By:

Michael A. Reardon  
WDR

Date

Date

1/10/85

1/10/85



RO-2 (A) CALIBRATION DATA SHEET

Source ID 9042

D<sub>t</sub> update due 10/19/85

Serial No. 1564

Source ID N/A

D<sub>t</sub> update due N/A

CALIBRATION

RANGE	DESIRED DOSE RATE	TRUE DOSE RATE(D <sub>t</sub> )	AS FOUND (D <sub>t</sub> ±10%)	AS LEFT (D <sub>t</sub> ±3%)	DESIRED DOSE RATE	TRUE DOSE RATE (D <sub>t</sub> )	LINEARITY (D <sub>t</sub> ±10%)
30 R/h	40 R/h	N/A	N/A	N/A	10 R/h	N/A	N/A
5 R/h	4 R/h	4.11	4.25	4.1	1 R/h	1.02	1.1
500mR/h	400mR/h	409	400	410	100mR/h	100	100
50mR/h	40mR/h	41.5	41	41	10mR/h	10.4	10
5mR/h	4mR/h	4.1	4	4.1	1mR/h	1.1	1.0
RANGE	DESIRED DOSE RATE	TRUE DOSE RATE(D <sub>t</sub> )	AS FOUND (D <sub>t</sub> ±10%)	OBSERVED DOSE RATE	CORRECTION FACTOR (CF)		
500mR/h	234mrad/h	N/A	N/A	N/A	N/A		

Remarks: Not calibrated for beta measurements

Calibrated By: [Signature]  
Reviewed By: [Signature]

Date 1-10-85  
Date 1/10/85



## UNITED STATES TESTING COMPANY, INC.

RESTRICTED VOLUME RADIUS & SURVEY METER READING WORKSHEET

6487

Joint & Trav.# & Location	Name Radiographer Init. of Assigned Perim. Guard	Ci	N	Sec	Shots	R (Yards)	R High (Yards)	S (Mr/Hr)
Trav # RR-1005 Joint # IRR-1005-17 730' Cent. for Daywell AZ 140°	Brinks, T. B. J. DK 13.1" S.O.D.	76	1	720 MIN	3	51.9	7.4	9.7

COMMENTS:

  
Supvr. Signature

1/5/85



## UNITED STATES TESTING COMPANY, INC.

## \* \* \* GLOSSARY OF VARIABLES \* \* \*

- Ci -----The number of Curies of the Source (Ir 192)
- N -----The number of Half Value Layers of Minimum Shielding  
Note:  $2^0 = 1$
- Sec-----The Total number of seconds exposure in any one hour on a particular weld. (or welds, if more than one weld in the same area can be shot in an hour)
- Shots-----The number of shots in any one hour on a particular weld. (or welds, if more than one weld in the same area can be shot in an hour)
- R -----A conservative estimate in YARDS of the minimum radius of the restricted volume.
- R (High)--A conservative estimate in YARDS of the minimum radius of the High Radiation Volume.
- S -----Permissible survey meter reading after isotope reaches the source tube tip or "J" tube tip.

## \* \* \* CALCULATION FORMULAS \* \* \*

$$R = \sqrt{(.091 * Ci * Sec \div 2^N) + (.91 * Ci * Shots)} \text{ Yards}$$

$$R \text{ (HIGH)} = R \div 7$$

$$S = 7200 \div (Sec + 10 * 2^N) \text{ mr/hr}$$

## \* \* \* EXAMPLE \* \* \*

4 one minute shots, double wall contact. TC Collimator. on a  $\frac{1}{2}$ " wall pipe, with a 75 Ci Source

$$R = \sqrt{(.091 * 75 * 240 \div 4) + (.91 * 75 * 4)} \text{ Yards}$$

$$\approx 26 \text{ Yards}$$

$$R(\text{High}) \approx 26 \div 7 \approx 3.7 \text{ Yards}$$

$$S = 7200 \div (Sec + 10 * 2^N) \text{ mr/hr}$$

$$\approx 25 \text{ mr/hr}$$



## SURVEY METER CALIBRATION RECORD

Manufacturer VICTOREENModel No. 492 Serial No. 1795Date of Calibration: 11-2-84 Date next Calibration Due: 2-2-85Source Type CS137 S/N S368 Curies .140

Instrument Range	Instrument Reading	Radiation Field
X-100 0-1000 mr/hr	200 and 750 mr/hr	200 and 800 mr/hr
X-10 0-100 mr/hr	20 and 77 mr/hr	20 and 80 mr/hr
X-1 0-10 mr/hr	2.0 and 7.8 mr/hr	2.0 and 8.0 mr/hr

Location UST VaultRemarks All readings within  $\pm 10\%$  of  
calculated values.Calibration by: RKenth ROSApproved by: J. R. [Signature] RPO

## Applicability of USTF-NDEC-1.D2, Rev. 1

- 1.0 This form shall be utilized as the survey meter calibration record when the survey meter is calibrated by U.S. Testing if USTF-NDEC-1, current revision is specified in the Project QA Manual.

## Instructions for Use of USTF-NDEC-1.D2, Rev. 1

- 1.0 Record the survey meter manufacturer's name on the "Manufacturer" line.
- 2.0 Record the survey meter model number on the "Model No." line.
- 3.0 Record the survey meter serial number on the "Serial No." line.
- 4.0 Record the date the survey meter is calibrated on the "Date of Calibration" line.
- 5.0 Record the date the survey meter is due for re-calibration on the "Date Next Calibration Due" line.
- 6.0 Record the type of Source used to calibrate the survey meter on the "Source Type" line.
- 7.0 Record the source serial number on the "S/N" line.
- 8.0 Record the number of curies of the source on the "Curies" line.
- 9.0 Record the calculated radiation field values in the "Radiation Field" block, in accordance with the type of source used, as specified in the UST Radiation Safety Program.
- 10.0 Calibrate the survey meter in accordance with the survey meter manufacturer's instructions and 4.0 of UST-NDEC-1, current revision. Record the readings on each scale in the "Instrument Reading" column.
- 11.0 Record the site location on the "Location" line.
- 12.0 Evaluate the results of the calibration in accordance with 4.0 of UST-NDEC-1, current revision. Record this evaluation on the "Remarks" line.
- 13.0 Sign on the "Calibration By" line.
- 14.0 Submit for the signature of approval of a person specifically designated on the Company License as a Radiation Protection Officer or Radiation Operations Supervisor.




 POCKET DOSIMETER RECORD  
 UNITED STATES TESTING COMPANY, INC.

 Dosimeter No. 8992-C Victoreen Model No. 541

 Name of Technician Ray Taylor

DATE	mR Begin Shift	mR End Shift	mR Daily	mR Weekly	DATE	mR Begin Shift	mR End Shift	mR Daily	mR Weekl
12-6-84	0	12	12	50	1-0-85	0	5	5	17
12-7-84	0	12	12	62	1-10-85	0	10	10	27
12-8-84	0	15	15	15	1-11-85	0	2	2	29
12-9-84	0	2	2	17					
12-10-84	0	0	0	17					
12-13-84	0	0	0	17					
12-14-84	0	0	0	17					
12-17-84	0	8	8	8					
12-18-84	0	0	0	8					
12-20-84	0	2	2	10					
12-21-84	0	2	2	12					
1-2-85	0	0	0						
1-3-85	0	0	0						
1-4-85	0	0	0						
1-5-85	0	2	2	2					
1-6-85	0	5	5	7					
1-7-85	0	3	3	10					
1-8-85	0	2	2	12					

TO: Dave Hillyer  
FROM: Mark Dodds *Mark Dodds*  
DATE: January 22, 1985  
SUBJECT: Operability of a US Testing Instrument

Per your request, a US Testing survey instrument used by US Testing personnel to conduct radiological surveys during radiography operations was response checked using our gamma calibrator. The response check was performed by M. Puckett. The following information is identifying data of that instrument:

Manufacturer: Victoreen	Date Calibrated: 11/2/85
Model Number: 492	Calibration Due Date: 2/2/85
Serial Number: 1795	

The instrument was exposed to fields of approximately 100, 200, 300, 400, 500, 600 and 700 mR/hr in the gamma calibrator. The instrument was orientated such that the front of the instrument was facing the source, and the active region of the detector was centerline with the source beam. The following are the results of the response check:

<u>True Dose Rate</u>	<u>Indicated Dose Rate</u>
100	80
200	190
300	280
409	380
500	440
600	510
700	600

The 100 and 409 mR/hr fields were determined from a SOURCE INTENSITY MEASUREMENT DATA FORM. This form accounts for the decay of the source and is generated on a periodic basis using a Condenser R-Meter. The 200, 300, 500, 600 and 700 mR/hr fields were determined using the graphs supplied by J. L. Shephard. These graphs were generated in October, 1983, and do not account for the decay of the source.

If you have any questions concerning this response check, please feel free to ask me.

MSD:dd

TO: Dave Hillyer  
FROM: Mark Dodds *Mark Dodds*  
DATE: January 22, 1985  
SUBJECT: Comparison of Instrument Readings

Per your request, an investigation of the difference in survey instrument readings for the January 5, 1985 radiography incident has been conducted. The following information is provided for your review.

The R0-2As used by Clinton Power Station personnel contain an ion chamber. The instrument is calibrated with a Cs-137 source (662KeV, Radiological Health Handbook (RHH), 1970). Per the technical manual (Attachment A) response to other energy photons can be determined. The radiography source used by US Testing personnel was an Ir-192 source (average energy of 336 KeV based on yields of 296 KeV (.29), 308 KeV (.30), 317 KeV (.81), and 408 KeV (.49), RHH, 1970). The relative response of this energy versus that of Cs-137 is 1.0. Therefore, the indicated meter response to Ir-192, even though the meter is calibrated to Cs-137, is the actual dose rate.

The Victoreen instrument used by US Testing personnel contains a geiger-mueller tube. Per the technical manual (Attachment B), the indicated dose rate versus the true dose for Cs-137 is 0.98 and the indicated dose rate versus the true dose rate for Ir-192 is 1.02.

US Testing personnel calibrates this instrument with a Cs-137 source. Therefore, based on the differences in response, the indicated dose rate to Ir-192 is higher than the true dose rate.

Per conversation with J. Grimm (US Testing) and R. Krauth (US Testing) the accuracy to which their instruments are calibrated is  $\pm 10\%$ . The results of the response check (using a Cs-137 source in the gamma calibrator) performed on January 21, 1985 indicate the Victoreen instrument responded low, outside the 10% band, on the 100, 500, 600 and 700 mR/hr fields.

#### Conclusion:

- 1) A review of the locations of measurements taken by UST and CPS technicians indicate that a possible cause in the differences in readings are personnel differences. UST and CPS technicians may not have surveyed in exactly the same locations and used the same techniques.

- 2) The radiation levels recorded by US Testing are higher than the actual levels. The difference in response as indicated above is compounded by the instrument responding low to the same type of source used to calibrate the instrument. Based on this, the differences in the CPS and US Testing instrument readings are greater.
- 3) Although US Testing personnel recreated the radiography incident for CPS evaluation on January 6, 1985, it was possible that source was not located exactly as it was on January 5, 1985. Directional characteristics of the collimated beam could cause small errors in setup to be realized at the distances in which the measurements were made. This is the most likely cause of the differences in readings.

Recommendation:

A dose to each of the BA workers involved should use the most conservative values. This would be the results of the survey performed by CPS personnel. The highest observed value was on the higher of the two scaffolds, 600 mR/hr. Using this value for the entire duration of the inadvertent exposure, and the time that the source was exposed (two minutes) yields the following dose:

$$600 \text{ mR/hr} \left( \frac{1 \text{ hour}}{60 \text{ minutes}} \right) \times 2 \text{ minutes} = 20 \text{ mR}$$

Per 10CFR20.4 (c)  $20 \text{ mR} = 20 \text{ mrem}$

Therefore, each of the BA workers should be assigned a dose of 20 mrem.

If you have any further questions concerning this evaluation, please feel free to ask.

Attachments

MSD:dd

MODEL RO-2

Technical Manual  
Eberline RO-2A

SECTION I  
GENERAL

A. PURPOSE AND DESCRIPTION

The Ion Chamber, Model RO-2, is a portable air ion chamber instrument used to detect beta ( $\beta$ ), gamma ( $\gamma$ ) and x-ray radiation. The RO-2 has four linear ranges of operation to measure dose rate for x-ray and  $\gamma$  radiation. The ion chamber is vented to atmospheric pressure and is specifically designed to have flat energy response into the x-ray region. The Model RO-2 is sensitive to  $\beta$ ,  $\gamma$  and x-ray and is calibrated to  $\gamma$  radiation ( $^{137}\text{Cs}$ ). A single rotary switch turns the instrument off, provides a battery check, checks the zero setting and selects the range of operation.

B. SPECIFICATIONS

1. DETECTOR

- Size: 3-inch diameter, volume 12.7 cubic inches (7.62 cm diameter, 208 cc).
- Fill: Air, vented to atmospheric pressure.
- Wall: One-sixteenth inch phenolic, approximately 200 mg/cm<sup>2</sup> inside 0.050 inch wall aluminum case.
- Window: Two layers 0.001 inch mylar, approximately 7 mg/cm<sup>2</sup> total.
- Beta Shield: Sliding shield on bottom of case with positive friction lock. Approximately 400 mg/cm<sup>2</sup> (1/8 inch phenolic).
- Radiation Detected: Beta, gamma, x-ray.

g. Photon Energy Response: Nominal  $\pm 15\%$  from 12 keV to more than 1.3 MeV. (See Figure 1-2.)

h. Example of Beta Response

- Uranium Slab: 33% of true mrad/hr field behind 7 mg/cm<sup>2</sup> window with RO-2 resting on slab, slide open.
- $^{90}\text{Sr}$ - $^{90}\text{Y}$ : 75% of true mrad/hr field at 40 cm with slide open, 8% with slide closed.

i. Fast Neutron Response: Reads approximately 10% in mR/hr of true neutron field in mrem/hr.

2. GENERAL

- Ranges: Four linear ranges: 0-5, 5-50, 0-500 and 0-5000 mR/hr.
- Meter: Ruggedized, sealed, 2.38 inch (6.04 cm) scale length, 2% accuracy. Linear markings from 0 to 5 in 25 minor increments.
- Response Time: 5 seconds, 0 to 90% of reading.
- Linearity: Within  $\pm 5\%$  of full scale.
- Battery Dependence: No calibration shift with battery voltage change (down to BATTERY check mark on meter).

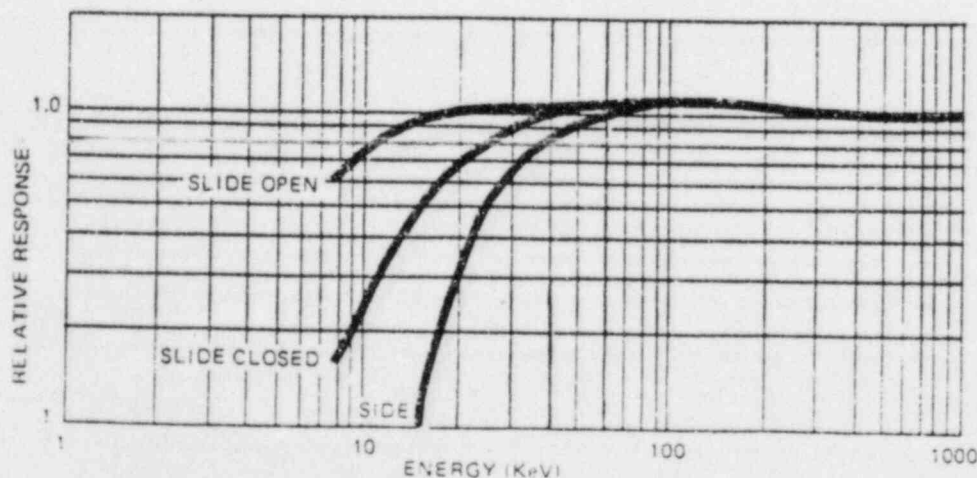


Figure 1-2. Nominal Photon Energy Response



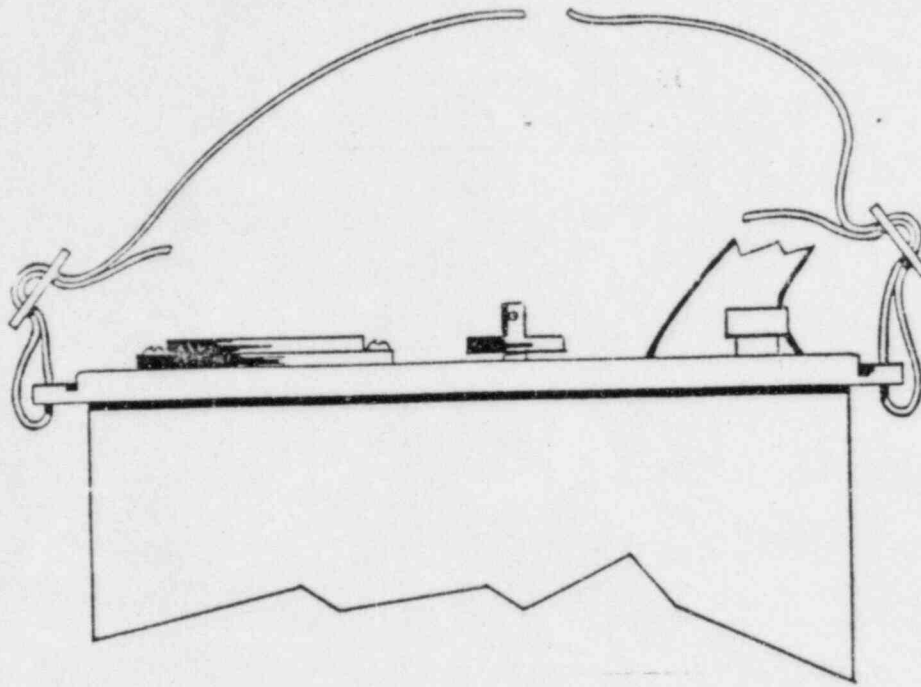


Figure 2. Attachment of Carrying Strap

Technical Manual  
Victoreen 492

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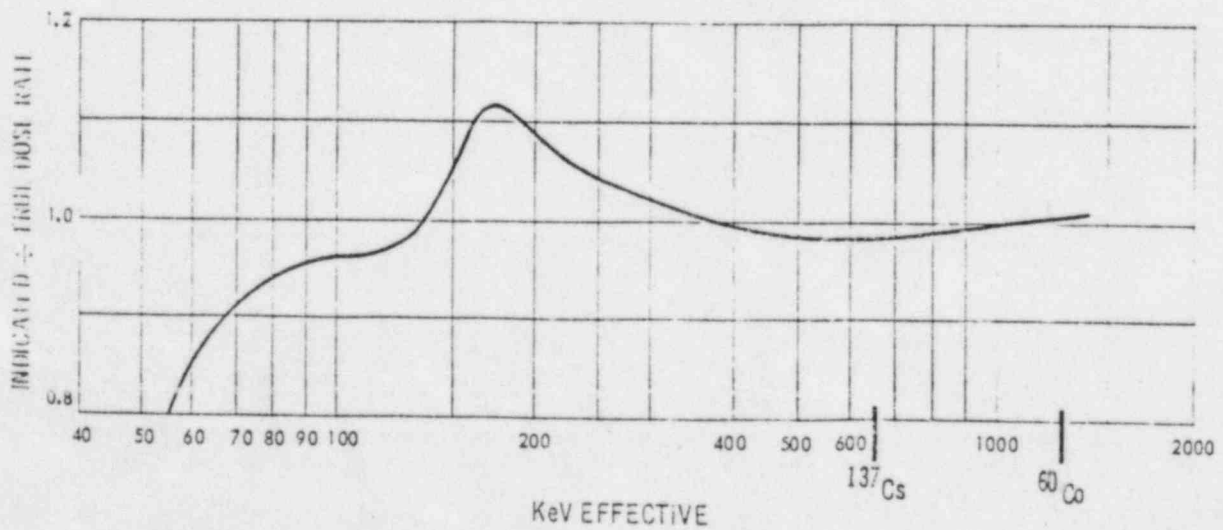


Figure 3. Energy Response



Date: \_\_\_\_\_

TO: Distribution

FROM: J.A. Grimm, UST Co. Radiation Protection Officer

PRELIMINARY NOTICE OF RADIATION OPERATIONS

Please find attached the list of radiographic shots scheduled

on \_\_\_\_\_ (time) \_\_\_\_\_ (date)

and \_\_\_\_\_ (time) \_\_\_\_\_ (date).

All work of any kind is to be scheduled in these areas during  
the time frames indicated on the attached schedule.

All conflicts in the schedule shall be discussed and agreed  
upon by the Shift Superintendent and Senior UST Supervisor.

1. J.A. Grimm - PI BA  
 2. J.A. Grimm - SBLT  
 3. J.A. Grimm - SU IP  
 4. J.A. Grimm - C/R  
 5. J.A. Grimm - Plt. Mgr.  
 6. J.A. Grimm - Plt. Maint.  
 7. J.A. Grimm - NP  
 8. J.A. Grimm - BA  
 9. J.A. Grimm - TM  
 10. J.A. Grimm - TFD  
 11. J.A. Grimm - Sc  
 12. J.A. Grimm - IPQA  
 13. J.A. Grimm - BAQA  
 14. J.A. Grimm - IP Trng.  
 15. J.A. Grimm - QA

1-27-85  
1508 hrs.

3

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or printed text on the paper.

and will be removed when operations are completed.

Date: \_\_\_\_\_

$\frac{1}{\sqrt{\pi}} \int_{-\infty}^{\infty} f(x) e^{-x^2} dx = \frac{1}{\sqrt{\pi}}$

Attachment 16

1/21/85

TO: John Cook

FROM: Jim Loomis

Attached is a list of names of second and third shift personnel to be considered for radiation protection training.

Bob Haight  
Please schedule  
training and contact  
Jim Loomis  
ASAP.  
JDL

RECEIVED  
1985  
Clinton Power Station

( 1st Shift First Line Supervisors )

Attachment 16

Q&TS

Don Rodgers	1-1314	
Dave Spicer	1-1509	TS
Brian Gardner	1-972	TS
Pete Warda	1-2023	TS
Jack Massie	1-1675	QC
S. Brown	1-2547	QC
D. Jones	SC-8741	QC
J. Karl	1-119	QC
Wayne Preston	1-2356	TS

HVAC

Terry Willis	BA
Chuck Bessler	BA
Dave Sronce	BA
Frank Beauchamp	Zack
Larry Rytlewski	Zack
Brian Brow	QC Zack
Tom Barber	QA Zack
Dale Miller	Zack
Dave Boyd	Zack
Rick Teschner	Zack
Bob Mack	A&M

Electrical

L. B. Woolridge	1-372	Superintendent
R. A. Jones	1-3300	Superintendent
F. Reed	1-9030	Superintendent
R. C. Smith	1-328	Superintendent
P. Hamner	1-389	Welding Superintendent
A. Kohllman	1-9022	Welding Supervisor 100% Reinspection
W. Laptew	1-2789	Lead Field Engineer
M. McClemore	1-3351	Lead Field Engineer
K. Bandeko	1-1308	Lead Field Engineer

PM&S

J. Fritsch	Superintendent
T. Doyle	Piping/Mechanical Engineer
R. Seifert	Electrical Engineer
V. Friedrich	Electrical Engineer

Civil Structural

Tom Laird Superintendent

Piping

Gary Billings  
Ora Maddix  
Ken Bergman

Surveyors

Mike Jubran Engineer



3rd Shift First Line Supervisors

PM&S

Bryan Puckett

/82)

CPS TRAINING COMPLETION FOR

1. Course Title:

Radiography Operations at Clinton  
Power Station

2. Course Number:

1.0 - 9.12

3. Instructor(s):

John G. Funk

4. Presentation Date:

5. Course Length (Classroom/Other)

.5 hrs

6. Passing Criteria:

N/A

NAME		COURSE GRADE
Print	Sign	N/A
JN ALLEN	JN Allen	NA
L.B. Woolbridge	L.B. Woolbridge	NA
RC Smith	RC Smith	NA
M.J. HEENAN	M.J. Heenan	N/A
FLOYD REED	Floyd Reed	N/A
B.A. JONES	B.A. Jones	N/A
JIM FRITZCH	Jim Fritzch	NA
Tyler Gray	Tyler Gray	N/A

NAME		COURSE GRADE
Print	Sign	N/A

7. REMARKS/COMMENTS:

CPS TRAINING COMPLETION FORM

1. Course Title: Radiography Operations at Clinton Power Station

2. Course Number: 1.0 - 9.12

3. Instructor(s): John G. Funk

4. Presentation Date: 2/15/85

5. Course Length (Classroom/Other) .5 hrs

6. Passing Criteria: N/A

NAME	COURSE GRADE
Print	Sign
S.D. WHICKER	S.D. Whicker
E. KIRCHMAN	E. Kirch
T. Laird	T.E. Laird
CHARLES BESSER	Chas. Besser
BRIAN BECK	Brian Beck
GARY BILLINGS	Gary Billings
KEN BERGMAN	Ken Bergman
BEN HILL	Ben Hill
Tony L. Willis	Tony L. Willis
RICK TESCHNER	Rich Teschner

NAME	COURSE GRADE
Print	Sign
FW BEAUCHAMPER	FW Beauchamp
L. Rytlewski	L. Rytlewski
KENNETH D. MILLER	Kenneth D. Miller
MICHAEL V. ANDERSON	Michael V. Anderson

7. REMARKS/COMMENTS:

CPS TRAINING COMPLETION FORM

1. Course Title:

Radiography Operations at Clinton  
Power Station

2. Course Number:

1.0 - 9.12

3. Instructor(s):

John G. Funk

4. Presentation Date:

2/27/85

5. Course Length (Classroom/Other)

.5 hrs

6. Passing Criteria:

N/A

NAME	Sigin	COURSE GRADE
Print		N/A
BRIAN GARDNER	Brian Gardner	N/A
ORA MADDIX	ORA MADDIX	N/A
David Spicer	David Spicer	N/A
DON R. RODGERS	DON R. RODGERS	N/A
John Karl	John Karl	N/A
Tom Doyle	Tom Doyle	N/A
WALT LAPIEN	Walt Lapien	N/A
J.M. MELENORE	J.M. MeLenore	N/A
Kirk BANDEKO	Kirk Bandeko	N/A
PAUL E. HAMMILL	Paul E. Hammill	N/A
ALLEN KOHLHORN	Allen Kohlhorn	N/A

NAME	Sigin	COURSE GRADE
Print		N/A
S.L. BROWN	S.L. Brown	N/A
H.P. WARD	H.P. Ward	N/A
TE BARBER	TE Barber	N/A
Dave Boyd	Dave Boyd	N/A
Scotty Egan	Scotty Egan	N/A
AWRIGHT A. JONES	AWRIGHT A. Jones	N/A
Van Friederich	Van Friederich	N/A
RP SEIFERT	RP Seifert	N/A
Tommy Matt Weeks	Tommy Matt Weeks	N/A

7. REMARKS/COMMENTS: