DUQUESNE LIGHT COMPANY

SHIPPINGPORT ATOMIC POWER STATION

TEST RESULTS

DLCS 1840307
T-612076

PERIODIC RADIATION SURVEY OF REACTOR PLANT CONTAINER AND COMPONENTS AFTER SHUTDOWN

CORE I, SEED 1

Section 3 of 6 Sections

First Issue, May 2, 1960
Second Issue, June 22, 1960

DISCLAIMER

TEST RESULTS

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Purpose

To determine the effect of isolation and forced draining on the radiation level of the 1AC hairpin loop and to determine, by chemical analysis, the extent of the activity in the horizontal and vertical legs (U-bend) of the loop piping.

Conclusions

Before isolation of the 1AC hairpin loop, radiation measurements of the horizontal leg varied between 500 mr/hr and 600 mr/hr and on the vertical leg between 410 mr/hr and 700 mr/hr. After isolation, but before draining, the radiation level on the horizontal leg was 48 mr/hr and on the vertical leg it was 31 mr/hr. During the twelve (12) hours following draining, the horizontal leg showed a decrease in radiation level from 30 mr/hr to 9 mr/hr and the vertical leg radiation decreased from 20 mr/hr to 3.5 mr/hr. The horizontal leg had a higher level of activity than did the vertical leg because of the relative age of the sections in each leg. Most of the sections in the horizontal leg had been in service for 4180 EFPH while those in the vertical leg had been in service for only 1000 EFPH.

The radiochemical analysis of the crud deposits was performed for three isotopes - Co^{60}, Fe^{59} and Mn^{54}. Only three isotopes were reported due to the unavailability of equipment necessary to perform the spectrometer analysis. The horizontal section yielded a higher activity level than did the vertical leg and confirmed the data taken during the radiation survey.

Description of Test Equipment and Test Procedure

Radiation level measurements were made with flow in the hairpin loop, with the loop isolated and with the loop drained. The U-bend section was cut from the loop and a radio chemical analysis was performed on the crud deposits.

Loop measurements were made with Jordan, Thyac and Cutie-Pie survey meters.

The radiochemical analysis was performed using a 20 channel scintillation spectrometer which was calibrated using a Cs^{137} source.

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Results

The test was performed on May 21, 1959 from 0950 to 2216 with 1106.5 EFPH on the 1AC hairpin loop since it was last put into service.

Prior to isolation of the loop, radiation measurements were made on the horizontal and vertical legs. The radiation levels for the horizontal leg using both a Cutie-Pie and Jordan detector were 600 mr/hr and 550 mr/hr, respectively. The levels for the vertical leg were 700 mr/hr and 410 mr/hr using both the Cutie-Pie and Jordan detectors, respectively.

The Cutie-Pie could not fit completely through the hole in the hairpin loop shielding, consequently, contact readings could not be taken with that instrument. However, contact readings were obtained using the Jordan Survey Meter. (See Table II for instrument calibration.)

At 1013, May 21, 1959, the loop was isolated with subsequent radiation measurements showing radiation levels of 48 mr/hr and 31 mr/hr for the horizontal and vertical legs, respectively.

At 1016, May 21, 1959, the loop was drained and measurements were made at various time intervals for twelve (12) hours following draining. (See Table I). During the twelve (12) hours, the radiation level ranged from a maximum of 32 mr/hr to a minimum of 1.5 mr/hr. Again, the horizontal leg was the more active.

Figure 1 is graph showing a plot of radiation level versus time after shutdown. The data for this figure was obtained from Table I. Only those readings obtained from the Jordan 733 were used to develop the curves. The readings made at 1816 and 2016 were ignored, since they were specifically noted as not being contact readings.

The U-bend of the 1AC hairpin loop was removed on May 21, 1959. This was the third time such a section had been removed from the loop for analysis.* A radiochemical analysis of the U-bend section was performed the first week in June. The 20 channel scintillation spectrometer counting was performed in September. This delay was due to the fact that the spectrometer was not available for service until that date.

Sections 1, 2, 3 and 4 of the U-bend section had been in service approximately 4180 EFPH; essentially since the Plant has been in operation. Sections 5, 6, 7 and 8 had been in service approximately 1000 EFPH (See Figure 2). The activity level was higher in the horizontal section than in the vertical section due to the greater amount of service on this section.

The radiochemical analysis and subsequent counting was only possible for three isotopes. Due to the length of time between the June radiochemical analysis and the September spectrometer analysis, only Co^{60}, Fe^{59} and Mn^{54} were still sufficiently active to justify recording. The specific activities of these isotopes are contained in Table III and are corrected to May 21, 1959.

* 8/18/58 and 11/3/58 in conjunction with "E" Survey, Section III, DL-S-184.

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Crud taken from Sections 5, 6, 7 and 8 was light brownish-grey and tightly adherent to the walls of the piping. Sections 1, 2, 3 and 4 contained tightly adherent crud, black in color.

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POWER STATIONS DEPARTMENT
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PERIODIC RADIATION SURVEY OF REACTOR PLANT CONTAINER AND COMPONENTS AFTER SHUTDOWN, "E" SURVEY, DLCS 1840303, (T-612076)

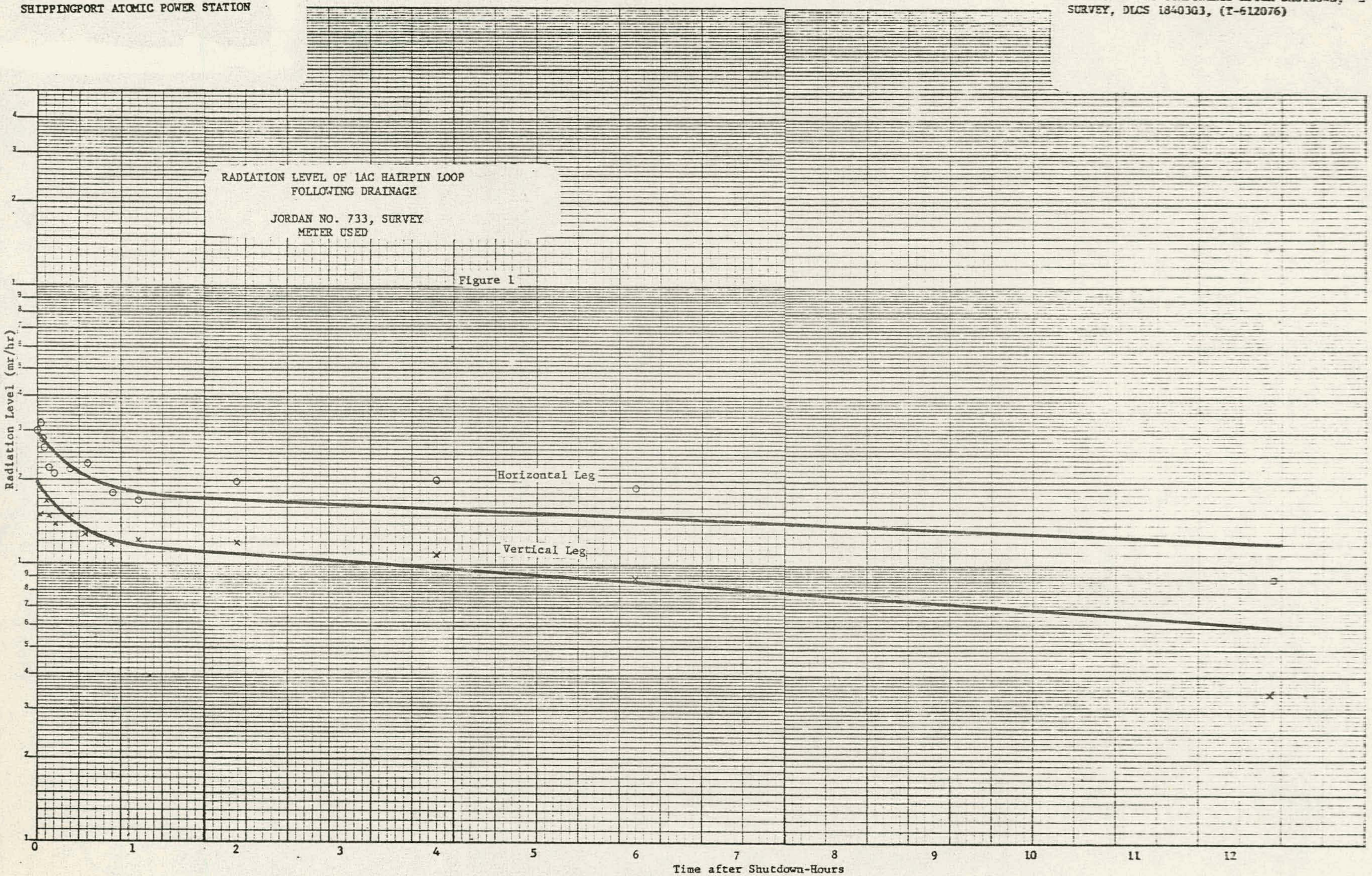

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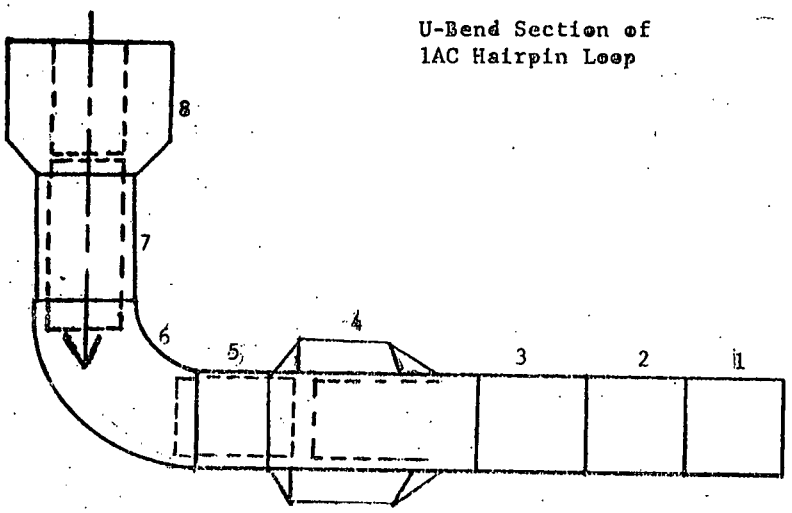
Figure 2

U-Bend Section of
1AC Hairpin Loop



Radiation Survey

Section No.	Inside Activity mr/hr	Outside Activity mr/hr
1	76	22
2	70	22
3	66	22
4	175	23
5	32	13
6	62	17
7	34	14
8	120	21

NOTE: Sections 1, 2, 3, 4 and 8 were in service approximately 4180 EFPH.
Sections 5, 6 and 7 were in service approximately 1000 EFPH.

TABLE I

1AC Hairpin Loop Isolated - 0959, March 21, 1959
1AC Hairpin Loop Drained - 1016, March 21, 1959
Time for Draining - 1 Minute

1AC Hairpin Loop Radiation Level

Time	Time Interval (min.)	Horizontal Leg (mr/hr)	Vertical Leg (mr/hr)	Meter Used	Remarks
0950		600	700	Cutie-Pie No. 1	Before isolation.
		550	410	Jordan No. 733	
1013		48	31	Jordan No. 733	Before draining, after isolation.
1014		53	27	Jordan No. 733	Draining
1015		20	25	Jordan No. 733	Draining
1016	0	30	20	Jordan No. 733	Drained
1017	1	32	15	Jordan No. 733	Drained
1019	3	28	16	Jordan No. 733	Drained
1021	5	26	17	Jordan No. 733	Drained
1023	7	22	15	Jordan No. 733	Drained
1026	10	21	14	Jordan No. 733	Drained
1036	20	22	15	Jordan No. 733	Drained
1046	30	23	13	Jordan No. 733	Drained
1101	45	18	12	Jordan No. 733	Drained
1116	60	17	12	Jordan No. 733	Drained
1216	120	20	12	Jordan No. 733	Drained
1416	240	20	11	Jordan No. 733	Drained
1616	360	19	9	Jordan No. 733	Drained
1816	480	9	5	Jordan No. 727	Probe net in contact with pipe.
2016	600	3.5	1.5	Jordan No. 733	
2016	600	4.0	2.0	Thyac No. 974	
2216	720	9.0	3.5	Jordan No. 733	
2216	720	8.0	4.6	Thyac No. 974	

TABLE II

Calibration Data										
Instrument	No.	Source	Calc. Val.	Meas. Val.	Calc. Val.	Meas. Val.	Calc. Val.	Meas. Val.	Calc. Val.	Meas. Val.
Thyac	974	Co^{60}	15	15	1.5	1.5	.5	.5	.15	.15
Jordan	727	Co^{60}	5	5	20	23	100	100	1000	1000
Jordan	733	Co^{60}	5	5	20	20	100	100	1000	1000

EFPH accumulated with 1AC Hairpin Loop in service - 1106.5
EFPH when 1AC Hairpin Loop was isolated - 4941.5, 5/21/59
EFPH when 1AC Hairpin Loop was put in service - 3835, 3/30/59

Reactor shutdown at 1702, 5/21/59

TABLE III

Radio Chemical Analysis

Isotope	Section No. 7 (dpm/cm^2)	Section No. 2 (dpm/cm^2)
Co^{60}	7.82×10^4	2.18×10^5
Fe^{59}	9.69×10^3	1.56×10^4
Mn^{54}	1.14×10^4	2.8×10^4

Note: The spectrometer analysis was performed in September, 1959 and the data corrected to May 21, 1959.

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Test Performed By R. W Noble **Date** 1/23/60

Results Prepared By John F. Potera NEH **Date** 1-23-60

Results Reviewed By R. W. Noble **Date** 1/23/60

Results Approved By G A Santel **Date** 2/4/60

Approved (Duquesne Light Company) C E Jones **Date** 4-30-60

Accepted (Atomic Energy Commission) R V Gaede **Date** 5-2-60

SECOND ISSUE:

Results Prepared By Roger J Lawrence

Results Reviewed By Roger J. Lawrence

Approved (Duquesne Light Company) G A Santel Date 6-22-60