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SUBJECT: Forwards rept on safety & operational impacts of impurities causing main steamline radiation spikes at facility. Long-term effects will be mitigated by installation of ultrasonic resin cleaning sys.

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	NRR/DSI/CPB 10	1	1	NRR/DSI/CSB 09	1	1
	NRR/DSI/ICSB 16	1	1	NRR/DSI/METB 12	1	1
	NRR/DSI/PSB 19	1	1	NRR/DSI/RAB 22	1	1
	NRR/DSI/RSB 23	1	1	REG FILE 04	1	1
	RGN1	3	3	RM/DDAMI/MIB	1	0
EXTERNAL:	ACRS 41	6	6	BNL(AMDTS ONLY)	1	1
	DMB/DSS (AMDTS)	1	1	FEMA-REP DIV 39	1	1
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REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

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AUTH.NAME AUTHOR AFFILIATION
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	NRR LB2 LA	1	0	PERCH,R. 01	1	1
INTERNAL:	ELD/HDS1	1	0	IE FILE	1	1
	IE/DEPER/EPB 36	3	3	IE/DEPER/IRB 35	1	1
	IE/DQAVT/QAB 21	1	1	NRR/DE/AEAB	1	0
	NRR/DE/CEB 11	1	1	NRR/DE/EHEB	1	1
	NRR/DE/EQB 13	2	2	NRR/DE/GB 28	2	2
	NRR/DE/MEB 18	1	1	NRR/DE/MTEB 17	1	1
	NRR/DE/SAB 24	1	1	NRR/DE/SGEB 25	1	1
	NRR/DHFS/HFEB40	1	1	NRR/DHFS/LQB 32	1	1
	NRR/DHFS/PSRB	1	1	NRR/DL/SSPB	1	0
	NRR/DSI/AEB 26	1	1	NRR/DSI/ASB	1	1
	NRR/DSI/CPB 10	1	1	NRR/DSI/CSB 09	1	1
	NRR/DSI/ICSB 16	1	1	NRR/DSI/METB 12	1	1
	NRR/DSI/PSB 19	1	1	NRR/DSI/RAB 22	1	1
	NRR/DSI/RSB 23	1	1	REG FILE 04	1	1
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	LPDR 03	2	2	NRC PDR 02	1	1
	NSIC 05	1	1	NTIS	1	1
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Norman W. Curtis
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NOV 22 1983

Director of Nuclear Reactor Regulation
Attention: Mr. A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, DC 20555

SUSQUEHANNA STEAM ELECTRIC STATION
ADDITIONAL INFORMATION ON RESIN FINES
ER 100450 FILE 841-8
PLA-1930

Docket No. 50-387

Dear Mr. Schwencer:

As requested by your Staff, enclosed is a report on the safety and operational impacts of the impurities causing the main steamline radiation spikes at Susquehanna SES Unit 1.

If you have any questions or comments, please call us.

Very truly yours,

N. W. Curtis
Vice President-Engineering & Construction-Nuclear

Enclosure

cc: R. L. Perch NRC

B001
1/1

Evaluation of Impurity Intrusions Associated with
Main Steam Line Radiation Spikes

References:
1. PLA-1757, dated July 22, 1983
2. INPO SOER 82-13, Intrusion of Resin, Lubricating Oil and Organic Chemicals into Reactor Coolant Water

PP&L is currently experiencing operating problems with the condensate polishing system which sometimes results in the release of impurities to the reactor vessel. Those impurities interact with radiolysis reactions in-core to produce a transient increase in N-16 activity in the steam. On occasion, these main steam line (MSL) radiation spikes have been large enough to exceed the current MSL radiation monitor setpoint of three times the full power background. When this occurs, the Main Steam Isolation Valves (MSIVs) close, the reactor scrams and the vessel experiences a large transient. In reference (1) PP&L requested a setpoint change which would provide additional margin against unnecessary main steam isolations. This letter provides information requested by NRC as to the nature and impact of the impurities causing steam line radiation spikes on safety and operation.

The impurities causing these transients have been identified as either anion resin fines or turbine lube oil (or both). The impurities are associated with iron oxides (crud) which are washed out of the condensate polishers by flow surges. In addition to steam line radiation spikes, the impurity intrusions have produced transient responses in reactor water chemistry and in the offgas system similar to those described in Reference (2).

The data indicating resin fines, specifically anion fines, is as follows:

1. Resin fines were found in crud samples filtered from the condensate polisher effluent during these transients. The quantity of fines appeared low, however, and about the same as observed in background samples. The majority of the fines appeared to be from anion resins.

2. The reactor water conductivity transients experienced during these events last only 10-15 minutes. This is much too short for removal by the Reactor Water Cleanup System, with its impurity removal half-life of about four hours. Rather, it appears as though the impurities break down to an ionic material which is removed almost as rapidly as generated. Volatile amines from thermal decomposition of anion resin would behave in this manner. Sulfuric acid from cation resin decomposition would be non-volatile and would persist much longer.

3. No detectable increase in sulfate was found in reactor water samples taken during conductivity transients, as compared to background. This would indicate very little cation resin intrusion.

Turbine oil is also considered a possibility for the following reasons.

1. A moderate degree of organic fouling was found in samples of anion resin removed from the polishing system.

2. A liquid organic similar to turbine lube oil was extracted from resin samples.

3. Organics such as turbine oil would depress reactor water oxygen; carbon dioxide or other decomposition products from "burnup" of the oil in the reactor would produce a short-lived increase in conductivity.

The most serious operational impact of these impurity intrusions is unnecessary isolation of main steam, which takes the plant off-line and imposes a large transient on the reactor vessel. The major safety concerns are the unnecessary challenges to other safety systems such as HPCI and Containment Isolation, and the risk of initiating further off-normal conditions such as an unplanned depressurization due to a stuck open steam relief valve.

The short-term impact of these events on reactor water chemistry and materials corrosion are negligible. With no main steam isolation, the conductivity transient is small and short-lived. The maximum increase observed in twenty flow transient events (nine with MSL radiation spikes) was +0.13 umho/cm. The transient lasted about 15 minutes. Larger and longer conductivity transients can occur with main steam isolations because the volatile impurities are then bottled up in the vessel.

The quantity of the impurity injected to the reactor vessel during these events appears to be very small. During one event, filter samples indicated that 150ppb of resin fines were in the effluent of a bed being put into service. The bed was processing 3700 gpm of water, and a reactor water conductivity transient lasting twelve minutes was observed. Assuming that resin fines were present in the bed effluent throughout the conductivity transient, the total resin ingress would have been about 0.06 pound (25 grams). Based upon the conductivity rise of +0.13 umho/cm, about 0.3 equivalents of ionic material (18 grams if sodium chloride) were in the vessel at the peak of the transient. Even if these estimates are in error by an order of magnitude, it appears as though less than a pound of either resin fines or turbine oil is injected into the vessel during these events. This quantity of material, injected at low concentrations (highly dispersed) over a small time interval, does not present a credible threat of local deposition on the fuel or on bundle flow blockage. Fuel damage due to these events is not a concern.

Although individual transients are not of concern, the cumulative effects of repeated transients are of concern in two areas. Each event results in the injection of metal oxide cruds along with the impurities producing MSL radiation spikes. Over the long term, repeated crud injections can produce increased crud acitivity and a more rapid rate of radiation field buildup. Also, the buildup of crud and organics in the condensate polisher resins can produce fouling of the resin and lead to difficulties in regeneration. The result can be a degradation in condensate polisher performance, which would be reflected in higher reactor water conductivity. This, in turn, will increase the potential for IGSCC of susceptible materials.

The root cause of these events is the inability of our present systems to remove corrosion products which are collected by the condensate polisher resins while in service. Our attempts to clean the resin, together with operation with excessive crud loadings, may also have generated an excess of

anion resin fines. We believe that the finely divided, high surface area crud may act as a collector of tramp oil in the system. When the resin is mixed during transfers and cleaning attempts, the crud phase becomes distributed throughout the bed. Subsequent flow surges strip out a portion of the crud, along with the associated oil and/or anion resin fines, resulting in the transients observed. We have taken the following actions to correct the problem.

- o Operating procedures were revised to make the most effective use of the available cleaning system.
- o A program was implemented to provide early warning that conditions for MSL radiation spikes were returning.
- o The design and installation of an Ultrasonic Resin Cleaning (URC) system, already in progress, were expedited. The URC is expected to be available during the first quarter of 1984.

In spite of these efforts, crud has accumulated on the new resin beds to the point that MSL radiation spikes are again possible. The change to the main steamline radiation - high setpoint would prevent unnecessary main steamline isolations during this period of operational difficulties in the condensate polisher system. There are no safety or short-term operational impacts due to the impurities cuasing MSL radiation spikes. The long-term effects of these problems on reactor water purity and radiation field buildup are of concern. The long-term effects will be mitigated by the installation of the Ultrasonic Resin Cleaning system.