UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

May 2, 1980

Docket No. 50-334

LICENSEE: Duquesne Light Company

SUBJECT: MEETING SUMMARY - ECCS DECAY HEAT EXCHANGER INTEGRITY FOR BEAVER VALLEY UNIT NO. 1

On April 22, 1980, the licensee and Stone and Webster met with the Staff to discuss the consequences of failure and methods to assure integrity of the recirculation spray heat exchanger system for the Beaver Valley Unit No. 1. The list of attendees is attached (Attachment 1).

The licensee had previously met with the Staff on March 25, 1980. The details of that meeting and background information are included in the meeting summary dated April 7, 1980. This meeting was held to discuss the consequences of failure of the heat exchanger and components and methods to mitigate unacceptable consequences.

Discussion

The consequence analysis performed by Stone and Webster assumed the TID 14844 source term in the reactor containment sump and with the releases held to the 10 CFR 20 limits, the recirculation heat exchanger leak rate can be no more than 2×10^{-4} gpm from the 3400 tubes in the four heat exchangers. Assuming a dilution factor of 10 in the river, the doses in the drinking water at the Midland water intake would be as follows for one liter of water consumed:

Adult Thyroid Dose	190 mrem
Child Thyroid Dose	583 mrem
Infant Thyroid Dose	1400 mrem

The potential air borne dose would be less than 10^{-2} mrem/hr at the site boundary when 2% evaporation rate is assumed in the cooling tower. It is not clear that this accounts for potential iodine releases from the water as the sump leakage pH drops from 8 in the sump to 7 in the cooling tower. The significance of the dose calculations is that almost any leakage in the heat exchanger would produce unacceptable results. The 2×10^{-4} gpm leakage is for less than one tube breaking out of the 3400; it is something just larger than a pin hole leak in a single tube.

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The licensee provided a basic information sheet on the recirculation heat exchangers which is attached (Attachment 2). Stone and Webster investigated the design for vibration damage between the tubes and tubes/baffel plates. Little potential exists for damage of this type. The tubes are rolled into a double grove in the tubesheets and seal welded so that a high initial integrity can be assumed. The tubes, baffels, and tubesheets are all 304L stainless steel and operate in an environment which is not expected to produce stress corrosion cracking or other modes of failure. While it is not apparent that the heat exchanger will deteriorate and fail, there is no assurance against tube degradation and eventual failure over the 30-40 year life of the plant.

The licensee had hydrotested the heat exchanger during construction and due to the containment isolation configuration, they had also performed a type C leak test on the tube side. No failures had been detected by these means. To provide further assurance of integrity, the licensee performed a freon test on the tube side. Water was drained from both the tube and shell side and about 10 to 20 lbs of freon at 70 psig was applied to the tubes. The test was allowed to "soak" for a period of time to allow any freon leak to accumulate on the shell side. A portable detection instrument with a sensitivity of 1×10^{-7} freon/cc of air did not detect any leakage from the four heat exchangers.

The radiation monitors on the discharge river water side are set for a sensitivity of 10^{-6} μ ci/cc with a background of 5 mrem/hr. The licensee did not quantify the expected radiation levels in the area of the monitors following an accident although the largest souce of radiation is expected to be from the sample line from the failed heat exchanger (assuming an accident and a leaking recirculation spray heat exchanger). The radiation monitors are seismic Class I designed to the 1968 ASME Code. The Hi-Hi alarm setpoint is equivalent to 2.2×10^5 cpm which also corresponds to 10 CFR 20 limits. The monitor pumps, flow indicators and radiation detector/ circuitry are tested and calibrated periodically.

The river water piping, the bellows expansion joints, and pressure relief valves were not tested during the freon tests by the licensee. The river water piping is carbon steel. A carbon steel to stainless steel transition joint is employed outside the heat exchanger on the inlet and outlet lines. Following a LOCA, it is not clear how a leak in the river pipes or bellows expansion joint inside containment would be detected and boron dilution of the sump prevented. The pressure relief valve outside containment on the river water discharge will relieve to the auxiliary building sump. Water discharge will be detected by the sump pump operation and by area monitors in the auxiliary building.

Conclusions and Positions

The licensee proposed an 18 month freon test of the heat exchangers tube side, as being adequate to detect leakage and assure integrity. While the Staff believes the freon test to be highly sensitive to leaks and does provide adequate assurance of the existing leak-tightness, it does not provide information on the required integrity for the subsequent periods of operation should the heat exchanger be called upon. The test recently performed by the licensee and the fact that the heat exchangers are relatively young in life led the staff to conclude there is reasonable assurance of continued integrity so that the Beaver Valley Unit No. 1 can be returned to power following the current outage without a tube degradation inspection.

The licensee was instructed to include a freon test at each refueling outage (normal 18 month cycle) to be preceded by a pneumatic or other pressure test along the requirements of Section XI of the ASME Code. This test is expected to produce leaks that are about to occur and then be detected by the freon test. The details of such a test are to be developed by the licensee and included in their Inservice Inspection Program before the second refueling outage.

The test for tube and tubesheet degradation is an open issue. At some point in the heat exchanger life, the licensee must begin to examine for degradation to assure continued integrity should operation ever be required. The licensee was instructed to consider means for testing for heat exchanger degradation including a schedule and basis for beginning such testing. The type of test, basis for acceptance criteria, and schedule for periodic performance of the tests is to be developed by the licensee, submitted to the NRC for review, and subsequently included in the licensee's Inservice Inspection Program.

The Staff did not reach a position on the preferred normal condition of the heat exchanger. The licensee was requested to develop a position and provide a technical basis for draining and drying the heat exchanger to include discussion of concentrating chlorine by drying and creating a water hammer problem by having a river water system charging to an empty heat exchanger.

Dave Wigginton

Dave Wigginton, Project Manager
Operating Reactors Branch #1
Division of Licensing

Attachments:
1. List of Attendees
2. Heat Exchanger Spec Sheet

cc: w/attachments
See next page

Docket Files
NRC PDR
Local PDR
ORB1 Reading
NRR Reading
H. Denton
E. Case
D. Eisenhut
R. Tedesco
G. Zech
B. Grimes
W. Gammill
L. Shao
J. Miller
R. Vollmer
T. J. Carter
A. Schwencer
D. Ziemann
P. Check
G. Lainas
D. Crutchfield
B. Grimes
T. Ippolito
R. Reid
V. Noonan
G. Knighton
D. Brinkman
Project Manager
OELD
OI&E (3)
C. Parrish/P. Kreutzer
ACRS (16)
NRC Participants
NSIC
TERA
Licensee
Short Service List

ATTACHMENT 1

DECAY HEAT EXCHANGER

MEETING

BEAVER VALLEY POWER STATION 1

APRIL 22, 1980

Name	Organization
D. Wigginton	NRC
D. Shum	NRC
J. D. Sieber	DLC - Licensing
K. D. Grada	DLC- Operations
P. C. Hearn	NRC
Frank H. Timpano	VEPCO
R. E. Vanasse	Stone and Webster
C. E. Ader	Stone and Webster
R. C. Tappan	Stone and Webster
C. F. Andreone	Stone and Webster
W. C. Drotleff	Stone and Webster
B. Turovlin	NRC
H. F. Conrad	NRC
J. E. Rosenthal	NRC
L. B. Engle	NRC
R. Woods	NRC
C. Y. Cheng	NRC
George Johnson	NRC
K. R. Wichman	NRC
J. Zudans	NRC
Vince Noonan (part time)	NRC

ATTACHMENT 2

INDUSTRIAL PROCESS ENGINEERS

8 LISTER AVE. NEWARK, N. J.

HEAT EXCHANGER SPECIFICATION SHEET

Customer: Stone & Webster Engineering Corporation		Job No. 6301	
		Reference No. J. O. #M-11700	
Address: Boston, Massachusetts		Proposal No. 18977	
Plant Location: Shippingport, Pennsylvania		Date 5/26/69	
Service of Unit: Recirculation Spray Coolers		Item No RS-E-1A, B, C, D	
Size: 31-444	Type: CEN (Vert)	Connected in Parallel	
Sq Ft Surf/Unit (Gross) 5150	Shells/Unit: One	Sq Ft Surf/Shell 5150	

PERFORMANCE OF ONE UNIT (Four Required)

	Shell Side		Tube Side	
Fluid Circulated	Recirculated Spray Water		Ohio River Water	
Total Fluid Entering, #/HR	1750000		2000000	
Vapor				
Liquid	1750000		2000000	
Steam				
Non-Condensables				
Fluid Vaporized or Condensed				
Steam Condensed				
Gravity Density #/ft 3	61.6		62	
Viscosity				
Molecular Weight				
Specific Heat	1	BTU/LB°F	1	BTU/LB°F
Thermal Conductivity		BTU/HR-FT-°F		BTU/HR-FT-°F
Latent Heat		BTU/LB		BTU/LB
Temperature In	139	°F	85	°F
Temperature Out	104	°F	115.6	°F
Operating Pressure	0-100	PSIG	45 Ext (1) 100 INT	PSIG
No. Passes per Shell	One		One	
Velocity	206 #/Sec ft 2	Ft/Sec	6.6	Ft/Sec
Pressure Drop Allow/Calc	10 / 10	PSI	10 / 7	PSI
Fouling Resistance (Min.)	0.0		0.0	
Heat Exchanged - B.T.U./Hr.	61000000	M.T.D. (Corrected) - °F	21.2	
Transfer Rate - Service	564	Clean	564	

CONSTRUCTION OF ONE SHELL

	Shell Side		Tube Side	
Design Pressure	150	PSI	150 INT. 48 EXT	PSI
Test Pressure	Code	PSI	Code	PSI
Design Temperature	280	°F	280	°F

Tubes 304L SS SMLS	No. 850 O.D. 5/8" BWG 20 Min Length 37'-0" Pitch: 7/8" TRI
Shell 304L SS ID 31" ~~OD~~	Shell Cover (Integ)(Remov)
Channel ~~or Bonnet~~ C.S.	Channel Cover C.S. (2)
Tubesheet-Stationary 304L	Tubesheet-Floating
Baffles-Cross 304SS 25" spc Type dbl seg 25% cut	Floating Head Cover
Baffles-Long Type	Impingement Protection S.S.
Tube Supports	
Tube to Tubesheet Joint: Expanded and seal welded	
Gaskets (2)	
Connections-Shell Side In 10" (3) Out 12"	Rating BW
Connections-Channel Side In 14" Out (14)	Rating BW Sch 40
Corrosion Allowance - Shell Side	Tube Side
Code Requirements: ASME III C (4)	T.E.M.A. Class R

Remarks: (1) External Pressure on channels and channel covers under "Accident" conditions.
(2) Welded Diaphram seal
(3) 10" x 14" Dome at shell inlet & 12"x14" @ outlet to avoid excessive velocities
(4) 100% Radiographed

FM 8-69 - 18720 H.N.P.

POOR ORIGINAL