

June 27, 1997

**NRC INFORMATION NOTICE 97-41: POTENTIALLY UNDERSIZED EMERGENCY
DIESEL GENERATOR (EDG) OIL COOLERS**

Addresses

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to the discovery of potentially undersized EDG oil coolers at Limerick Generating Station, Units 1 and 2. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

Philadelphia Electric Company (PECO) Nuclear, the licensee for Limerick Generating Station, Units 1 and 2, and its consultant Stone and Webster were recently evaluating EDG heat exchangers in response to NRC Generic Letter (GL) 89-13. In the course of this evaluation it was determined that the Limerick EDG lubricating oil coolers were undersized relative to the design conditions reported on the heat exchanger data sheet. The oil coolers in question are used to cool lubricating oil for the Coltec EDGs and were designed and manufactured by American Standard in May 1976. The cooling water for heat removal circulates through the tubes and the lubricating oil circulates on the shell side. Finned tubes are used to provide additional heat transfer surface. In the process of verifying the design adequacy of the heat exchanger, the licensee utilized the widely used computer modeling program ST-5, Mod 0.5-1.3, developed by Heat Transfer Research Inc. (HTRI). HTRI is the leading association for the heat-exchanger industry; its membership includes all major heat exchanger manufacturers and designers. The licensee used data obtained from the design data sheet of the heat exchanger. This data included the design geometry and design conditions, as well as the tube-side fouling factor of 0.002 and the oil-side heat transfer rate of 83.2 BTU/(hr ft² °F) for SAE 30 oil. The calculation indicated that the heat exchanger was 22.8 percent undersized. The licensee informed Coltec about this discrepancy and requested further evaluation.

Discussion

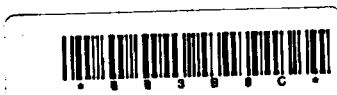
An evaluation performed by Coltec and its consultants indicates that all design calculations performed by American Standard in 1976 for this heat exchanger were complete and correct,

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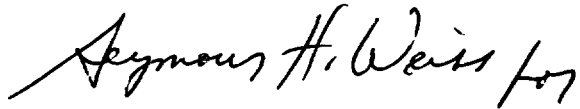
including the proper application of the finned tubing surface area ratio to the specified tube-side fouling factor. PECO Nuclear and its consultant originally suspected that the 0.002 fouling factor was erroneously applied unmodified to the outside surface in the original design of the heat exchanger, resulting in an undersized heat transfer surface. The evaluation demonstrated that this was not the case. Heat transfer calculations supported by HTRI at the time of design were considered "state of the art" and the heat exchanger design was based on the methodology that was current at that time.

The discrepancy between the newly calculated and original design heat transfer surfaces, according to Coltec and its consultants, was caused by a revision in the calculational methodology for designing heat exchangers implemented in 1985. Calculations based on the revised method invariably lead to a lower heat transfer surface in comparison with the previously used calculation procedure. Thus heat exchangers designed before 1985, if evaluated in accordance with the revised design methods, would be considered undersized.

In 1985, after extensively testing industrial-sized heat exchangers, HTRI modified its calculation method for cooling viscous shell side fluids. The new calculation method is considered to be more precise in predicting actual heat transfer and pressure drop performance. In general, the calculated shell-side heat transfer coefficients obtained with this revised method are lower than those obtained with the former method. In some cases, the coefficient can be appreciably lower, depending on fluid viscosity, operating temperatures, flow velocity, and fin geometry.

It therefore appears that heat exchangers designed before 1985 are smaller in size for the same performance requirements than those designed after 1985. This does not necessarily mean that they are now considered inadequate for meeting the design requirements. It, however, does mean that they have a lower fouling margin, possibly requiring more frequent cleaning and testing of the heat exchangers in order to maintain operability. PECO Nuclear has determined that for the Limerick design, sufficient margin is available given the calculated temperatures of the emergency service water (ESW) system to handle the post-accident loading (which is below the continuous rating). PECO Nuclear's analysis takes into consideration the seasonal variation of ambient temperatures and the results indicate that by scheduling of the heat exchanger cleaning precisely, Limerick will be able to maintain EDG operability. Evaluation of similar heat exchangers of the same vintage may yield similar results.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.



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97-39	Inadequate 10 CFR 72.48 Safety Evaluations of Independent Spent Fuel Storage Installations	06/26/97	All holders of OLs or CPs for nuclear power reactors. All holders of licenses for independent spent fuel storage installations
97-38	Level-Sensing System Initiates Common-Mode Failure of High-Pressure-Injection Pumps	06/24/97	All holders of OLs or CPs for nuclear power reactors
96-53, Supp. 1	Retrofit to Amersham 660 Posilock Radiography Camera to Correct Inconsistency in 10 CFR Part 34 Compatibility	06/23/97	All industrial radiography licensees
97-37	Main Transformer Fault with Ensuing Oil Spill into Turbine Building	06/20/97	All holders of OLs or CPs for nuclear power reactors
97-36	Unplanned Intakes by Worker of Transuranic Airborne Radioactive Materials and External Exposure Due to Inadequate Control of Work	06/20/97	All holders of OLs and CPs permits. All licensees of nuclear power reactors in the decommissioning stage and fuel cycle

OL = Operating License
CP = Construction Permit

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Tech Editor has reviewed and concurred on 5/21/97
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Correction as noted

OFFICE	Tech Contacts	EMEB	C	C:PECB	D:DRPM
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DATE	6/11/97 6/14/97	6/9/97		6/16/97	6/ / 197

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