FPL

To: M.A. Smith, JEN

Date: February 12, 1991

From: K.R. Olen

Department:

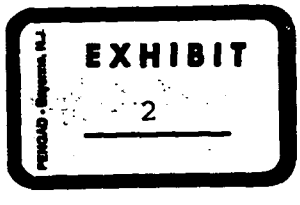
Subject: ORIMULSION TEST BURN:
OPACITY COUNTERMEASURES

With reference to the Sanford Plant Test Burn of Orimulsion, higher than expected opacities have been experienced, when compared to the 45-50% opacity measured while burning Orimulsion at the Dalhousie Generating Station in Canada. At least three major factors appear to account for these differences in opacity: (1) A slight difference in Orimulsion composition, (2) differences in boiler design, which result in different boiler tube fouling rates, and (3) different flue gas temperatures.

Opacities at Dalhousie were determined in the duct connecting the air preheater and the electrostatic precipitator. Because of problems encountered in achieving efficient boiler operation, the flue gas temperature in the connecting duct was between 425 and 450F. In comparison the temperature of the flue gas in the stack at Sanford has typically been less than 375F. We believe, that because of the lower flue gas temperatures at Sanford, the small ash particles that cause opacity have been allowed to grow due to sulphation. The result of this growth is slightly larger particles that have a greater efficiency in scattering light, hence higher opacity.

In an attempt to minimize opacity without jeopardizing our major test objectives of quantifying boiler operating characteristics and defining emission rates for the design of control systems a number of counter measures have been implemented:

(1) We have requested that BITOR, the Orimulsion supplier, ensure that future shipments contain only the minimum required amount of added magnesium (Mg). The magnesium added to Orimulsion serves a dual-purpose in that it preserves fuel flow properties during storage, and combines with fuel vanadium (V) during combustion to prevent high-temperature corrosion. Unfortunately, magnesium oxide and sulphate particles also contribute to opacity. The first shipment of Orimulsion had a Mg/V ratio of about 1.6, and only 1.0-1.3 is needed to prevent high-temperature corrosion, and provide reasonable storage stability.



(2) A Service Engineer from the burner vendor, NEI-International Combustion Ltd., was flown in from England to assist in determining if burner operation might be contributing to high opacity. He suggested several changes in fuel gun and air swirler alignment to improve flame shape and combustion efficiency. When these changes were completed it was possible to reduce excess combustion air to about 1%, while maintaining an acceptably low carbon monoxide concentration in the flue gas. Thus, these changes suggested that high combustion efficiencies are possible while firing Orimulsion at low excess air levels. No appreciable changes in opacity were evident from the burner alignment adjustments alone.

(3) Replacing the atomizers with a new set of the same design as the original atomizers resulted in a reduction in the fuel pressure required to achieve a given fuel flow. This change improved flame profiles, but had no apparent effect on opacity.

Please note that despite the execution of the above counter measures, it is still necessary to restrict boiler load and maintain a high excess combustion air level to keep opacity below 60%.

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