

SAFETY EVALUATION BY THE OFFICE OF REACTOR REGULATION
RELATED TO INTRUSION OF BORON INTO REACTOR COOLANT SYSTEMS

MATERIALS AND CHEMICAL ENGINEERING BRANCH

(TAC NOS. M81949 AND M81950)

CAROLINA POWER AND LIGHT COMPANY

BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2

DOCKET NOS. 50-324 AND 50-325

1.0 INTRODUCTION

By letter dated October 23, 1991 Region II of the NRC requested our assistance in evaluating the Engineering Evaluation Report prepared for Brunswick Steam Electric Plant, Units 1 and 2 by Carolina Power and Light Company (the licensee).

In April 1990 significant concentration of boron was detected in several coolant systems in Units 1 and 2 of the Brunswick plant. The systems affected included reactor vessels, condensate storage tanks and radwaste systems. The situation has worsened with time and the concentration of boron in the cooling systems was increasing, eventually reaching significant amounts (e.g. 580 ppb in the Unit 2 reactor cooling water). The licensee has identified the source of boron to be a boron based corrosion inhibitor which was added to the head tank in the Turbine Building Component Cooling Water System (TBCCW). The inhibitor consisted of sodium nitrite pH buffered by sodium tetraborate. Because of faulty valves this solution was being periodically bled to the Radwaste System and made its way to the Condensate Deep-bed Demineralizer (CDD). Boron was then released from the demineralizer in the form of boric acid whenever significant amounts of air or chlorides were introduced or the resin in the CDD became overheated. The released boric acid contaminated coolant systems of the plant.

2.0 EVALUATION

The licensee estimated that currently there are about 1.58 pounds of boron in the Unit 1. Similar amount could be expected to exist in Unit 2. This amount of boron, if completely displaced, would produce about 3 to 4 ppm concentration of boron in the plant's coolant systems. If all boron is assumed to be in boric acid form, this would correspond to approximately $2E-3$ percent solution. Solution of such low boric acid concentration would be benign towards the materials used in primary coolant systems including fuel claddings and no corrosion damage could occur.

In the Engineering Evaluation Report the licensee proposed to implement a program to monitor boron concentration by measuring reactor coolant and condensate conductivity. Whenever the conductivity exceeds 1 s/cm the licensee committed to shut down the plant. This measure provides additional assurance that the presence of boric acid in plant coolant systems would not cause corrosion damage.

3.0 CONCLUSIONS

Based on the above evaluation, the staff concludes that the intrusion of boron into the coolant systems of the Brunswick Steam Electric plant would not cause corrosion damage of these systems.

SALP INPUT

FACILITY NAME: BRUNSWICK STEAM ELECTRIC, UNITS 1 AND 2

SUMMARY OF REVIEW ACTIVITIES:

The review consists of evaluating the licensee's Engineering Evaluation Report on boron intrusion into the cooling systems of the Brunswick Steam Electric plant. The areas of review include evaluation of a possible corrosion effect of boric acid on materials of construction.

ENGINEERING AND TECHNICAL SUPPORT:

The submittals provided by the licensee were well organized and contained the information pertinent to our review.