

ENCLOSURE

PHIPPS BEND NUCLEAR PLANT
DEFECTIVE FLORIDA STEEL REBAR
10CFR50.55(e) REPORT NO. 1 (FINAL)
NCR PBN-044

On October 17, 1979, TVA notified NRC-OIE Region II, Inspector R. W. Wright, of a potentially reportable condition under 10CFR50.55(e) regarding defective (extremely brittle) No. 6 rebar produced by the Florida Steel Corporation, Charlotte, North Carolina (hereinafter referred to as Florida Steel) for use at the Phipps Bend Nuclear Plant.

This is the final report on the subject reportable condition.

Description of Deficiency

No. 6 rebar (bought by TVA to meet ASTM A-615, Grade 60) of heat lot CO-0006 was produced by Florida Steel on October 1, 1979, at their plant in Charlotte, North Carolina. The entire heat (39 tons total) was shipped to the Phipps Bend Nuclear Plant and arrived on October 12, 1979. This heat, CO-0006, of rebar was rejected and placed in "over, short, or defective status" upon arrival because it was so brittle that when bundles of the rebar were lifted, some of the rebar in the bundles broke. Following the rejection of the material, Phipps Bend employees took six samples from unbroken bars in that heat and four samples of rebar of the other heats, two each of heats CO-0005 and C9-3834, received on the same rail shipment as the defective heat. The samples were tested and analyzed at Phipps Bend and the TVA Singleton Test Laboratory with the following results:

1. All samples tested of heats CO-0005 and C9-3834 passed tensile testing performed both at Phipps Bend and at Singleton Laboratory.
2. a. Five of the six rebar samples of heat CO-0006 broke well below acceptable limits (90,000 psi required ultimate strength) in testing at Phipps Bend.
b. The other sample of CO-0006 passed tensile testing at Phipps Bend with a 94,000 psi ultimate strength.
c. Samples of fractured rebar sent to Singleton Laboratory were verified to have failed by brittle fracture.
d. Singleton analyzed samples of the rebar of heat CO-0006 which had broken by brittle failure and found a manganese content of 4.7 percent, a level which would cause the rebar to be extremely brittle and which does not appear to be a normal manganese level for any type of normally used steel.
e. Singleton analyzed a sample of "good" rebar from the CO-0006 heat and found normal rebar chemistry. The manganese level in it was 0.89 percent.

1552 331

7912130 431

3. Mill certifications provided with the CO-0006 heat from Florida Steel show normal rebar chemistry. The manganese level shown therein is 0.77 percent.

TVA concludes from the above data that rebar heat lot CO-0006 was extremely nonhomogeneous.

Cause of Deficiency

The cause of the deficiency is the presence of the high manganese content of part of the rebar causing it to be extremely brittle. The high manganese content in part of the heat evidently escaped detection due to the nonhomogeneous of the batch of material and because the sample taken was from a section of the heat which had acceptable properties. The Florida Steel QA manager indicated verbally to TVA that the heat was properly sampled with one bar taken from the middle one-third of the heat of a batch of less than 50 tons as required by the purchase specification.

Safety Implications

Because of the obvious nature of the deficiency and the fact that it was discovered before the rebar being approved for receipt, TVA does not believe that this rebar deficiency would or could have gone undetected. However, this occurrence caused TVA to question the Florida Steel QA program which allowed it to happen and bring to question the possibility of similar occurrences of a less obvious nature.

Corrective Actions

Half of the defective heat of rebar was returned to Florida Steel from the Phipps Bend Nuclear Plant on November 9, 1979. The other half will be shipped from Phipps Bend on or before November 16, 1979. TVA also tested other rebar heats shipped to Phipps Bend on the same rail car as the defective heat (see previous discussion) and found the other heats to be acceptable.

Means Taken to Prevent Recurrence

TVA has been informed by the Florida Steel QA manager that they will review melting procedures with individuals (melters) working in the melt shop. They will discuss the problem and provide training to shearing shop supervisors and crews to alert them to methods of discovering deficient material before shipment. Florida Steel will document internally the retraining and review discussed above.

TVA Quality Engineering Branch (QEB) engineers have had numerous discussions concerning this situation with Florida Steel. The TVA Charlotte inspection office has increased surveillance of Florida Steel operations. Also, TVA (QEB) has scheduled an audit of Florida Steel's Charlotte, North Carolina, office for the first quarter of 1980. The actions discussed above should prevent the chance of future recurrences of a similar problem.