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Docket No. 50-546
-547

MEMORANDUM FOR: J. H. Sniezek, Director
Division of Resident and
Regional Reactor Inspection, IE

FROM: H. J. Wong, Civil Structural Engineer, Mechanical, Structural
and Metallurgical Section, Reactor Engineering Branch, RRRI, IE

SUBJECT: SUMMARY OF JANUARY 8, 1981 MEETING WITH PUBLIC SERVICE
COMPANY OF INDIANA, INC.

A meeting was held on January 8, 1981 in Bethesda, Maryland with Public Service of Indiana, Inc. (PSI) to discuss the results of inspections and additional testing performed by PSI relating to cadweld splices at Marble Hill Units 1 and 2. The meeting agenda, a list of the attendees, and handouts provided during the meeting are enclosed (Enclosures 1, 2, and 3).

PSI's inspection of accessible cadwelds, as part of the "Construction Verification" program at Marble Hill Units 1 and 2, revealed numerous visual deficiencies which exceeded the acceptance criteria, both the Marble Hill project and manufacturer's specifications. Of the 2431 accessible cadwelds inspected, 504 cadweld's (20%) were identified to have deficiencies which would cause rejection of the cadwelds under the original project specifications. Approximately 50% of the deficient cadwelds had gage mark indication problems although there is not a requirement for permanent markings. Approximately 7500 cadwelds are buried in concrete and therefore not accessible for inspection.

Tests on accessible cadwelds were performed to evaluate the types of deficiencies in the accessible population to draw conclusions on the acceptability of the buried cadwelds. A random sample of 59 cadwelds were selected and reinspected. For cadwelds which failed the visual inspection or radiography criteria, tensile tests were performed. All 59 cadwelds met the visual inspection criteria or had acceptable tensile test results. An additional sample of 58 cadwelds with gage mark deficiencies, biased by selecting the worst cases, were radiographed. Three cadwelds were additionally identified to exceed gage mark tolerances. These were tensile tested and had acceptable results. Also, 21 cadwelds with the worst case physical deficiencies were removed and tensile tested. These 21 also met the tensile test requirements. Based on the acceptable results from the additional tests and inspections performed and the PSI evaluation that the embedded cadwelds were at least as good as those cadwelds accessible, PSI concluded that no additional testing was necessary and that no "substandard" cadweld splices exist at Marble Hill.

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The cadweld deficiencies at Marble Hill were clearly beyond those covered by NRC Regulatory Guide 1.10 and normal industry practice. The NRC staff had previously expressed that in addition to reviewing the strength characteristics of the defective cadwelds, PSI should evaluate the effects of strain (softening) on the behavior of the structures. To address this issue PSI evaluated the past and current code requirements for cadweld splices, compared tests performed for the cadweld manufacturer (Erico) and the situation at Marble Hill, and performed stress analysis of structures assuming no load carrying capability for physically defective cadwelds. In summary, PSI concluded that (1) strength not strain is the primary criterion of concern; (2) the Erico tests, although more severe than the situation at Marble Hill, showed acceptable results; and (3) the ACI code allowable stress for reinforcing bar was met for the worst case (cracking is not significant). *stungta*

In conclusion, the NRC staff provided the following comments:

1. PSI should submit a written report describing with sufficient detail the discussions presented during this meeting. It was agreed that the report would be provided by January 23, 1981.
2. As an item for information, the Region III Office would review the results of the radiography test program.
3. PSI should address the corrective actions, if any, planned for the visually rejectable cadwelds. The NRC would review those specific cases in which removal and replacement of cadwelds would be impractical (such as "B" type splices attached to the containment liner).
4. PSI should indicate in the written report the acceptance criteria that would be used for the future production of cadwelds. PSI indicated that the original Marble Hill project acceptance criteria would be applied for subsequent work.
5. PSI should provide in the written report a discussion of the effects of deformation (deflection) on the structures related to the analysis assuming no load carrying capability for the physically defective cadwelds.
6. A detailed NRC review of the written report will be necessary, but it appears based on the discussions during this meeting that additional testing will not be required. PSI would be formally notified if additional actions are required.

The written report has been submitted to the NRC and is being initially reviewed in this office. It is anticipated that the review of this issue will be formally transferred to NRR. The Structural Engineering Branch, NRR has been kept informed of this issue at Marble Hill and has been involved in discussions with the IE staff.

IE:REB	IE:REB	IE:RRRI:DD	
HJWong:mkm	RWoodruff	ELJordan	Howard J. Wong, Civil Structural Engineer
2/5/81	2/ /81	2/ /81	Mechanical, Structural & Metallurgical Section
			Reactor Engineering Branch, RRRI, IE

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Enclosures: As stated

cc: w/enclosures

C. Williams, RIII

F. Schauer, NRR

G. Arndt, SD

w/o enclosures

E. Jordan, IE

J. Henderson, IE

J. Keppler, RIII

G. Fiorelli, RIII

D. Hayes, RIII

A. Varela, RI

D. Eisenhower, NRR

T. Novak, NRR

B. Youngblood, NRR

J. Wilson, NRR

D. Jeng, NRR

R. Lipinski, NRR

S. Chan, NRR

H. Graves, SD

AGENDA FOR MEETING ON
"CADWELDS AT MARBLE HILL"

Agenda

A. Background of Cadweld Data

1. Construction Verification Program at Marble Hill
 - a. Visual Inspection Results
 - b. Radiography Results
 - c. Tensile Test Results
2. Production and Sister Splice Test Results
3. Similarities and Differences Between Accessible and Inaccessible Cadwelds (Locations of Inaccessible)

B. PSI Evaluation of Adequacy of Embedded and Accessible Cadwelds

C. NRC Concerns

1. Stress/Strain Measurements
2. Adequacy of Embedded Cadwelds
3. Others as identified

MEETING ATTENDEES

MEETING WITH PUBLIC SERVICE OF INDIANA, INC.

ON JANUARY 8, 1981

PUBLIC SERVICE OF INDIANA, INC.

S. Brewer
W. Petro
D. Ingmire

SARGENT AND LUNDY

A. Morcos
P. Wattelet
K. Kostal
D. Carreira
O. Zaben

NRC

H. Wong
D. Jeng
R. Lipinski
H. Graves
G. Arndt
J. Henderson
F. Schauer
A. Varela
C. Williams
D. Hayes
J. Wilson