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8004290

Westinghouse Electric Corporation Power Systems

Box 355
Pittsburgh Pennsylvania 15230

April 23, 1980
NS-TMA-2235

Ref.: a. NS-TMA-2099, 6/11/79
b. NS-TMA-2214, 3/14/80

Mr. Stefan S. Pawlicki, Chief
Materials Engineering Branch
Division of Systems Safety
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
7920 Norfolk Avenue
Bethesda, Maryland 20014

Dear Mr. Pawlicki:

Subject: Summary of Westinghouse/TVA/NRC Meeting on March 20, 1980 on Sequoyah Control Rod Guide Tube Support Pins

Please find enclosed:

1. One (1) copy of "Summary of Westinghouse/TVA/NRC meeting on March 20, 1980 on Sequoyah Control Rod Guide Tube Support Pins" (Proprietary) as Attachment A.

2. One (1) copy of "Figures for Background and Operating Plant Experience and New Support Pin Design for Sequoyah" as Attachment B

3. One (1) copy of "Viewgraphs for Microstructural Evaluation of Alloy Inconel X-750", as Attachment C.

Also enclosed is: (1) copy of Application for Withholding, AW-80-20.
(2) Affidavit AW-77-47, Proprietary

The purpose of this letter is to transmit a summary of the oral presentations made by Westinghouse Water Reactor Division's personnel to the NRC Staff on March 20, 1980 on the subject control rod guide tube support pin cracking. The purpose of that meeting was to present available information to the Staff on pin cracking that has been observed in PWR plants operating in a foreign country and the relationship of such experience to the safety and licensing of the TVA Sequoyah nuclear plant. This information is being transmitted in accordance with your request made at the completion of the March 20, 1980 meeting.

Reference a. submitted information on pin cracking as of June, 1979 which stated that no cracks were found in foreign plants in support pins which had been supplied by Westinghouse and concluded there was not a safety issue in domestic operating plants. Reference b. also reported that the potential for broken guide tube support pins due to stress corrosion cracking was

B001 S 1/2 PROP ENCL TO FILES P.M. PAWLICKI

ADD: L E O M RUSHBROOK

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reportable to NRC, under Title 10CFR21, in that for UHI plants, breakage of a guide tube support pin could jeopardize the operation of the associated control rod. Because Sequoyah is a UHI plant, and the Sequoyah support pins had received a metallurgical heat treatment similar to those pins that had sustained cracking in the foreign plant, Westinghouse recommended the replacement of the existing support pins with new support pins manufactured using heat treatment processes that would provide extremely low susceptibility to stress corrosion cracking.

Attachment A, and the associated figures and tables of Attachments B and C, provide a summary of the technical information describing the foreign operating plant experience related to pin cracking, the information on the Sequoyah replacement pin design and the technical basis for the selected heat treatment to minimize stress corrosion cracking.

It is our conclusion that with the installation in the Sequoyah plant of the newly designed support pins which have received the Westinghouse recommended solution anneal and single aging heat treatment, the potential for guide tube misalignment, with the possible restriction of the associated control rod movement, has been eliminated. We conclude that no unresolved safety question exists with respect to the future performance of the guide tube pins.

This submittal contains proprietary information of a foreign entity and of Westinghouse Electric Corporation. In conformance with the requirements of 10CFR2.790, as amended, of the Commission's regulations, we are enclosing with this submittal, an application for withholding from public disclosure and an affidavit. The affidavit sets forth the basis on which the information may be withheld from public disclosure by the Commission. Correspondence with respect to the affidavit or application for withholding should reference AW-80-20 and should be addressed to R. A. Wiesemann, Manager of Regulatory and Legislative Affairs, Westinghouse Electric Corporation, P. O. Box 355, Pittsburgh, Pennsylvania 15230.

Very truly yours,

Robert A. Wiesemann for
T. M. Anderson, Manager
Nuclear Safety Department

WSB:pj
Enclosure

cc: [redacted]
NRC, Division of Project Management

D. L. Lambert, TVA

Westinghouse Electric Corporation Power Systems

Box 355
Pittsburgh Pennsylvania 15230

April 23, 1980

AW-80-20

Mr. Stefan S. Pawlicki, Chief
Materials Engineering Branch
Division of Systems Safety
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
7920 Norfolk Avenue
Bethesda, Maryland 20014

APPLICATION FOR WITHHOLDING PROPRIETARY INFORMATION FROM PUBLIC DISCLOSURE

SUBJECT: Sequoyah Control Rod Guide Tube Support Pins - Summary of March 20, 1980 Meeting Between Westinghouse, Tennessee Valley Authority and NRC.

REF.: Westinghouse Letter No. NS-TMA-2235, Anderson to Pawlicki dated April 23, 1980.

Dear Mr. Pawlicki:

The proprietary material transmitted by the referenced letter supplements the proprietary material previously submitted concerning properties of fuel and core components materials. Further, the affidavit submitted to justify the material previously submitted, AW-77-47, is equally applicable to this material. The information designated by the letter (g) is proprietary to a foreign entity.

Accordingly, withholding the subject information from public disclosure is requested in accordance with the previously submitted proprietary affidavit, AW-77-47, dated October 25, 1977, a copy of which is attached.

Correspondence with respect to this application for withholding or the accompanying affidavit should reference AW-80-20, and should be addressed to the undersigned.

Very truly yours,

Robert A. Wiesemann

Robert A. Wiesemann, Manager
Regulatory and Legislative Affairs

/pj
Attachment

cc: J. A. Cooke, Esq. (without attachment)
Office of the Executive Legal Director, NRC

WESTINGHOUSE PROPRIETARY AFFIDAVIT

TO BE WITHHELD FROM PUBLIC DISCLOSURE

WESTINGHOUSE PROPRIETARY CLASS 2

AW-77-47

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF ALLEGHENY:

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Before me, the undersigned authority, personally appeared Robert A. Wiesemann, who being duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Corporation ("Westinghouse") and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:

Robert A. Wiesemann
Robert A. Wiesemann, Manager
Licensing Programs

Sworn to and subscribed
before me this 25 day
of October, 1977.

Notary Public

THE NATURE OF THE COMPETITION IN THE NUCLEAR BUSINESS

Westinghouse's principal competitors in the nuclear steam supply business are Babcock & Wilcox, Combustion Engineering, and General Electric. The principal U. S. competitors in the nuclear fuel fabrication business are Babcock & Wilcox, Combustion Engineering, Exxon, and General Electric. With the exception of General Electric, these competitors are new entries in the business with substantially smaller investments in technology. Westinghouse also has competition from foreign fabricators. This competition can drastically affect our ability to obtain contracts in the international market. Specific competitors include ASEA-ATOM (Sweden), Kraftwerk AEG (Germany), Framatome (France), BNFL (Great Britain), Enusa (Spain), Mitsubishi (Japan), and Fabricazione Nucleari (Italy).

Both the nuclear steam supply and the nuclear fuel fabrication businesses involve high technology, and competition is on the basis of that high technology rather than on price. Only if competition continues based on technology will Westinghouse be able to recover its substantial investments in technology and product development.

EFFECT OF RELEASE OF INFORMATION ON WESTINGHOUSE COMPETITIVE POSITION

If, as a matter of general practice, cost or price information or information about the basis on which Westinghouse makes its business judgements were made publicly available, it would have the general effect of altering the nature of competition from a technology base to a price base. This would change the entire complexion of the business and drive it toward a low investment-low technology development business. Under such circumstances, those in the business with heavy unrecovered investments in technology such as Westinghouse would have difficulty competing successfully with those who have made relatively small investments since

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business would tend to go to the lowest qualified bidder. The general public would also suffer in that they would be deprived of the benefits of technological developments that would most likely far exceed any short-term benefits derived from lower prices. Likewise, a general practice of making publicly available information obtained from investments in technology would enable competitors to benefit without having to make commensurate investments. This would stifle the incentive for further investments in technology and drive the business to price-based competition instead of competition on the basis of technology with the same end results as in the case of disclosure of cost or price information.

WHAT WESTINGHOUSE SEEKS TO PROTECT

Westinghouse seeks to protect its ability to recover its investments in:

(1) Basic data resulting from research and development.

(2) Analytical methods and models.

(3) Details of our designs including margins, tolerances, etc.

(4) The knowledge of what data to present and how to present the data to satisfy NRC licensing requirements. NOTE: In the current licensing environment, the capability to obtain licensing approval has become very important in the marketplace.

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The above identified information is of considerable commercial advantage to the competitors of Westinghouse to the extent that it eliminates the need for similar investments in technology.

RELATIONSHIP OF INFORMATION SOUGHT TO BE WITHHELD FROM PUBLIC DISCLOSURE TO WHAT IS SOUGHT TO BE PROTECTED

INFORMATION SOUGHT TO BE WITHHELD

The information sought to be withheld in this report includes conclusions regarding thermal, physical, chemical and mechanical properties of fuel and core component materials based upon Westinghouse experimental data and an extensive literature survey and data reduction program. The report also contains Westinghouse material specifications. The release of this information would result in the following competitor benefits:

POTENTIAL ADVANTAGES TO COMPETITORS

1. It would allow competitors to verify their material property design values by mere reference to the Westinghouse Report without having to expend the time, resources and funding otherwise necessary.

2. For the materials listed in the report, the data presented would enable competitors to determine to a close approximation some of the final heat treatments, processes, densities, etc., used by Westinghouse.

3. Knowledge of the materials properties presented, or the implied specifications may permit competitors to either relax their material specifications or reduce design margins, either of which circumstances could lead to sales advantages detrimental to the Westinghouse marketing position.

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INVESTMENT BY WESTINGHOUSE IN WHAT IS SOUGHT TO BE PROTECTED

It is estimated that four to five man-years of engineering and one man-year of technician effort, amounting to approximately $500,000 was expended to perform the literature survey, obtain Westinghouse experimental data, perform detailed analysis of selected data and to derive acceptable design equations and values.

Competitors could obtain the equivalent information, with difficulty, by investing a similar sum of money and provided they had the appropriate resources available and the requisite experience.

POTENTIAL HARM TO WESTINGHOUSE

We believe there is a likelihood of substantial harm to the competitive position of Westinghouse if the information sought to be withheld is publicly disclosed, which could result in a loss of revenue to Westinghouse of approximately $10,500,000 in potential first-core and $7,000,000 in potential reload fuel business.

Further the deponent sayeth not.

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ATTACHMENT A

SUMMARY OF WESTINGHOUSE/TVA/NRC MEETING ON 3/20/80 ON SEQUOYAH CONTROL ROD GUIDE TUBE SUPPORT PINS

I. Background and Operating Plant Experience

Guide tube support pins align the lower guide tube to the upper core plate. (Figures 1, 2, 3, 4) There are two support pins per guide tube. (Figures 5,6) This same basic design has been used in all Westinghouse PWR plants since Southern California Edison (SCE). The material is Inconel X-750, heat treated and age hardened.

[ ] (g)

[ ] (g)

In the unlikely event that a pin leaf were to break off, there may be some small potential for a loose part to adversely affect control rod operation. The possibility of this is remote because of the torturous path the loose part would have to traverse plus the preferential orientation and location that would be required. (Figures 9 and 10) If the support pins were completely broken at the shank to shoulder juncture, the loose part is too large to enter any clearance space to adversely affect control rod operation.

For an Upper Head Injection (UHI) plant, such as Sequoyah, if the guide tube support pin should break in the present design, the guide tube alignment with the support plate would not be maintained under all conditions, because of the clearance between the bottom of the guide tube flange and the upper core plate. (Figure 11) Such guide tube misalignment could jeopardize the operation of the associated control rod. It was noted that for non-UHI plants, the clearance between the guide tube flange and upper core plate is smaller, and misalignment could <u>not</u> occur in the event of a broken support pin.

II. New Support Pin Design for Sequoyah

To eliminate the potential for guide tube-upper core plate misalignment, a new support pin has been designed for replacement of the original pins in the Sequoyah plant. The new design includes the following features:

[ ] (a,c)

[ ] (a,c)

[ ] (a,c)

III. Microstructural Evaluation of Alloy Inconel X-750

[ ] (a)

[ ] (a)

[ ] (a)

[ ] (a)

The results of both the SCC tests in primary coolant and pure water, and the microstructural evaluations indicated that a high temperature heat treatment (>1800°F) would provide the desired microstructure. Because

[ ] (a,

Testing of full size pins in both primary coolant and pure water did not result in any failures (cracking). (Viewgraph 15)

[ ] (a,

IV. Safety Evaluation and Conclusions

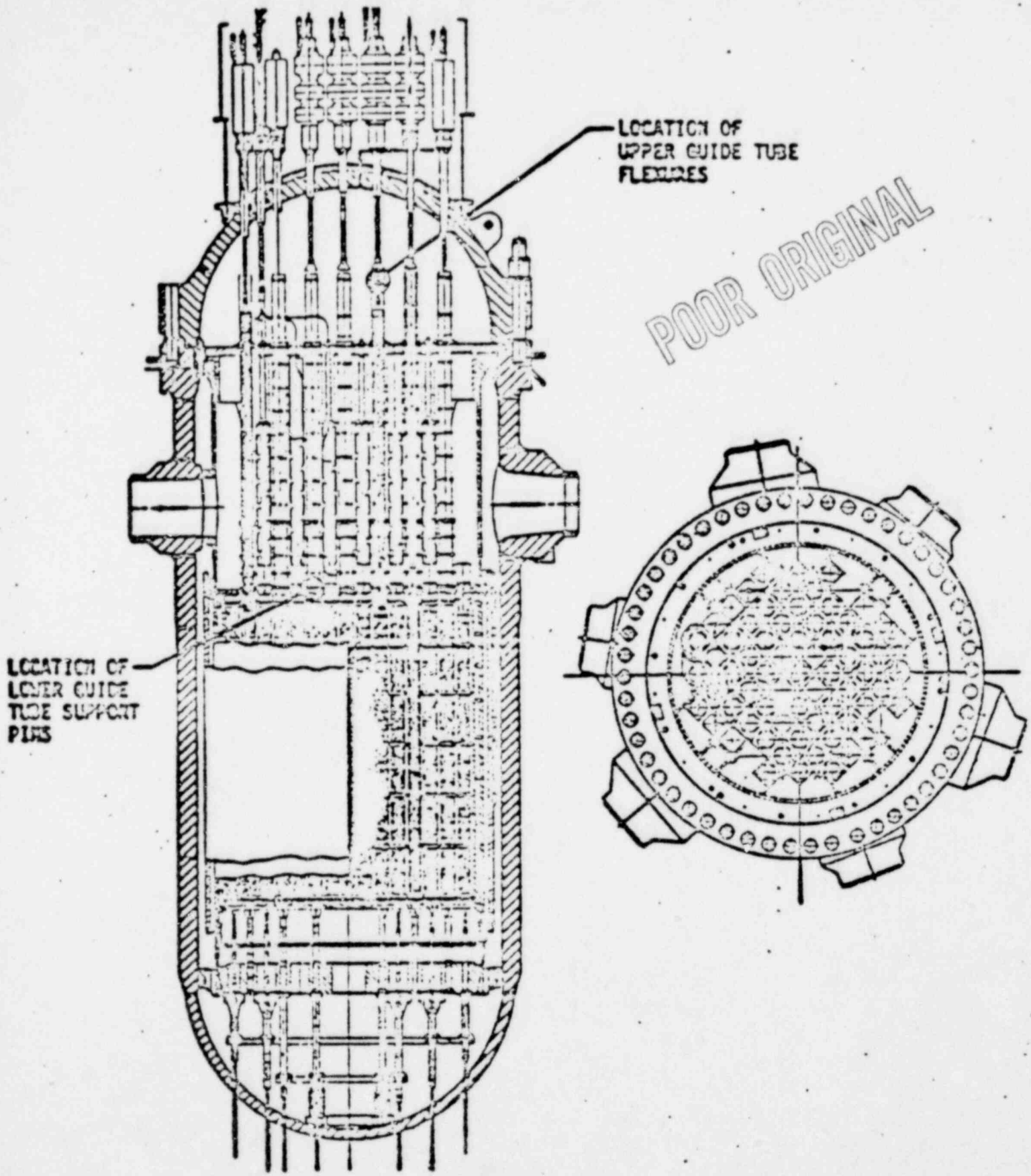
[ ] (a,c

2. The replacement pins are of a new mechanical design, such that even if failure occurred in the shank or leaf of the pin, the alignment of the guide tube/upper core plate is not lost for all conditions that require control rod operation.

3. The potential for a loose part resulting from a broken pin leaf to adversely affect control rod operation is extremely remote. Breakage of a pin leaf due to stress corrosion cracking is highly unlikely because of the heat treatment process received by the replacement pins. Even if such a loose part was created, and transported to a location so as to interfere with control rod movement, such circumstance is not an unresolved safety question. Accident analyses have shown that the reactor can be safely shutdown with one control rod stuck in the fully withdrawn position.

ATTACHMENT B

Figures for Background and Operating Plant Experience and New Support Pin Design for Sequoyah.



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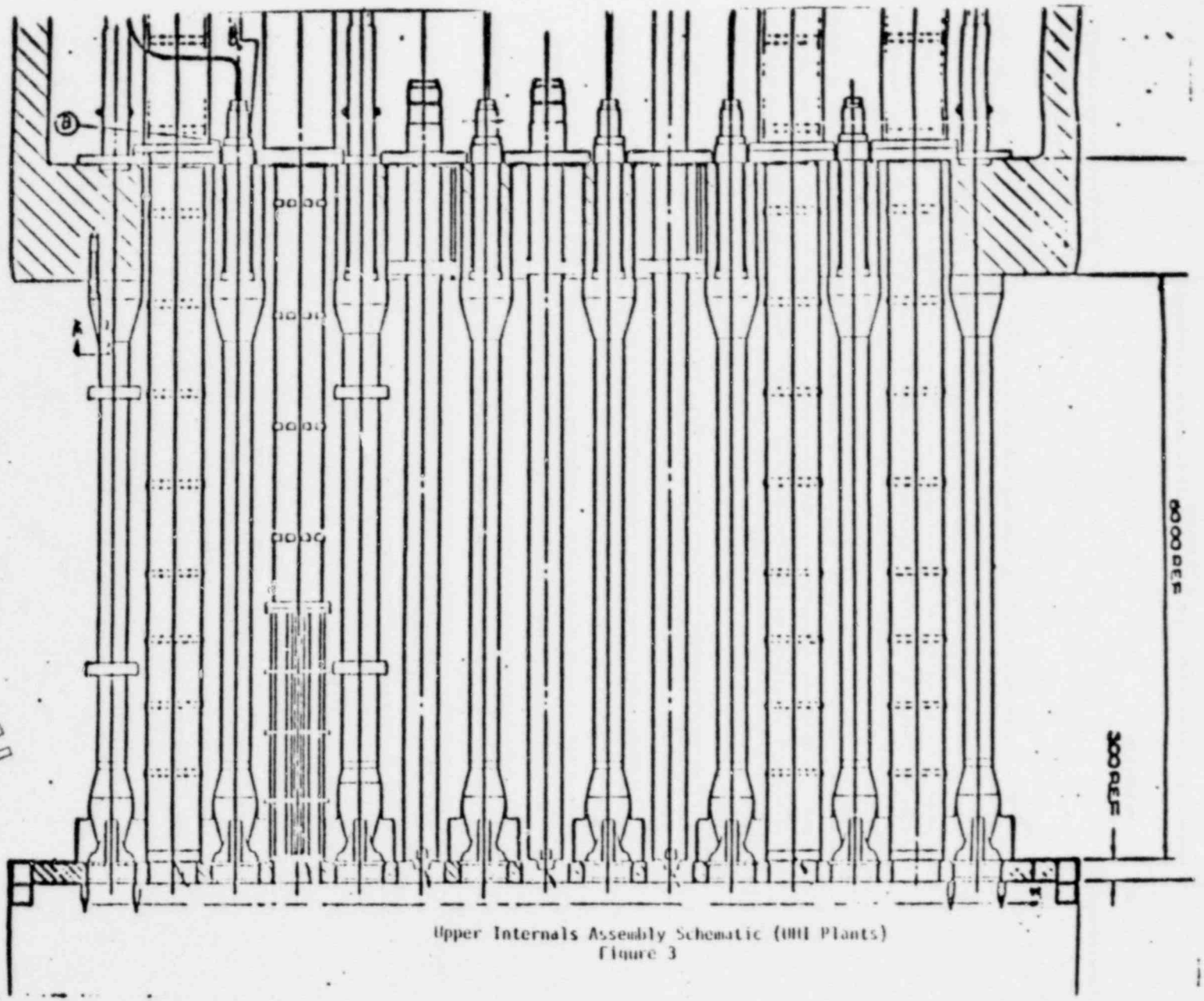
REACTOR VESSEL GENERAL ASSEMBLY

Figure 1

POOR ORIGINAL

GUIDE TUBE ASSEMBLY

Figure 2



Upper Internals Assembly Schematic (WHI Plants)
Figure 3

POOR ORIGINAL

(a,c)

POOR ORIGINAL

DIAMETER 'B'
500 [69.21] 247 [28.57] DIAMETER
0 FOR A .0001 [0.002] TO .0009 [0.022] RANCE FIT AT ASSEMBLY

Guide Tube Support Pin
Figure 4

(a,c)

POOR ORIGINAL

SUPPORT PIN ASSEMBLY IN LOWER GUIDE TUBE (15 x 15) GUIDE TUBE
Figure 5

GUIDE TUBE SUPPORT PINS

SUMMARY

[ ](g)

[ ](g)

[ ](g)

[ ](g)

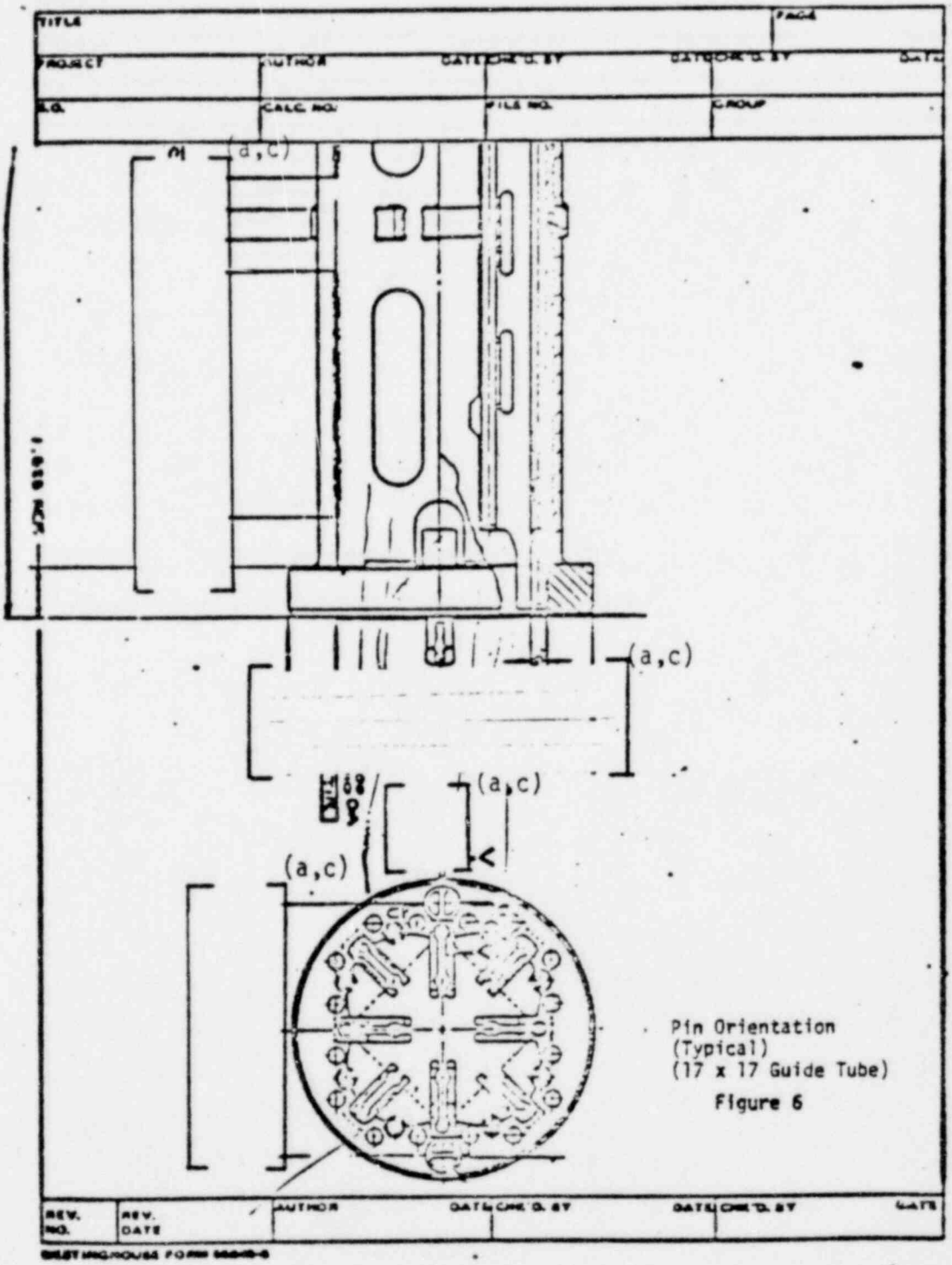
- WESTINGHOUSE SUPPLIED PINS IN 1 OUT OF 4 PLANTS WERE CRACKED.

- NO BROKEN PINS IN DOMESTIC PLANTS BASED ON VISUAL EXAMINATION.

Figure 7

POOR ORIGINAL

WESTINGHOUSE NUCLEAR EQUIPMENT DIVISIONS



Pin Orientation
(Typical)
(17 x 17 Guide Tube)

Figure 6

3/19/80

OPERATED PLANTS IN JAPAN

STATUS OF GUIDE TUBE SUPPORT PIN INSPECTION

AS OF MARCH 1980

(g)

Figure 8

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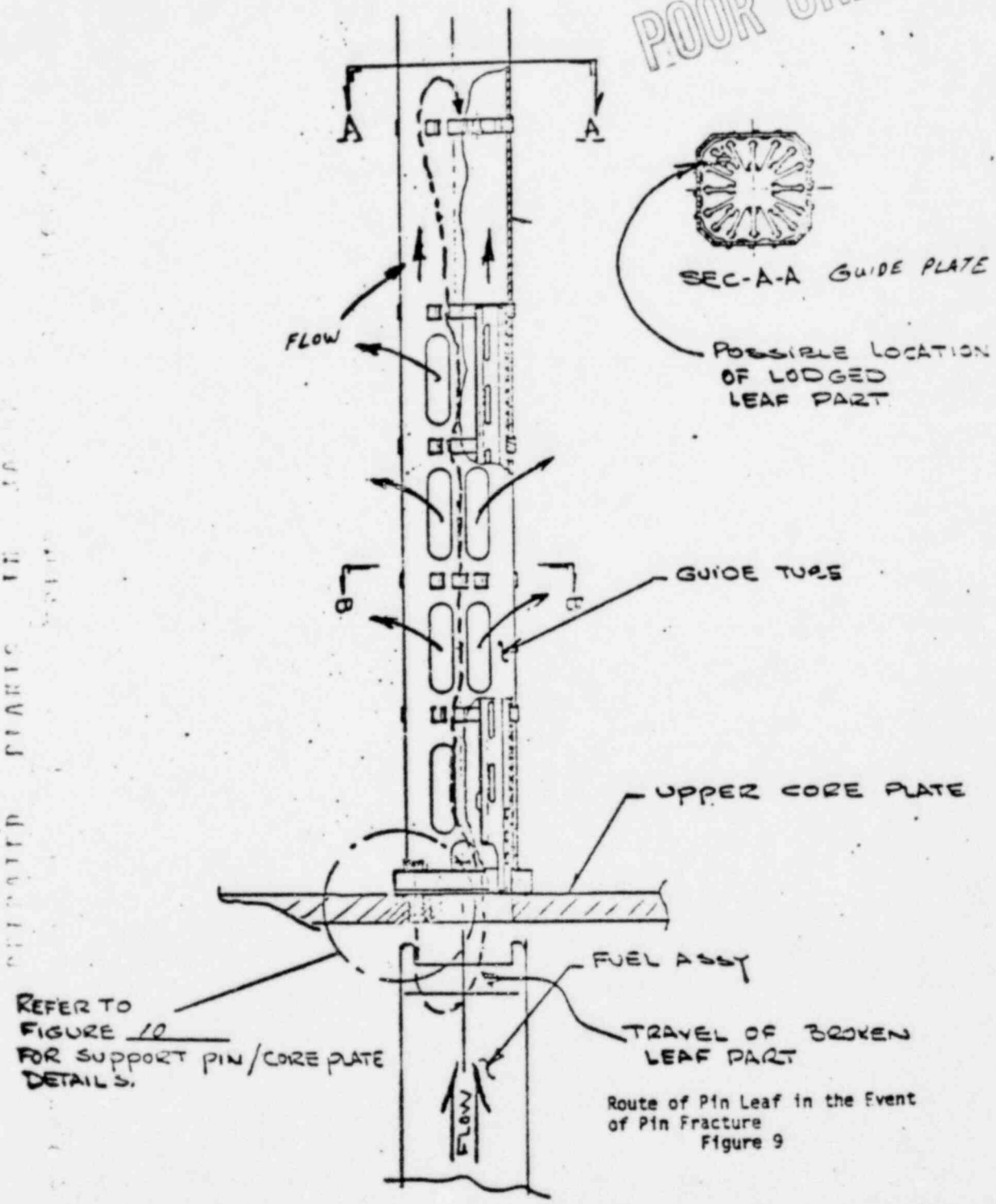
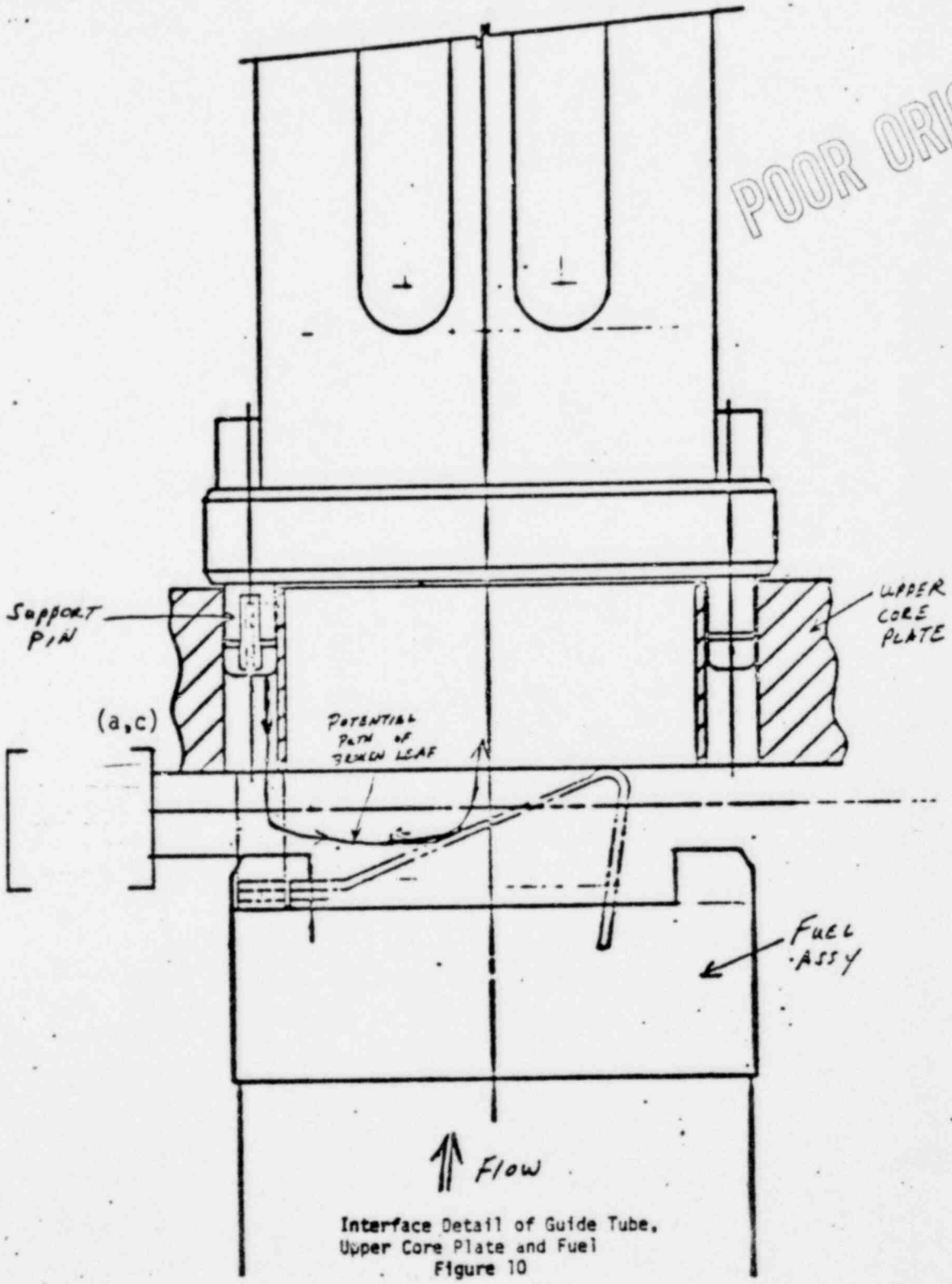


Route of Pin Leaf in the Event of Pin Fracture
Figure 9



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Interface Detail of Guide Tube, Upper Core Plate and Fuel
Figure 10

(c)

FIGURE 11 DESIGN FEATURE COMPARISON-PRESENT VS. MODIFIED UHI PLANTS

(a,c)

Figure 12 Modified Support Pin Sequoyah

ATTACHMENT C

Viewgraphs for Microstructural Evaluation of Alloy

Inconel X-750

LIST OF VIEWGRAPHS

1. Environmental Exposures
2. Specimens
3. Schematic of Semi-Static Autoclave System for SCC Tests
4. Inconel X-750 Starting Materials for SCC Test Program
5. Composition (W/O) of Inconel X-750 SCC Test Materials
6. SCC Incidence: Pin Material U-Bends -[ ](g)
7. SCC Incidence: Pin Material U-Bends - RCS Exposures,[ ](g)
8. SCC Incidence: Pin Material U-Bends -[ ](g)
9. SCC Incidence: Stock U-Bends -[ ](g)
10. SCC Incidence: Stock U-Bends - RCS Exposures,[ ](g) 650°F (343°C)
11. SCC Incidence: Stock U-Bends -[ ](g)
12. Effect of Pre-Age Thermal Treatment on SCC of Stock U-Bends -[ ](g)
13. Effect of Pre-Age Thermal Treatment on Stock U-Bends -[ ](g)
14. SCC Incidence: Stock & Pin U-Bends -[ ](g)
15. Full Size Torqued Pins in SCC Tests
16. Analyses of Graphite-Base Lubricants Used On Torqued Pins In SCC Tests

FOOTNOTES FOR VIEWGRAPHS

- FOOTNOTES FOR VIEWGRAPH 6 (a)

Note 1

Note 2

Note 3

- FOOTNOTES FOR VIEWGRAPH 7

Note 1 - Further identification appears in Viewgraph 4.

Note 2 - AR = As Received (See Viewgraph 4) (g)

- FOOTNOTES FOR VIEWGRAPH 9

Note 1 - Further identification appears in Viewgraph 4.

Note 2 - AR = As Received (See Viewgraph 4) [ ](g)

Note 3 - SCC* = [ ](g)

Note 4 - [ ](g)

- FOOTNOTES FOR VIEWGRAPH 10

Note 1 - [ ](g)

Note 2 - [ ](g)

VIEWGRAPH NO. 1

ENVIRONMENTAL EXPOSURES

[ ] (g)

VIEWGRAPH NO. 2

SPECIMENS

(g)

Dwg. 7702A42

VIEWGRAPH NO. 3 — Schematic of semi-static autoclave system for SCC tests.

(g)

Dwg. 7702A42

VIEWGRAPH NO. 4

INCONEL X750 STARTING MATERIALS FOR SCC TEST PROGRAM

Material Type	Heat No. or Identification	Source (A-D) & Producer	Thermal Treatment in As-Received Condition (Source Information

VIEWGRAPH NO. 5

COMPOSITIONS (w/o) OF INCONEL X750 SCC TEST MATERIALS

VIEWGRAPH NO. 6

STRESS-CORROSION CRACKING (SCC) INCIDENCE: PIN MATERIAL U-BENDS

[ ](g)

INCONEL X-750

PIN	HEAT (Note 1)	CONDITION (Note 2)	SAMPLE NUMBER	RESULT (Note 3)	EXPOSURE (Days)	PREVIOUS INSPECTIONS (Days)
A						
B						
E						
F						
J						
K						
L						
M						
Q						
R						
S						
T						
85						

(g)

VIEWGRAPH NO. 7

STRESS-CORROSION CRACKING (SCC) INCIDENCE: PIN MATERIAL U-BENDS

[ ] (a)

INCONEL X-750

PIN	HEAT (Note 1)	CONDITION (Note 2)	SAMPLE NUMBER	RESULT	EXPOSURE (Days)	PREVIOUS INSPECTIONS (Days)
A						
B						
E						
F						
J						
K						
L						
M						
Q						
S						
T						

(a)

VIEWGRAPH NO. 8

STRESS-CORROSION CRACKING INCIDENCE (SCC): PIN MATERIAL U-BENDS [ ](g)

INCONEL X-750

PIN	HEAT (Note 1)	CONDITION (Note 2)	SAMPLE NUMBER	RESULT	EXPOSURE (Days)	PREVIOUS INSPECTIONS (Days)
A						
B						
E						
F						
J						
K						
L						
M						
Q						
S						
T						
85						

(g)

VIEWGRAPH NO. 9

STRESS-CORROSION CRACKING (SCC) INCIDENCE: STOCK U-BENDS

[ ](g)

INCONEL X-750

ANNEALING TEMP (Note 1)	AGE (Note 2)	HEAT	SAMPLE NUMBER	RESULT	EXPOSURE (Days)	PREVIOUS INSPECTIONS (Days)				
					--	--	--	--	--	--

VIEWGRAPH NO. 10

STRESS-CORROSION CRACKING (SCC) INCIDENCE: STOCK U-BENDS[a]

RCS EXPOSURES (Li,B,H_2),[ ]

INCONEL X-750

ANNEALING TEMP (Note 1)	AGE (Note 2)	HEAT	SAMPLE NUMBER	RESULT	EXPOSURE (Days)	PREVIOUS INSPECTIONS (Days)

(a)

VIEWGRAPH NO. 11

STRESS-CORROSION CRACKING (SCC) INCIDENCE: STOCK U-BENDS (g)

INCONEL X-750

ANNEALING TEMP (Note 1)	AGE (Note 2)	HEAT	SAMPLE NUMBER	RESULT	EXPOSURE (Days)	PREVIOUS INSPECTIONS (Days)

(g)

VIEWGRAPH NO. 12

EFFECT OF PRE-AGE THERMAL TREATMENT ON SCC OF STOCK U-BENDS*

SINGLE AGE

Pre-Age Temperature	Heat	Number of U's Failed/Number of U's Tested		
		Neolube-free RCS	High-Purity H_2O	Total (g)

* Various exposure periods in tests (see Viewgraphs 9 and 10)

VIEWGRAPH NO. 13

EFFECT OF PRE-AGE THERMAL TREATMENT ON SCC OF STOCK U-BENDS*

DOUBLE AGE

Pre-Age Temperature	Heat	Number of U's Failed/Number of U's Tested		
		Neolube-free RCS	High-Purity H_2O	Total

(g)

* Various exposure periods in tests (see Viewgraphs 9 and 10)

VIEWGRAPH NO. 14

STRESS-CORROSION CRACKING (SCC) INCIDENCE: STOCK & PIN U-BENDS [9]

ANNEALING TEMP.(1 HR)	AGE (Note 1)	HEAT (Table 1)	SAMPLE NUMBER	RESULT	EXPOSURE (HOURS) (Note 2)

(9)

VIEWGRAPH NO. 14 (Continued)

STRESS-CORROSION CRACKING (SCC) INCIDENCE: STOCK & PIN U-BENDS

[ ] (g)

ANNEALING TEMP.(1 HR)	AGE (Note 1)	HEAT (Table 1)	SAMPLE NUMBER	RESULT	EXPOSURE (HOURS) (Note 2)

(g)

FULL-SIZE TORQUED PINS IN SCC TESTS*

(✓ = One Pin per Test)

(g)

Pin (Table 1)	Torque See Below
A	1
E	2
F	2
I	3
J	1
K	2

Torque Values (applied with torque wrench):

(a,c,g)

1 =

2 =

3 =

* The torque values and the special stressing apparatus (nuts, blocks, and caps) were furnished by Westinghouse Pensacola.

VIEWGRAPH NO. 16

ANALYSES OF GRAPHITE-BASE LUBRICANTS USED ON TORQUED PINS IN SCC TESTS

(Emission Spectroscopy; Values = ± 3x Estimates Shown)

Element	Concentration (ppm) (g)