MASTER

FFTF MATERIALS OF
CONSTRUCTION AND SURVEILLANCE PLANS

F. R. Shober

May 4, 1979

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ASTM Committee E-10 Workshop on
Codes and Standards for
Advanced Reactor Systems

May 22, 1979
San Francisco, California

292 6800
HANFORD ENGINEERING DEVELOPMENT LABORATORY
Operated by Westinghouse Hanford Company, a subsidiary of
Westinghouse Electric Corporation, under the Department of
Energy Contract No. EY-76-C-14-2170

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FFTF MATERIALS LOG

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<u>System No.</u>	<u>Bechtel Eqm't No.</u>	<u>Component Name</u>	<u>HWS Spec. No.</u>
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31	T-32M	Horizontal Thermal Baffle	1612
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31	U-343 - U-351	Control Rod Drive Mechanism	1512
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31	U-358 - U-363	Core Restraint Mechanism	1601
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31	U-552	Fuel Assembly	1827
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31	ZR-M01	Material Surveillance Assembly	
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31	(TBD)	Proximity Instrumented Open Test Ass'y	1506B

FFTF SYSTEM 31 REACTOR SYSTEM

MATERIAL STANDARDS CITED ON SYSTEM 31 COMPONENTS DRAWINGS

<u>RDT Std (Base Spec.)</u>	<u>ASTM</u>	<u>AMS</u>
M1-2T (SFA 5.9)	A-167	5542G
M2-2T (SA-182)	A-182	5596
M2-7T (SA-508)	A-240	
M2-13T (SB-247)	A-269	
M2-15T (SA-637)	A-276	
M2-17T (A-461)	A-312	<u>FEDERAL</u>
M2-18T (A-637)	A-351	QQ-C-320A-2A
M3-2T (SA-213)	A-637	
M3-3T (SA-376)		
M3-5T (SA-249)		
M3-6T (SA-312)		<u>AISI</u>
M3-28T —	<u>ASME</u>	D2
M3-29T (AMS-5589)	SA-182	
M3-31T (SA-451)	SA-213	
M4-2T (SA-351)	SA-240	
M5-1T (SA-240)	SA-269	
M5-2T (SA-516)	SA-376	
M5-4T (SB-168)	SA-453	
M5-19 —	SA-479	
M5-21T (AMS-5596)	SA-540	
M6-3T (SA-193)	SB-162	
M6-4T (SA-194)	SB-166	
M6-6T (SA-453)		
M7-3T (SA-479)		
M7-4T (SB-166)		
M7-6T (SA-564)		
M7-8T (AMS-5687)		
M7-23T —		
M7-24T —		
M8-1T —		

RAMoen
2-8-79

FFTF REACTOR

FAST FLUX TEST FACILITY Invessel Handling Machine

Equipment No. M-010, -011, and -012

Materials of Construction

Grapple assembly - primarily Alloy 718 with other parts constructed of Stellite 3, Alloy X-750 and 304SS.

Arm stem and foot assembly

- Rising stem and stem arm assembly - primarily 304SS
- Bell crank assembly - primarily Alloy 718
- Other materials include Stellite 3 and A-286

Arm support/RRP assembly -

miscellaneous parts made of 302SS, 304SS, 4140, 4340, Alloys 600 and 718, Stellite 3, and carbon steel

Toe adjust drive assembly -

primarily 304SS with other parts constructed of A-286 and 4340

Orientation plug assembly

- Top plug - SA508 Class 2
- Shielding plates - SA-516 Gr55, 410SS,
- Alloy 600 and 304SS
- Other parts - A-286, Alloy 718, and 4340

Chain hoist system - primarily 304SS with other parts constructed of 4130, 4340, and A-286

Manufacturer - Sundstrand

FAST FLUX TEST FACILITY
Reactor Guard Vessel

Equipment No. T-033

Materials of Construction

Entirely

304SS

Manufacturer - Combustion Engineering

FAST FLUX TEST FACILITY Core Basket

Equipment No. U-276

Materials of Construction

**Top forging, barrel basket, base forging, tubes,
perforated plate, etc. - 304LSS**

Liner and pin - Alloy 718

Seal ring - A-286 and Alloy X-750

**Manufacturer - Newport News Shipbuilding and
Drydock Co.**

FAST FLUX TEST FACILITY Reactor Vessel Support Structure

Equipment No. U-293

Materials of Construction

Forging - SA-508, Cl. 1

Plate - SA-533, GrB

Manufacturer - Combustion Engineering

FAST FLUX TEST FACILITY Reactor Vessel Head

Equipment No. U-292

Materials of Construction

Head forging

SA-508, Cl. 2

**Shielding
Plates**

**{ SA-516, Gr 55
410SS
Alloy 600
304SS**

**Penetration
Liners,
Nozzles,
Sleeves, etc.**

**{ 316SS
Alloy X-750
Alloy 718
SA-516, Gr 70
304L SS**

Manufacturer - Combustion Engineering

FAST FLUX TEST FACILITY Primary Pipe & Fittings

Hot leg (28", 16", & 2")

**Material
AISI 316SS**

Cold leg (16")

**Material
AISI 304SS**

Secondary Pipe & Fittings

**Hot leg materials
AISI 316SS
AISI 304SS**

**Cold leg materials
AISI 304SS
AISI 316SS**

**Manufacturer - Pipe: Rollmet
Fittings: Crane - Midwest**

**FAST FLUX TEST FACILITY
Reactor Vessel**

Equipment No. T-032

Materials of Construction

Shells,
Support forgings,
& Nozzles }

304SS

Other Materials

Outlet Piping

316SS

Manufacturer - Combustion Engineering

FAST FLUX TEST FACILITY Instrument Tree

Equipment No. U-352, -353 and -354

Materials of Construction

Lower bearing

- Pin and bearing - Alloy 718
- Ring - 304SS

Plug assembly

- Plug - SA 508 Class 2
- Shielding plates - SA516 Gr70, 410SS, and Alloy 600

In-reactor assembly - entirely of 304SS

Manufacturer - Westinghouse Marine Division

FAST FLUX TEST FACILITY Core Support Structure

Equipment No. U-275

Materials of Construction

Lower core support structure assembly

- Forging, casting, cone,
- barrel, gussets, plate
- and dome - 304SS
- Other miscellaneous
- parts - A-286

- Core barrel assembly -
304SS throughout

**Manufacturer - Newport News
Shipbuilding and Drydock Co.**

FFTF COUPON SURVEILLANCE PROGRAM

PURPOSE

- TO ASSURE SAFE OPERATION OF FFTF BY MONITORING REACTOR SERVICE EFFECTS ON COMPONENT SAMPLE MATERIALS

DESCRIPTION

- ACCELERATED FTR IRRADIATION OF MATERIAL FROM CRITICAL REACTOR COMPONENTS, TEST OF IRRADIATED MATERIAL, EVALUATION OF MATERIAL DEGRADATION

DOCUMENTATION

- HEDL - TME 72-106, REV: 3 - FFTF COUPON SURVEILLANCE PROGRAM

FFTF COUPON SURVEILLANCE PROGRAM

COMPONENTS

- CORE SUPPORT STRUCTURE
- CORE BASKET
- CORE RESTRAINT MECHANISM
- RADIAL SHIELD
- RADIAL REFLECTOR
- REACTOR VESSEL
- CONTROL ROD DISCONNECT DRIVELINE
- INSTRUMENT TREE
- IVHM
- LOW LEVEL FLUX MONITOR
- BAFFLE LINER AND INTERFACE SEAL

IRRADIATION

- FLUENCE
TO $2.0 \times 10^{23} \text{ n/cm}^2$ (TOTAL)
- TEMPERATURES
 $682^\circ\text{F} - 1200^\circ\text{F}$
- TIMES
1.3 YEARS TO REACTOR LIFE

FFTF COUPON SURVEILLANCE PROGRAM
IRRADIATION ASSEMBLIES

<u>NAME</u>	<u>ASSEMBLY DESIGNATION</u>	<u>FTR POSITION</u>	<u>FULL POWER RUNS</u>
ORRSA	HM013	RR 2812	12
ORRSA	HM014	RR 2901	20
MSA	HM015	IVFSM-X	22
MSA	HM016	IVFSM-X	REACTOR LIFE

FFTF COUPON SURVEILLANCE PROGRAM

IRRADIATION LOCATIONS

REACTOR VESSEL WALL

SYMBOL KEY

- FUEL ASSEMBLIES
- RADIAL REFLECTORS
- CONTROL AND SAFETY RODS
- INVESSEL FUEL STORAGE MODULES

SURVEILLANCE TEST POSITIONS

- MATERIALS OPEN TEST ASSEMBLY
(POSITION 2406)
- ROW 8B RADIAL REFLECTOR
(POSITION 2812)
- ROW 9 RADIAL REFLECTOR
(POSITION 2901)
- FUEL STORAGE MODULE
(POSITION X, SECTOR 1)
- FUEL STORAGE MODULE
(POSITION X, SECTOR 2)

FFTF COUPON SURVEILLANCE PROGRAM

RADIAL REFLECTOR IRRADIATION ASSEMBLY

FFTF COUPON SURVEILLANCE PROGRAM
DESIGN CONSIDERATIONS
ORRSA (HM013 AND HM014)

- DESIGN DESCRIPTION IN SDD-31, SECTION 2.3.5-1
- IDENTICAL TO ROW 8b AND ROW 9 RADIAL REFLECTORS
- UNINSTRUMENTED
- SUBCAPSULES GAS-GAPPED FOR HIGHER IRRADIATION TEMPERATURES
- CONTAINS LOW CYCLE FATIGUE, TENSILE AND METALLOGRAPHIC SPECIMENS ALONG WITH THERMAL EXPANSION DEVICES AND NEUTRON DOSIMETERS
- NO SPECIAL HANDLING REQUIREMENTS
- MAINTAINS STRUCTURAL INTEGRITY OVER THE PROJECTED DESIGN LIFE OF THE TEST

FIFTH COUPON SURVEILLANCE PROGRAM

INVESSEL FUEL STORAGE MODULE IRRADIATION ASSEMBLY

**MATERIALS SURVEILLANCE
ASSEMBLY (MSA)**

FFTF COUPON SURVEILLANCE PROGRAM
DESIGN CONSIDERATIONS
MSA (HM015 AND HM016)

- DESIGN DESCRIPTION IN SDD-31, SECTION 2.3.4.2-1
- THREE SECTIONS FABRICATED FROM MATERIALS MEETING RDT STANDARDS
 - INLET NOZZLE
 - ENCLOSURE TUBE
 - HANDLING SOCKET
- CONTAINS TENSILE AND FRACTURE TOUGHNESS SPECIMENS ALONG WITH THERMAL EXPANSION DEVICES AND NEUTRON DOSIMETERS INSIDE PERFORATED CANISTERS
- COMPATIBLE WITH FTR HANDLING EQUIPMENTS
- MAINTAINS STRUCTURAL INTEGRITY OVER REACTOR LIFE

ASTM E10.10.22

TEST METHODS FOR

SOLID METALLIC

CORE COMPONENTS

FOR SERVICE ABOVE 325°C

ASTM E10.10.22

- REACTOR COMPONENTS
- MATRIX DESCRIPTION
- SPECIFIC APPLICATIONS

CORE COMPONENTS OPERATING ABOVE 325°C

- DUCTS
- CLADDING
- WIRE WRAP
- WEAR PADS
- WELDED STRUCTURES

FUEL ELEMENTS OF THE EBR-II

FPF DRIVER FUEL ASSEMBLY

END

END

END OF PLATES

1025

1025

1025

1025

1025

1025

END OF PLATES

1025

PURPOSE OF MATRIX

- PROVIDE SPECIFIC STANDARDS FOR REFERENCE
- INDICATE NEW AREAS OF INTEREST OR NEED
- CONVEY OVERALL TESTING CONCEPTS

**TEST METHODS FOR SOLID METALLIC CORE COMPONENTS
FOR SERVICE ABOVE 325°C**

TEST METHODS	DUCTS	CLADDING (TUBING)	CLADDING (END CAPS)	WIRE WRAP	WEAR PADS	WELDED STRUCTURES
BULK DENSITY	E453	E453	E453	E453	E453	E453
TENSILE PROPERTIES	E8 E453	E8 E453	E8 E453	E8 E453	E8 E453	E8 E453
FATIGUE PROPERTIES	E206 E453 (1)	E206 E453 (1)	E206 E453 (1)	E206 E453 (1)	NR	E206 E453 (1)
FLEXURAL STRENGTH	E453	E453	E453	E453	E453	E453
STRESS RUPTURE PROPERTIES	E453	E453	E453	E453	NR	E453
THERMAL CREEP PROPERTIES	E8 E453	E8 E453	E8 E453	E8 E453	NR	E8 E453
IRRADIATION-INDUCED CREEP PROPERTIES	0	0	0	0	NR	0
IRRADIATION-INDUCED SWELLING PROPERTIES	0	0	0	0	NR	0
HARDNESS	E92 E112	E92 E112	E92 E112	E92 E112	E92 E112	E92 E112
THERMAL EMISSIVITY	0	0	0	0	0	0
THERMAL CONDUCTIVITY (3)	C177 C518	C177 C518	C177 C518	C177 C518	C177 C513	C177 C518
THERMAL EXPANSIVITY (3)	E228	E228	E228	E228	E228	E228
OPTICAL LIGHT MICROSCOPY EXAMINATION	E3 E453	E3 E453	E3 E453	E3 E453	E3 E453	E3 E453
TRANSMISSION ELECTRON MICROSCOPY EXAMINATION	E521 (4)	E521 (4)	E521 (4)	E521 (4)	NR	E521 (4)
COMPOSITIONAL DETERMINATIONS	(2)	(2)	(2)	(2)	(2)	(2)

NR = NOT REQUIRED

0 = STANDARD DOES NOT EXIST

(1) = NO ASTM STANDARD EXISTS FOR FATIGUE TEST ON IRRADIATED MATERIALS, E453 SUMMARIZES COMMON PRACTICES

(2) = SEE ASTM STANDARDS, PART 12 FOR SPECIFIC METAL OR ALLOY

(3) = STANDARDS ARE WRITTEN FOR UN-IRRADIATED MATERIALS TESTING ONLY

(4) = ADDITIONAL STANDARDS ARE IN PREPARATION

HEDL 7904-172.7