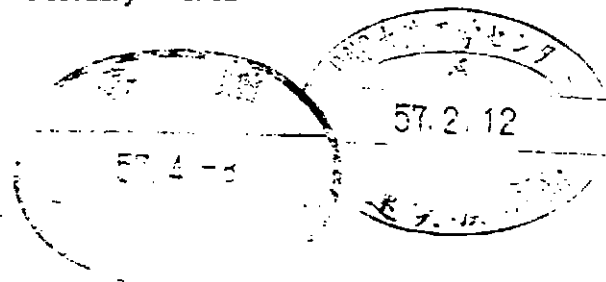


**Material Surveillance Program of JOYO**

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**POWER REACTOR AND NUCLEAR FUEL DEVELOPMENT CORPORATION**

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**Abstract**

The structural materials of the Experimental Fast Reactor, "JOYO", must maintain sufficient mechanical strength during the entire reactor plant lifetime.

In JOYO, the material surveillance for reactor structural components, safety vessel, primary cooling system piping, secondary cooling system piping and tank have been planned to confirm the design integrity of these structures. The material surveillance specimens have been loaded in the reactor plant and they will be periodically taken out and examined during plant life to monitor any changes in mechanical properties.

This report summarizes the material surveillance program of JOYO.

## 1. Surveillance Test

The material surveillance test program of JOYO are shown in Table 1.

The components selected for the material surveillance are reactor vessel, core support, core barrel, safety vessel, primary cooling system piping, secondary cooling system piping and tank and they were made of 304 stainless steel, 316 stainless steel, low-alloy steel and carbon steel respectively.

The surveillance test specimens were made of the same material (i.e, lot & manufacturing process) as actually used in JOYO components. The welded joint specimens were welded under the same welding conditions. The material surveillance test program are shown in Table 2.

The surveillance test specimens, as shown in Figure 1., have been loaded in various parts of the reactor plant before initial criticality. The specimens which has been loaded in the Intermediate Heat Exchanger (IHX) will be taken out and examined only when changing condition require the confirmation of the material. But the other specimens will be taken from the reactor plant in 5 time over 20 years of the lifetime of JOYO and will be conducted the material testing such as tensile, creep, fatigue, etc. to detect the degradation of the mechanical properties at the Material Monitoring Facility (MMF) and the Sodium Technology Section in Oarai Engineering Center, PNC.

Figure 2 shows the irradiation rig loaded in the outer-raw reflector position. Its configuration is the same as the reflector. The Sic capsules and the dosimetry capsules are installed in this rig to monitor the temperature and neutron flux.

### Surveillance Confirmation Test

In order to estimate the surveillance test result, it is necessary to estimate the mechanical properties of the as-received material. The tests of as-received material for this purpose are called "Surveillance Confirmation Test" and have been conducted by MMF and Sodium Technology Section to obtain the basic data for use of comparison with the result of the surveillance test.

TABLE 1. MATERIAL SURVEILLANCE TEST PROGRAM OF JOYO

COMPONENTS		LOCATION OF TEST SPECIMENS
1. REACTOR	REACTOR VESSEL (304SS)	IN-VESSEL STORAGE RACK
		IRRADIATION POT
	CORE SUPPORT PLATE (316SS)	REFLECTOR POSITION
2. SAFETY VESSEL	CORE BARREL (316SS)	IN-VESSEL STORAGE RACK
	SAFETY VESSEL (SB-42)	INSIDE OF SAFETY VESSEL
3. PRIMARY COOLING SYSTEM	PIPING (304SS)	MAIN PUMP (B)
		I.H.X. (A)
4. SECONDARY COOLING SYSTEM	PIPING (21/4CR-1MoSTEEL)	MAIN PIPING (A, B)
	TANK (SB-42)	OVERFLOW TANK (A)
		DUMP TANK

Table 2. Structural Material surveillance Test Program

Material	Test Item	Remarks
1. Reactor Vessel 304 Stainless Steel (base metal and Welded Joint)	Tensile, Impact (Charpy) Creep-rupture, Fatigue Metallurgical	These specimens have been loaded in Reactor Vessel, Safety Vessel, Primary hot leg (in the IHX), Primary cold leg (in the pump), Secondary hot leg (in the pipe) and Secondary cold leg (in the tank).
2. Core Support 316 Stainless Steel (Base Metal)	Tensile, Metallurgical	
3. Core Barrel 316 Stainless Steel (Base Metal)	Tensile, Metallurgical	These specimens will be taken out five times during the plant life.
4. Safety Vessel Carbon Steel (Base Metal and Welded Joint)	Tensile, Impact (Charpy)	
5. Primary Cooling System Piping 304 Stainless Steel (Base Metal and Welded Joint)	Tensile, Creep-rupture Metallurgical	
6. Secondary Cooling System Piping Low alloy steel and Carbon Steel (Base Metal and Welded Joint)	Tensile, Creep-rupture Impact, Metallurgical	

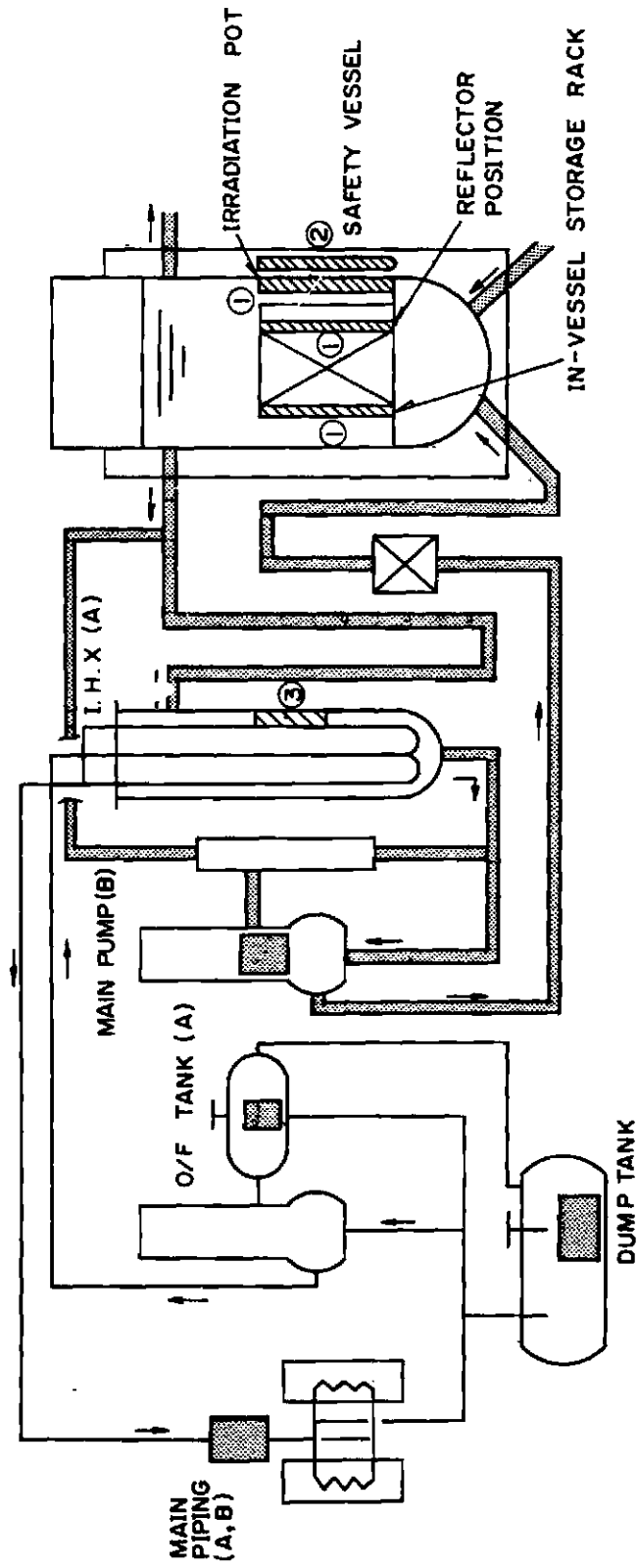


Figure. 1 LOCATION OF TEST SPECIMENS

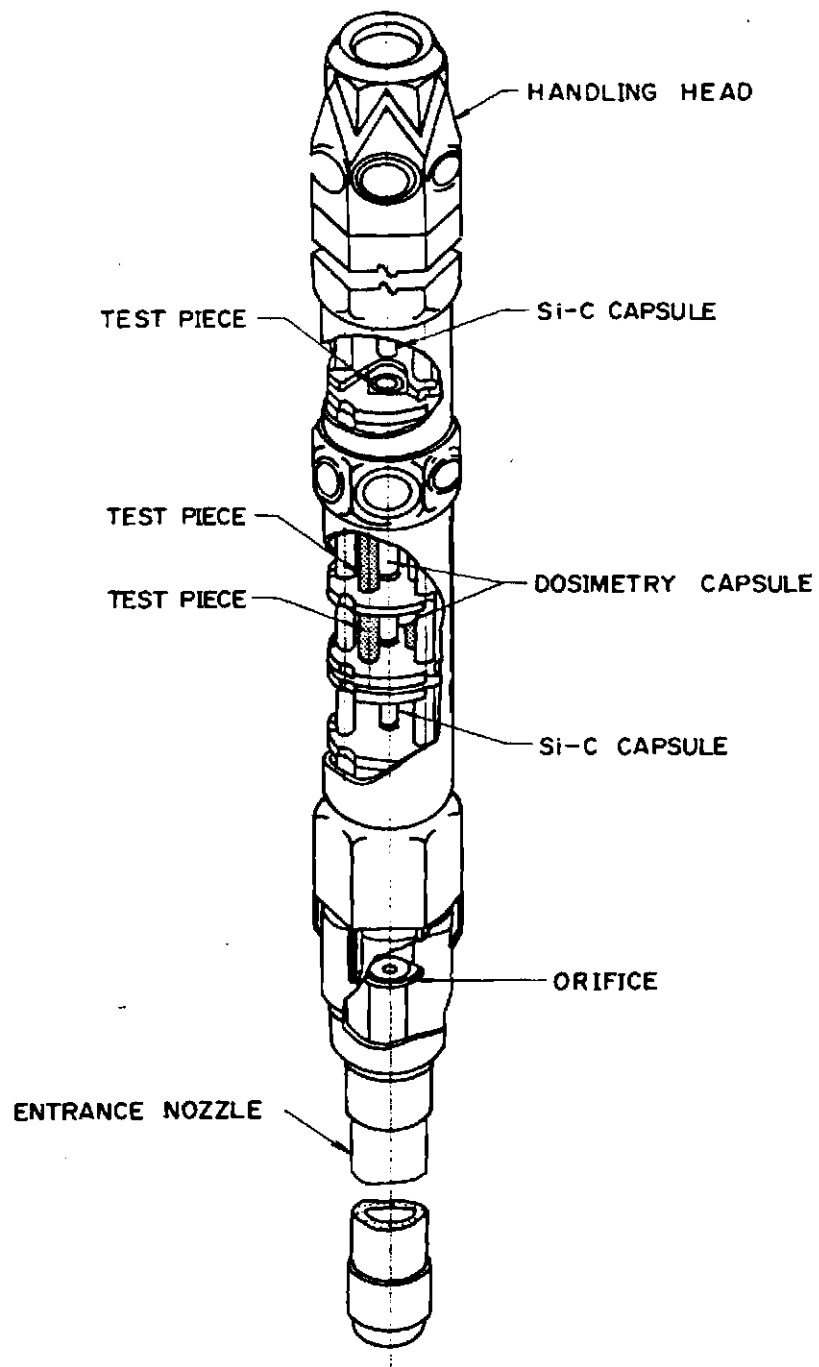


Figure. 2 IRRADIATION RIG  
(REFLECTOR POSITION)