

## DUPIC

### A Status of Installation and Operational Experience of Safeguards Equipment for DFDF Safeguards Implementation

, , , , ,

150

		DUPIC	IAEA	13
'Other Facility'		DUPIC		
. DUPIC		DUPIC		
(Special Nuclear Material)		(DSNC)		
(DSNM)	IAEA	IAEA		
	IAEA			
DUPIC	IAEA			

#### Abstract

DUPIC Fuel Fabrication Facility (DFDF) fabricates CANDU-type fuel directly out of spent PWR fuel material with no alternation of composition of spent fuel throughout the whole process. DFDF belong to 'Other Facilities' among the 13 facilities types under IAEA safeguards criteria and is a unique facility type in the world because the DUPIC process has no separation activity of fission products from process materials. For the IAEA safeguards implementation of DFDF, facility was developed the DUPIC Safeguards Neutron Counter (DSNC) and DUPIC Safeguards Neutron Monitor (DSNM) for accountancy of SNM in DUPIC fuel and a monitoring of DUPIC fuel, respectively. These instruments were used jointly between IAEA and facility operator after authorized by IAEA and installed at DFDF. And facility operator and IAEA also installed and operated the surveillance systems for DFDF surveillance each other. This paper describes the status of installation and operational experience of safeguards equipment for DFDF safeguards implementation

1.

(DUPIC)

(IMEF) M6

DUPIC (DUPIC Fuel Development Facility ; DFDF)

IAEA DFDF IAEA 13 <sup>(1)</sup> 'Other Facility' (Design Information Questionare ;

'KOY-'

DIQ) 1994 6 IAEA ,

1998 12 15 IAEA

, DFDF IAEA 1 3 1

IAEA가 DFDF 2가 . 1) DUPIC (Non-destructive Assay Instrument), 2) DFDF / (Containment & Surveillance System) . DFDF

DUPIC

IAEA가 ,

DUPIC PWR

가 .

DFDF (Los Alamos National Laboratory ; LANL)

Cm-242 DUPIC -235, , Pu

SNM (DUPIC Safeguards Neutron Counter ; DSNC)<sup>2,3)</sup>

. DSNC IAEA 가, 가

<sup>4),5)</sup> , DFDF DUPIC

, IAEA 가 .

DFDF ,

가 가

가 . 2가 가

(DUPIC Safeguards Neutron Monitor ;

DSNM) CCD

<sup>6)</sup> .

IAEA . IAEA 가 DCM-14

DFDF .

2.

1999 IAEA DFDF M6 .

1999 12 . 1 1 DFDF

IAEA

DFDF IAEA가 DSNC, (

:PSR-B, IAEA:JSR-12), (PC) . DSNC M6b  
, DSNC M6 operation area  
. IAEA DSNC  
IAEA cabinet (splitter)  
3 IAEA JSR-12 2 , DFDF  
PSR-B . 2 M6b 가 DSNC  
, 3 IAEA 가 IAEA cabinet . 4 DFDF  
. 4 DSNC DSNM  
IAEA cabinet 2 JSR-12 HV power가 가  
가  
(DUPIC Safeguards Surveillance System ; DSSS) CCD , DSNM,  
(PC) .<sup>6)</sup> 5 DSSS . DSSS intervention area  
3 CCD 2 DSNM IAEA cabinet DSNC  
가 . DSSS 가  
( 1). 2 real door  
isolation room CCD ,  
M6 rear door isolation room DSNM .  
6 DSNM M6b rear door M6a isolation  
room .  
IAEA . ,  
DSNM , 5 DCM-14  
SDIS sever . 3 DCM-14 DSSS CCD  
, 2 DCM-14 M6 operation area toboggan  
. DCM-14 digial operation area SDIS sever .  
metal VACOSS IAEA 가

### 3.

#### 3.1.

DUPIC PWR  
DUPIC .<sup>7)</sup> , SNM ,  
. IAEA DFDF 가  
DSNC . IAEA가  
DSNC , LANL 가 IAEA  
가가 <sup>4)</sup> (calibration) .  
IAEA IAEA가 (CF-252, IAEA  
K868, 20,217.6 n/s as 1999-02-19) 2 IAEA VACOSS holder

M6b DSNC  
 5 PWR (spontaneous fission neutron) Cm-244<sup>8)</sup> Cm-244  
 DSNC  
 SNM Multi-Instrument Collect(MIC), Radiation  
 Review(RAD) IAEA Neutron Coincidence Collect(INCC) LANL NIS-5 IAEA  
 MIC version 1.652, INCC version 4.04 . MIC RAD IAEA  
 cabinet PC , INCC PC . DSNC  
 IAEA MIC RAD data  
 INCC data  
 DSNC IAEA MIC RAD  
 , IAEA data copy IAEA RAD review  
 DSNC INCC IAEA

3.2.

DFDF  
 (DSSS) IAEA data  
 . DUPIC  
 가 . 가  
 가 . DSNM  
 . DSNM DSNC  
 IAEA cabinet IAEA 가  
 DSSS CCD DSNM PC  
 , data  
 data Review  
 , 가 . 가 IAEA cabinet  
 DSNC  
 가 . 7 DSSS (Graphic User Interface ; GUI)  
 IAEA DSNM MIC RAD DSNM  
 , IAEA data copy . DCM-14 SDIS sever  
 IAEA data copy 가 .

4.

DSNC IAEA , DUPIC PWR 가  
 DFDF 2000 1 DFDF IAEA

batch Cm-ratio (Pu/Cm, U-235/Cm, U/Cm) DSNC DUPIC SNM (U-235, U, Pu isotope)

PWR

8 DFDf IAEA

sampling DSNC, INCC

2 3 IAEA DSNC

2 ORIGEN2 code ~2%

IAEA NDA

IAEA가 , IAEA

review copy IAEA

IAEA 가

DSSS 9

cask DSSS cask

1) , 2) 가 , 3)

, 4) DFDf

IAEA

5.

DFDF DSNC DSSS, IAEA 1999

DFDF

DSNC IAEA가

NDA , DSSS

가 가 IAEA

SDIS sever 가 가

(member State Support Program ; MSSP)

DFDF IAEA

6.

1. IAEA, "Safeguards Criteria (1991-1995)", 1992
2. Y.G.Lee, H.R. Cha, et. Al, "Development of DUPIC Safeguards Neutron Counter", INMM, July 1998

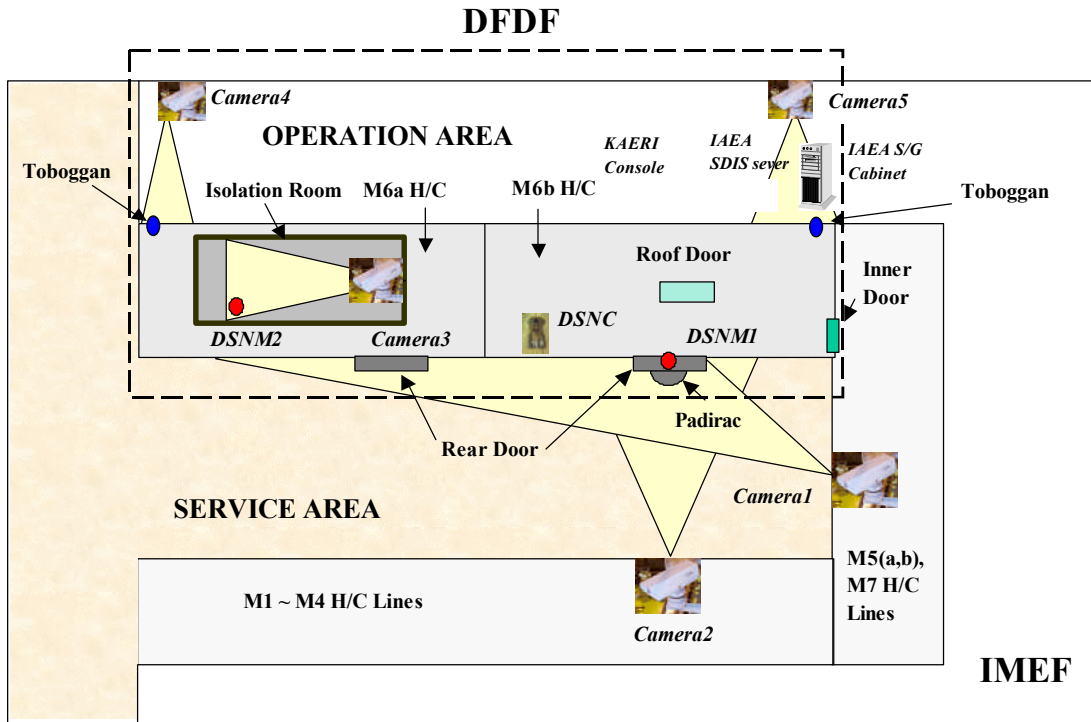
3. , , “ DUPIC ”, KAERI/TR-1381/99, 1999
4. H.O. Menlove, et al, “The Calibration of the DSNC for the Measurement of Cm-244 and Plutonium”, LA-UR-99-6217, 1999
5. , “DUPIC DSNC IAEA ”, KAERI/TR-1477/2000
6. , “DUPIC (I)”, Korea Nuclear Society, May 2000
7. , “ . ”, TR-760, KAERI, 1996
8. D. Reilly, et al, “ Passive Nondestructive Assay of Nuclear Materials”, NUREG/CR-5550, 1991

1. DFDF IAEA

	DFDF	IAEA		
DSNC	1	-	DUPIC Cm-244	
DSNM	2	-	DFDF /	
	3	5	DFDF	
JSR-12	-	2	DSNC DSNM	
PSR-B	1	-	DSNC	
SDIS	-	1	IAEA	
/	1	-	KAERI DSNM	
PC	1	2	DSNC DSNM , JSR-12 PSR-B	
MIC	-	1	DSNC DSNM	
INCC	1	-	DSNC Pu	
Cf-252	-	2	DSNC, DSNM	IAEA
VACOSS	-	2		IAEA
Metal Seal	-			IAEA

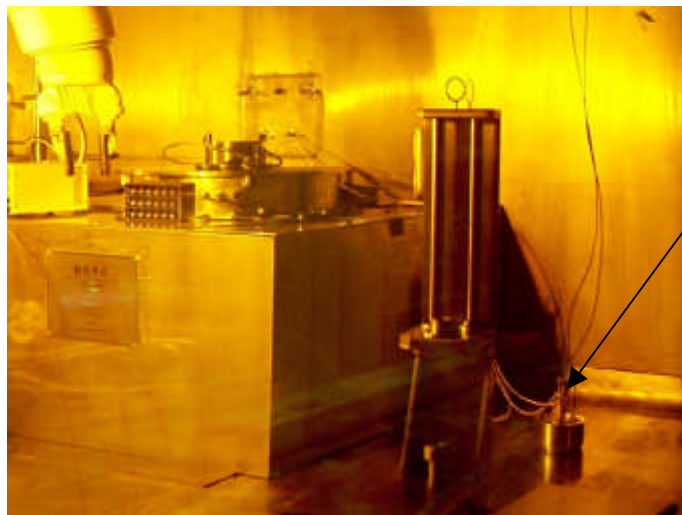
2. IAEA DUPIC DSNC (\* : ORIGEN2 code)

Sample	Pu Mass (g)			U-235 Mass (g)			U Mass (g)		
	Mea. by DSNC	Decl. by Code*	Rel. Diff. (%)	Mea. by DSNC	Decl. by Code*	Rel. Diff. (%)	Mea. by DSNC	Decl. by Code*	Rel. Diff. (%)
Pellet	0.070 ± 0.002	0.070	-0.517	8.623 ± 0.225	8.736	1.292	0.091 ± 0.002	0.092	1.292
Powder	0.067 ± 0.001	0.068	0.806	6.455 ± 0.294	6.585	1.967	0.036 ± 0.001	0.037	1.967



1. DFDF

IAEA



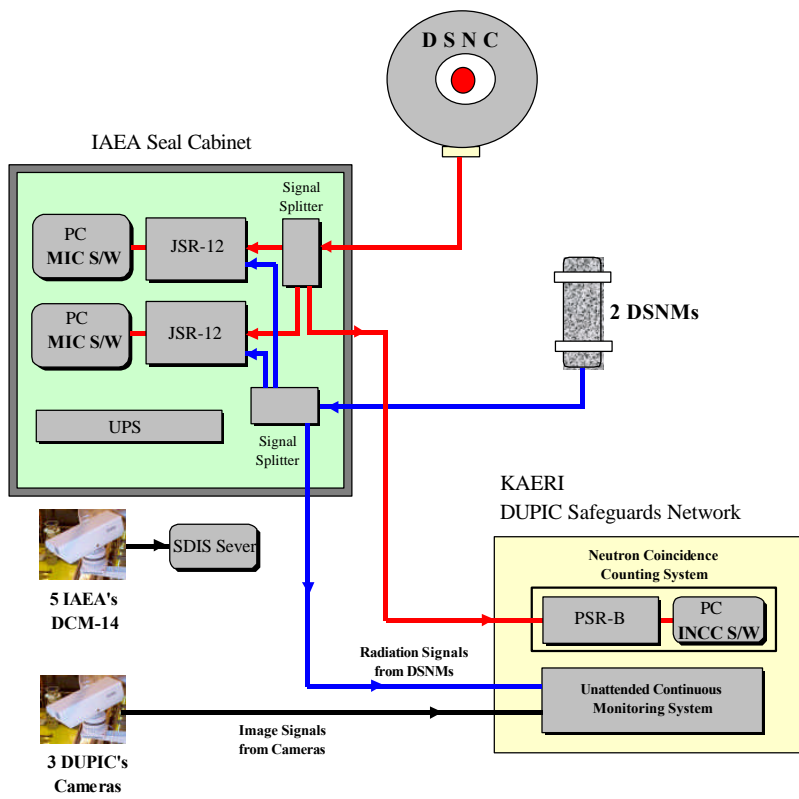
Cf-252 source  
under VACOSS seal

2. DFDF M6b

DSNC

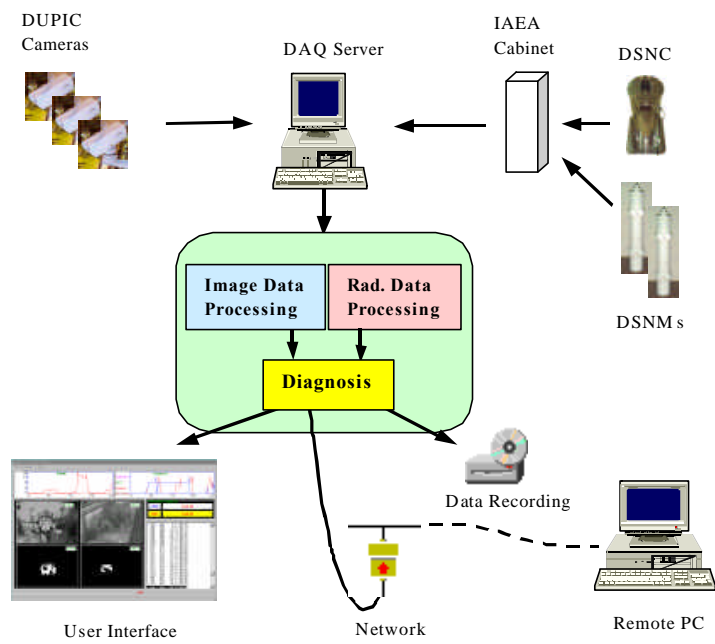


3. DFDF IAEA cabinet

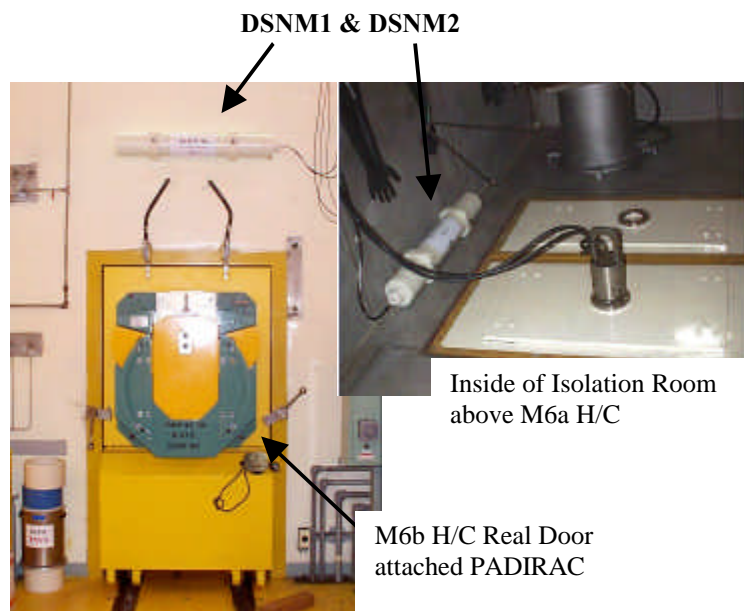


4. DFDF





5. DSSS

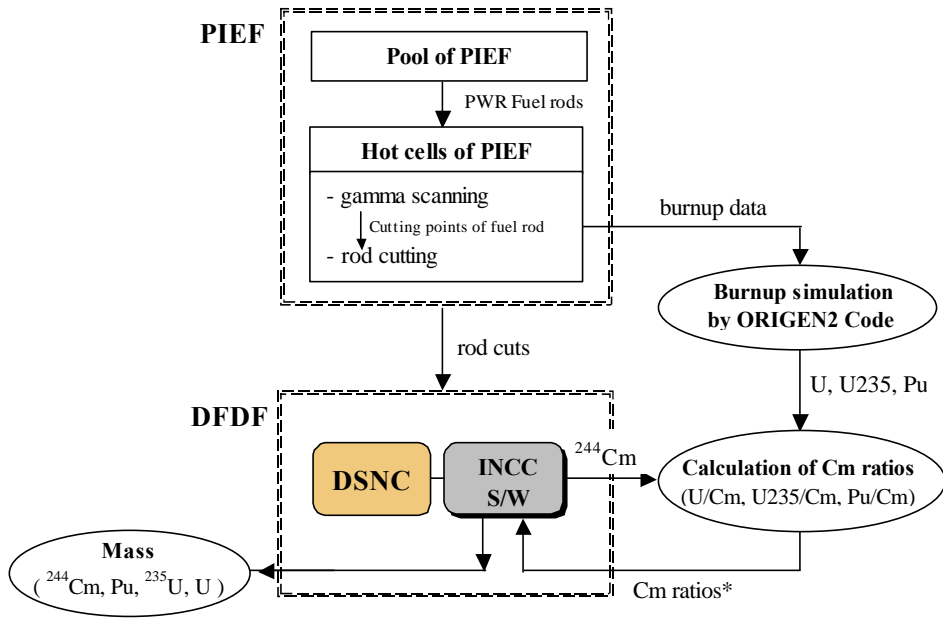


6. DFDF

DSNM

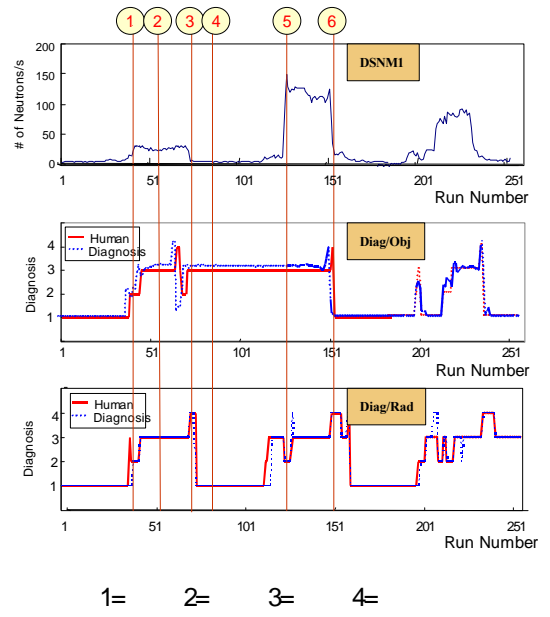
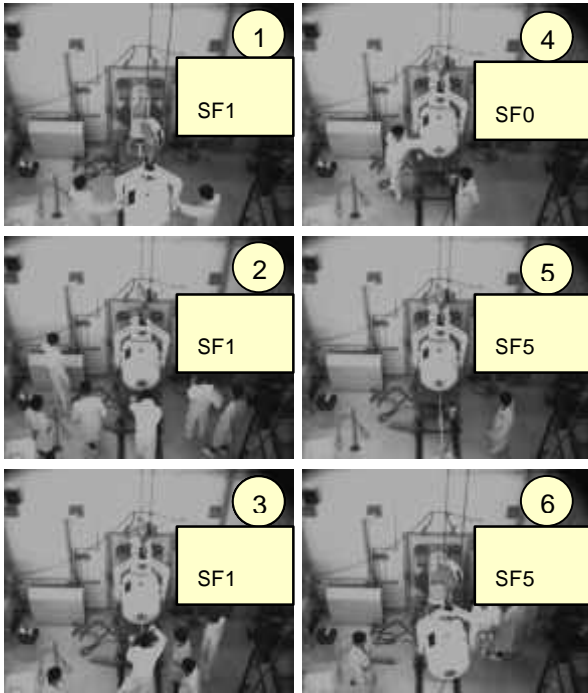


7. DSSS



\* Each batch has one specific Cm ratio

8. DUPIC



9. DSSS