

Irradiation and Flow Measurement of a Magnetic Flow Meter

, , , , ,

150

CHINO ()

296- 1

2 가 1 PVDF 1 5
가
4 $\pm 5\%$ 5
가 .

Abstract

In order to evaluate the applicability of a commercial magnetic flow meter to NPP's primary loop, the sensors of a magnetic flow meter have been irradiated 5 times (24 hours each time) in the Co60 irradiation facility at KAERI. After the irradiation the differences in the flow measurement were evaluated. A 24hour irradiation at the 80,000Ci Co60 facility at 15cm away from the source plate(0.55MRad/hr) would be equivalent to approximately 1 year irradiation at NPP. The electrode of the flow meter being tested was made of a teflon called PVDF.

The flow measurement after each 24hour irradiation showed errors in the range of $\pm 5\%$ of the actual value. After 120hour irradiation the sheathes of the electric cables were hardened to break away and the flow measurement by the flow meter became impossible.

I.

feedwater

nozzle fouling, d/p cell ,
가 .
2%
2% 1000MWe 가 3 ¢
/kw-hr 가 530 (64)
[1]. NRC
2% 1% (10CFR50 App.K) [2].
1%
feedwater
(ORNL/ OSU)
RCS 1
가

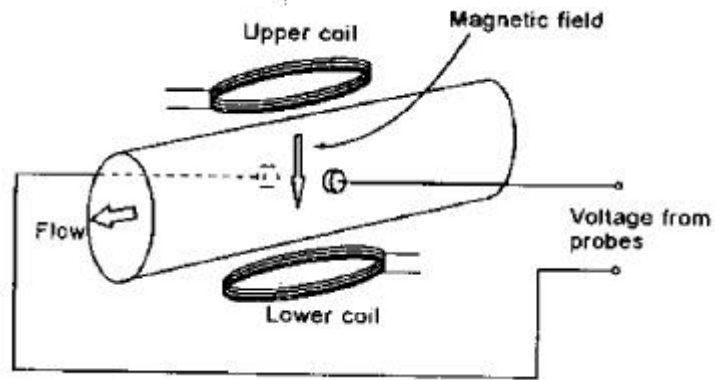
II.

1.

가.

가 Faraday
()가
, [3].
1
$$E = k \times B \times V \times D \dots (1)$$

, E :
k :
B :
V :
D : ()



1- 1.

[4]

(magnetic flow tube)

(magnetic flow transmitter)

()

(lining)

가

1

가

μ

V mV

4 20mA

0 10000Hz

-
-
-
-
-
-
-

가
가

가

가

가

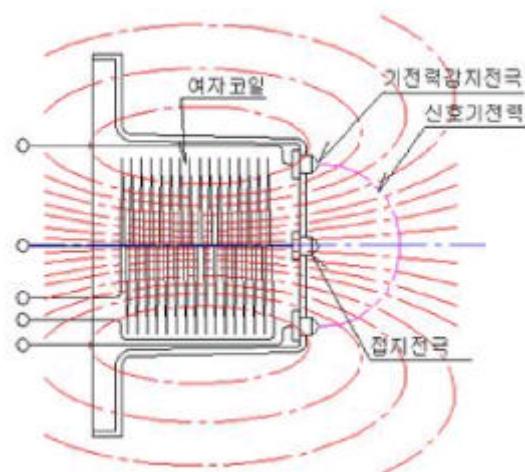
가 .

2. [5]

Flowtech() 2-1
 2 , 1 , 1 2-2
 PVDF(Poly Vinylidene Fluoride)
 , 3
 2-1 .



2-1



2-2

2- 1

	DT06CET XR7N
	6"(150mm)
	300 m ³ /hr
	4- 20 mA
/	carbon steel
	PVDF
/	Fusion-bonded Epoxy Coating
	0.5 μS/cm

3.

가.

$$\text{RCS 1} \quad 1,320 \text{ Rad/hr} \quad 1$$

$$1,320 \text{ MRad/hr} \times 24\text{hr/} \times 365 / \approx 11.6 \text{ MRad/}$$

$$\text{Co-60 } 80,000\text{Ci}$$

$$15\text{cm} \quad 0.55$$

$$\text{MRad/hr} \quad \text{가} \quad 2$$

$$24 \quad 5 \quad 24 \quad 0.55 \text{ MRad/hr} \times 24\text{hr} = 13.2$$

$$\text{MRad} \quad , \quad \text{RCS 1} \quad 1$$

(Flowtech)

2-2

2-2

	600 mm	
	1200 m3/hr	
	3 kg/cm2	

4.

가. 2-3 2 가 가 .

2-3

[hr]		[Ω]		
		Coil (+, -)	Ref.(+,-)	
0	# 1	40.5	0.8	. :
	# 2	40.5	0.8	
24	# 1	41.8	0.8	. .
	# 2	41.8	0.8	
48	# 1	41.5	0.8	.
	# 2	41.5	0.8	
72	# 1	41.6	0.8	.
	# 2	41.5	0.8	
96	# 1	41.1	0.8	.
	# 2	41.1	0.8	
120	# 1	41.8	0.8	. .
	# 2	41.8	0.8	

2-3



(a) 0 hr



(b) 24 hr



(c) 48 hr



(d) 72 hr



(e) 96 hr



(f) 120 hr

2-3

2-4

51 m³/hr, 101 m³/hr, 162 m³/hr, 232 m³/hr

± 5%

. 120

(

5

)

가

2-4

[hr]	[%]				
	51 m ³ /hr	101 m ³ /hr	162 m ³ /hr	232 m ³ /hr	
0	- 0.32	- 0.34	- 0.07	0.13	
24	3.54	3.68	3.36	2.82	
48	4.15	3.44	3.65	3.93	
72	2.98	2.8	3.57	0.96	
96	5.35	4.14	4.71	2.93	
120	-	-	-	-	

5.

NPP 1

,

4

가

,

4

가

.

4

± 5%

.

1

5

가

.

(PVDF) 5

가

.

III.

RCS 1

,

가 , 1 4
 1
 ,
 ,
 가 가

- [1] David E. Holcomb, "Magnetic Flowmeters for Primary Loop Measurements at PWRs", Presented as part of the Joint U.S.-Korean Nuclear Energy Research Initiative Program, Mar. 2002.
- [2] Federal Register Vol. 65, No. 106, June 1, 2000-ECCS Models.
- [3] Donald Ginesi, Magnetic Flowmeters, Caldon Inc., 1999.
- [4] Curtis D. Johnson, Process Control Instrumentation Technology, 6th ed., Prentice Hall, 2000.
- [5] Deltamag and DemiMag Instruction Manual, () .