Evaluation of Fire Resistance on Fire Wall in Kori NPP 1

Wan-Yeong Koh, O-Hyun Keum, Soo-Hyun Ryu
Korea Institute of Nuclear and Safety(KINS)
wykoh@kins.re.kr

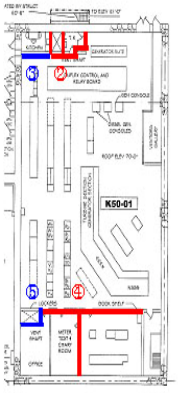
1. Introduction

The fire resistance of the fire barrier is very importance to prevent the spreading of fire to adjacent fire area. The fire barriers, such as fire wall, floor, fire door, fire damper and penetration seals, shall have an equivalent fire rating with the adjacent fire barriers in accordance with the applicable standards.

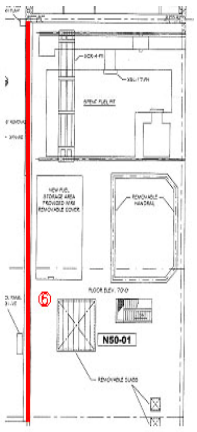
As a part of the license renewal for Kori #1, the fire resistance of the all fire barriers was inspected.

However, the fire walls of some fire areas (main control room, cable spreading room and fuel building) were not able to conform about the fire resistance. Therefore, in order to verify the fire resistance of applicable fire walls, the applicable tests were performed and the relevant results of the tests are presented.

Cable spreading Room



Main control Room



Fuel BLDG

2. Test Procedures and Results

In this section, some of the test procedures and results used to test the fire barriers are described. As a representative of the fire barriers, the fire walls were tested.

2.1 Test Procedure

Actual fire walls and related data in the field were investigated to identify the configurations and prepare the specimens. The test specimens which have equivalent material were prepared for fire resistance test. The fire resistance tests for fire walls were executed in accordance with ASTM E119-2008. The test consists of fire endurance test and hose stream test. The acceptance criteria for test are follows;

Table 1 : Acceptance Criteria for Test

Item	Fire resistance acceptance criteria
Fire endurance test	Without the passage of flame or the ignition of cotton on unexposed side
	Maximum temperature on the unexposed side of fire barrier does not exceed 139℃ above ambient.
Hose stream test	Not allow projection of water beyond the unexposed surface.

2.1.1 Fire endurance test

In case of wall, the specimen is fixed on the 3m x 3m vertical heating furnace and 3m x 3m horizontal heating furnace in case of floor. The specimens are heated in accordance with the standard heat curve stipulated in the ASTM E119-2008. After the 3hr's heating, the maximum temperature is measured on the 9 thermocouples installed on the unexposed side of heating furnace.

Fig 1. Vertical heating furnace

2.1.2 Hose Stream Test

After the fire endurance test, remove the specimens from the heating furnace and make the specimens stand. The stream is delivered through 29mm nozzle tip with nozzle pressure of 207kPa, located 6m from the

exposed surface for 150 seconds. And any hole penetrating the whole thickness is observed.

2.2 Test Results

The results of test for the fire wall of MCR, CSR and Fuel building are follows;

2.2.1 FR of MCR wall

Item		Test Results
Required Fire Rating		3hrs(180min.)
Temp.	Average Temp. on unexposed face	59 ℃ / 180min.
	Max. Temp. on unexposed face	74 ℃ / 180min.
Hose stream test		No hole found
Fire Resistance		180min.
Results		Succeed

2.2.2 FR of Fuel building wall

Item		Test Results
Required Fire Rating		1hr (60minutes)
Temp.	Average Temp. on unexposed face	145 ℃ / 6min.
	Max. Temp. on unexposed face	190 ℃ / 5min
Hose stream test		No hole found
Fire Resistance		4min.
Results		Fail

2.2.3 FR of CSR wall

Item		Test Results
Required Fire Rating		3hrs (180min)
Temp.	Average Temp. on unexposed face	140 ℃ / 177min
	Max. Temp. on unexposed face	161 ℃ / 180min
Hose stream test		No hole found
Fire Resistance		176min
Results		Fail

2.2.4 FR of floor

Item		Test Results
Required Fire Rating		3hrs (180min)
Temp.	Average Temp. on unexposed face	59 ℃ / 88min
	Max. Temp. on unexposed face	104 ℃ / 88min
Fire Resistance		86min
Results		Fail

3. Conclusions

The fire resistance on the fire wall installed in Kori NPP #1 was evaluated.

Only 1 kind out of 4 kinds of fire resistance test was succeeded in accordance with ASTM E119 and Reg. Guide 1.189. Therefore, in order to improve the fire resistance of the fire wall for Kori NPP #1, fire walls will be replaced with the structure of test specimen accepted from this fire resistance test.

REFERENCES

[1] Regulatory Guide 1.189 Rev.0 “Fire Protection for Operating Nuclear Power Plants” April 2001, p. 70.
[2] NUREG-0800 USNRC Standard Review Plan 9.5.1 “Fire Protection Program.”
[3] ASTM E119-08a “Standard Test Methods for Fire Tests of Building Construction and Materials.”