MAAP4 analysis for determining Rapid Depressurization Valve Size

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1. Introduction

Korea Electric Power Corporation (KEPCO) has developed the APR1000 standard design, which is a two-loop 1000MWe pressurized water reactor(PWR). The APR1000 Standard Design is an evolutionary development of the proven OPR1000 design constructed and operated at the Shin-Kori Nuclear Generating Station in Korea. The APR1000 incorporates a variety of advanced design features to provide sufficient reliability, safety, and economic aspects, which satisfy the desires of nuclear customers.

The RCS has three pilot-operated safety relief valves (POSRV) to provide overpressure protection. But, POSRVs alone can`t satisfy overpressure protection. So Rapid Depressurization Valve(RDV) is expected to install.

2. Methods and Results

Reactor vessel failure Accident of reactor coolant system pressure of 250 Psig or less maintained for the prevention of severe accidents and pressure release valve for the determination of flow rate analysis was performed. Rapid depressurization valve by using high-pressure flow scenario analysis by using MAAP 4.0.4 carried out for determining capacity.

2.1 RDV Installation Method

Because of pressurizer upper space is narrow, one branch line is installed. This pipe is divided into two. And Rapid depressurization valve is the installation.

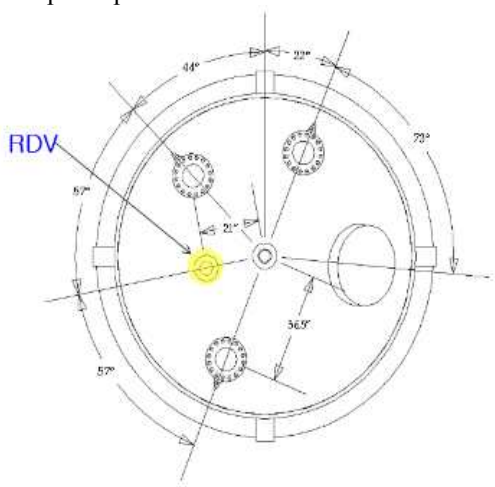

Fig. 1 APR1000 Pressurizer Valve Disposition

2.2 Analysis Code

MAAP (Modular Accident Analysis Program) code that caused the accident, the reactor system's response and containment Behavior Trend, Source Term is a computer program to simulate the behavior.
MAAP code is an integrated computer program. Reflect the relationship between phenomena and isolated bupeurogeuraemdeulyi specific geometric structure and physical phenomena to represent each module is structured. In addition, simulation can be an arbitrary operator acting and performing quick calculations
Reference plant of APR1000 is Shin-Kori 1,2 . So in this study, Shin-Kori 1,2 parameter file was used.

2.3 Analysis Method

In this paper, accident scenario for analysis is as follows: If the max core Exit Thermocouple reaches 1200 ˚F, 3 POSRV was assumed that all does not work. And most of the safety systems have failed.The max core Exit Thermocouple reaches 1200 ˚F and operator open one of the SDV after a period of time passed
Using this scenario, the three initial event(SBO, TLOFW, SLOCA) analyzed. At this point, Reactor Vessel in each of the initial events that had to be broken under pressure 250psig.

Table. 1 Initail Event Analysis Scenario

IE	*Scenario*
TLOFW	*Total Loss of Feedwater* *+ Safety Injection failed* *+ RDV 1 open*
SBO	*Station Blackout* *+Auxiliar Feedwater failed* *+ Safety Injection failed* *+ RDV 1 open*
SLOCA	*Small Break Loss of Coolant Accident* *+ Auxiliar Feedwater failed* *+ Safety Injection failed* *+ RDV 1 open*

2.4 Analysis Result

Following the three initial events may cause an High pressure severe accident : SBO, SLOCA, TLOFW.
About these events, each capacity and RDV opening

time differently analysis. At the setpoint of RDV opening is assumed 17.5MPa.
At the time of the severe accident launch comes (MAX_CET 1200 °F) after 30 minutes, the Rapid depressurization valve to open up the following results.

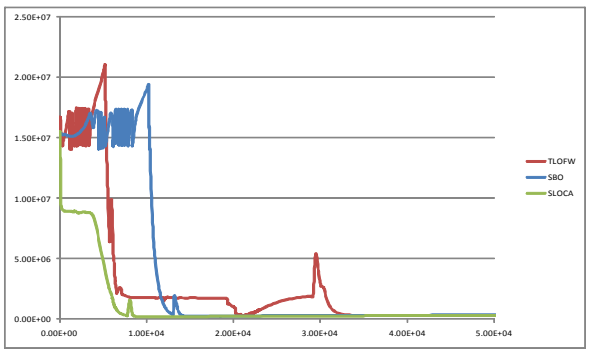

Fig. 2 Analysis Result for MAAP4

Table. 2 RV Fail Time & RCS Pressure

	RV fail(sec)	PPS(psi)
TLOFW	35721	43.1378
SBO	18132	35.0512
SLOCA	12221	30.7480

To do this on the release capacity of Rapid depressurization valve at least 105.33kg/sec. And at the time of the severe accident launch comes (MAX_CET 1200 °F) after 30 minutes, the rapid decompression valve to open. So the high pressure severe accident will be able to prevent.

3. Conclusions

Korea Electric Power Corporation (KEPCO) has developed the APR1000 standard design. The APR1000 incorporates a variety of advanced design features to provide sufficient reliability, safety, and economic aspects, which satisfy the desires of nuclear customers.

One of those, Rapid depressurization valve (RDV) is expected to install. Reactor vessel failure Accident of reactor coolant system pressure of 250 Psig or less maintained for the prevention of severe accidents.

Rapid depressurization valve by using high-pressure severe accident analysis by using MAAP 4.0.4 carried out for determining capacity. Three scenarios were analyzed. To do this on the release capacity of Rapid depressurization valve at least 105.33kg/sec. And at the time of the severe accident launch comes (MAX_CET 1200 °F) after 30 minutes, the Rapid depressurization valve to open. So the high pressure severe accident will be able to prevent.

The study will find out any issues for application of RDV to APR1000 and suggest resolutions. The study result will be used for detail design of APR1000.

REFERENCES

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