Improvement of JAEA model reflecting conditions of actual equipment and results of evaluation

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Modifications from JAEA model

1. A new model is added so that the core spray system directly removes heat from the uncovered core

[Objective of modification]

Considering the results that water injection from the core spray system exerted a great effect in decreasing the temperature, a new model is added instead of JAEA model which the injected water from the core spray system streams down the wall of the shroud. In the new model, a part of the injected water directly removes the heat from the uncovered core.

2. A heat conduction model is added to the head of the upper part of RPV

[Objective of modification]

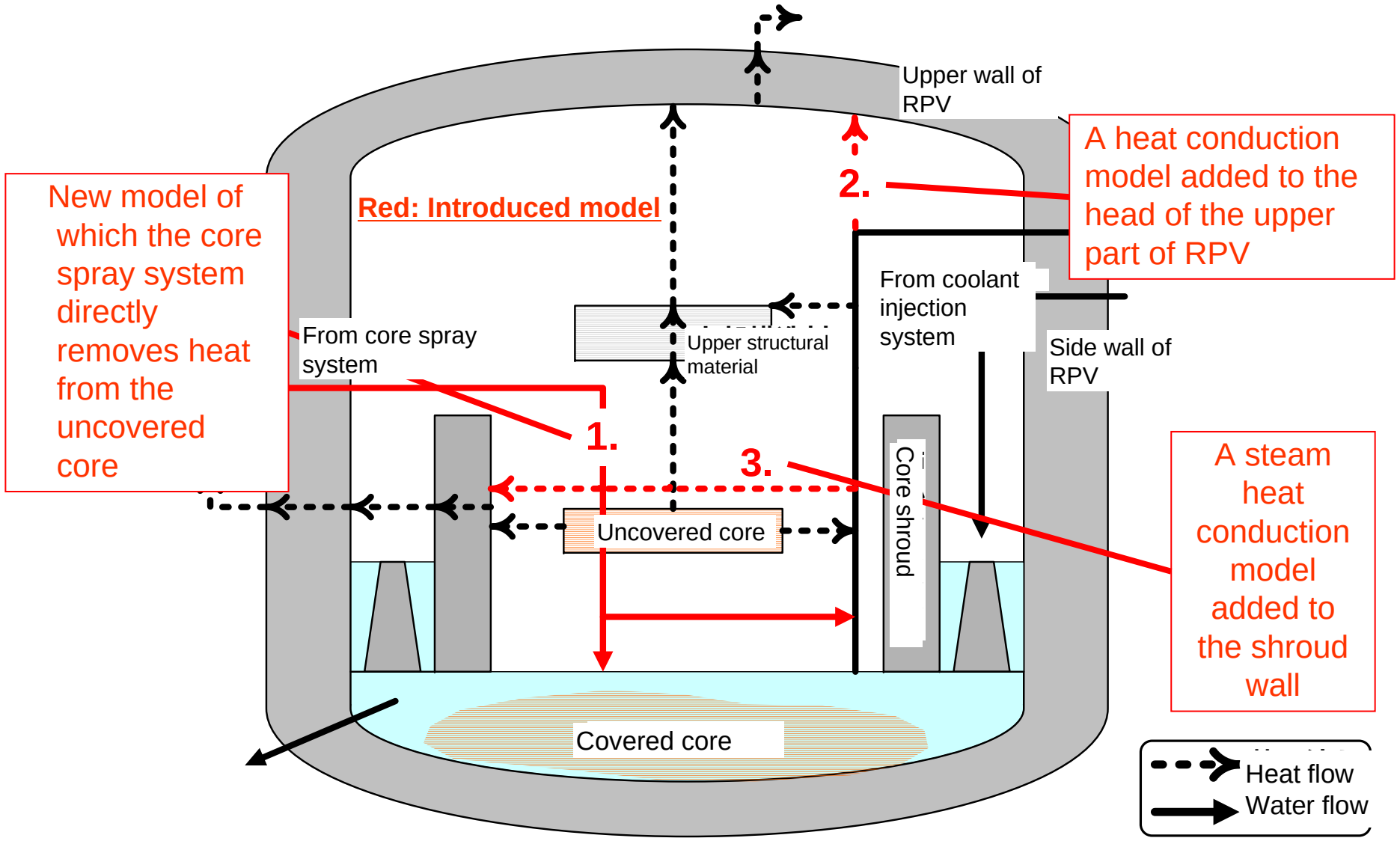
Assuming the steam leakage from the main steam line or around the RPV flange, the new model considers the heat conduction by the steam that has passed through the structural material, which was not considered in the JAEA model.

3. A steam heat conduction model is added to the shroud wall

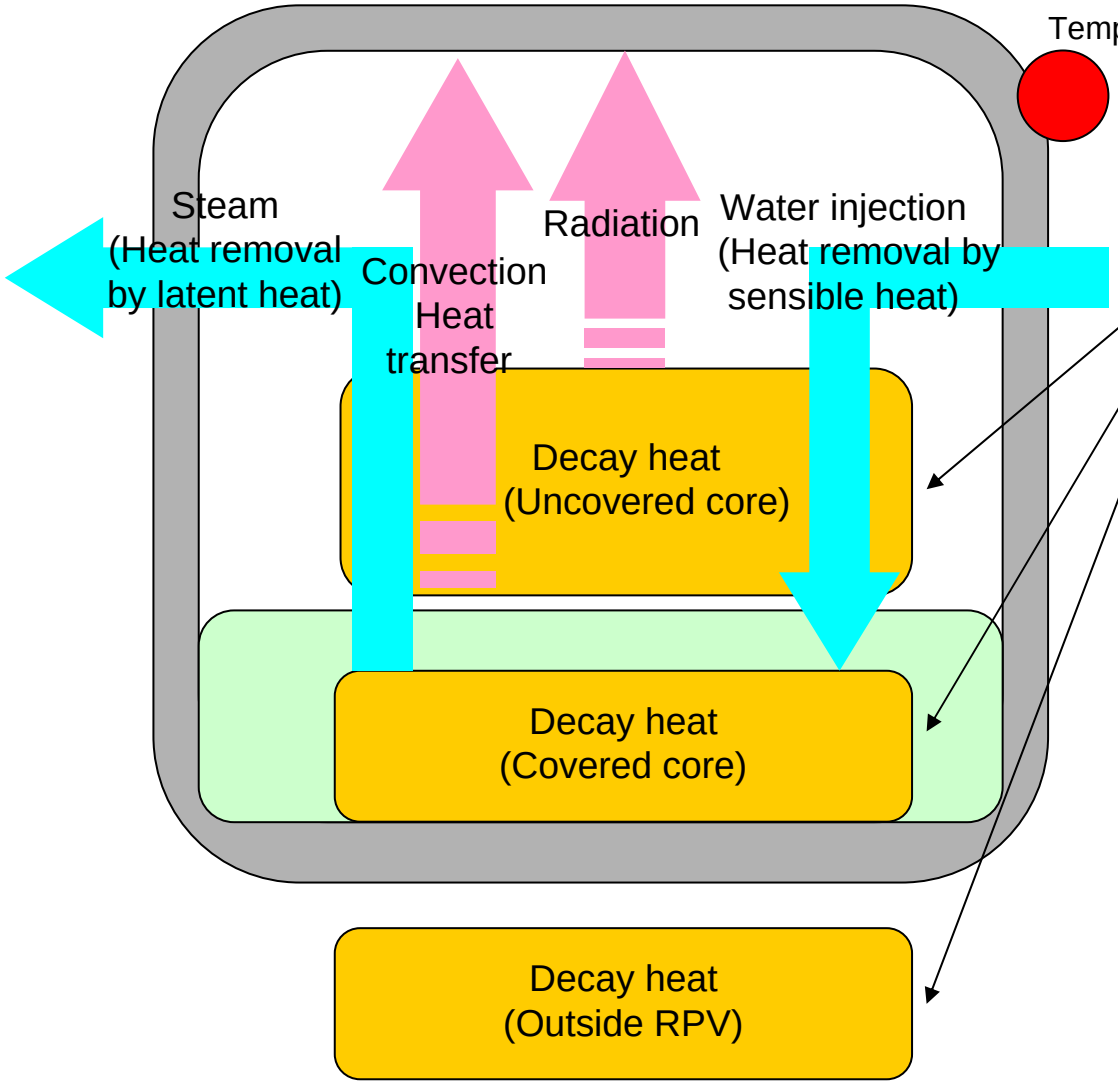
[Objective of modification]

In addition to the radiation, which was considered in JAEA model, heat conduction by the steam is considered in the heat transfer in a direction toward RPV.

Additionally introduced Model



Method of estimating the conditions in the reactors



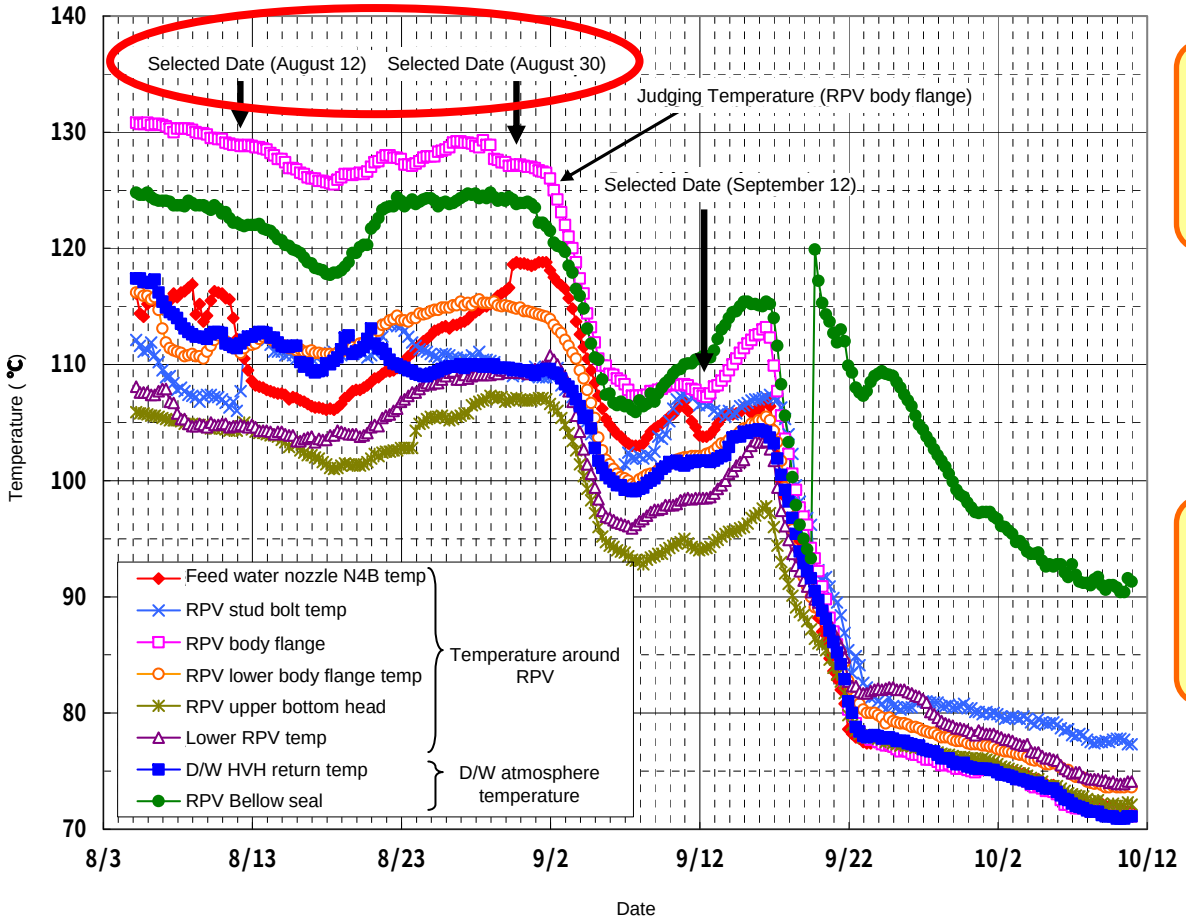
Parameters are substituted for the value indicating the position of the fuel, as they are unknown.

Temperature at the upper part of RPV is estimated by solving the heat balance equation using the proportion of the core inside RPV

Estimation of the proportion of the uncovered core which create the measured temperature at the upper part of RPV

Method of estimating the conditions in the reactors

Inside RPV heat evaluation model by **Steady-state heat balance method** is now used



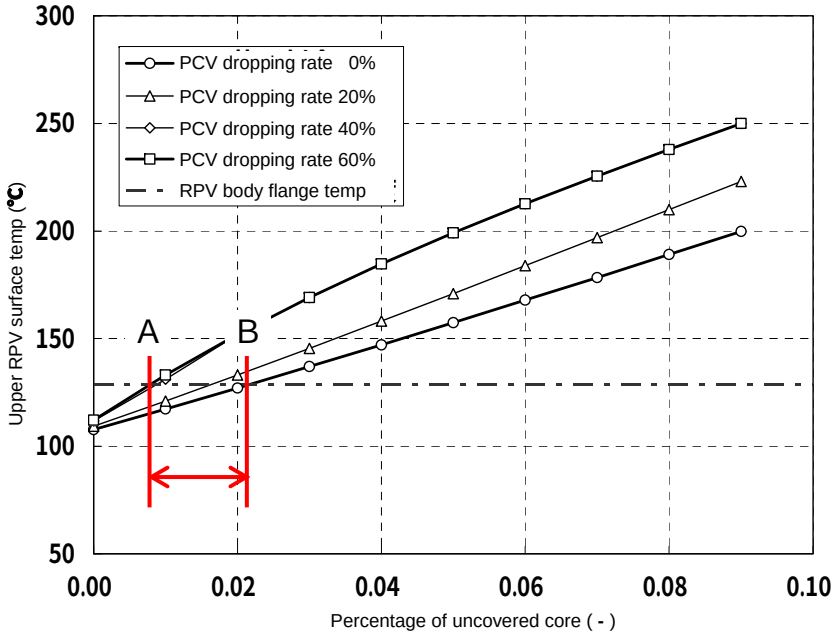
Select the date when plant parameter is not significantly changing

Survey parameter to reproduce temperature measurement (upper RPV)

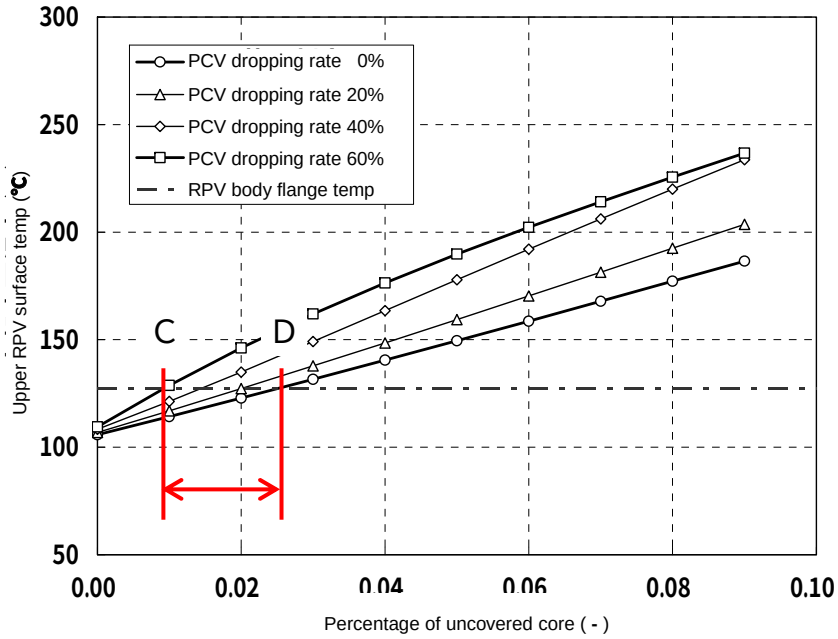
Estimate the condition in the reactors

Example of evaluation (1F3)

August 12



August 30



Estimated to maximize range of percentage of uncovered core

Concept of percentage of uncovered core

if A≦C、B≦D ⇒ A ≦ percentage of uncovered core ≦D

Example of evaluation result (1F3)

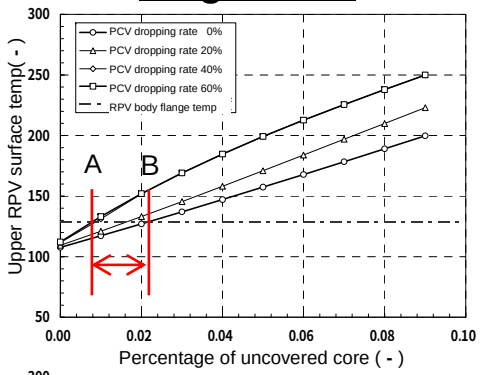
Percentage of water leakage

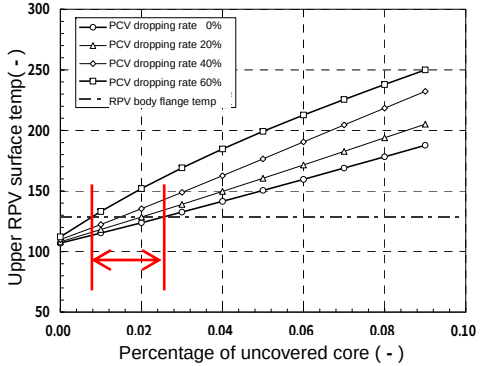
20%

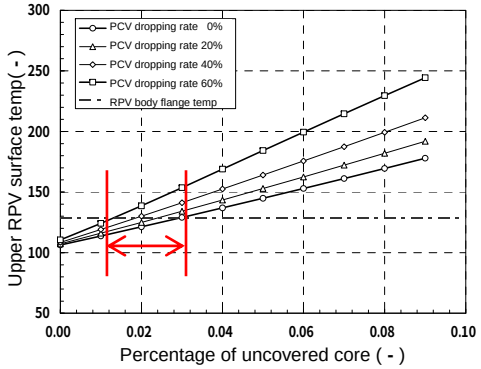
40%

60%

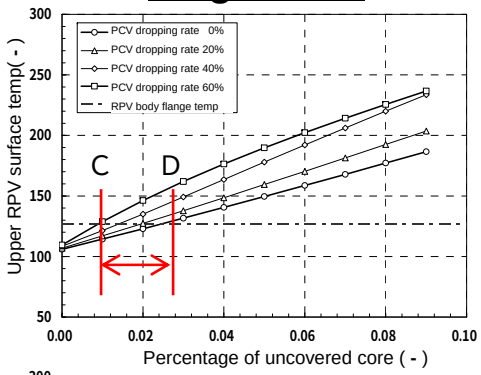
August 12

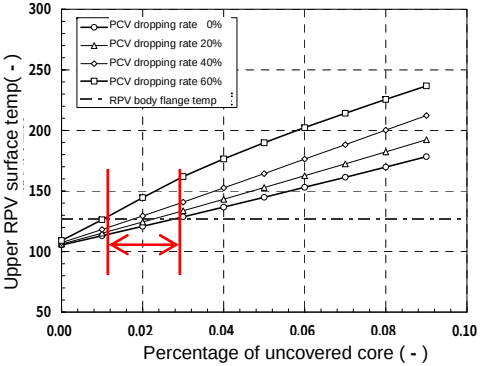


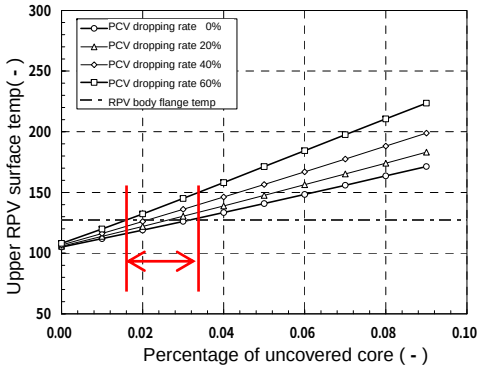




August 30







Evaluation result

Unit 2

	August 12	September 12	Result of estimation
Portion of uncovered core	0.011～0.031	0.008～0.027	0.008～0.031

Unit 3

	August 12	August 30	Result of estimation
Portion of uncovered core	0.008～0.030	0.009～0.031	0.008～0.031

Result

Percentage of uncovered core is 3% at maximum.

(※Model was not applied to 1F1)

Summary

- JAEA model was improved reflecting conditions of actual equipment and results of evaluation.

- As a result of evaluation, using improved model, percentage of uncovered core is estimated 3% at maximum in the case dropping percentage is small and also estimated below 1% when PCV dropping percentage is assumed 60% (result of MAAP estimation).

- It is confirmed in estimating the dropping percentage of fuel on the PCV based on the measured temperature reading, in the case of Unit 2 and 3, there is no contradiction up until 60%.