Evaluation of Radiation Dose by Wild Fire in Evacuation Zone after the Fukushima Accident

17-21 February 2014

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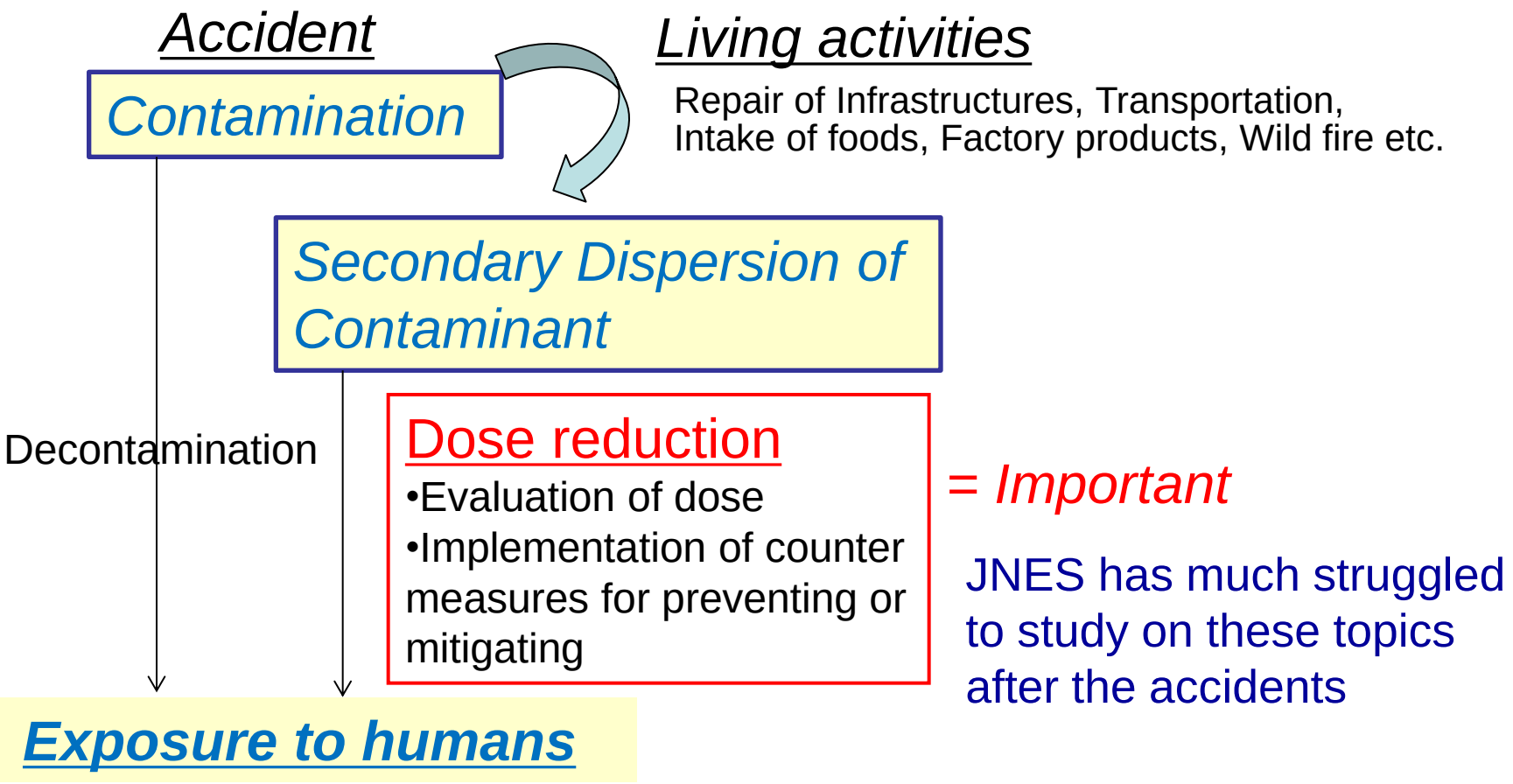
Important roll of remediation

Definition of “Remediation” (quoted from IAEA Safety Glossary)

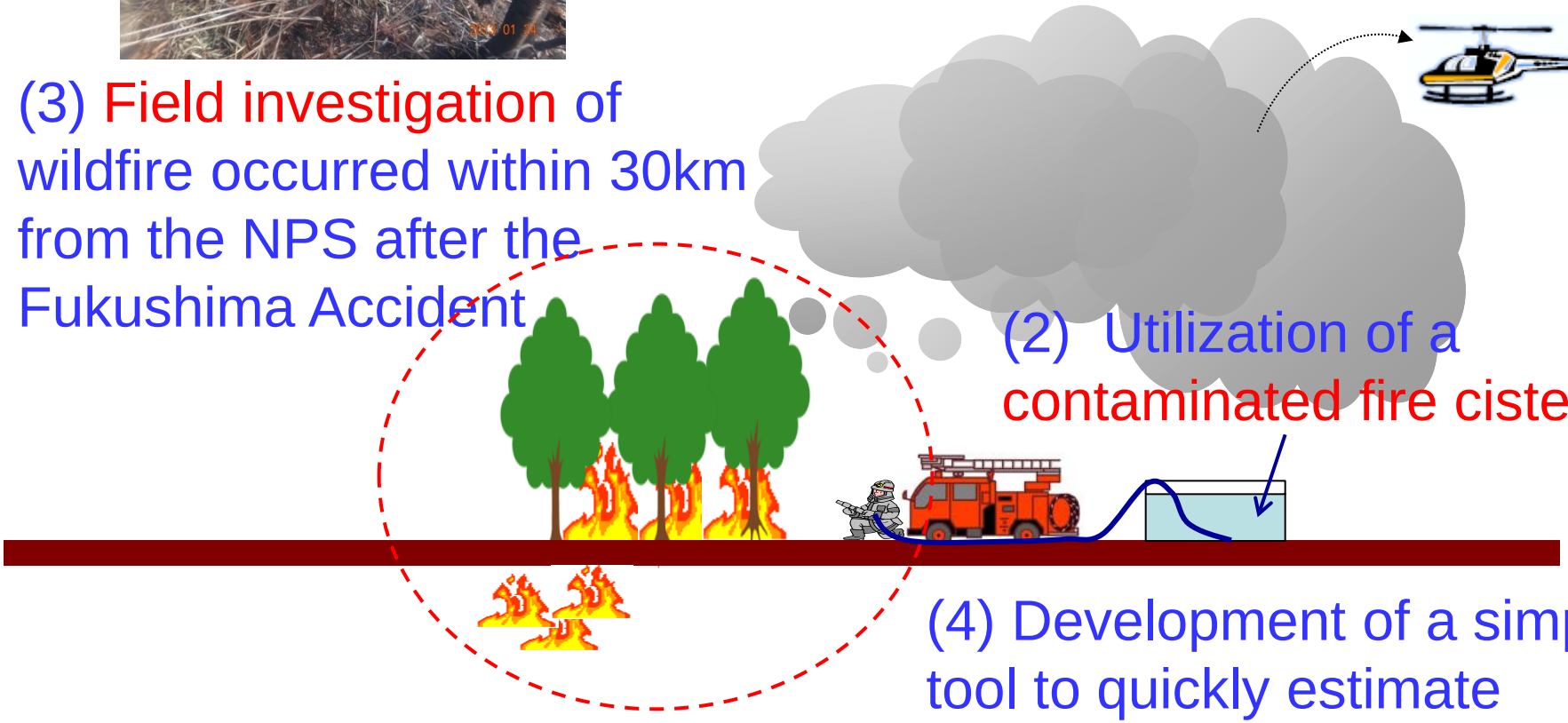
Any measures that may be carried out to reduce the *radiation exposure* due to existing *contamination* of land areas through actions applied to the *contamination* itself (the *source*) or to the *exposure pathways* to humans.



Today's Topics

(1) Exposure dose to crew members and radioactive contamination of a helicopter during firefighting operation

(3) Field investigation of wildfire occurred within 30km from the NPS after the Fukushima Accident



(2) Utilization of a contaminated fire cistern

(4) Development of a simple tool to quickly estimate exposure dose to firefighters

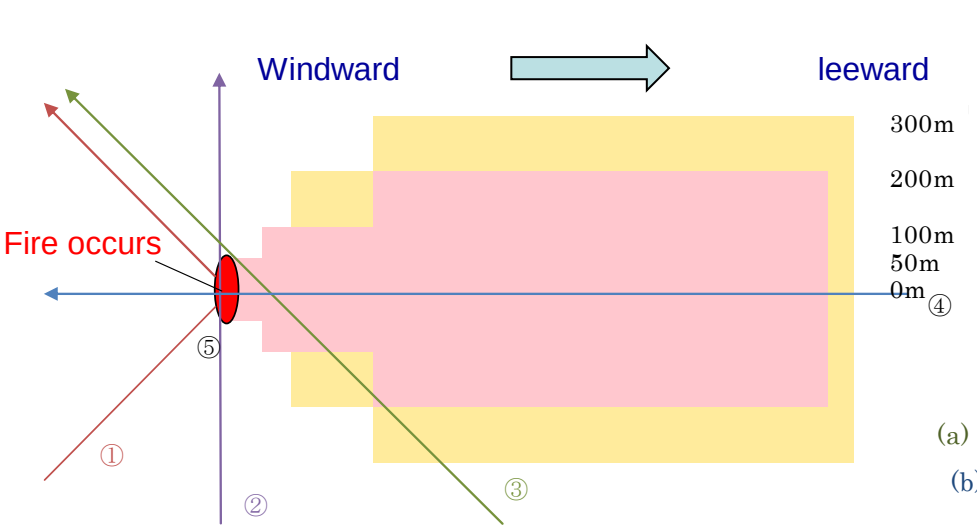
Investigation on a helicopter

Parametric studies are performed to estimate

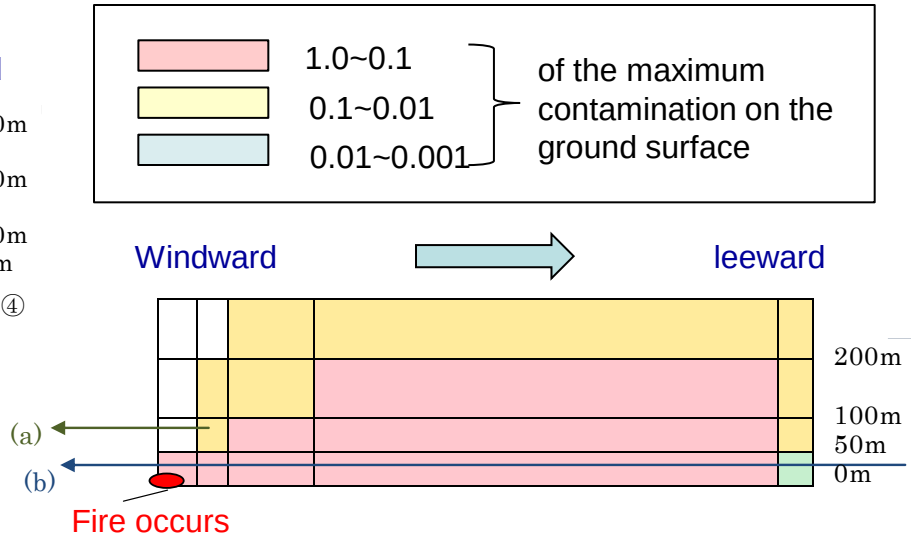
- exposure doses to crew members
- contamination on an outer surface of a helicopter

In advance, the dispersion of contaminated smoke is estimated by ALOFT developed by US NIST according to weather and incineration conditions.

Then, approaching direction and vertical height are varied.



Horizontal Dispersion



Vertical Dispersion

The main Results

The main results in the most conservative case

Wlid fire occurs in the highest contaminated area among the off-site regions.

Assuming the following parameters,

- Ambient dose rate : parameter (μSv/h)
- Burned area : 20 ha
- Wind velocity : 2m/sec
- Flight height : less than 50m high
- Approaching : from fire leeward to windward
- Operating time : 10 hours (100 times flights)

■ Exposure doses to crew members

With a mask : ambient dose rate × 12 (internal dose is 14%)

(Without a mask : 25 times as large as ambient dose rate ,internal dose is 66%)

■ Contamination on an outer surface of a helicopter

Contamination of ground surface × 5.5E-2

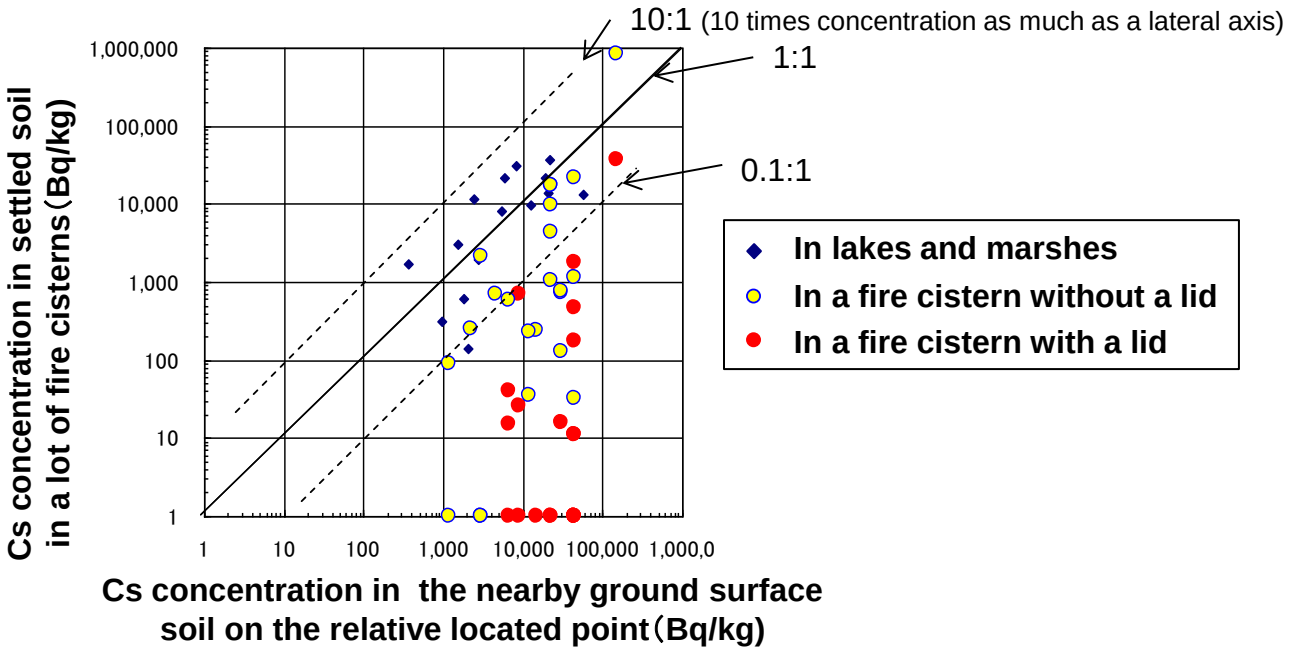
, assuming the sedimentation rate of 1cm/sec

Remarks

It is much important to approach from windward or vertical direction to wind flow and to keep vertical distance from the ground surface, wearing a mask

Investigation on a contaminated fire cistern

Contamination in settled soil
in a lot of fire cisterns in the evacuation zone



- In case of lakes and marshes, the concentration of the settled soil is close to the one of the nearby ground surface soil in the vicinity of the lake and marshes
- In case of fire cisterns especially with a lid, the concentration is lower than that of the nearby ground surface soil
- As a result, it was found that the radioactive materials is not condensed in the settled soil in fire cisterns

→ It is preferred that uncontaminated water carried in from outside is used
If necessary, the water from fire cisterns with a lid will be allowed to be used

Field investigation of wild fire occurred within 30km from the NPS after the Fukushima Accident

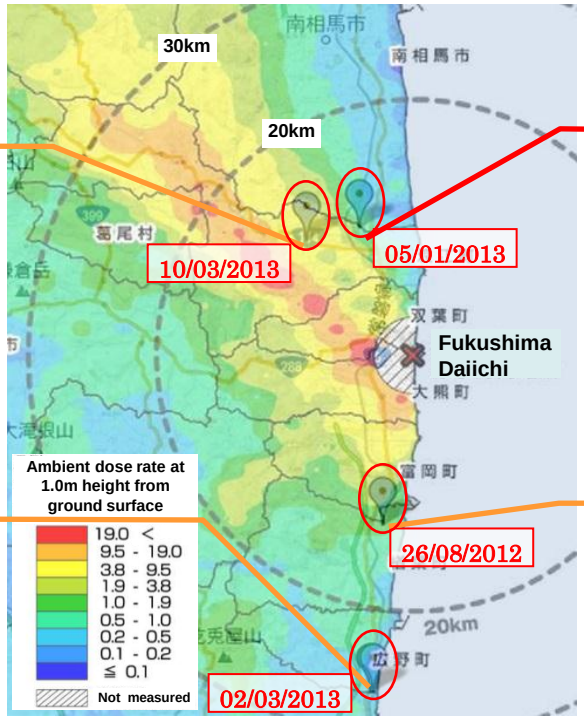
Some wild fires occurred within 30km from the NPS

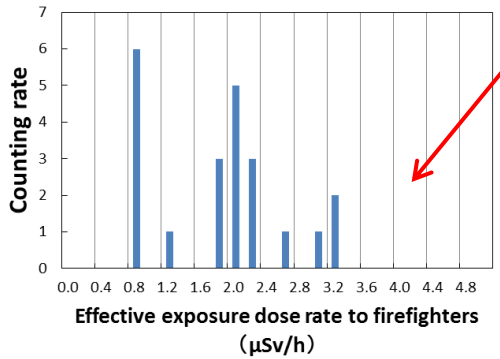
→Just after the wild fire, JNES conducted the filed investigation

Field type：Graveyard, field and field fallow
Ambient dose rate：3.8～9.5μSv/h*)
Fire scale : about 4ha
Fire duration : about 2hours

Field type：Forest and field fallow
Ambient dose rate : 0.2～0.5μSv/h*)
Fire scale : about 8ha
Fire duration : 16hours

↑
Outside of the evacuation zone





Field type : Forest
Ambient dose rate：1.0～1.9μSv/h*)
Fire scale : about 0.08ha
Fire duration : about 3hours

Field type : Slope of grassland
Ambient dose rate : 1.0～1.9μSv/h*)
Fire scale : about 0.05ha
Fire duration : about 1hour

*) Air dose rate monitored by the aircraft survey
（Converted into the value as of 16 Nov, 2012）

Investigation about radioactive materials by a fire (1)

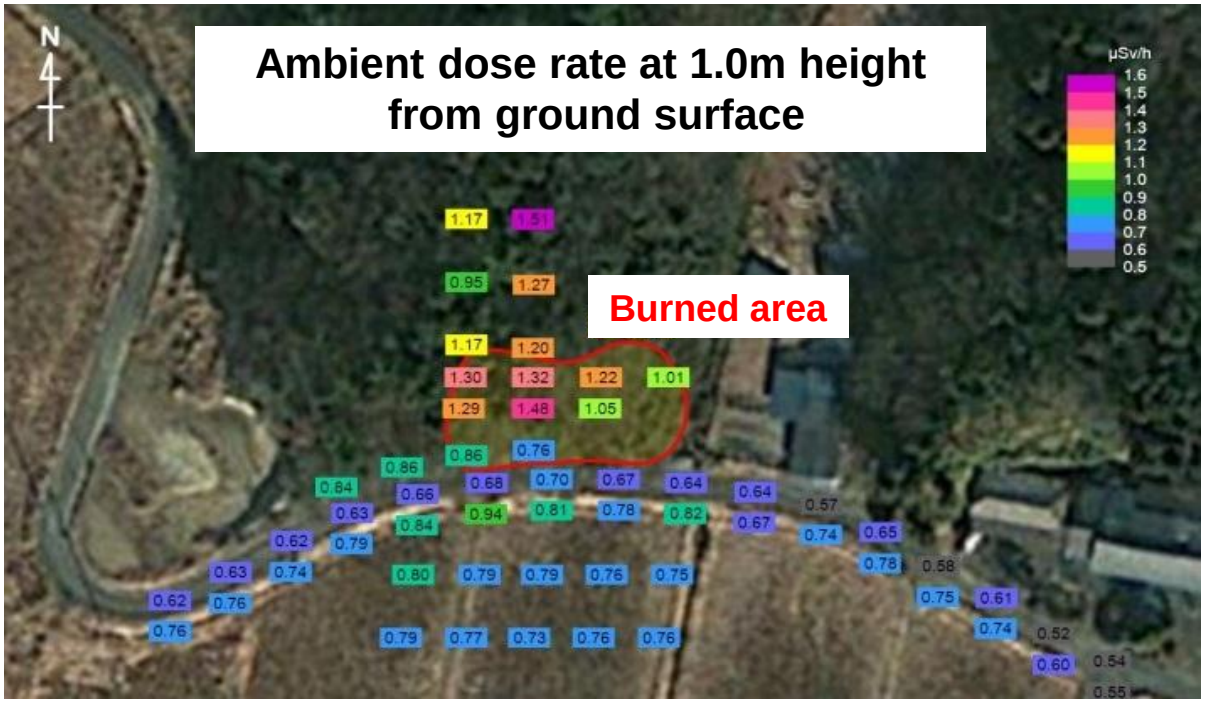
Field Investigation Objectives

- To specify Cs concentration in burnable parts
- To identify whether burned ash will be dispersed or remained

Situation of wild fire in Namie Town (05/01/2013)

Field type : Forest
Ambient dose rate ：1.0～1.9μSv/h*)
Fire scale : about 0.08ha
Fire duration : about 3hours
Fire Type : Surface Fire

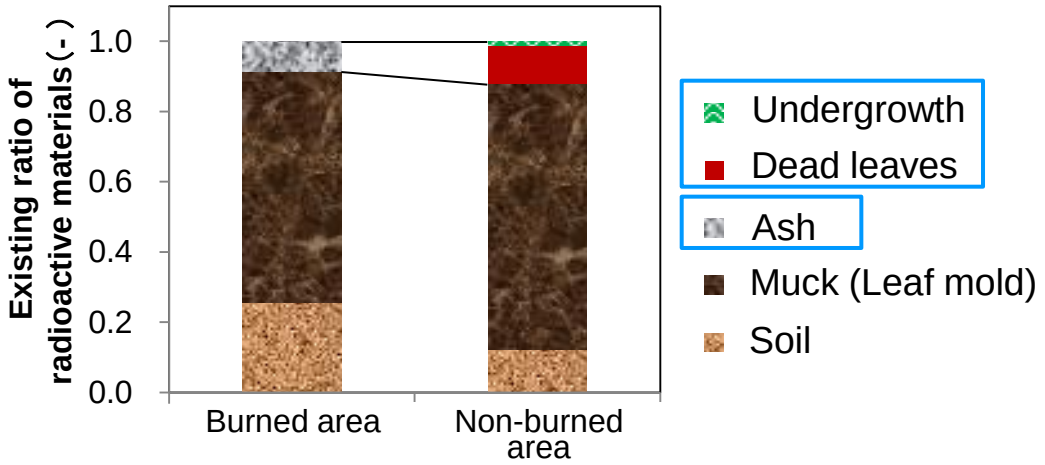
*) Air dose rate monitored by the aircraft survey
（Converted into the value as of 16 November, 2012）



If burned ash is dispersed during wild fire, the ambient dose rate within burned area should decrease, but the indication could not be observed.

Investigation about radioactive materials by a fire (2)

Existing ratio of radioactive materials which exists per unit area



- The ratio of radioactive materials in ash in burned areas corresponds to that of undergrowth and dead leaves in non-burned area

Remarks

- Most of the fire type in Japan is surface fire (not high temperature)
- The most of radioactive materials adhering to burned parts still remain on the same place as ash
- Shortly, the flying radioactive materials due to wild fire are slight

This finding is taken into consideration as "Radioactive material concentration indicator" and "Land use indicator"

A simple and quick evaluation tool developed by JNES

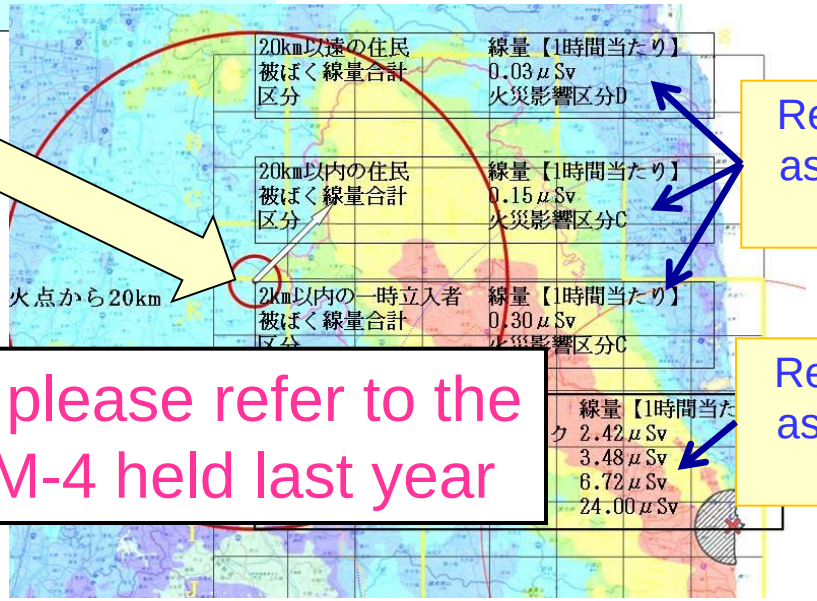
・We developed a simple and quick evaluation tool.
→ To estimate conservative results even if available information is limited.

It can provide proper information to firefighters and surrounding people in the early phase of large fire.

[Input Data]

Fire duration	西暦	2011	年	11	月	5	日	12	時	0	分	
	西暦	2011	年	11	月	5	日	18	時	0	分	
Position of fire	住所											
	東経	140.60	度									
	北緯	37.60										
Cs concentration	0.3～0.6MBq/m2 （水色）											
Land use	◉ 森林 ○ 森林以外											
Terrain	○山間部◉山間部以外											
Fire scale	0.5～1ha											
Wind direction												
Wind velocity												
Temperature												
Humidity												
Weather	薄曇り											

[Output Data]



Results of dose assessment for residents

Results of dose assessment for firefighters

As for the details, please refer to the proceeding of IEM-4 held last year

Background：distribution of Cs concentration

This tool is provided to the fire fighting offices of Fukushima prefecture

Concluding Remarks

- A few of investigation especially focusing on the exposure pathway were conducted by JNES after the Fukushima accident
- Just after the wild fire, JNES conducted the some investigations. Based on the results, it was found that radioactive cesium was condensed in the ash and most of the ash stayed in the vicinity of the fire location
- Based on the result of fire investigations , the dose evaluation tool was improved so that more quickly realistic evaluation could be performed. The revised version was distributed to the Fukushima fire department
- These efforts resulted in knowledge of public on exposure dose and safety precautions were broadly disseminated through the workshops and the released technical reports
- It is important to continue this kind of efforts in order to avoid undesirable exposure and live without needless concern on safety even under existing exposure conditions

Thank you for your attention