

FTC in Indonesia

Emergency Response at Nuclear Science Research Institute of JAEA

August 20th, 2025

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Nuclear Science Research institute of JAEA



Research Reactor (JRR-3)



Nuclear Safety Research Reactor (NSRR)



Critical assembly (STACY)



Concrete cells for high level radioactivity

As long as facility is running always, accident will happen.

But, it is possible to prevent or reduce an accident by taking the following measures.

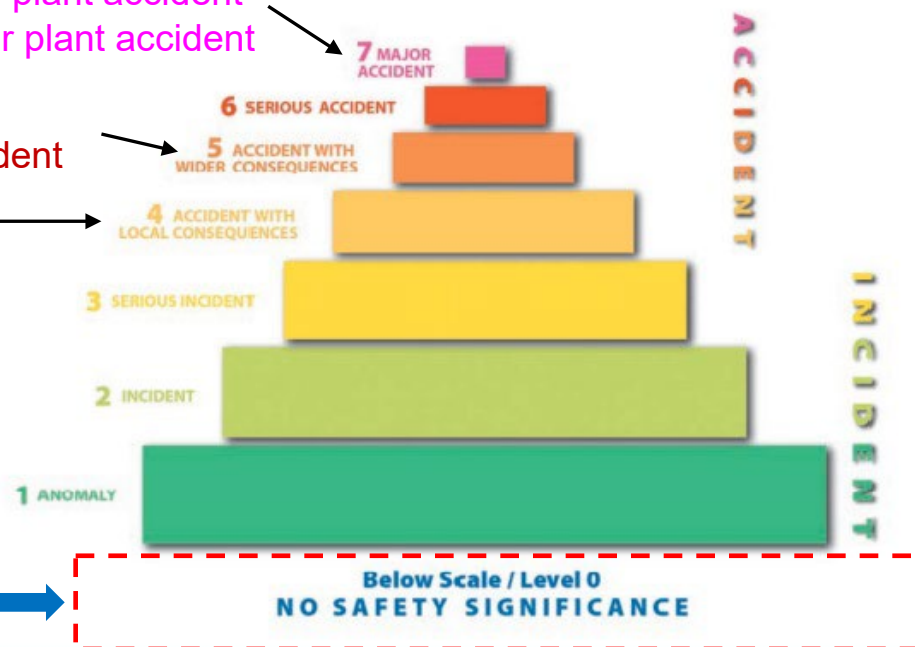
- (1) To maintain regularly and operate facility by the book not to cause an accident.
- (2) To drill for emergency response for a rainy day.
- (3) To find out the root cause of an accident not to repeat the same accident.
- (4) To foster safety culture.

INES

The International Nuclear and Radiological Event Scale

User's Manual 2008 Edition

- Chernobyl nuclear power plant accident
- Fukushima nuclear power plant accident
- Three Mile Island nuclear power plant accident
- JCO criticality accident



Co-sponsored by the
IAEA and OECD/NEA



IAEA

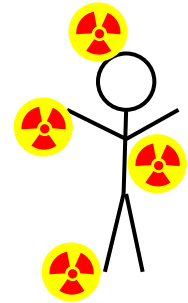
International Atomic Energy Agency

Example of small-scale Incident at Nuclear Science Research Institute

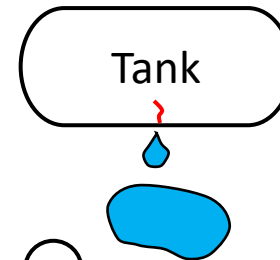
(1) Fire of equipment



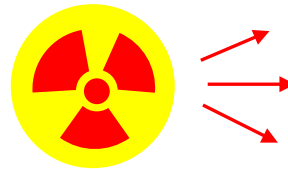
(2) Contamination of body



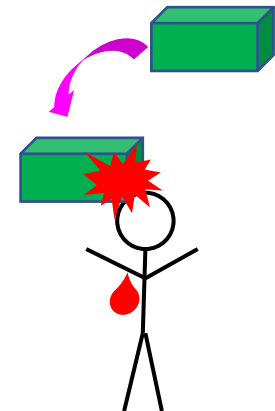
(3) Trouble of facility



(4) Exposure



(5) Injury



After Fukushima Accident

The Latest JAEA Laboratories established after Fukushima Accident

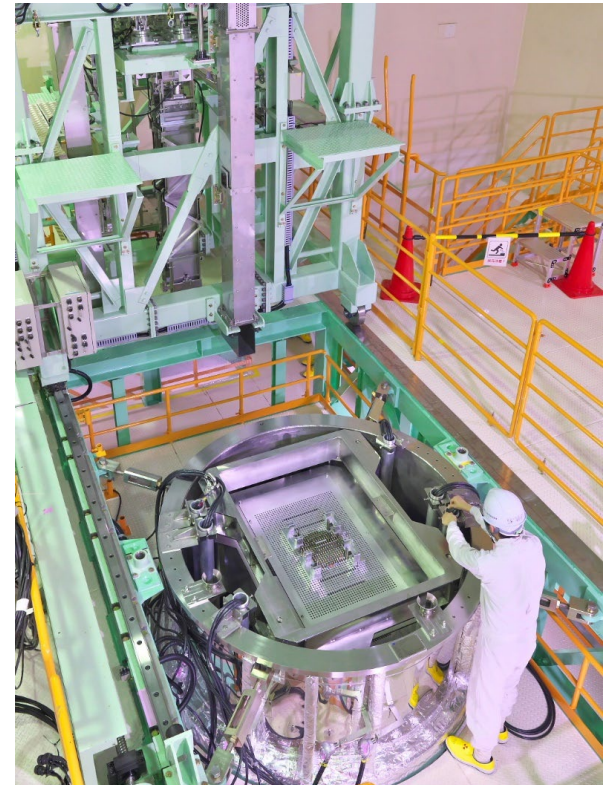
Latest Institutes and Facilities	Purpose
■ Analysis and Research Center (Fukushima Pre.)	Analysis of samples obtained from Fukushima Nuclear Power Station
■ Center for Remote Control Technology Development (Fukushima Pre.)	R & D for Remote Technology used in the Decommissioning of Fukushima Nuclear Power Station
■ Critical Assembly, STACY (Ibaraki Pre.)	Research on Critical Safety for removal of Fuel Debris



Concrete Cells for Highly Radioactive Material
(Analysis and Research Center)

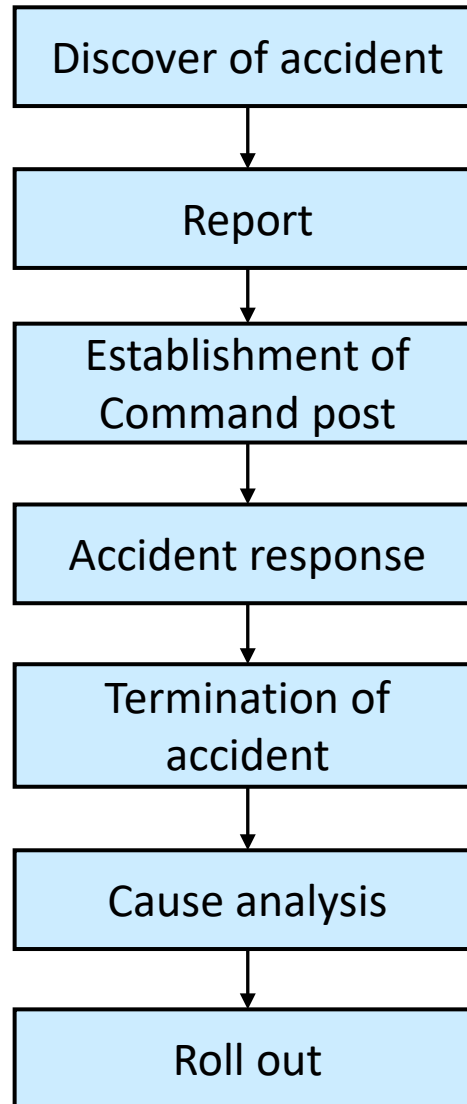


Mock-up Test Building
(Center for Remote Control Technology
Development)

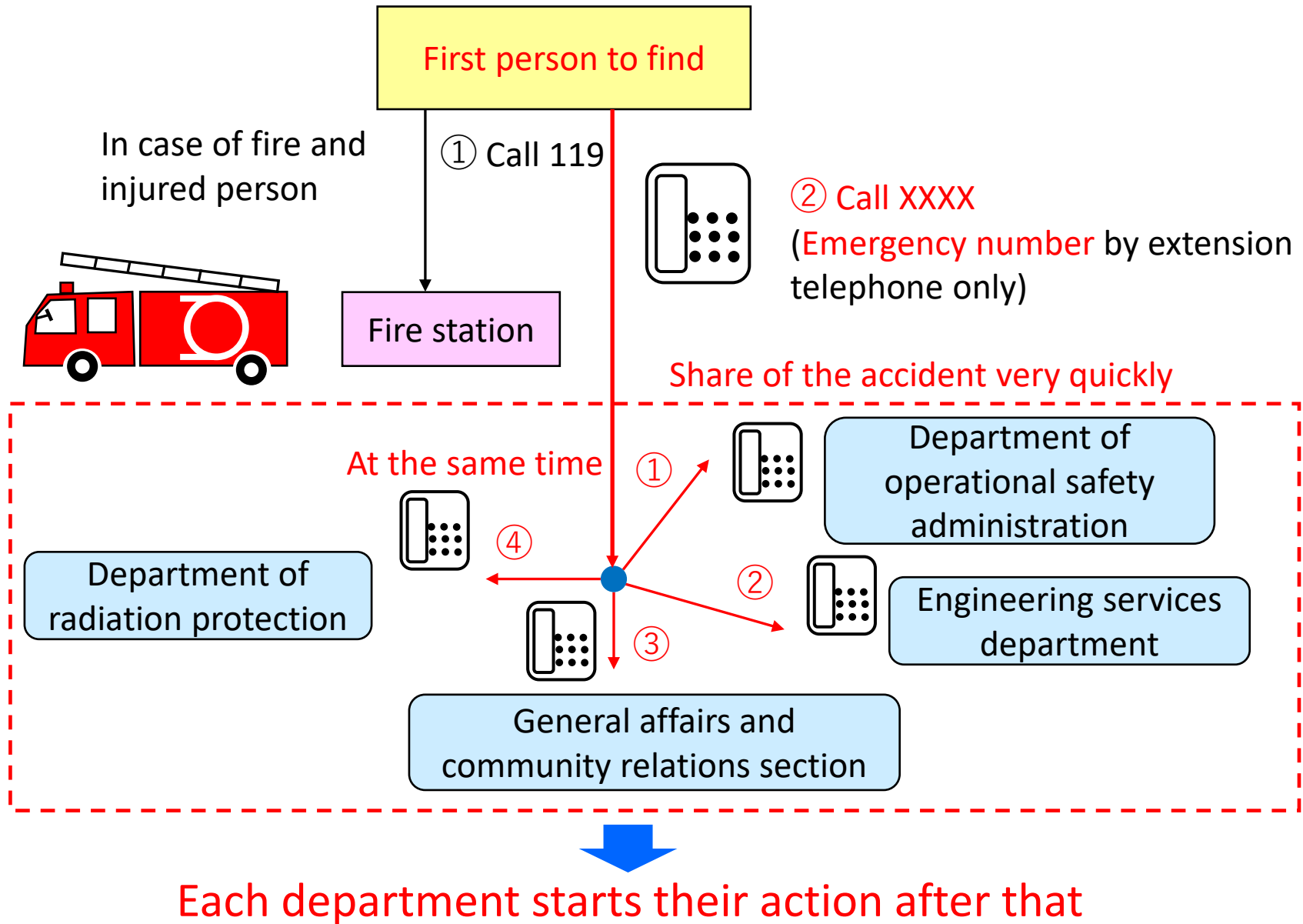


STACY
(Critical Assembly)

1. Discover of accident and Report



Flowchart of emergency Response at Nuclear Science Research institute of JAEA

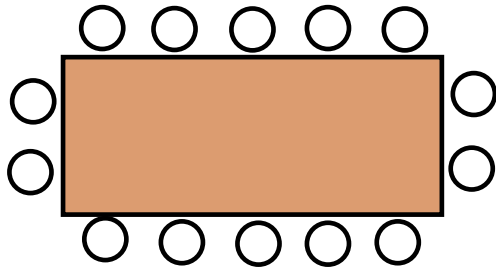


2. Establishment of command post



(In nuclear science research institute)

Authority is big



Safety control building

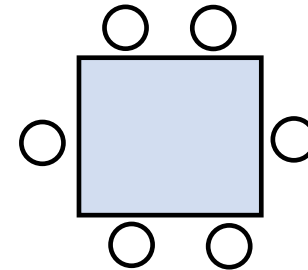
Report of conditions



Instruction



(In accident facility)



The accident facility

Example



Nuclear Science Research institute of JAEA



Safety control building

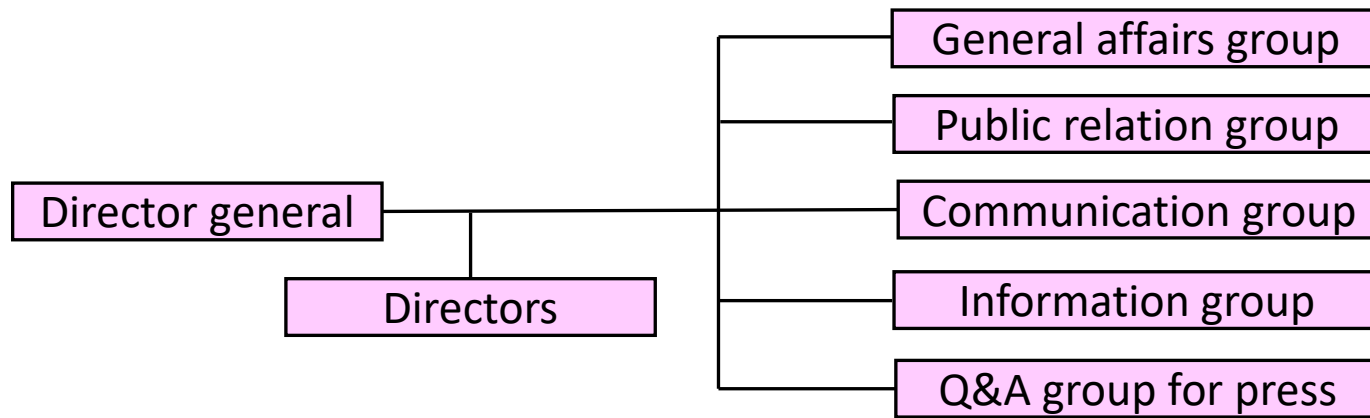
Former safety control building was broken due to the Great East Japan Earthquake in 2011. So JAEA built new safety control building which is earthquake resistant. **The whole first floor is command post 1 of emergency response.**



Seismic isolation structure
(quake-adsorbing structure)²⁰

3. Accident response

(1) Command post 1



Composition (more than 100 people in total)

Main Task

- **Institute announcement** on the accident for all employees in the premises.
- **Understanding of the situation**
Sharing the information of the accident with command post 2 by TV meeting system.
- **Effective measures against the accident**
- **Dispatch of information to related organization**, such as community, government, police, head-office of JAEA, etc.

Report to the related organizations of an accident information

In case of an accident, JAEA and other companies are supposed to quickly report an accident information to the related organizations both **with Facsimile (FAX) and with Telephone.**

Related organizations:

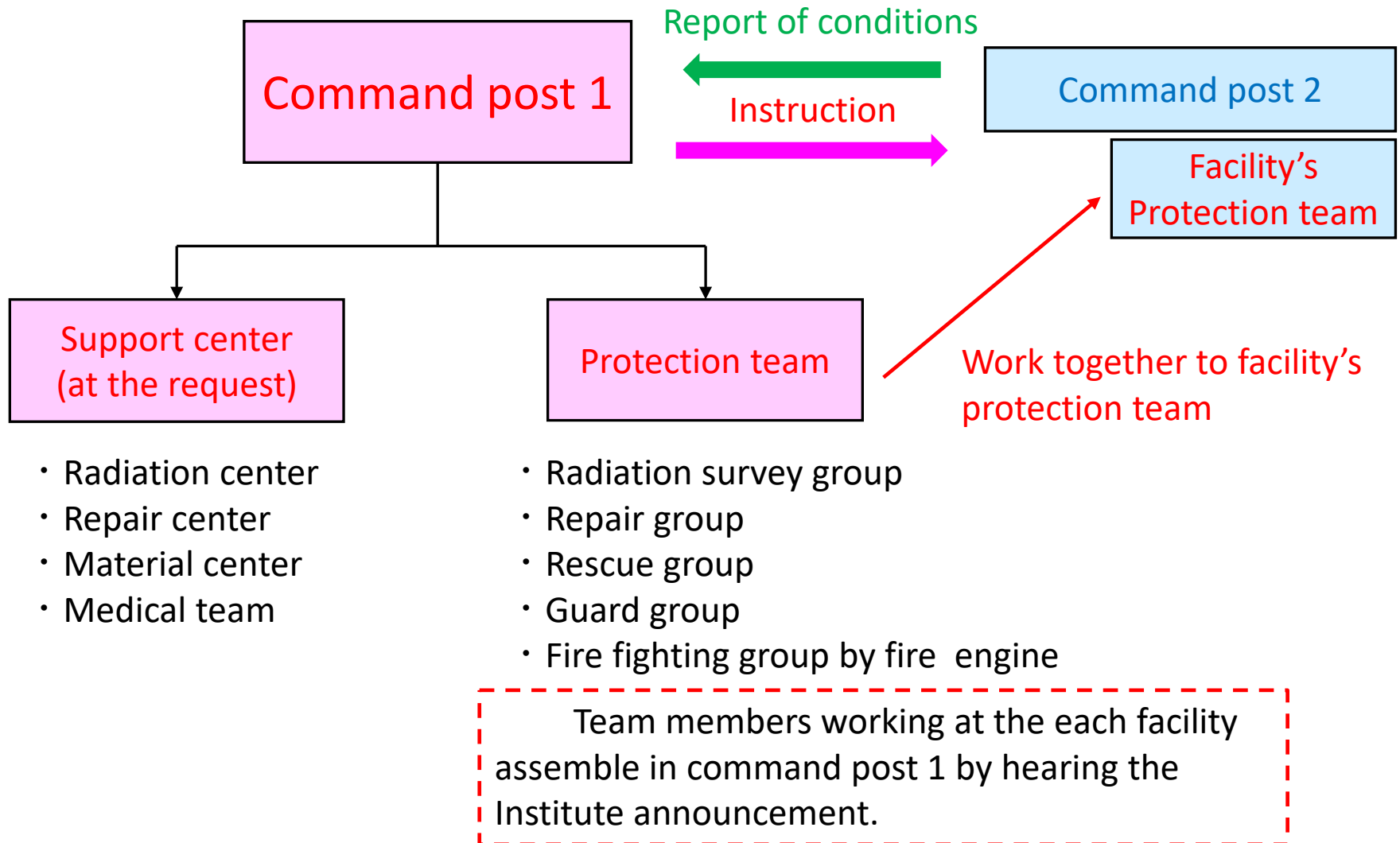
Regulatory authority, Prefectural office, Police
Fire department, Local governments etc.

Q Why do we use Facsimile (FAX) ?

A FAX is the more secure measures than E-mail.

And it is possible to exactly send an information with FAX.

(2) Command post 1

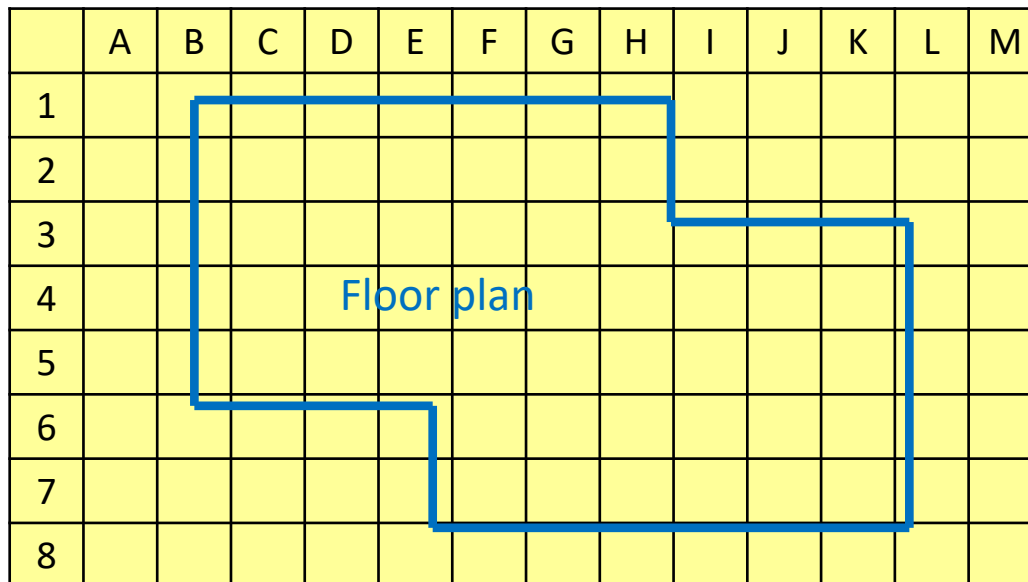


(3) Command post 1

The command post 1 is always preparing following materials.

- Leaflets of all facilities
- **Grid maps of all facilities**
- Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors
- Safety Regulations

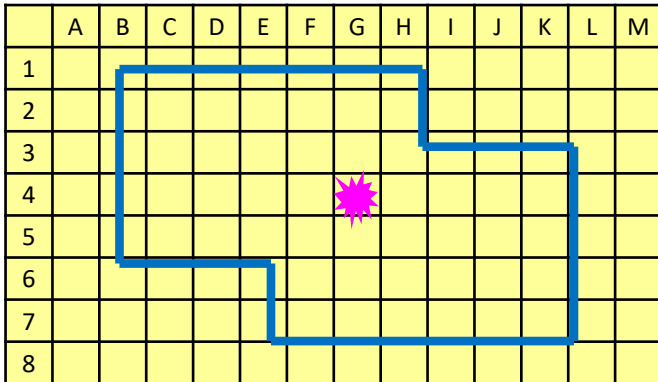
JAEA have to make the safety regulations, in which the detail items of safety role was written, in each important facility.



Grid map of research reactor TTR-1

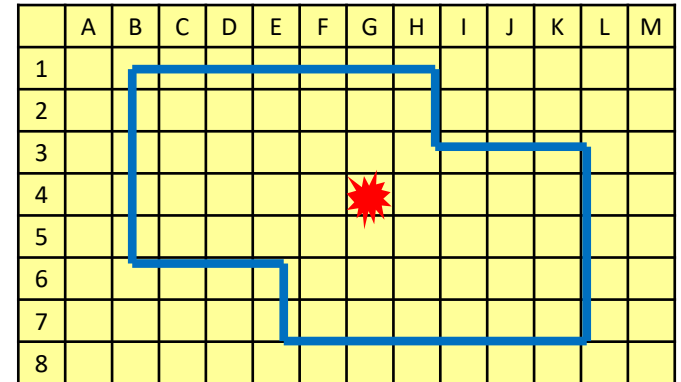
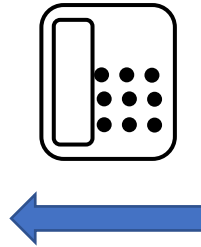
(4) Command post 1

Inform accident area "G4" by phone
to command post 1 immediately



The command post 1

The same grid map as command post 2

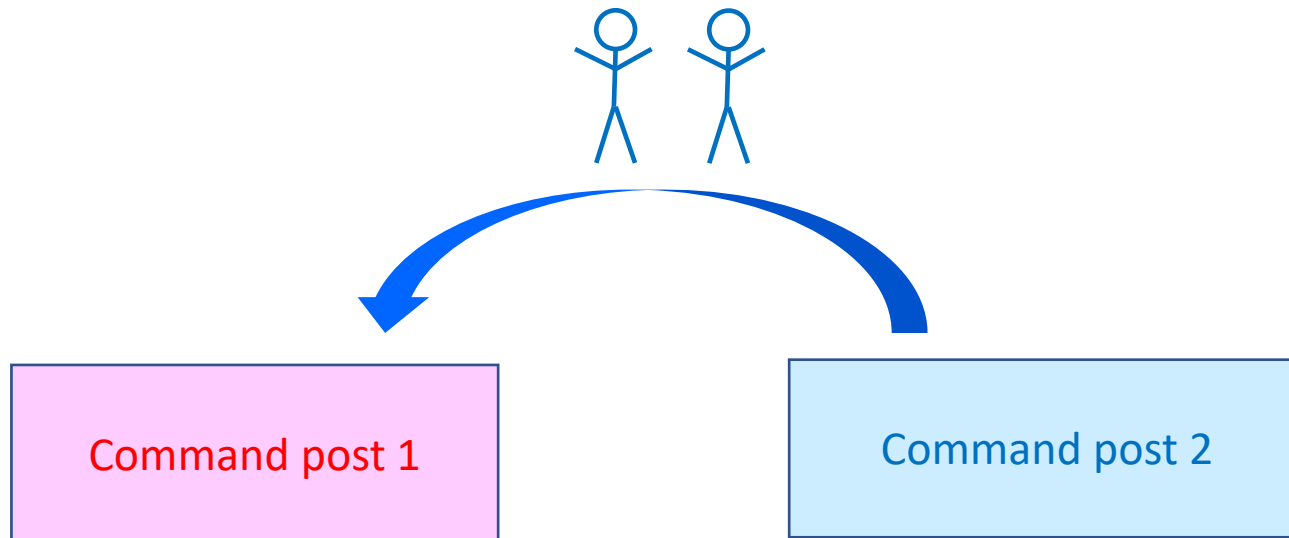


Grid map of research reactor TTR-1

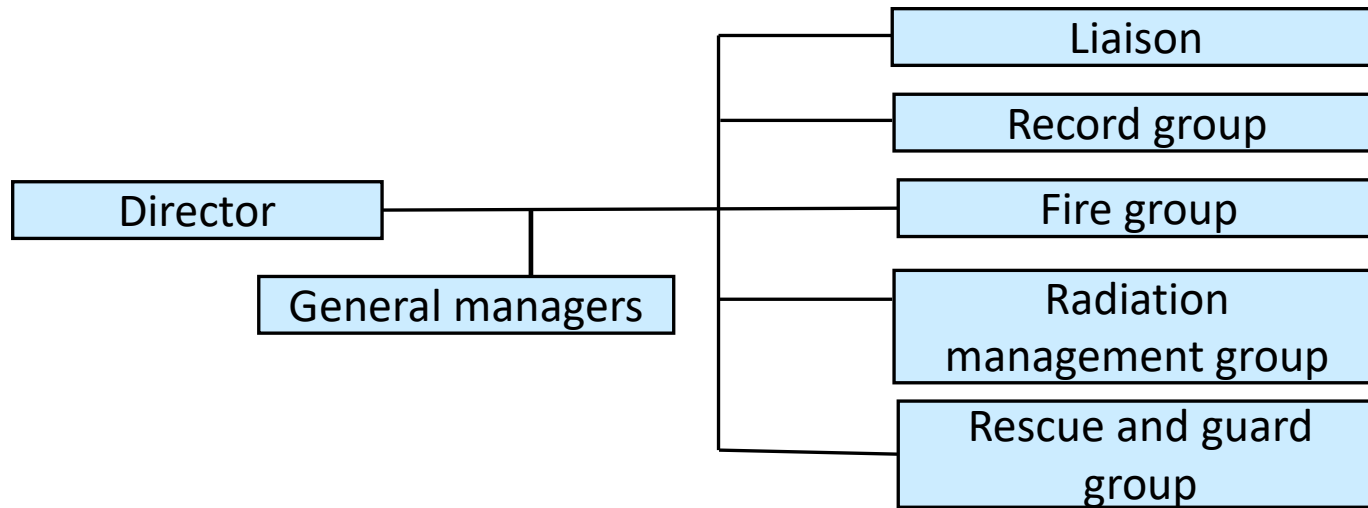
The command post 2 in accident
sight TTR-1

(5) Command post 2

Dispatch of several facility experts at the request from command post 1



(6) Command post 2



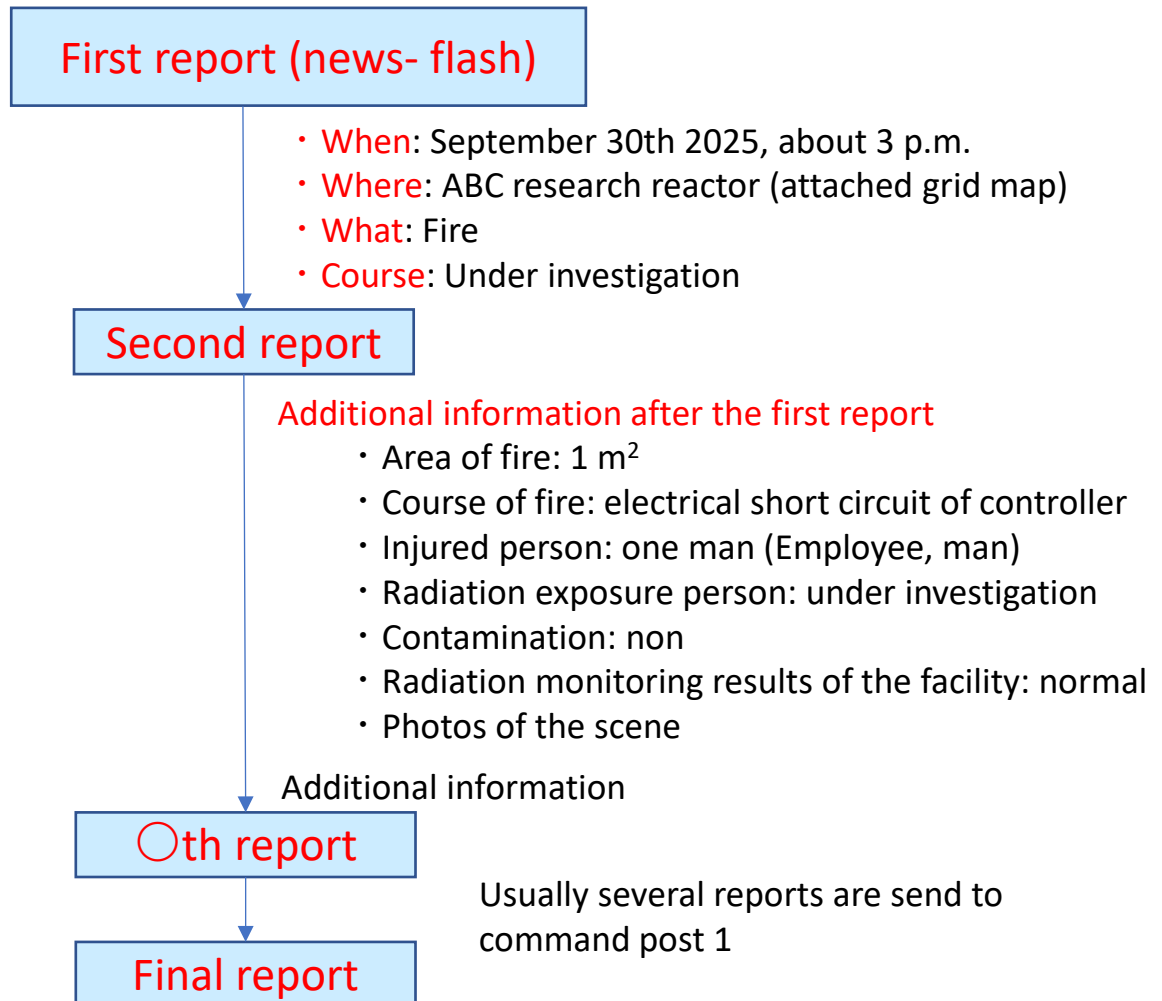
Composition (more than 10 people in total)

Main Task

- Information gathering on the accident
- Effective measures against the accident
- Understanding of the situation

The all information on the accident are owned to command post 1 by TV meeting system.

(7) Command post 2



Transmission of information on the accident
by Facsimile to the command post 1

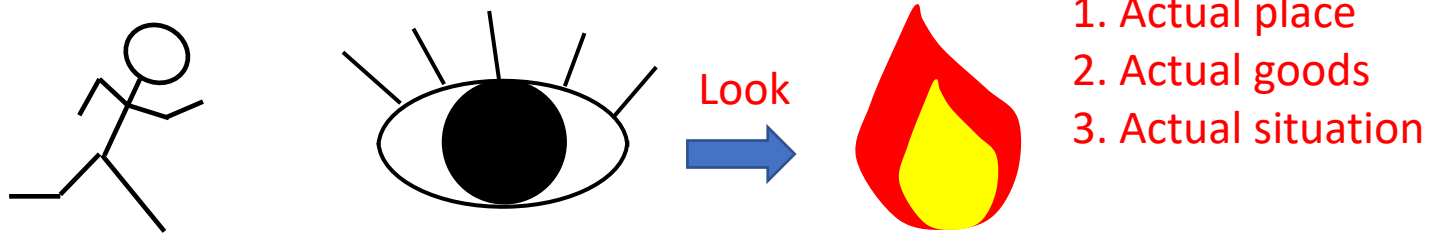
4. The fundamental rules

- for right Judgement and proper measures at the accident facility -

Rule 1 The Three Reals Philosophy

If accident happened, the person in charge of the facility has to go to the accident site, make a direct observation, and determine the facts.

We say that act “the Three Reals Philosophy”.



The person in charge of the facility can give right instructions to his men by the Three Reals Philosophy.

Rule 2 3-way communication

One of **the communication tools** to tell surely the instruction.

Bad communication

- Superior: Stop the reactor.
- Worker: OK. Rector was stopped.
- Superior: All right.

Possibly that operation might be wrong to stop the reactor.

Good communication

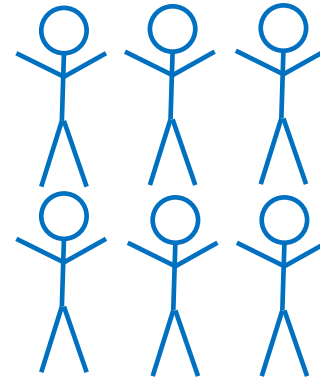
- Superior: Push bottom A to stop the reactor ← **specifically**
- Worker: Push bottom A, right? ← **repeat**
- Superior: Yes.
- Worker: I pushed bottom A. The reactor was stopped just now.
- Superior: Is a stop lamp on? ← **confirmation**
- Worker: Yes, the stop lamp is on now. ← **repeat**
- Superior: All right. Thank you.

5. Press conference

If the accident is serious one and affects society, JAEA usually holds a press conference on the accident at Tokyo and Ibaraki prefecture at the same time.



Presenter



Newspaper reporter

Notice

- The content for press should be **simple**.
- The answer to the question must be according to **Q&A materials only**.
- **Professionally trained person as a presenter** should speak.

6. Q&A material (Question and answer) for press conference

The presenter should answer the question from a news reporter according to Q&A material made together experts of the facility.

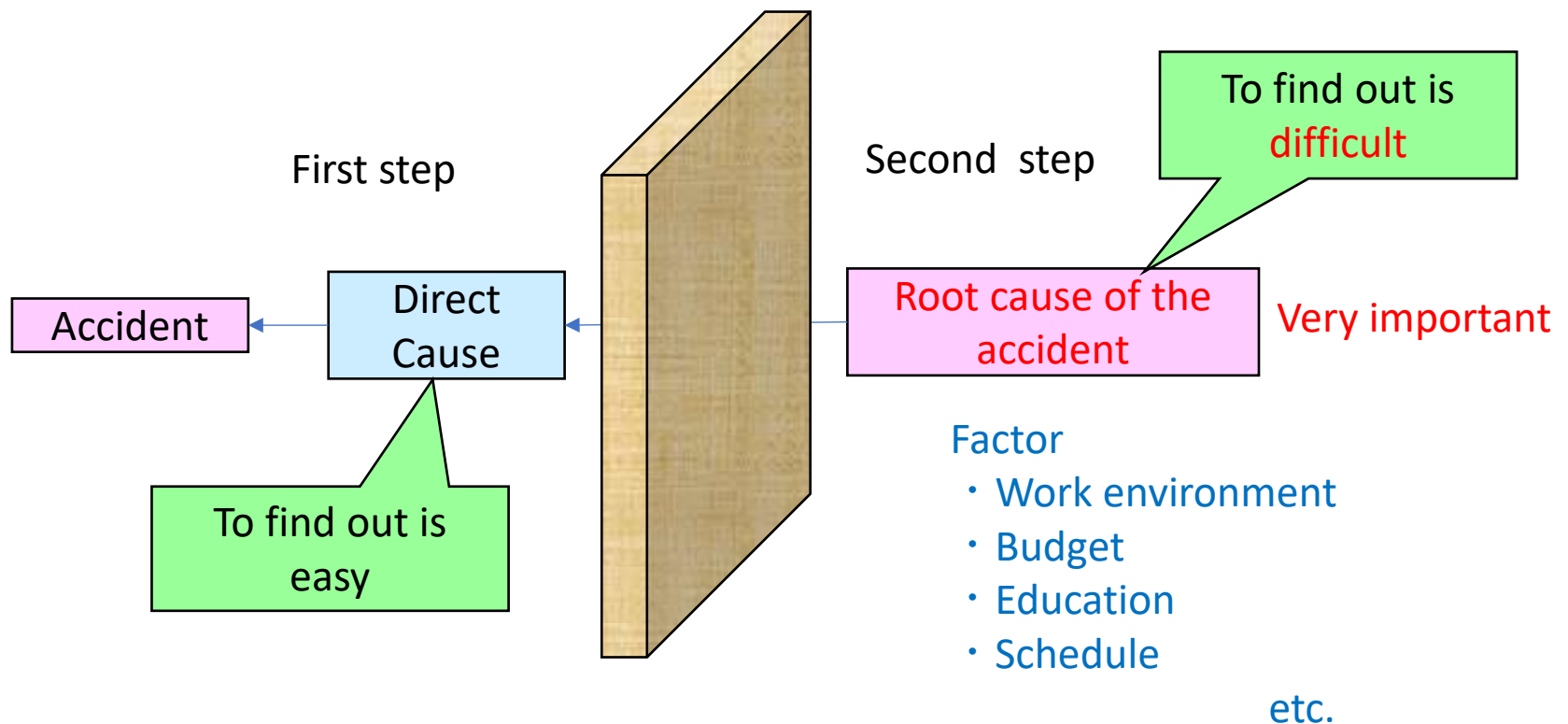
Q&A material should contain expected many questions for that reason.

For example

- Summary of the accident
- Completion of the facility: May 1960
- Purpose: irradiation of materials
- Specification of A-1: 10MW, U metal fuel, . . .
- Today's work: irradiation of the materials of ABC company from 13:00 to 17:00
- The latest inspection: April 10th 2024
- Released nuclide: Cs-137
- Released activity : under consideration
etc.

7. Cause analysis

Institute usually investigates the cause of the accident thoroughly. Especially **the root cause is the most important** than the direct cause.



(1) How to find out the background of the accident.

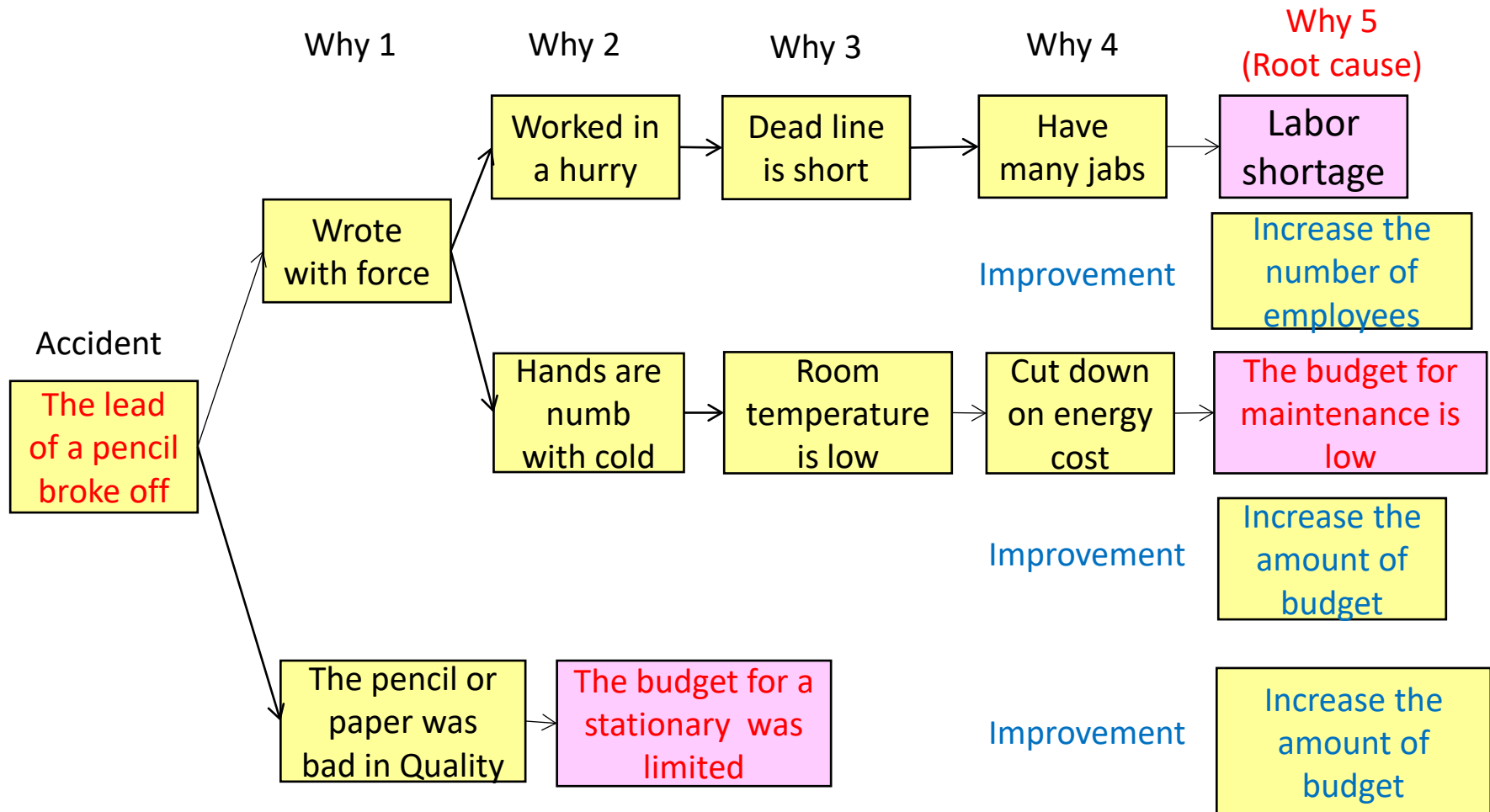
The root causes are hiding behind the direct one, so it is very difficult to find out the root one.

Many kinds of tools to find out the root cause for that purpose have worked out.

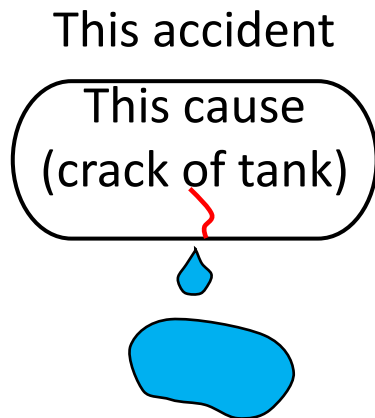
Especially “**Why-why analysis**” (in other words, “Root Cause Analysis”, or “Five Ways”) is one of the most effective analytical methods for identifying the root causes of accident.

So JAEA and another company often use the “Why-why analysis”.

(2) Typical example of “why-why analysis”

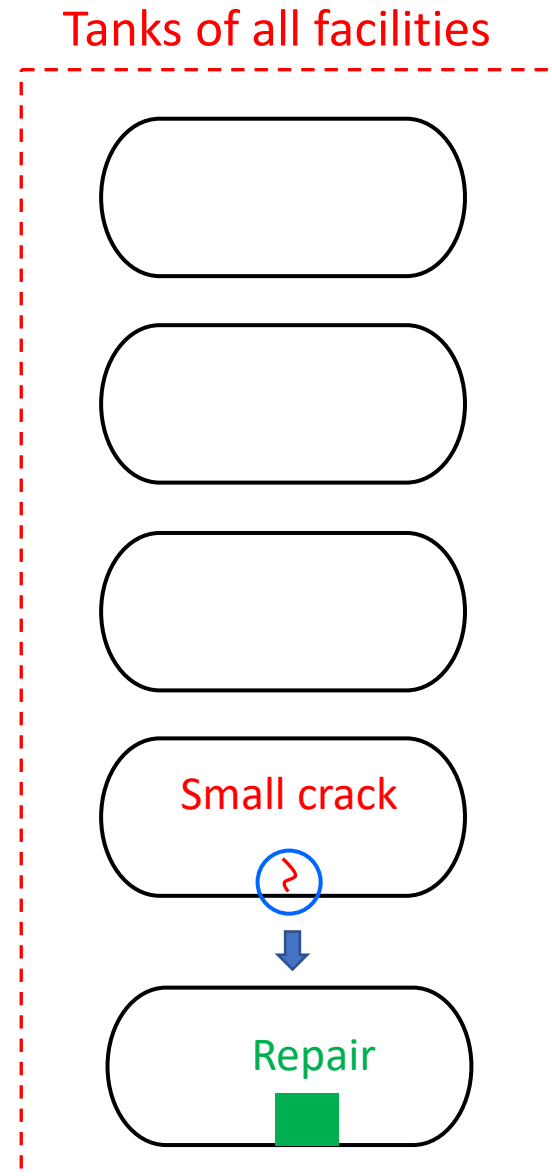


8. Roll out



JAEA investigates if
other tanks have the
same crack or not

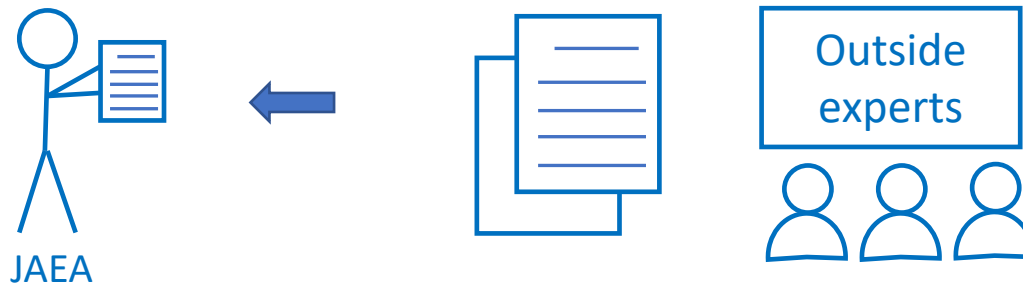
Preventive
maintenance



9. Formation of the committee composed of outside experts

If the accident is serious one and have a significant impact on society, JAEA forms **the committee composed of outside experts**.

The committee will make a recommendation to JAEA.



10. Activities to foster a Nuclear Safety culture

Activities to foster a Nuclear Safety Culture on JAEA or Nuclear power station are mainly based on daily occupational safety.

For example

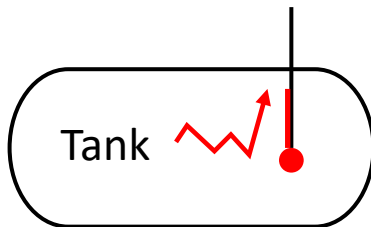
- ① On-site Safety Patrols by Administrator
- ② Extraction of Near miss
- ③ Learning on Past Accident Case
- ④ Exchange of Opinion

(1) Extraction of minor incident

Safety culture activity on JAEA or Nuclear power station are mainly based on daily occupational safety.

To keep accidents as low as possible, JAEA conducts minor incident reports. And the reports were shared among the workers.

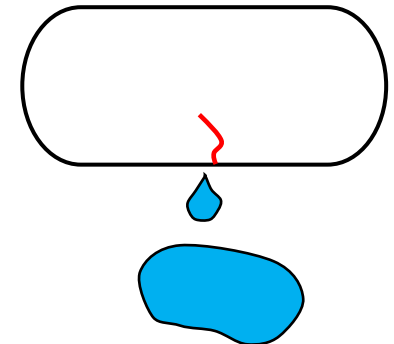
Slight fluctuation
in temperature
or flow rate



Unusual sound
from machines

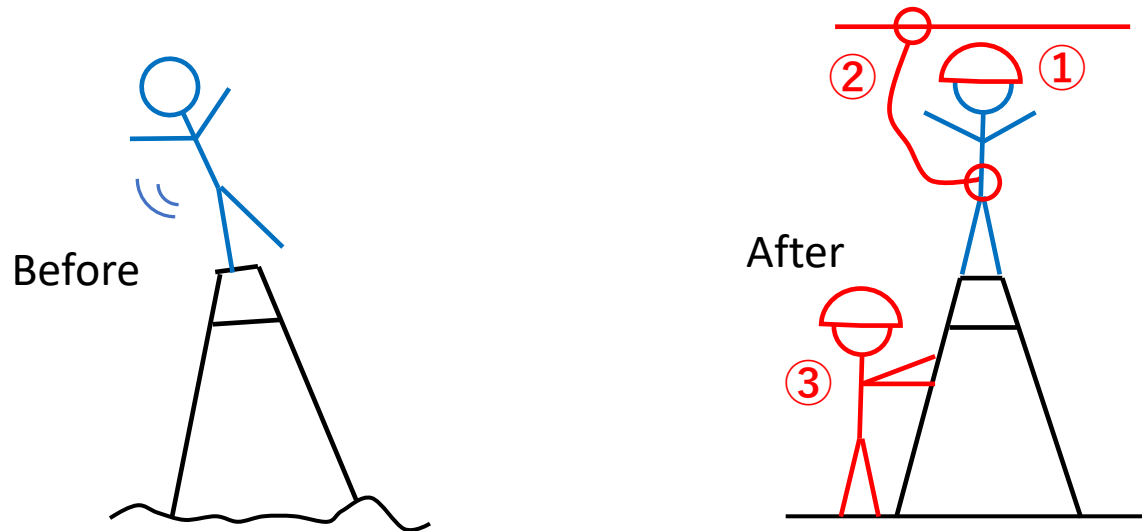


Leak of oil from
machines



(2) Evaluation for job risk

We evaluate the job risk and take measures against the risk before the job.



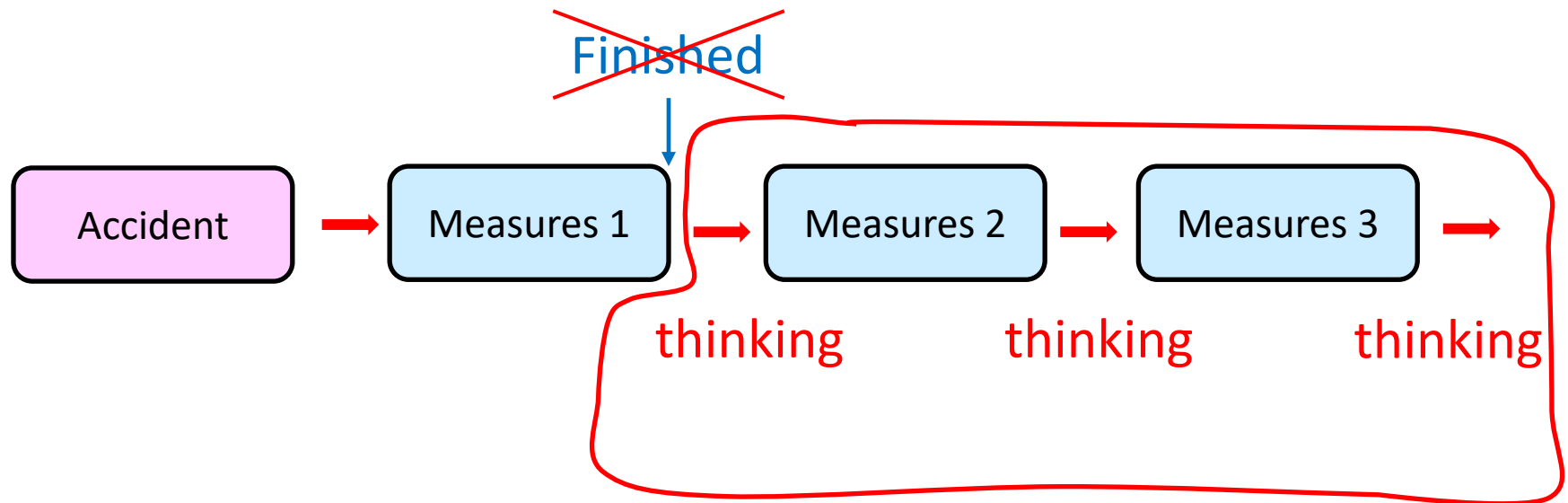
- Inspection

Safety chief has to go checking the job being safe at the scene.

(3) Reduction of safety risk

We usually take measures against an accident.
But the measures are not complete.

We must always have been thinking about other better measures to reduce the risk. This process is important.



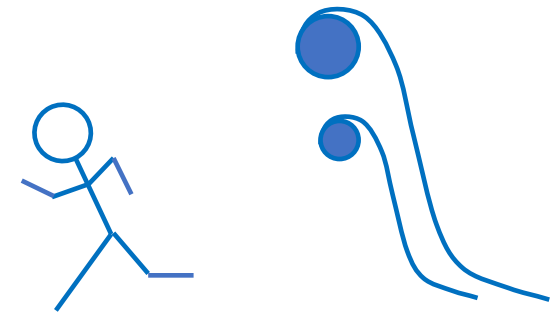
Magnitude of risk

11. Drill, training, and education

(1) Drills

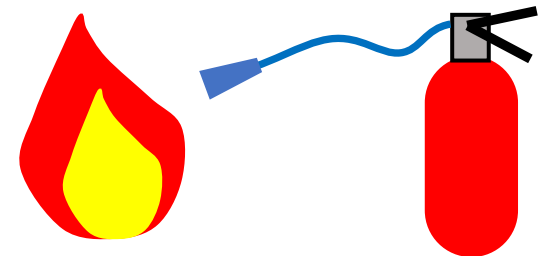
(1) In Nuclear Science Research institute of JAEA

- Integrated drill
- Integrated drill under prefecture
- Drill of protection team
- Evacuation drill for huge earthquake and TSUNAMI
- Drill at the training center of another company



(2) At each facility

- Drill of protection team
- Fire drill
- Reporting drill by telephone



(2) Training

- Training for press conference
The training contains clothes, posture, attitude and how to speak of presenter.

(3) Education

- Succession of the past trouble cases in JAEA.
- Information sharing on the latest trouble of the nuclear power plants.



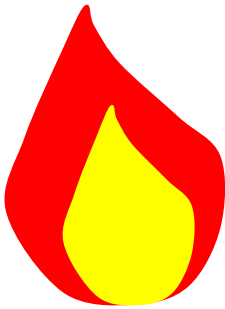
Integrated emergency drill

The all participants wear helmets and pinnies (bibs). The pinnies color such as orange, blue, white, yellow are decided depending on the role.

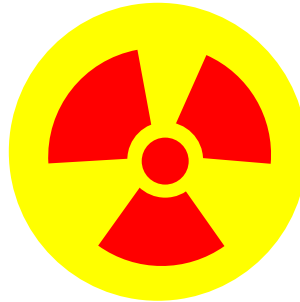


12. Basic behaviors for troubles

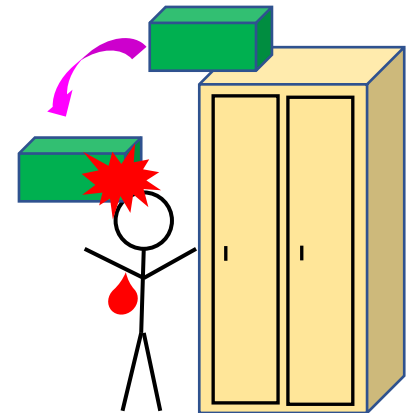
All facilities have prepared scenarios for each accident.



Fire accident



Radiation accident



Injury accident

Employees have gained knowledges in the basic behaviors through the drill based on the scenarios.

13. Emergency response of JAEA for Fukushima accident

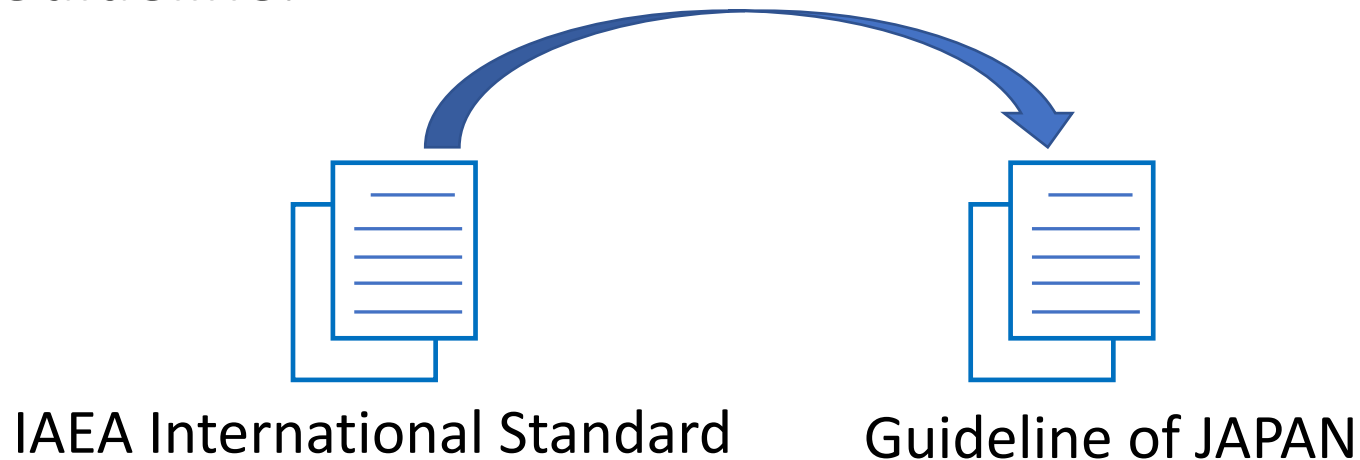
1. **Dispatching of nuclear engineering specialists** to government, prefecture, and Tokyo electric power company.
2. **Environmental monitoring** in Fukushima area.
3. **Mapping of environmental data** accumulated from all over Japan at government.
4. **Body survey** for residents of Fukushima.
5. **Cesium absorption test** for absorbent, zeolite.
6. **Analysis** of the environmental samples collected at Fukushima.
etc.

II. Nuclear Emergency Preparedness and Response in Japan after the Accident of Fukushima Daiichi Nuclear Power Station

1. Nuclear Emergency Response

Nuclear disaster prevention system of Japan was greatly revised after the accident of Fukushima Daiichi Nuclear Power Station.

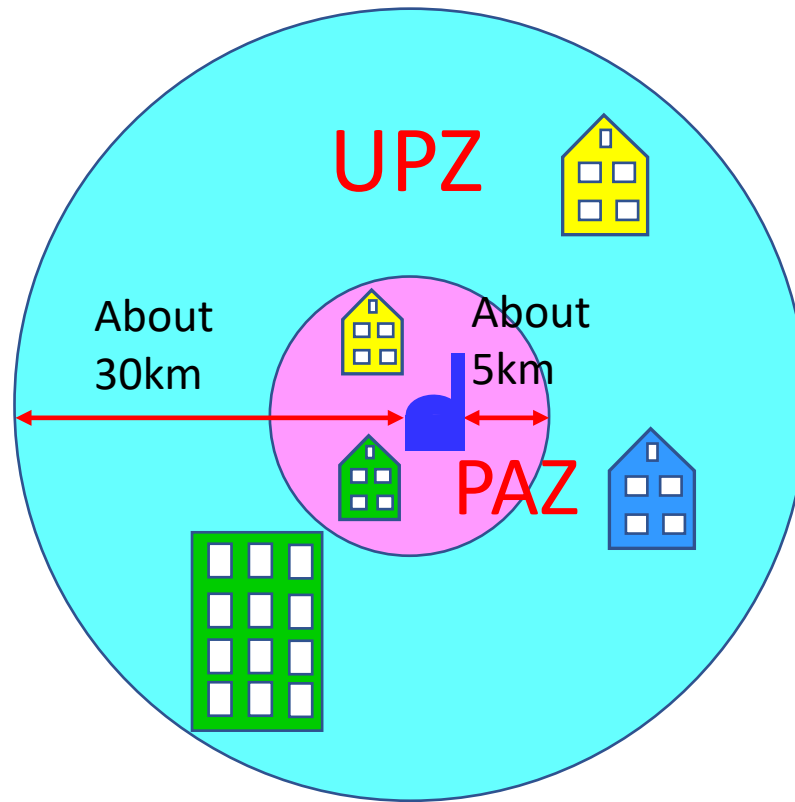
IAEA International Standard on Nuclear Emergency Response was incorporated into the Guideline.



2. Emergency Zones

Two kinds of Emergency Zones, such as PAZ (Precautionary Action Zone) and UPZ (Urgent Protective Action Planning Zone) in proportion to the distance from Nuclear Power Station have to decide in advance.

Further more, the behavior of citizens has to decide in advance too.

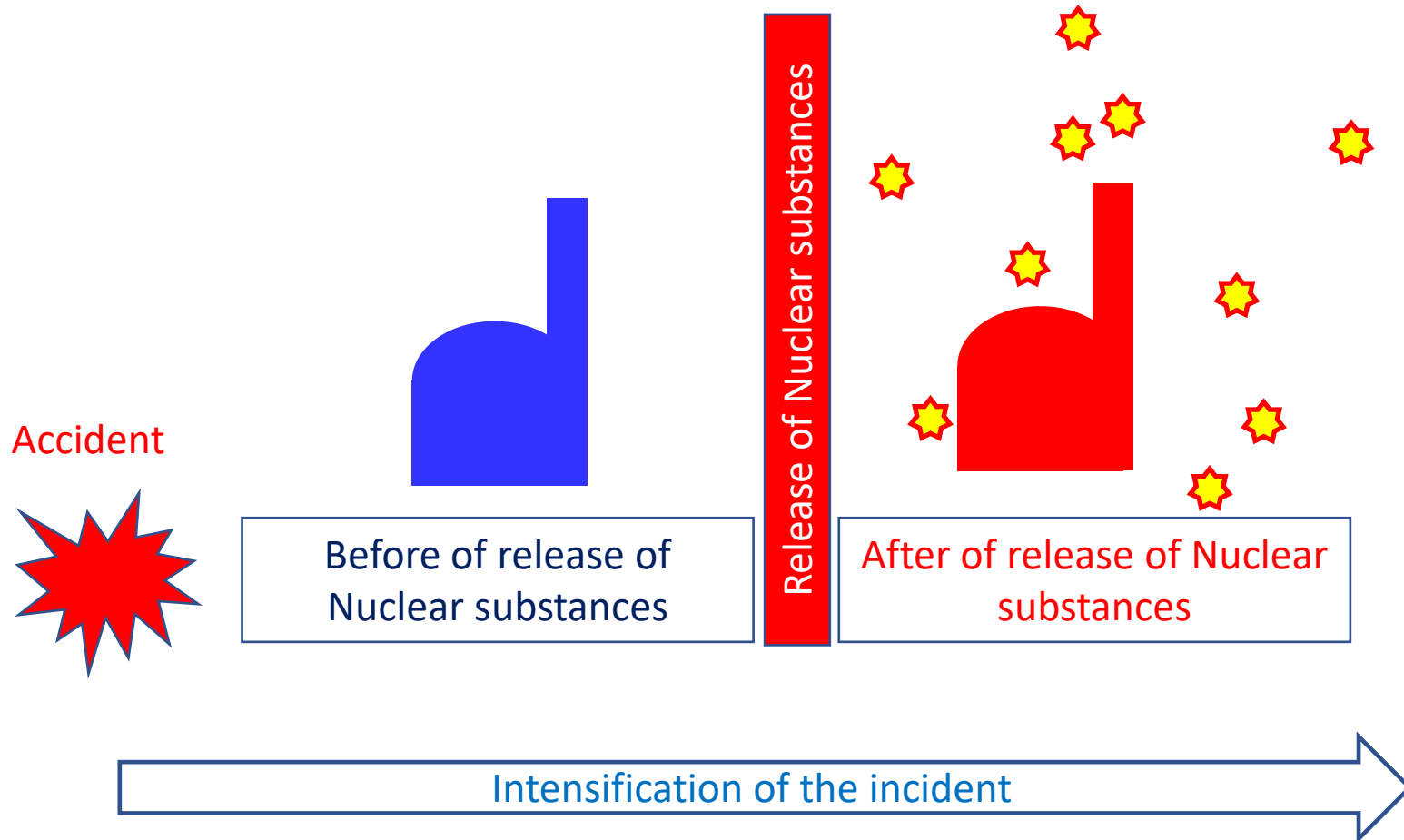


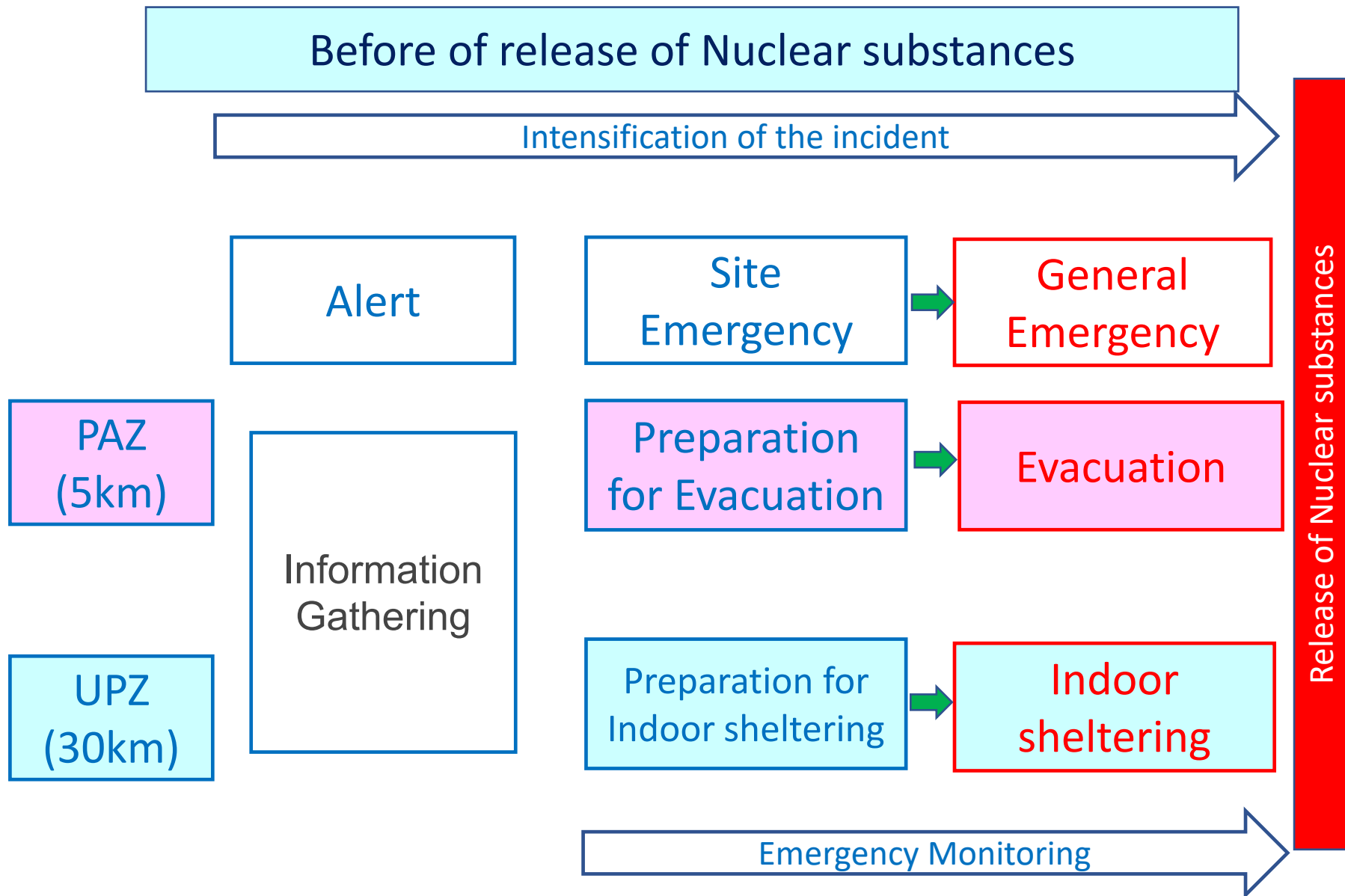
Off-site emergency zones and area size
(Case of Nuclear Power Station)

3. Emergency Zones of other facilities

	PAZ	UPZ
Nuclear Power Station	5km	30km
Research Reactor	—	5km(Max.)
Fabrication Facility	—	5km(Max.)
Reprocessing Facility	—	5km

Radioactive Substances





Protective Measures(Step 1)

4. Emergency Radiation Monitoring in UPZ zone

First the citizens living in UPZ zone (30 km) have to stay in a house or a building to prevent to internal and external exposure.

Next emergency radiation monitoring in UPZ will be carried out by government as soon as possible. And according to the air radiation dose level, the citizens are plan to evacuate to outside the UPZ.

After of release of Nuclear substances

Intensification of the incident

PAZ
(5km)

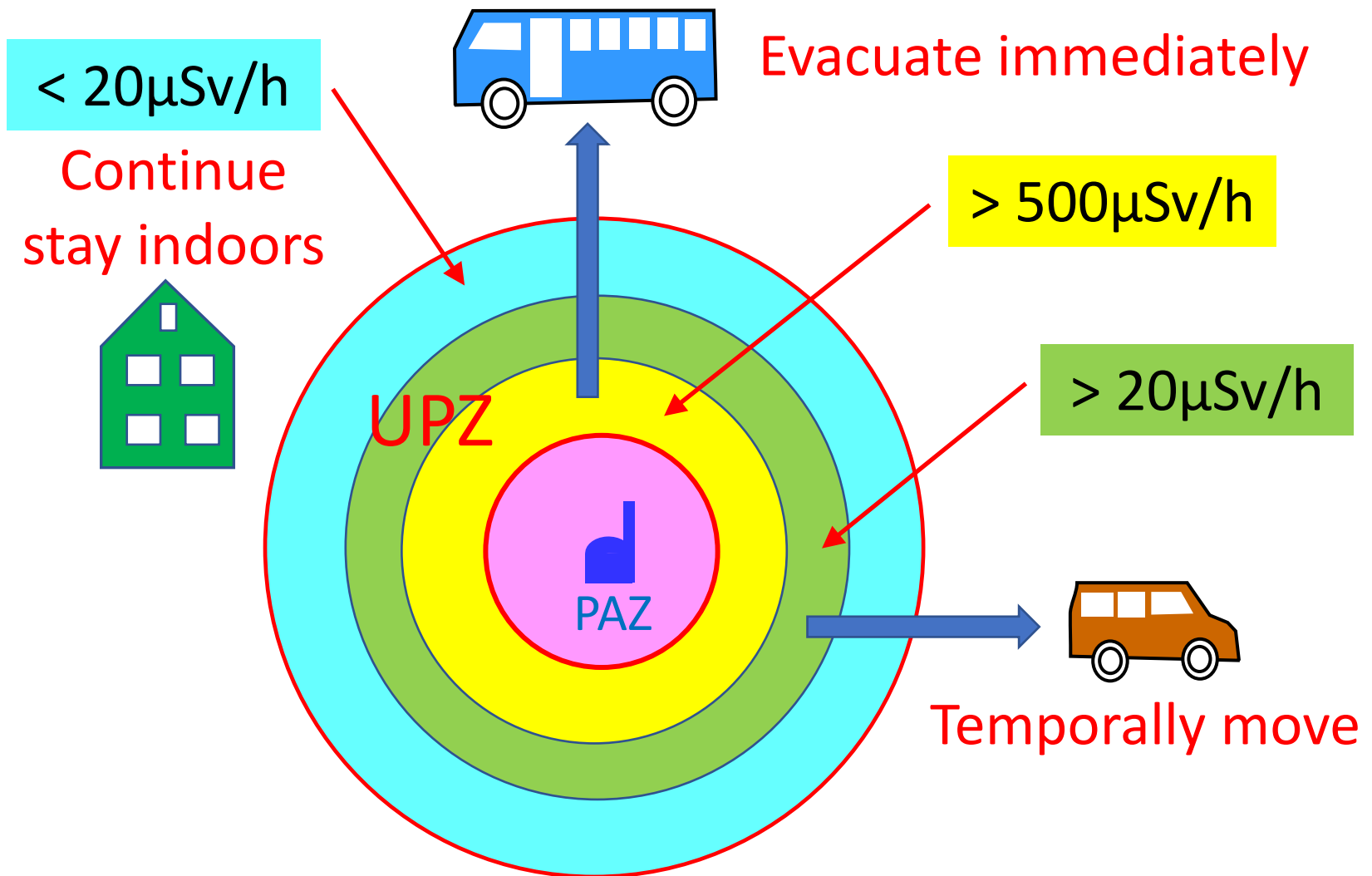
UPZ
(30km)

Release of Nuclear substances

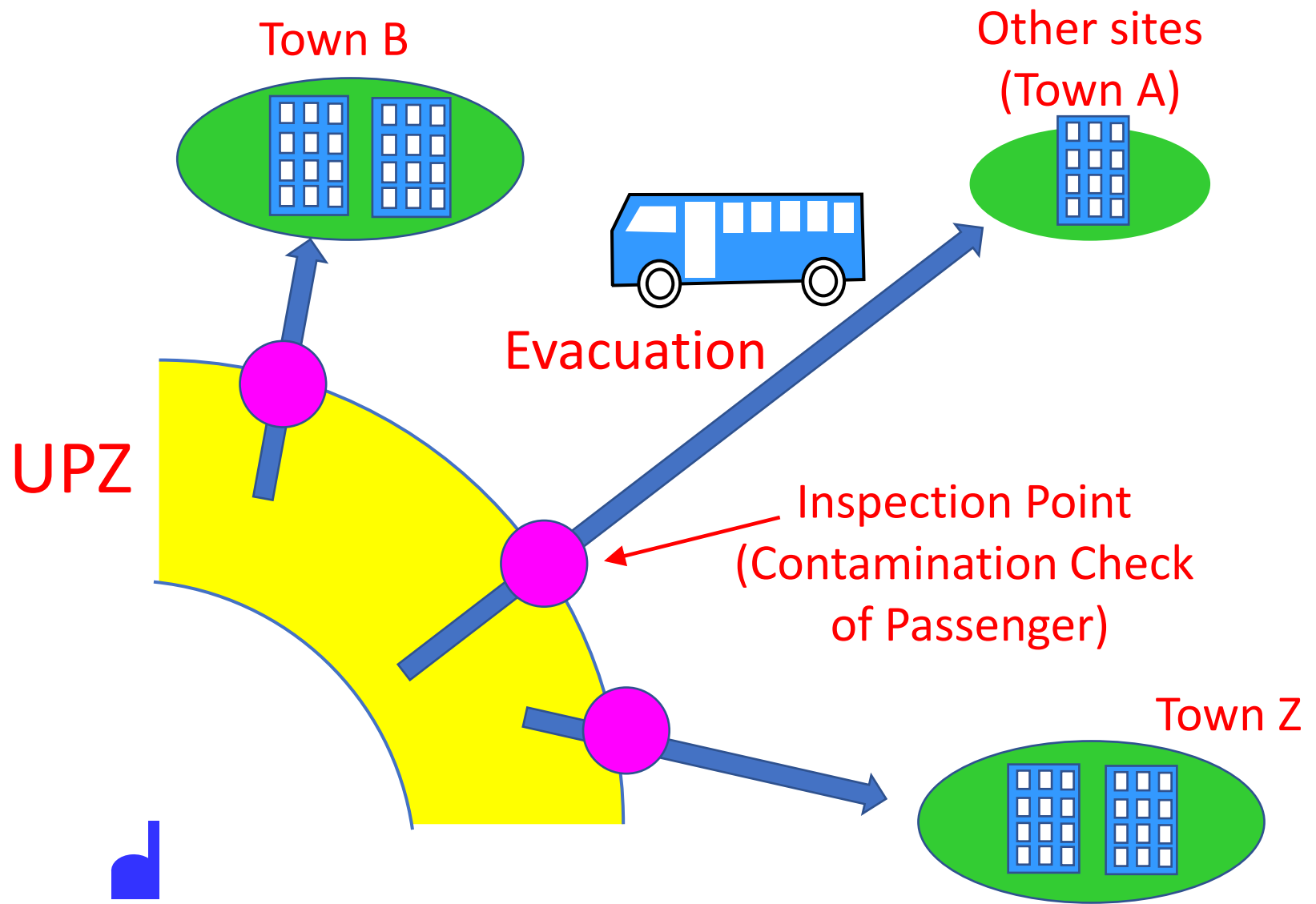
Rate of air radiation dose	Protective measures
> 500 μ Sv/h	Evacuate immediately
> 20 μ Sv/h	Temporally move
< 20 μ Sv/h	Continue stay indoors

Emergency Monitoring

Protective Measures (Step 2)



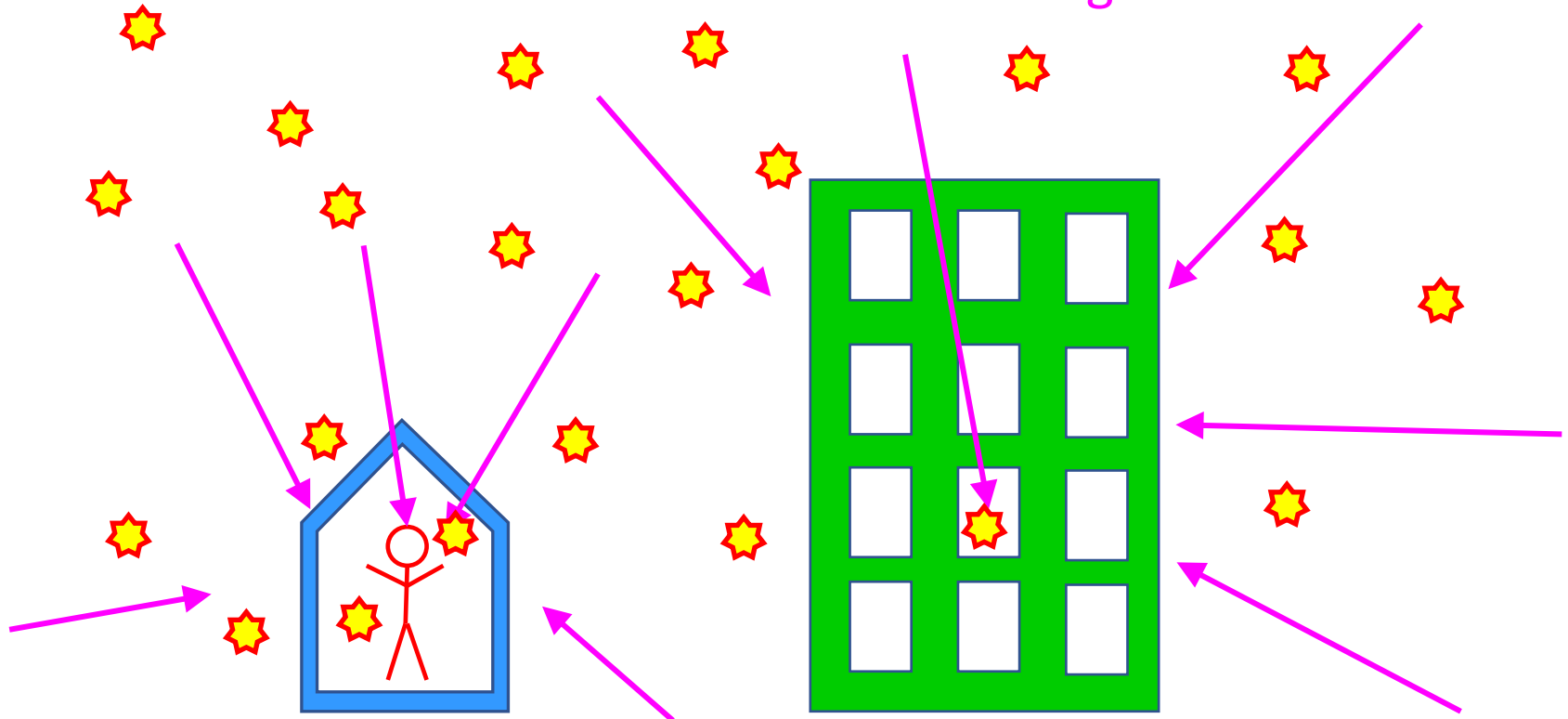
Off-site Emergency Zones and Area Size



Evacuation Inspection and Shelter

Radioactive Substances

Radiation from Radioactive Plume
or Surrounding Environment



Wooden House

Concrete Building

- Internal exposure: Down 75%
- External exposure: Down 10~60%

- Internal exposure: Down 95%
- External exposure: Down 40~80%

Effect of Indoor Shielding

5. Important problems

(1) The citizens living in the PAZ or the UPZ are hundreds of thousands of people.

It is important to obtain in advance the required towns and facilities where all the citizens in the emergency zones can evacuate.

(2) It is important to get ready for a means of transportation such as bus for all the citizens too.

III. Conclusions

If accident happens, the accident keeps us busy for a long time.

So it is best not to cause accident according to examination and maintenance of apparatus, education, drill, and training.

I know very well “the accident keeps us busy” because I have experienced a lot of accidents so far.

So be careful not to cause an accident.

Terima kasih

