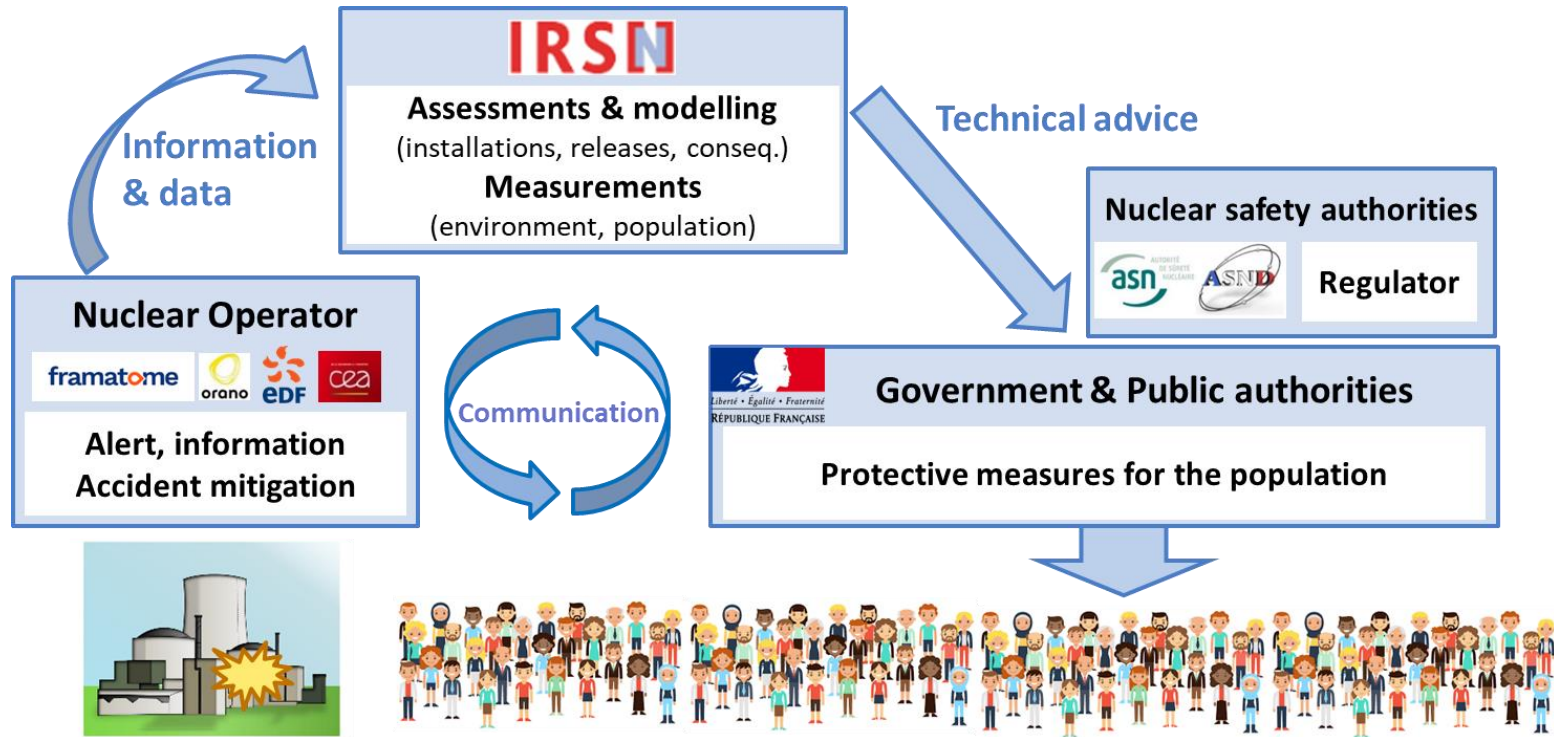


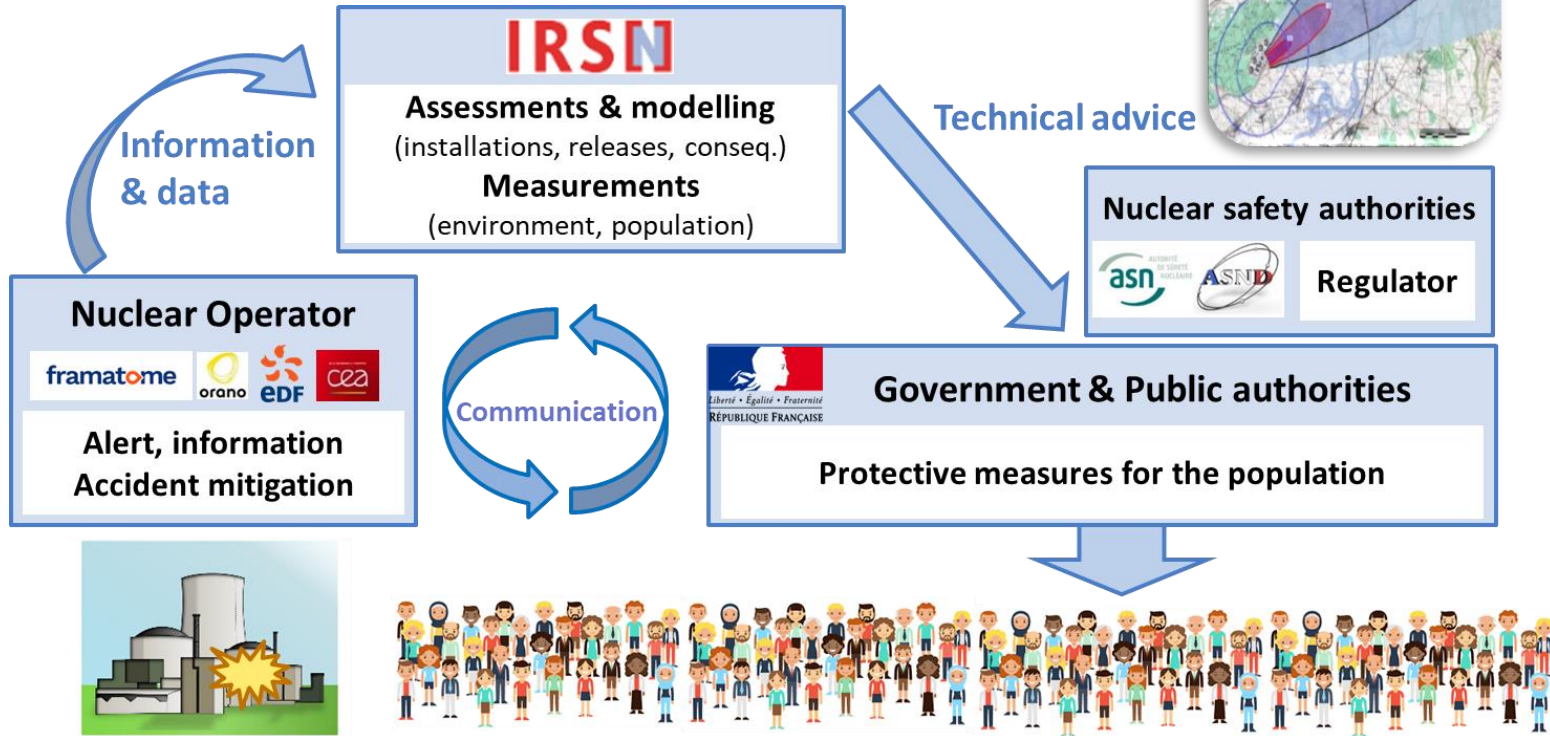
IRSN PROGRESS ON EMERGENCY PREPAREDNESS AND RESPONSE IN CASE OF CRITICALITY ACCIDENT

Julien Rannou , Gaël Loubert
Speaker: Gabriel Frontier

French National Emergency Response System



French National Emergency Response System



IRSN's Emergency Response Organization

EMERGENCY TECHNICAL CENTRE

Nerve centre of IRSN's emergency response

Emergency
Director



Direction Unit
(technical advises/recommendations)

Communication
Unit

Facility assessment Unit
(state/source term)

International
relations

Radiological consequences assessment Unit
(air/ground contamin., doses)

Health unit

Logistic support Unit

- 50 people dedicated to emergency preparedness
- 400 experts trained for emergency response
- 35 on call each week

MOBILE EMERGENCY RESOURCES



In the field operations

- Environment measurements (1,200/day)
- Health means (2,400 controls/day)

NETWORK REAL-TIME MONITORING

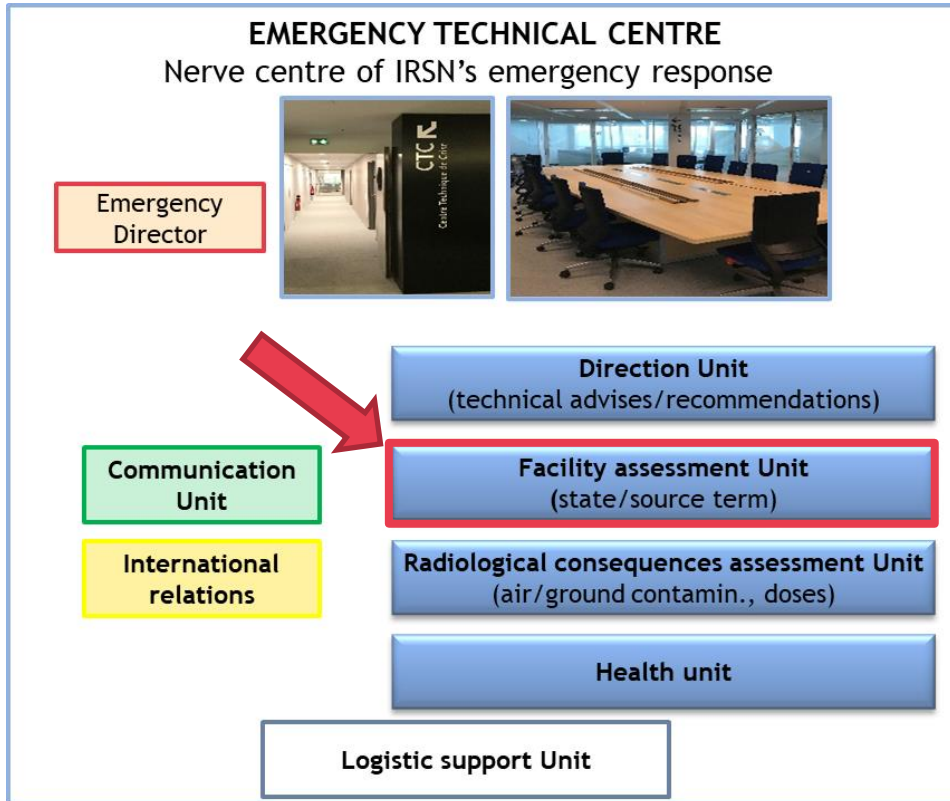
446 gamma stations
40 aerosols



LABORATORIES



IRSN's Emergency Response Organization



- 50 people dedicated to emergency preparedness
- 400 experts trained for emergency response
- 35 on call each week

MOBILE EMERGENCY RESOURCES



In the field operations

- **Environment** measurements (1,200/day)
- **Health means** (2,400 controls/day)

NETWORK REAL-TIME MONITORING

446 gamma stations
40 aerosols



LABORATORIES



Recruitment, training and practise of the criticality specialist

Selection among the criticality
safety specialists pool

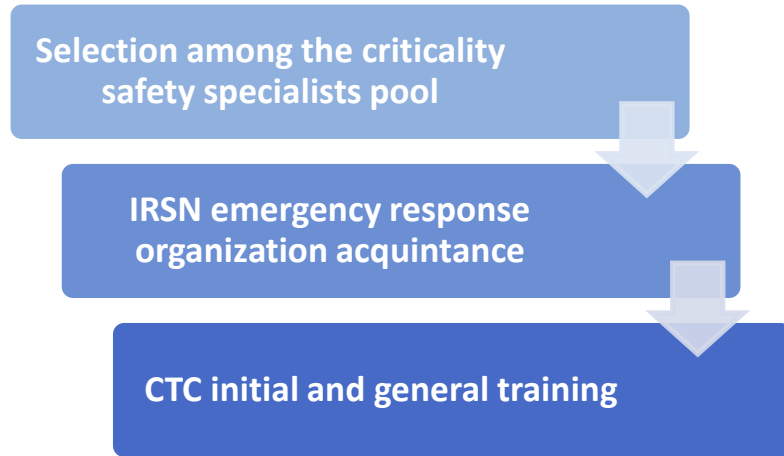
Recruitment, training and practise of the criticality specialist

Selection among the criticality
safety specialists pool

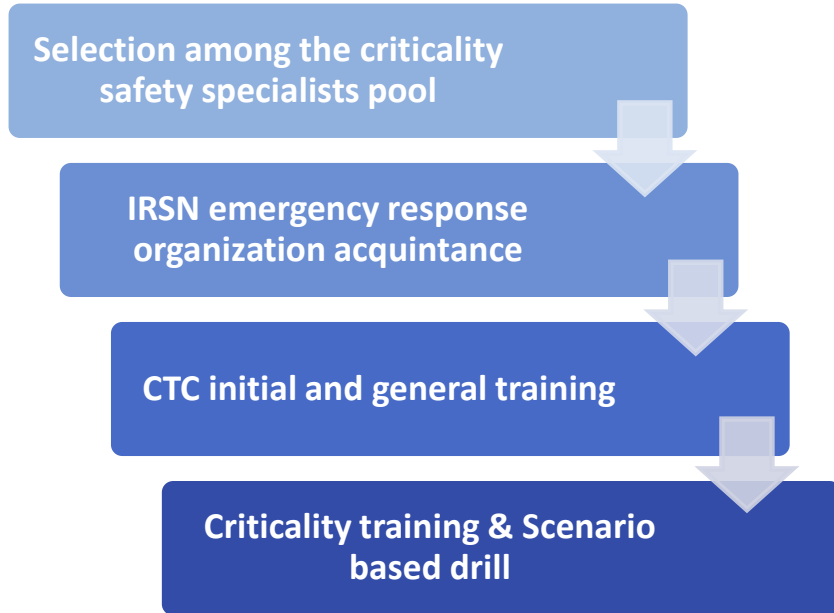
```
graph TD; A[Selection among the criticality safety specialists pool] --> B[IRSN emergency response organization acquaintance];
```

IRSN emergency response
organization acquaintance

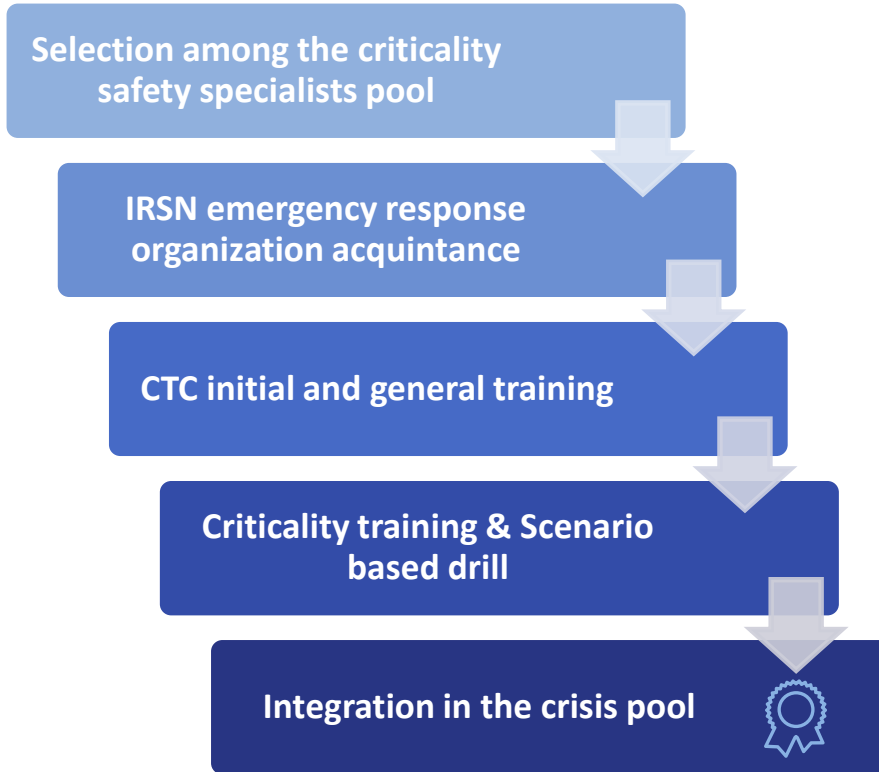
Recruitment, training and practise of the criticality specialist



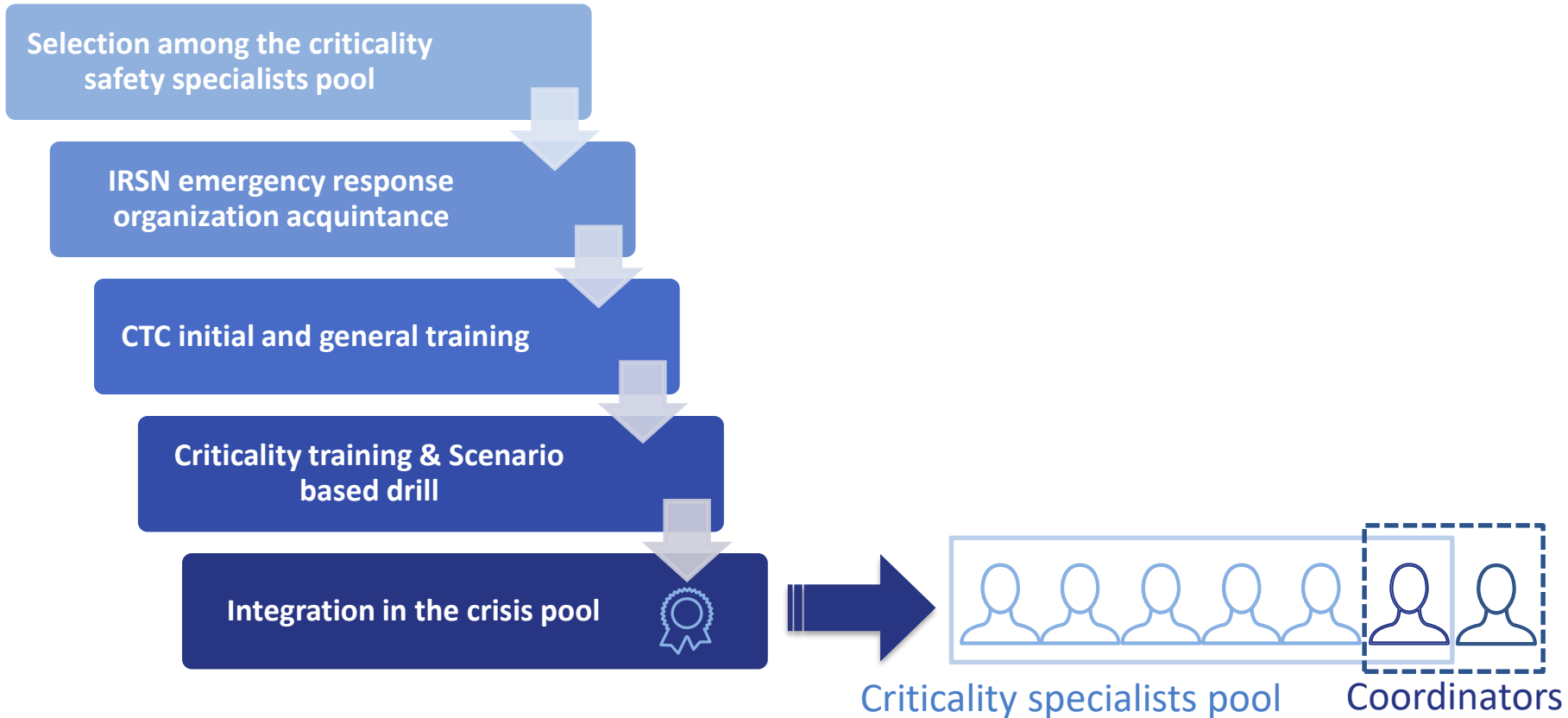
Recruitment, training and practise of the criticality specialist



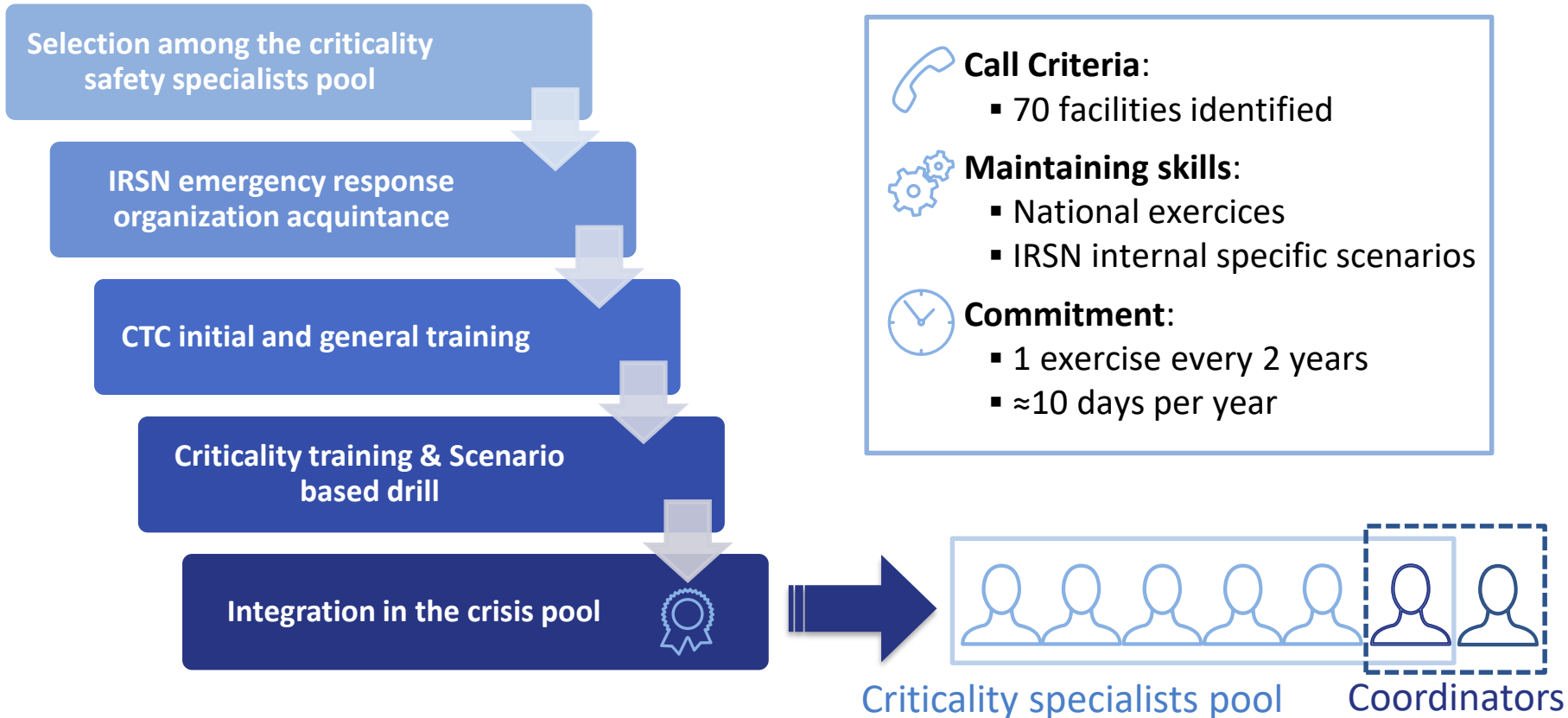
Recruitment, training and practise of the criticality specialist



Recruitment, training and practise of the criticality specialist

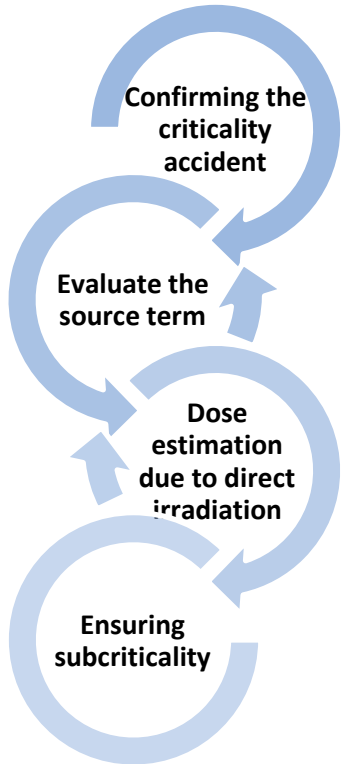


Recruitment, training and practise of the criticality specialist



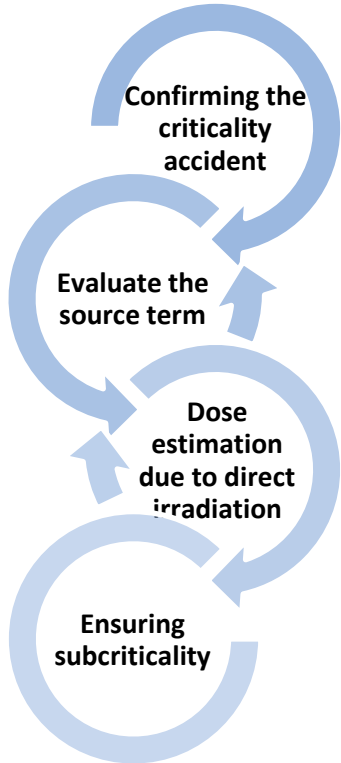
Emergency situation with a criticality accident

Key milestones



Emergency situation with a criticality accident

Key milestones



Immediate resources



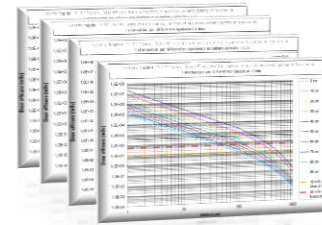
Criticality Specialist guide



Typical accident sheets



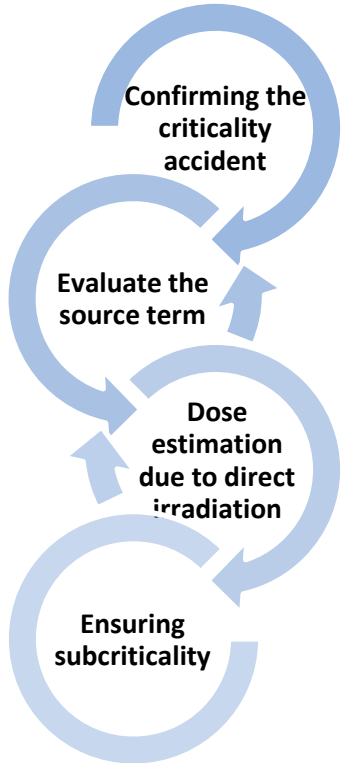
Number of fissions estimation models



Direct reading abacuses

Emergency situation with a criticality accident

Key milestones



Immediate resources



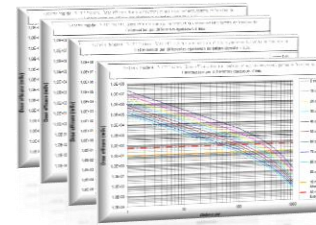
Criticality Specialist guide



Typical accident sheets

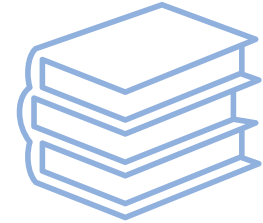


Number of fissions estimation models

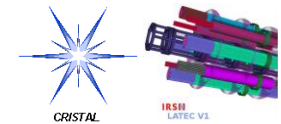


Direct reading abacuses

Other tools & resources

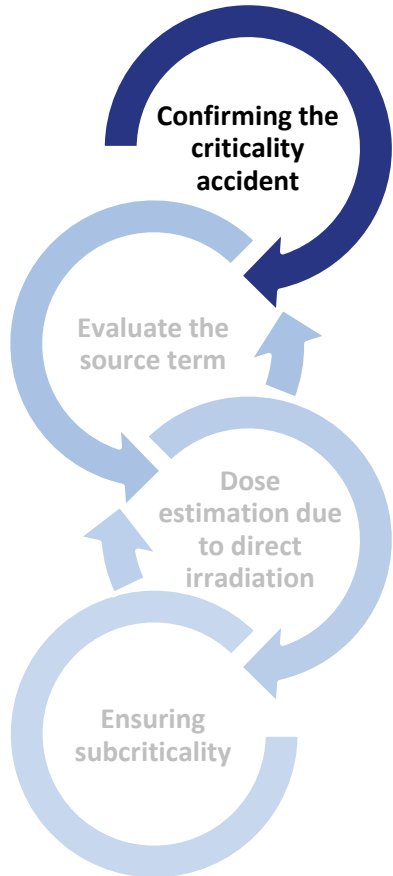


Facility documentation

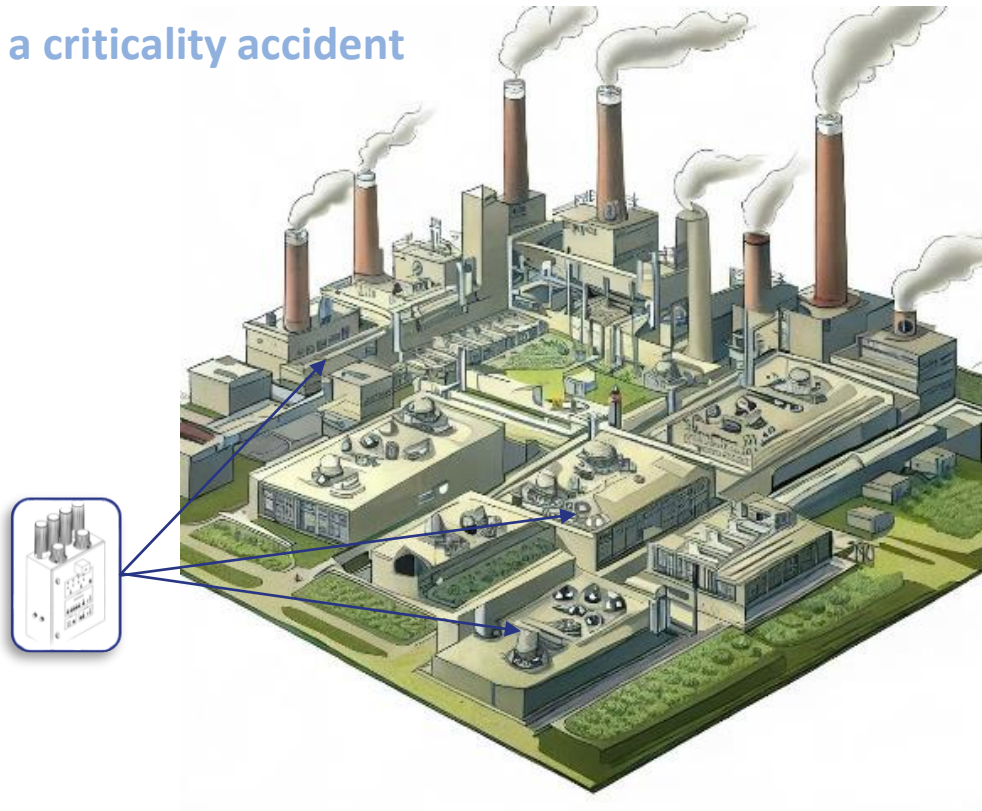
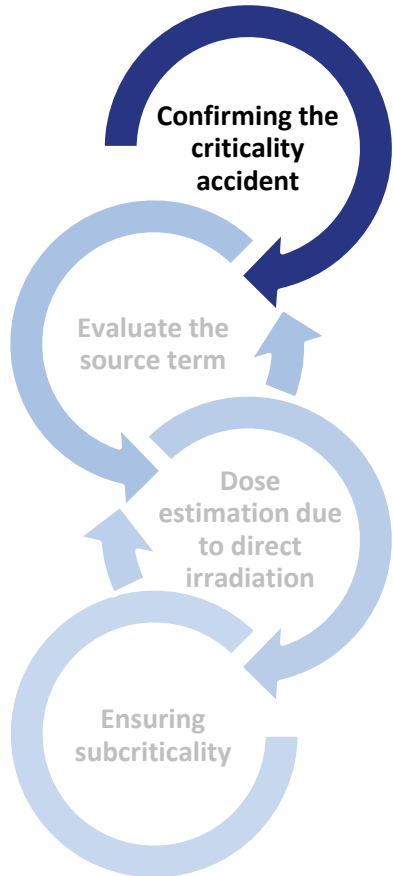


Calculation tools

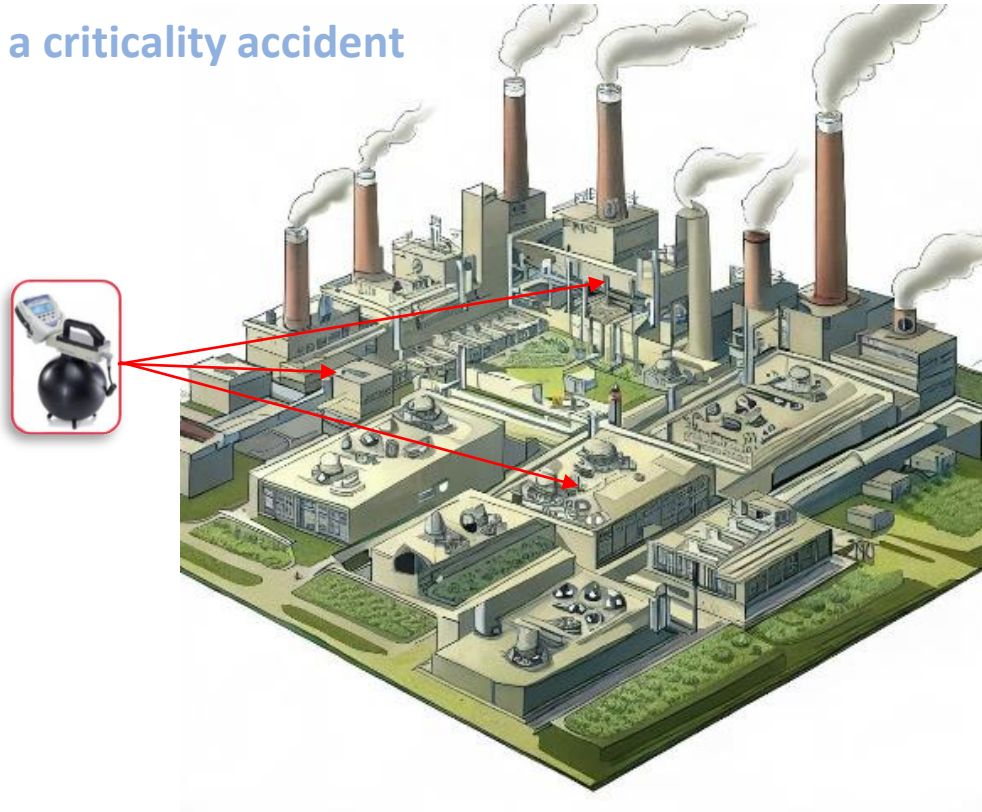
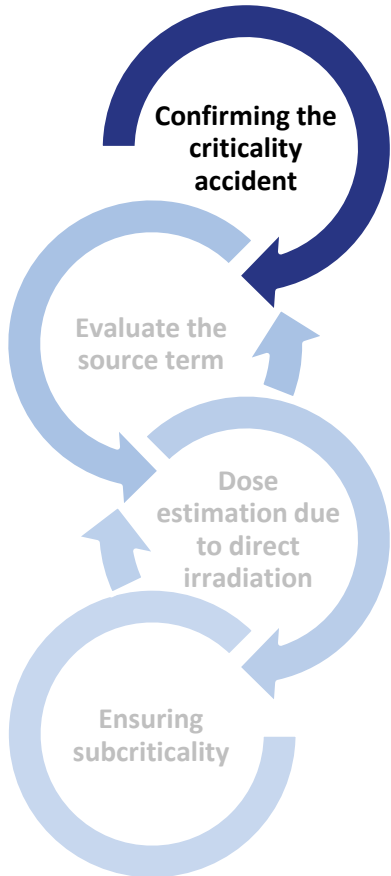
Emergency situation with a criticality accident



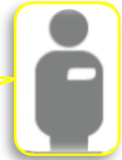
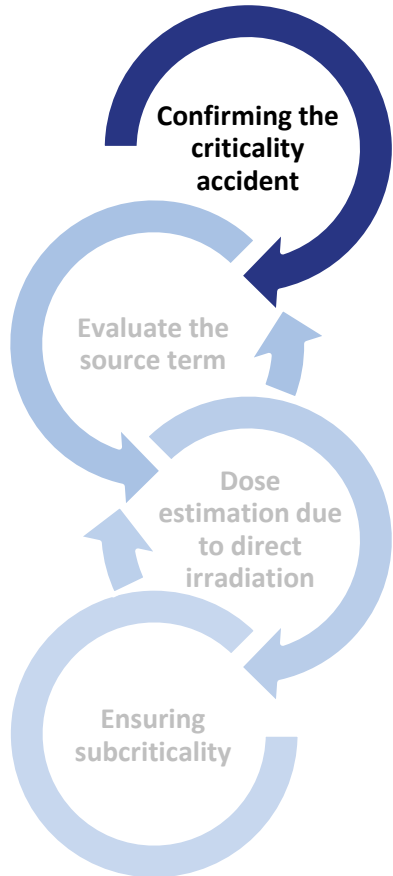
Emergency situation with a criticality accident



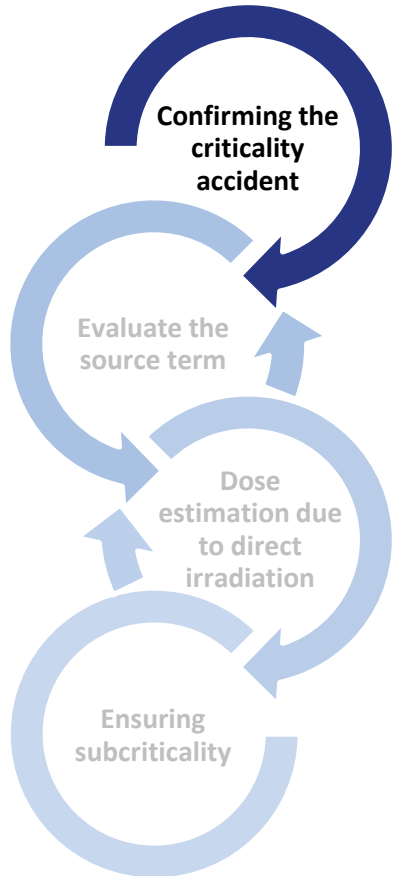
Emergency situation with a criticality accident



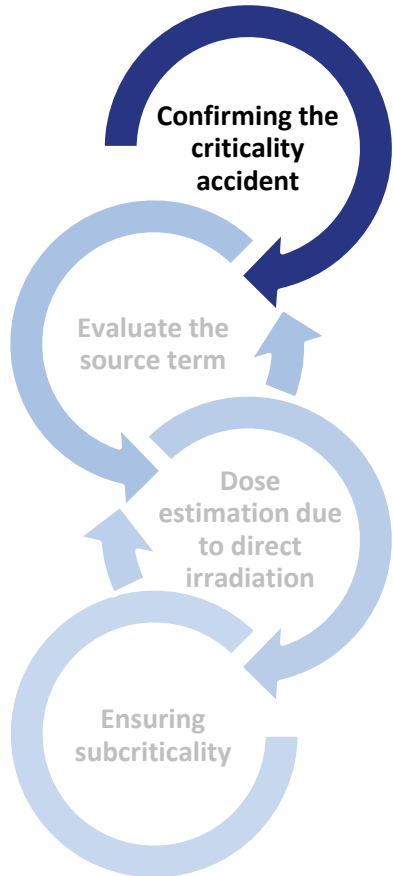
Emergency situation with a criticality accident



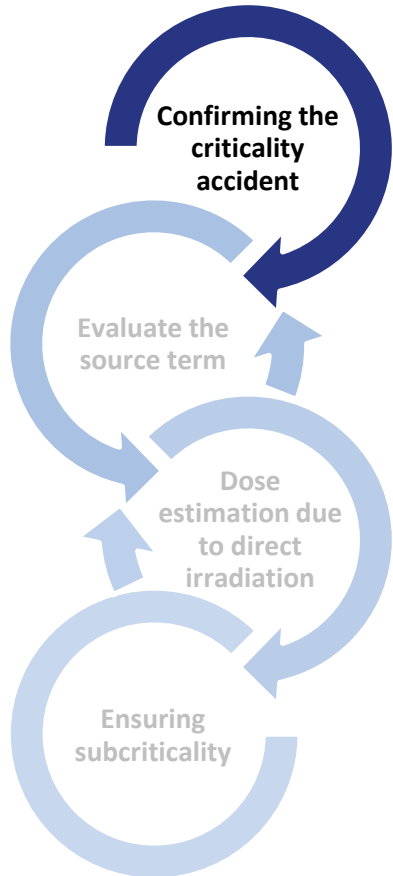
Emergency situation with a criticality accident



Emergency situation with a criticality accident

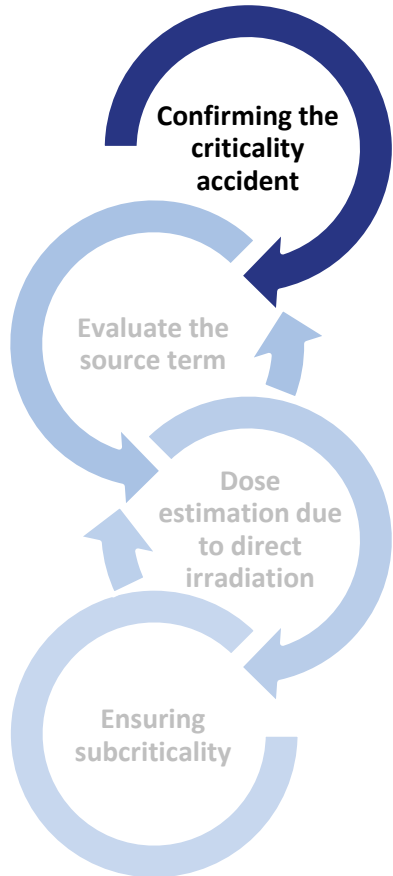


Emergency situation with a criticality accident



Diagnosticate the state of the facility

Emergency situation with a criticality accident



Diagnosticate the state of the facility



Accident location?

Emergency situation with a criticality accident

Confirming the criticality accident

Evaluate the source term

Dose estimation due to direct irradiation

Ensuring subcriticality



Sheets for specific type of criticality accident

- Plutonium solution
- Dissolution of spent fuels
- Solid plutonium metal
- Plutonium powder
- Fuel rods in water

Emergency situation with a criticality accident

Confirming the criticality accident

Evaluate the source term

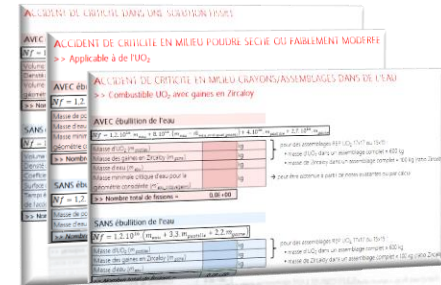
Dose estimation due to direct irradiation

Ensuring subcriticality



Sheets for specific type of criticality accident

- Plutonium solution
- Dissolution of spent fuels
- Solid plutonium metal
- Plutonium powder
- Fuel rods in water



Number of fissions estimation models

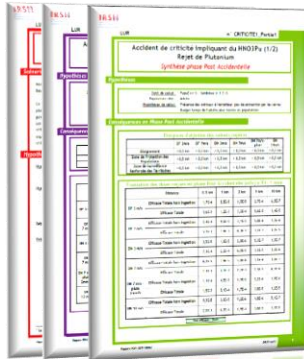
Emergency situation with a criticality accident

Confirming the criticality accident

Evaluate the source term

Dose estimation due to direct irradiation

Ensuring subcriticality

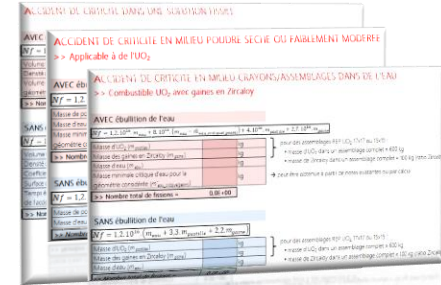


Sheets for specific type of criticality accident

- Plutonium solution
- Dissolution of spent fuels
- Solid plutonium metal
- Plutonium powder
- Fuel rods in water



Source term



Number of fissions estimation models

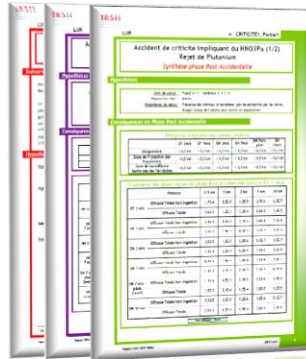
Emergency situation with a criticality accident

Confirming the criticality accident

Evaluate the source term

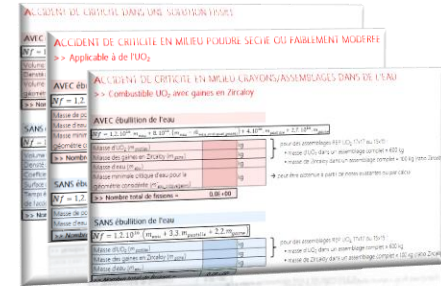
Dose estimation due to direct irradiation

Ensuring subcriticality



Sheets for specific type of criticality accident

- Plutonium solution
- Dissolution of spent fuels
- Solid plutonium metal
- Plutonium powder
- Fuel rods in water



Number of fissions estimation models

Effective dose due to fission products from a nitrate plutonium solution, normalised to 5.10^{18} fissions, 500 m from the release point:

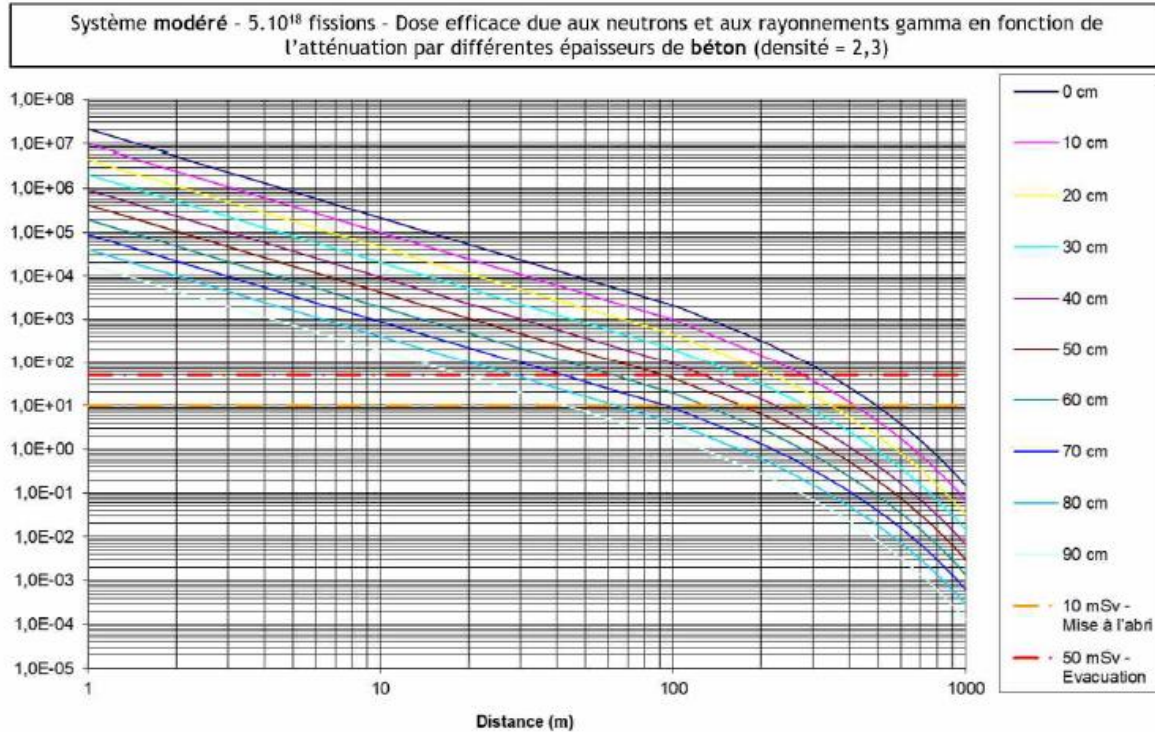
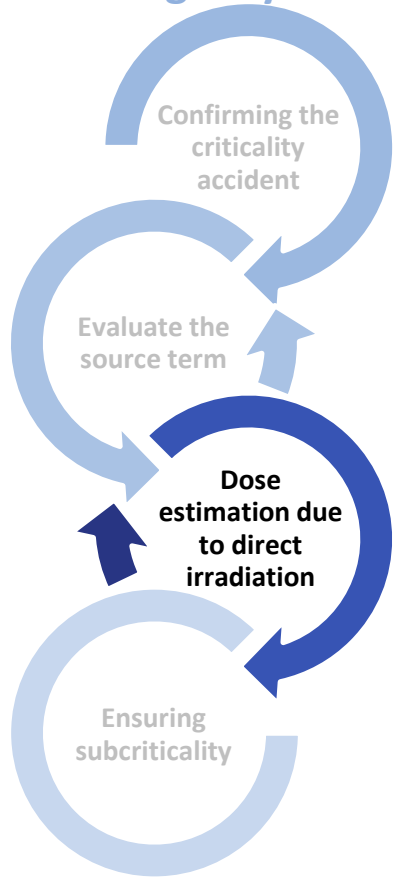


Source term

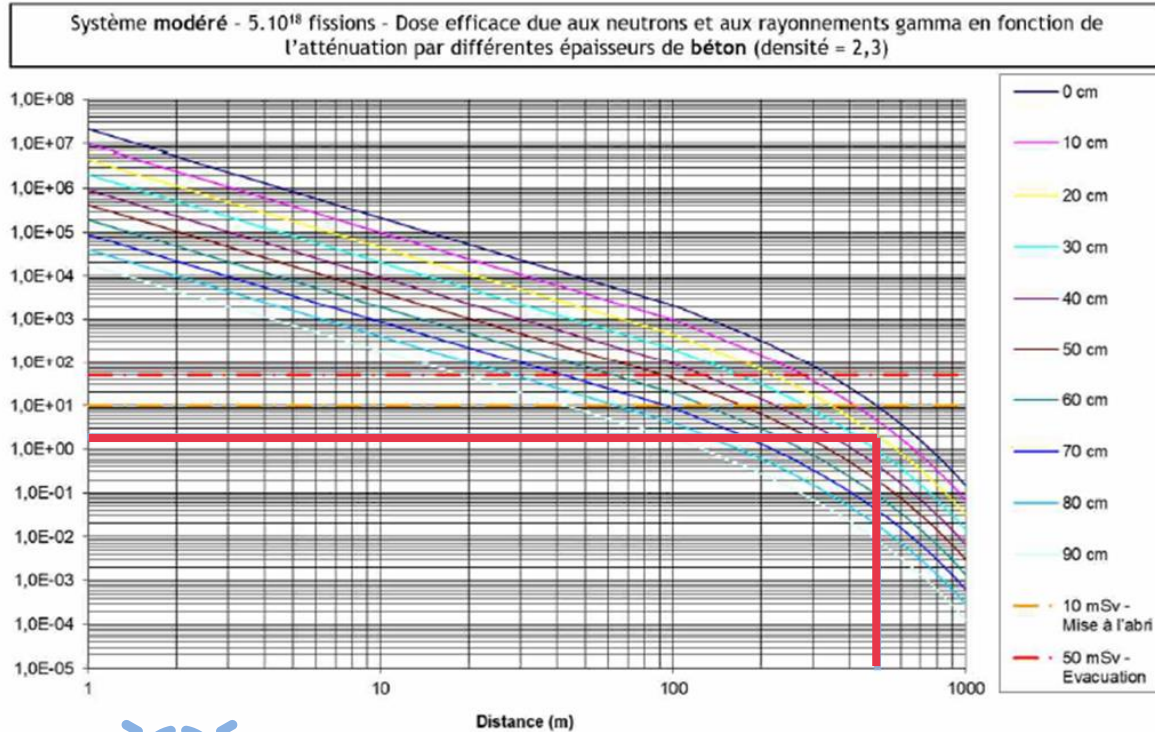
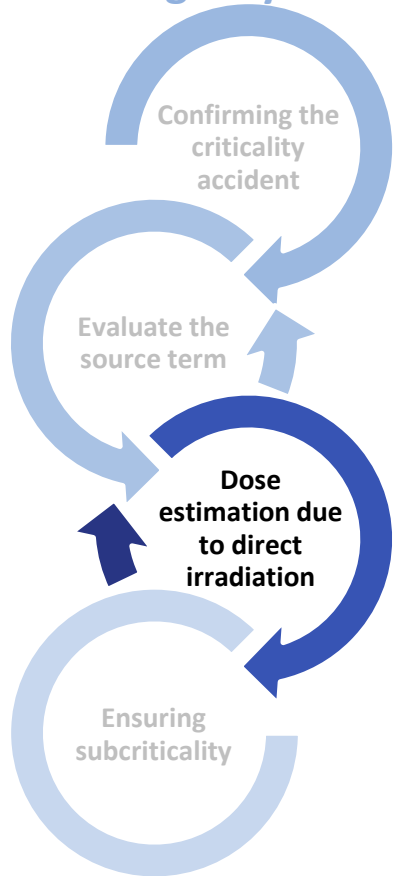


8.3 mSv

Emergency situation with a criticality accident

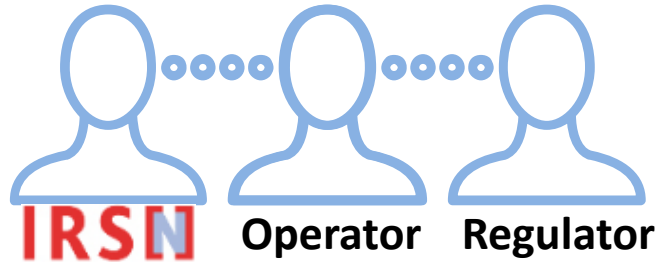
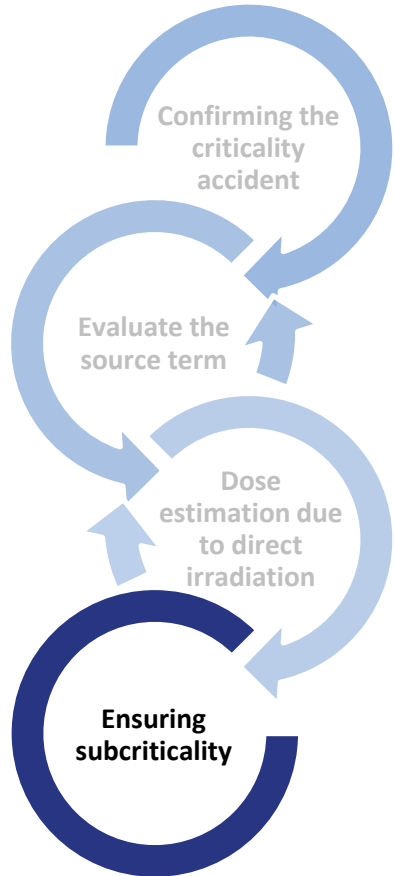


Emergency situation with a criticality accident

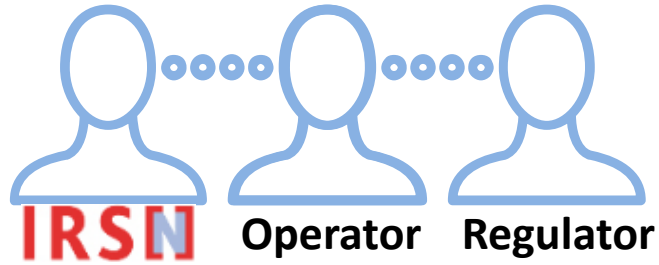
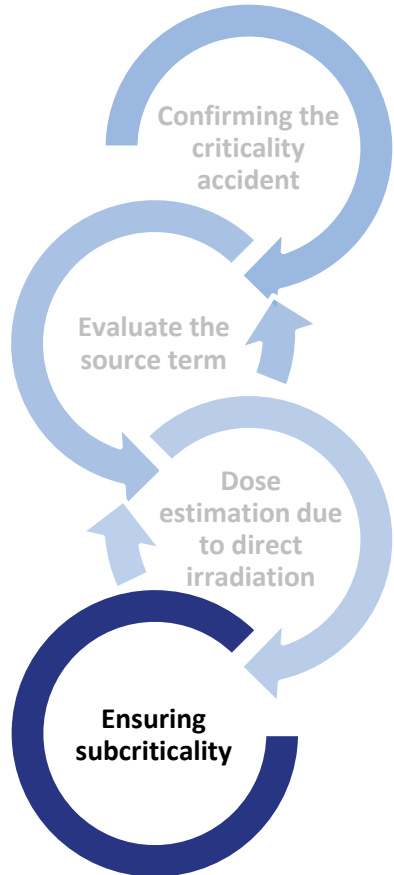


Effective dose due to direct irradiation : 2 mSv

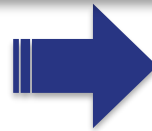
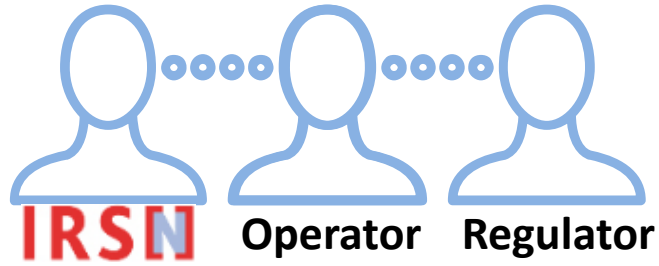
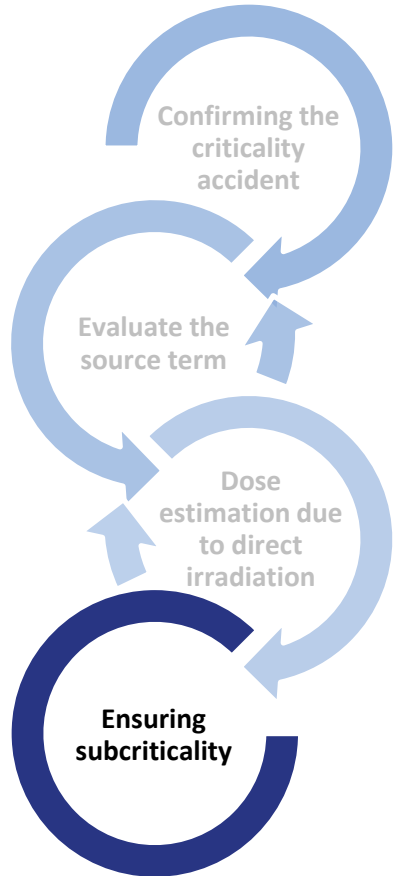
Emergency situation with a criticality accident



Emergency situation with a criticality accident

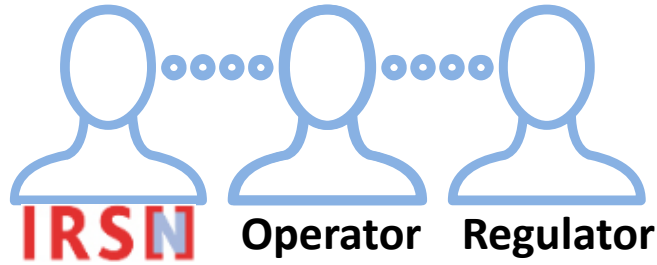
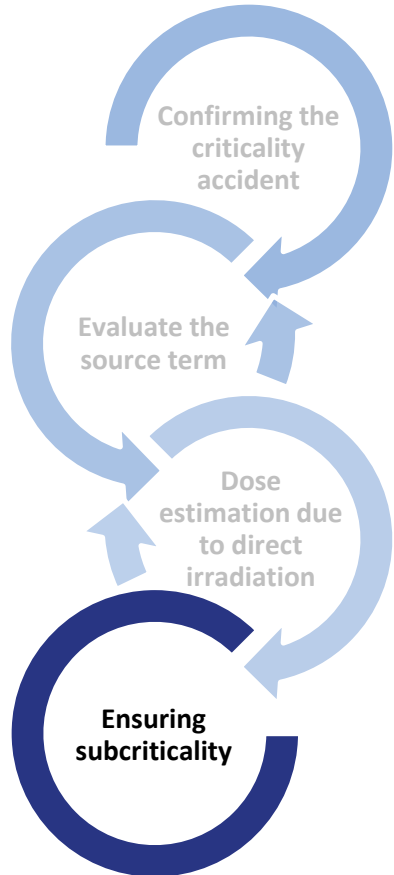


Emergency situation with a criticality accident



Means of action

Emergency situation with a criticality accident



Means of action



Emergency situation without a criticality accident

Assess conditions under which a criticality accident could occur

Situation degeneration scenarios?

Criticality safety evaluation

Predict dosimetric consequences



Emergency situation without a criticality accident

Assess conditions under which a criticality accident could occur

Situation degeneration scenarios?

Criticality safety evaluation

Means of control affected?

Requirements no longer respected?

Potential current or planned interventions affecting subcriticality?

Predict dosimetric consequences



Emergency situation without a criticality accident

Assess conditions under which a criticality accident could occur

Situation degeneration scenarios?

Criticality safety evaluation

Means of control affected?

Requirements no longer respected?

Potential current or planned interventions affecting subcriticality?

Predict dosimetric consequences

Potential criticality accident location?

Type of fissile material involved?

Feared mechanism of criticality reaching?



Conclusion & perspectives



Low frequency of mobilization of the criticality specialist for the past 5 years:

- 10 mobilizations for drills,
- 2 mobilizations for real events.



Improvement Strategies:

- Set up an annual periodic internal IRSN exercise involving a criticality accident,
- Participate to internal operator drills.

Conclusion & perspectives



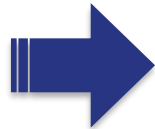
Low frequency of mobilization of the criticality specialist for the past 5 years:

- 10 mobilizations for drills,
- 2 mobilizations for real events.



Improvement Strategies:

- Set up an annual periodic internal IRSN exercise involving a criticality accident,
- Participate to internal operator drills.



Practice makes perfect!

CRISTAL & Licorne (standard calculation)

