

Updated emergency planning zones in Germany and the importance of release source term

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Nuclear Power Plants in Germany – after Fukushima

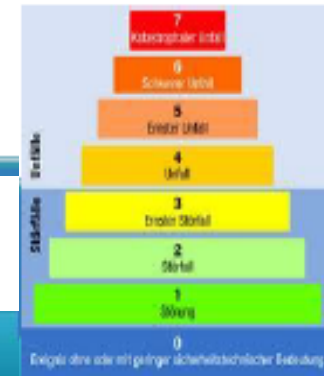
-  in operation
-  decommissioned



German lessons learned from the Fukushima accident

Lesson learned from Fukushima:

Nuclear accidents even those of the INES Level 7 happen. Despite high safety requirements and the low calculated probability for such cases we can never be sure, that severe nuclear accidents do not happen.



Consequence:

Detailed Planning of emergency response is necessary even for Level 7 Accidents!

German lessons learned from the Fukushima accident

Recommendation of the German Commission on Radiological Protection:

Reference source terms are required as a basis for detailed planning.

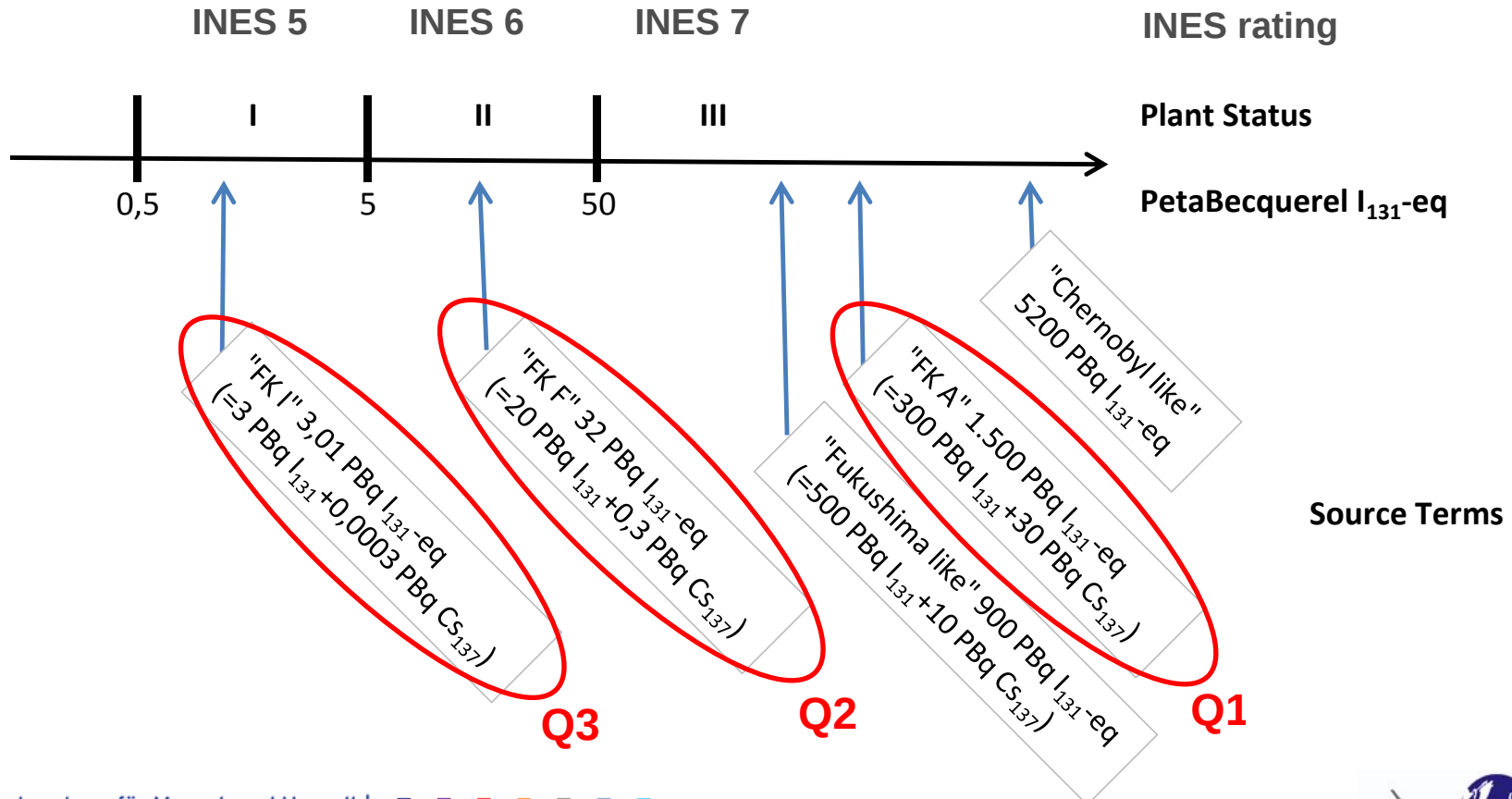
Name	Release of Iod-131 Bq	Release of Cs-137 Bq	Assumed Start of major releases (only for planning purposes) Hours [h] after shutdown of the reactor	Duration of releases	Release via	
Q1	3.0×10^{17}	3.0×10^{16}	6	48 Hours	Building Roof	INES 7
Q1L	3.0×10^{17}	3.0×10^{16}	6	14 Days	Building Roof	INES 7 long
Q2	2.0×10^{16}	3.0×10^{14}	12	48 Hours	Building Roof	INES 6
Q2L	2.0×10^{16}	3.0×10^{14}	12	14 Days	Building Roof	INES 6 long
Q3 ⁶	3.0×10^{15}	3.0×10^{11}	12	48 Hours	Stack	INES 5
Q3L ⁶	3.0×10^{15}	3.0×10^{11}	12	14 Days	Stack	INES 5 long

Source terms used as basis for NPP emergency planning

„could lead to
core melt,
no indication of
loss of contain.“

„could lead to
core melt,
loss of
containment“

AtHLET description



Assessment of potential consequences of an emergency

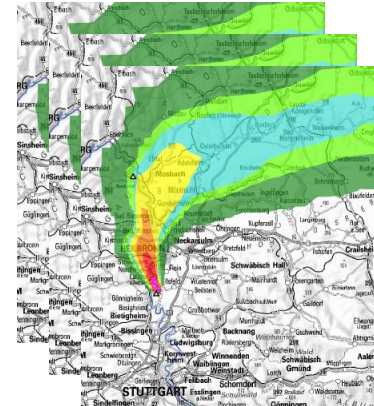
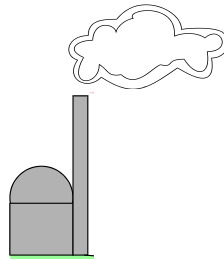
Scenario
list

Source terms
(for planning)

Radiological
consequences

Emergency
response plans

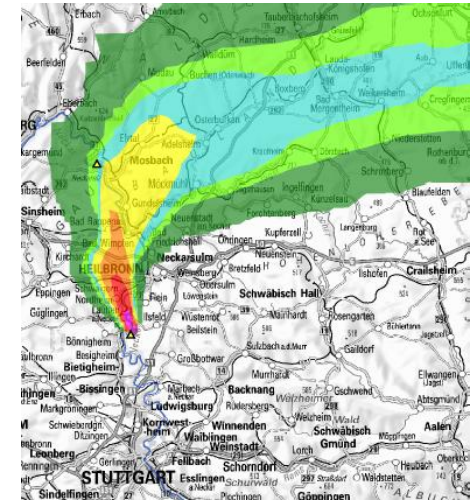
1. NPP accident in Germany



**Optimised
strategy
(including
EPZ)**

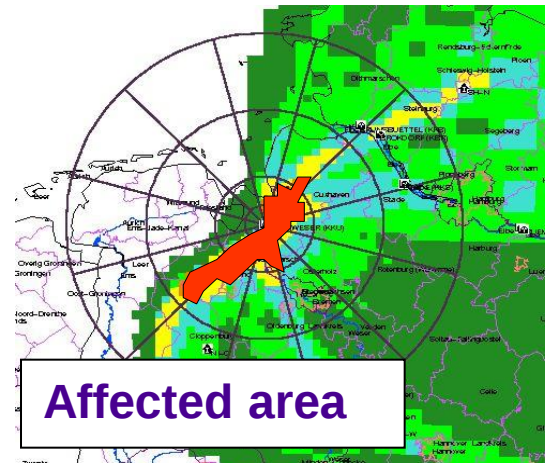
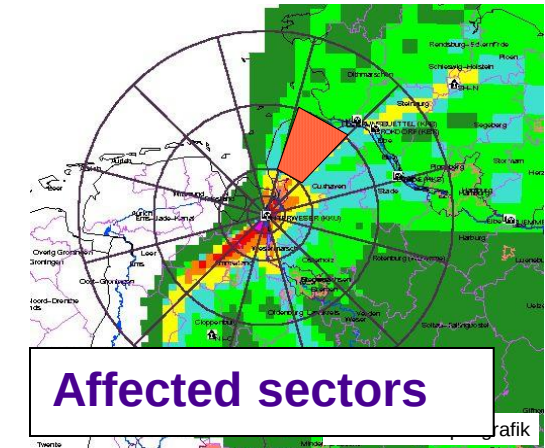
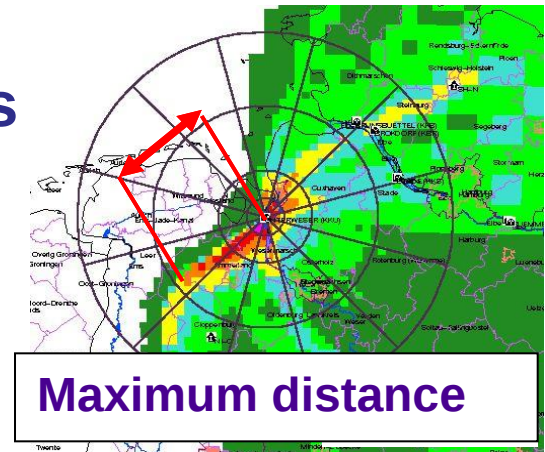
Assessment of potential consequences

- Selection of „reference source terms“ for each accident/release category
- Selection of representative NPP sites ([Unterweser](#), [Grohnde](#), [Philippsburg](#))
- Simulations performed with RODOS based on numerical weather prediction data
([Nov. 2011 - Oct. 2012](#); releases for each day)

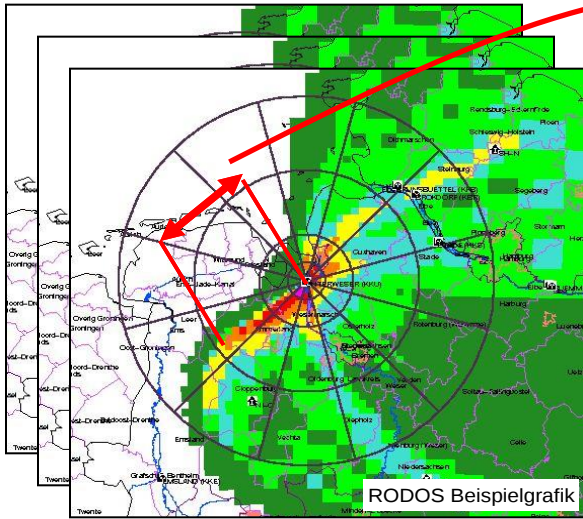


Assessment of potential consequences

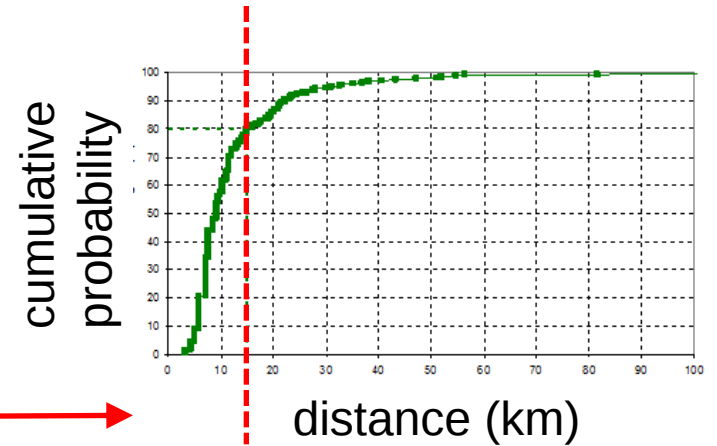
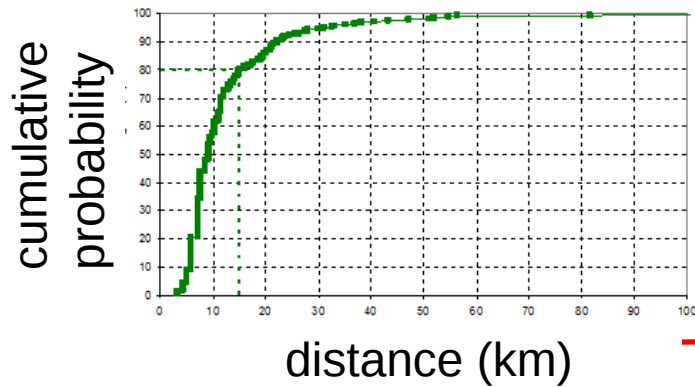
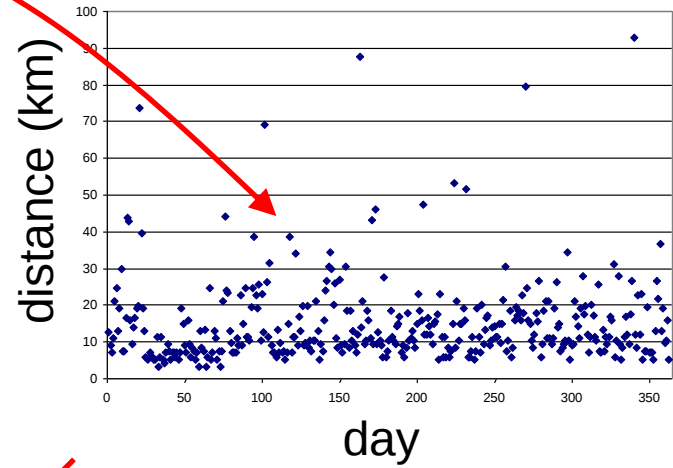
- **Selection of „reference source terms“ for each accident/release category**
- **Selection of representative NPP sites (Unterweser, Grohnde, Philippsburg)**
- **Simulations performed with RODOS based on numerical weather prediction data (Nov. 2011 - Oct. 2012; releases for each day)**
- **More than 5000 separate simulations**
- **Definition of analysis procedures (Statistical analysis based on national and generic dose intervention limits)**



Assessment of potential consequences

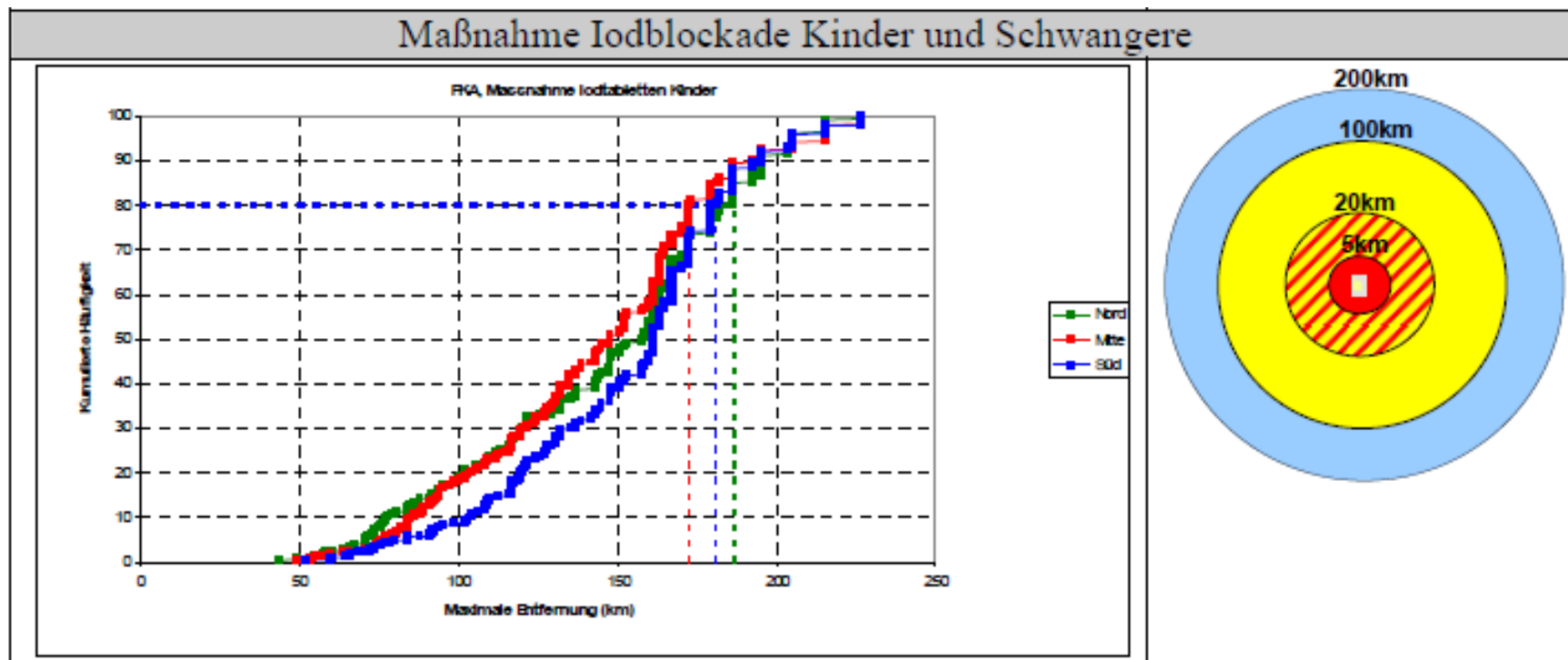


Maximum distance



Results of the assessment of potential consequences

E.g., maximum distances in which ITB for children is required („FKA source term / Q1“)



Results of the RODOS simulation

Maximum distance for evacuation, source term FKA / Q1

Adult	Maximum distance (km) in which intervention level for evacuation is exceeded		
	50%- Percentile	80%- Percentile	90%- Percentile
North (Unterweser)	9	15	22
Central (Grohnde)	11	20	26
South (Philippsburg)	18	25	31
Central (Grohnde) - FKF	0	0	0
Central (Grohnde) - FKI	0	0	0

Results of RODOS simulations

RODOS-based simulation of potential accident scenarios for emergency response management in the vicinity of nuclear power plants

Schriften

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Bundesamt für Strahlenschutz

Now available in English on request:

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Will be published on BfS website soon



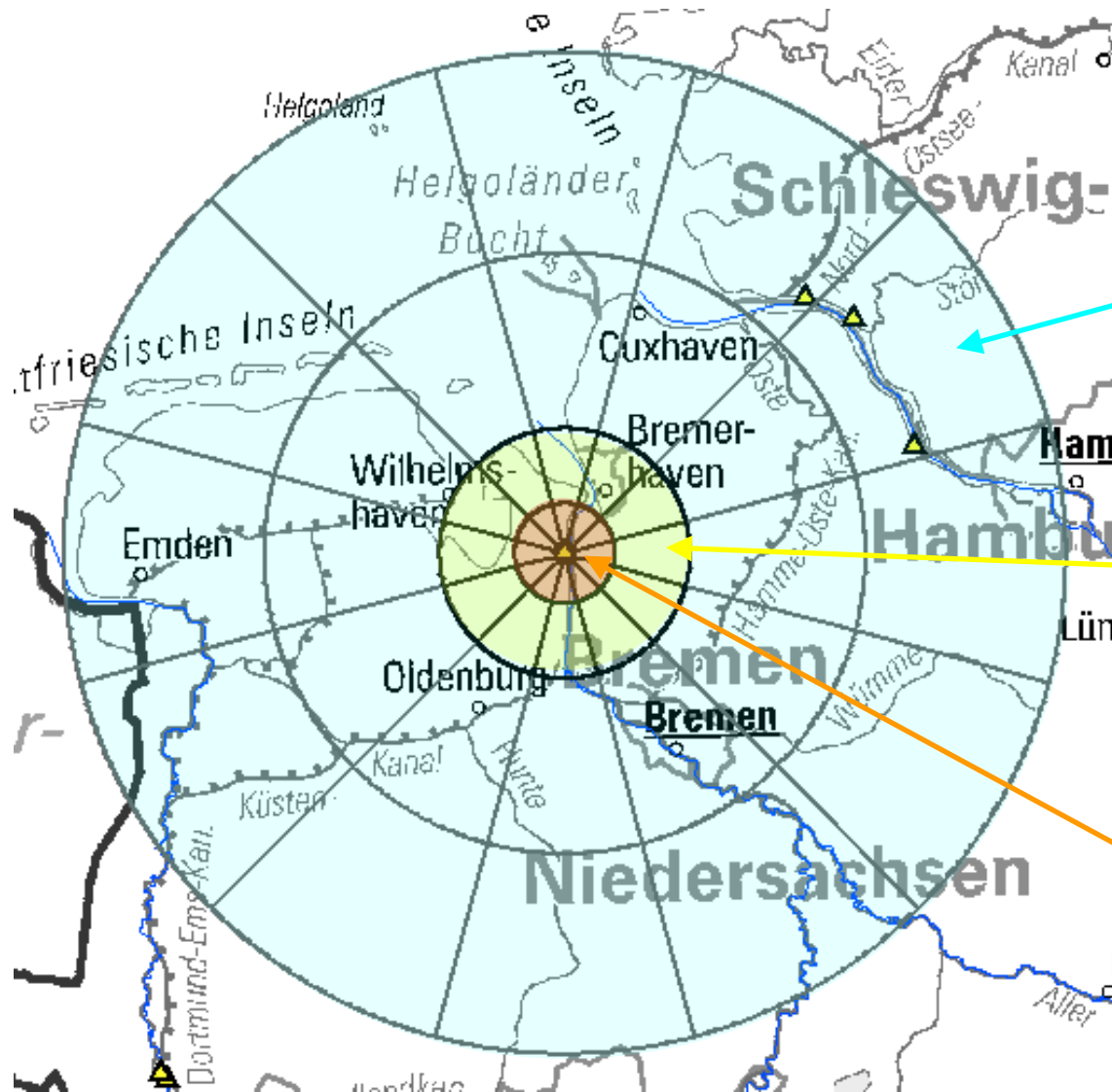
Bundesamt für Strahlenschutz

Changes in emergency planning zones in Germany

Recommendation by the German Commission on Radiological Protection:
Planning areas for emergency response in the vicinity of nuclear power plants (www.ssk.de)

Previous	New
Central zone with a radius of 2 km Sheltering, evacuation (6h), ITB (6h)	Central zone extends up to about 5 km around NPPs
Middle zone with a radius of 10 km Sheltering, evacuation (24h), ITB (12h)	Middle zone extends up to about 20 km around NPPs
Outer zone with a radius of 25 km Sheltering, ITB	Outer zone extends up to about 100 km around NPPs
Remote zone with a radius of 100 km ITB only for children and pregnant women	Entire Territory of Germany

Emergency planning zones for NPPs (before 2014)



Emergency planning zones:

<100 km:
ITB for children and pregnant women

<25 km:
ITB for all persons
< 45 years

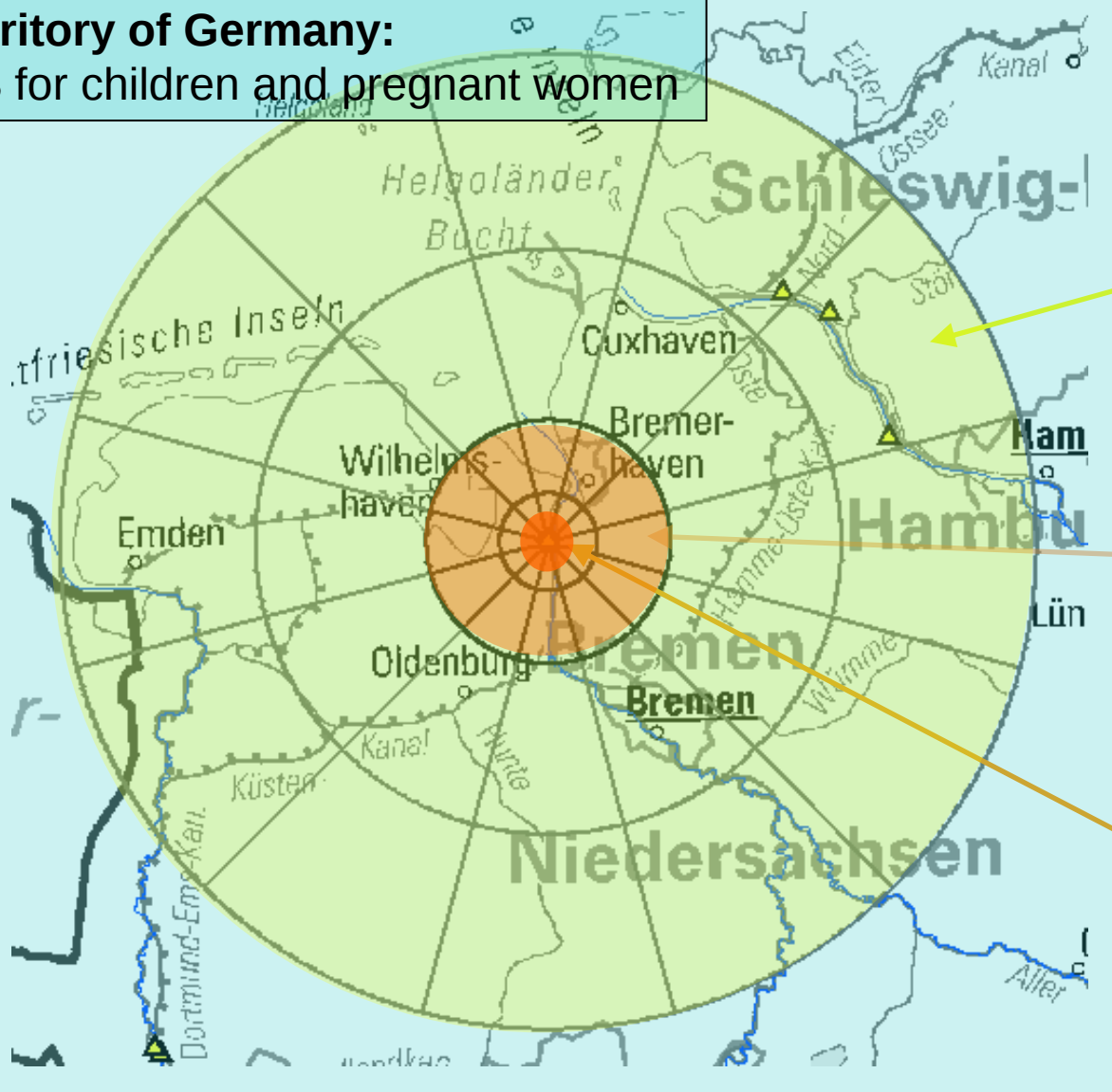
<10 km:
Evacuation,
Sheltering

Territory of Germany:

<100 km:
ITB for all persons
< 45 years,
sheltering

<20 km:
Evacuation,
Sheltering

<5 km:
Evacuation (priority),
Sheltering



German lessons learned from the Fukushima accident

Lesson learned from Fukushima:

Consequences of severe accidents are always international!

Lessons learned from Fukushima (in Germany!):

Regulations and plans for measures to be taken in case of accidents outside of Europe are not available!



Consequence:

Definition of Szenarios

which have to be covered up by regulations

Development of enhanced list of planning scenarios

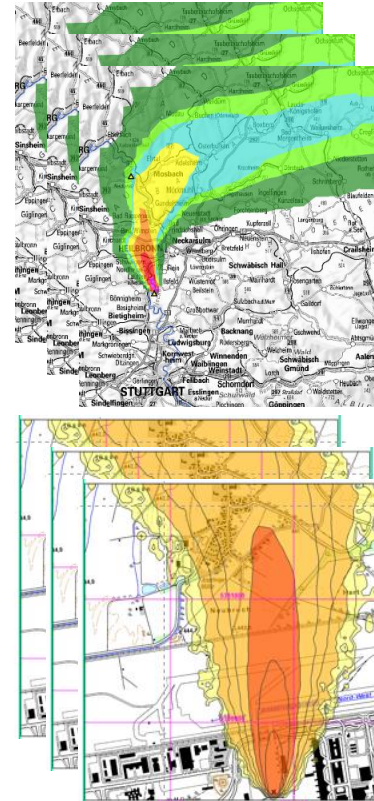
Scenario list

0. Unclear situation
1. NPP accident in Germany
2. NPP accident in neighbouring countries
3. NPP accident within Europe
4. NPP accident outside Europe
5. Accident in a nuclear facility
6. Terroristic attack
7. Transport accident
8. Radiological emergency situations
9. Satellite crash

Source terms (for planning)



Radiological consequences



Emergency response plans

Optimised strategy

Optimised strategy



...

...

German lessons learned from the Fukushima accident

Lesson learned from Fukushima:

Planning is necessary for all phases of an accident.

In particular, the planning for the Post-accident-phase must be improved so that the lives of people affected can be normalized as quickly as possible!

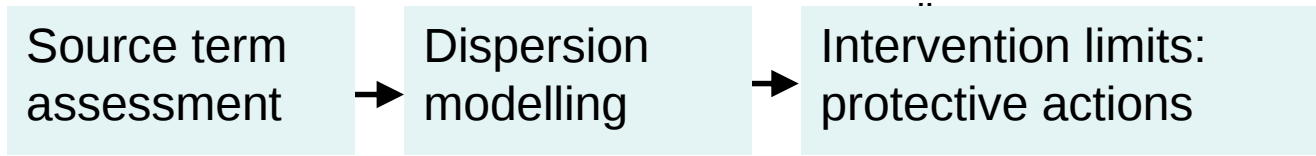


Consequence:

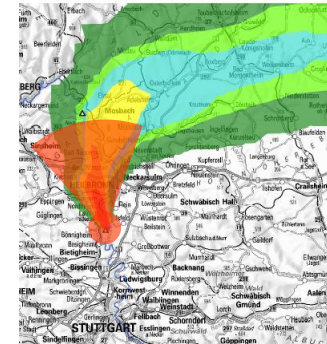
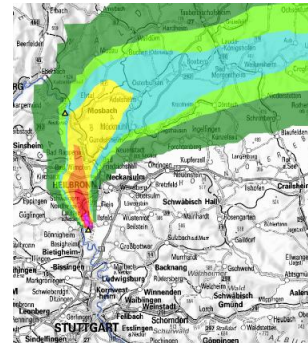
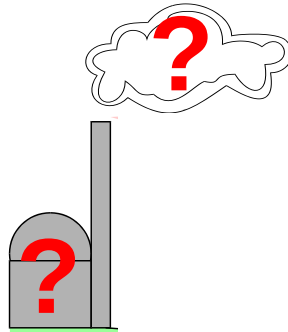
Enlargement of planning to all phases of accidents!

Thank you for your attention!

Decision about protective actions

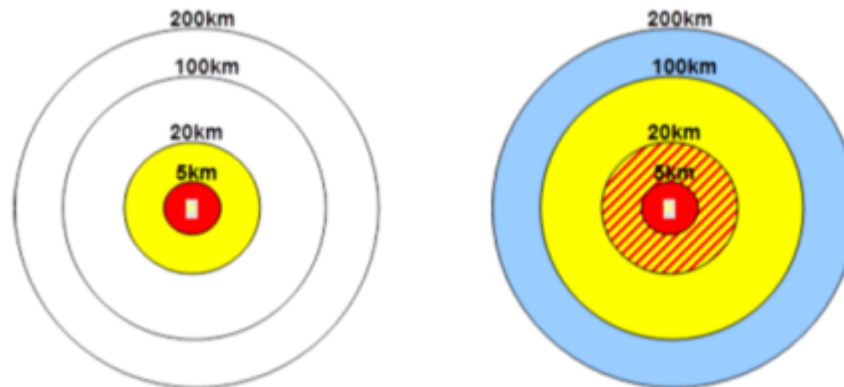


„Standard approach“:



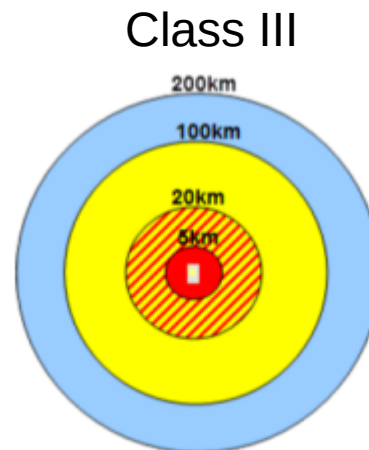
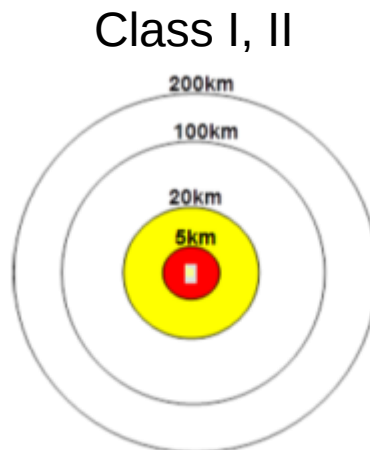
Protective actions to be recommended to the decision makers be decided on the basis of the plant status and weather conditions:

Supplementary NERDA approach:

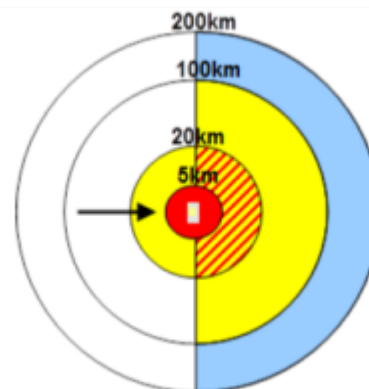
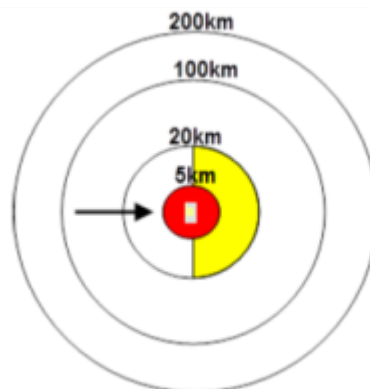


Identifying actions (graded approach)

Weather conditions
unknown or unstable

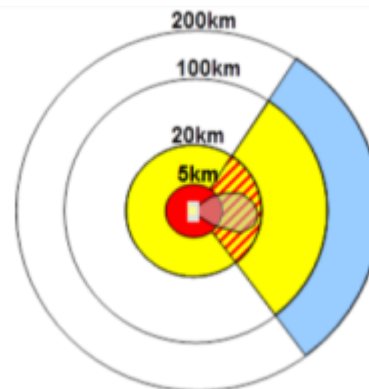
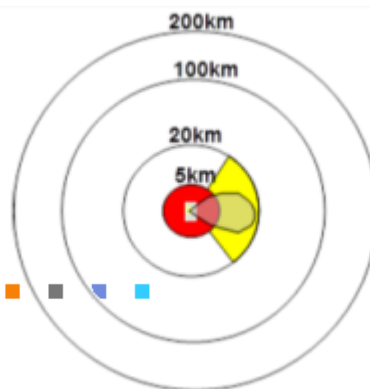


Wind direction stable



- ITB Children
- ITB + Sheltering
- Evacuation
- Shelter 1st, Evacuate later

Dispersion calculation
available and
wind direction stable



New published or reviewed publications by SSK ¹

- Kriterien für die Alarmierung der Katastrophenschutzbehörde durch die Betreiber kerntechnischer Einrichtungen (Empfehlung, 2013, together with RSK)
Criteria for the alert of emergency response authorities by the operators of nuclear plants
- Rahmenempfehlungen für die Planung von Notfallschutzmaßnahmen durch Betreiber von Kernkraftwerken (Empfehlung, 2014, together with RSK)
Guidelines for planning of emergency measures by operators of NPPs (only in German)
- Radiologische Grundlagen für Entscheidungen über Maßnahmen zum Schutz der Bevölkerung bei Ereignissen mit Freisetzungen von Radionukliden (Empfehlung, 2014)
Basic radiological principles for decisions on measures for the protection of the population against incidents involving releases of radionuclides
- Planungsgebiete für den Notfallschutz in der Umgebung von Kernkraftwerken (Empfehlung, 2014)
Planning areas for emergency response near nuclear power plants
- Fragestellungen zum Aufbau und Betrieb von Notfallstationen (Stellungnahme, 2014)
Questions regarding set-up and operation of emergency care centres (only in German)

New published or reviewed publications by SSK 2

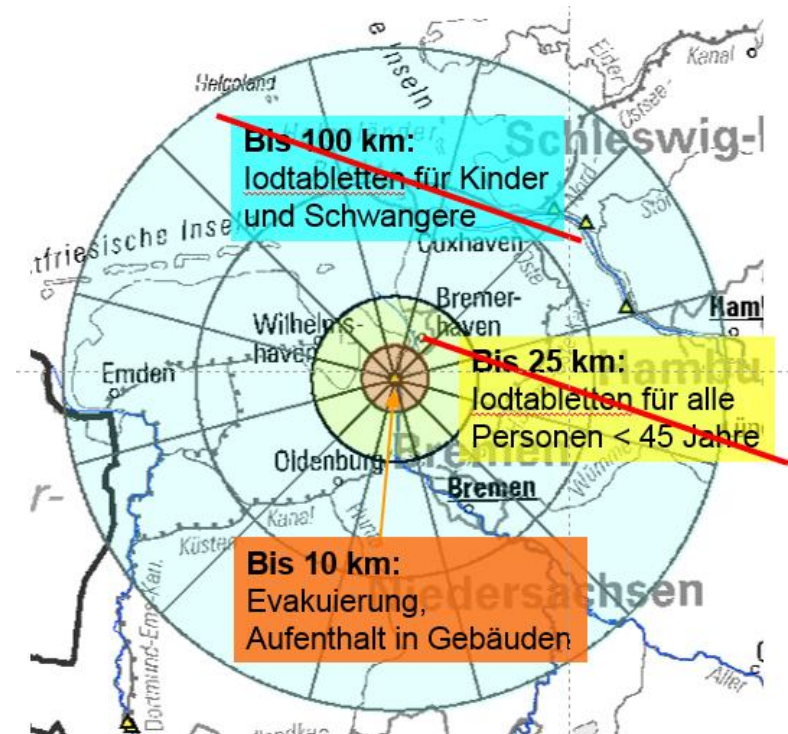
- Kriterien für die Alarmierung der Katastrophenschutzbehörde durch die Betreiber kerntechnischer Anlagen
Planung der Jodblockade in der Umgebung stillgelegter Kernkraftwerke (Empfehlung, 2014)
Planning iodine thyroid blocking in the vicinity of decommissioned nuclear power plants
- Prognose und Abschätzung von Quelltermen bei Kernkraftwerksunfällen (Empfehlung, 2014)
Prognosis and estimation of source terms at accidents of NPPs (only in German)
- Planungsgebiete für den Notfallschutz in der Umgebung stillgelegter Kernkraftwerke
(Empfehlung, 2014)
Planning areas for emergency response in the vicinity of decommissioned NPPs (only in German)
- Rahmenempfehlungen für den Katastrophenschutz in der Umgebung kerntechnischer Anlagen
(Empfehlung, 2015)
Guidelines for disaster control in the vicinity of nuclear plants (only in German)
- Weiterentwicklung des Notfallschutzes durch Umsetzen der Erfahrungen aus Fukushima
(Empfehlung, 2015)
Enhancements of emergency preparedness and response through implementation of lessons learned after Fukushima (only in German)

Planungsgebiete für den Notfallschutz in der Umgebung bereits stillgelegter Kernkraftwerke

Die Planungsgebiete, die in der Umgebung der in 2011 stillgelegten Kernkraftwerke entsprechend **BMU 2008** ausgewiesen sind, können beibehalten werden.

Die **Fernzone** kann aufgehoben werden.

Die Planung der **Iodblockade** für die Umgebung der in 2011 endgültig stillgelegten Kernkraftwerke muss nicht mehr aufrechterhalten werden.

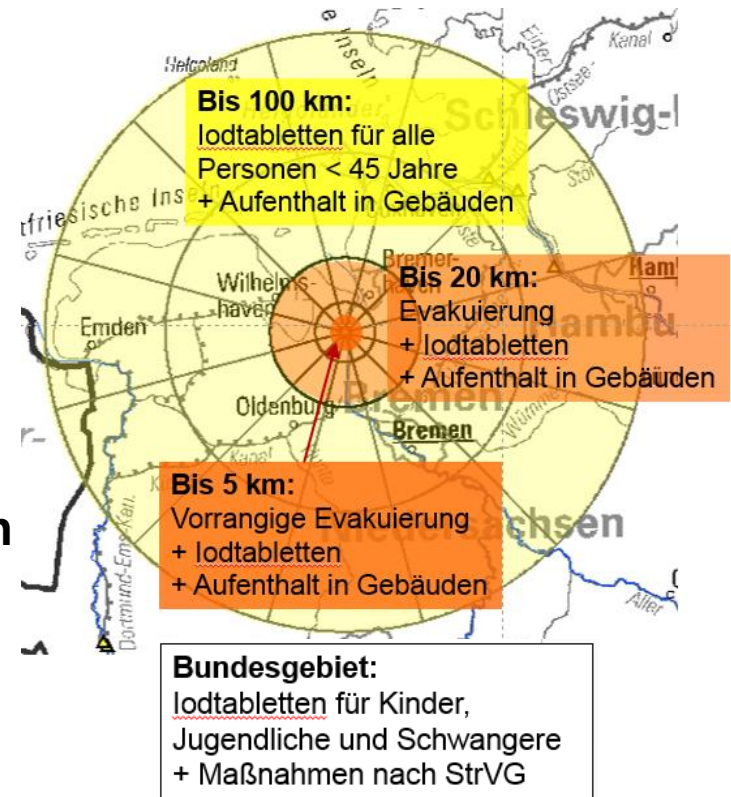


Planungsgebiete für den Notfallschutz in der Umgebung zukünftig stillzulegender Kernkraftwerke

Für die Umgebung der künftig in Deutschland endgültig stillgelegten Kernkraftwerke empfiehlt die SSK, dass die **Planungsgebiete entsprechend SSK 2014-2** solange aufrechterhalten werden, solange Brennstoff in der Anlage verwahrt wird jedoch **längstens für die Dauer von drei Jahren** ab dem Tag der letzten Abschaltung.

Für den Fall, dass **nach Ablauf von drei Jahren noch Brennstoff** in der Anlage vorhanden ist, können die Planungsgebiete entsprechend den o.g. **Regelungen für heute bereits stillgelegte Kernkraftwerke** festgelegt werden.

Für die Umgebung aller künftig in Deutschland endgültig stillgelegten Kernkraftwerke empfiehlt die SSK, dass die **Planung der Iodblockade für die Dauer eines Jahres** entsprechend 12 Monaten ab dem Tag der letzten Abschaltung beibehalten werden muss.



| Verantwortung für Mensch und Umwelt | ■ ■ ■ ■ ■ ■ ■

