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Eidgenössisches Departement des Innern EDI
Bundesamt für Gesundheit BAG
Direktionsbereich Verbraucherschutz



Consideration of emergency situations in the new Swiss ordinance on radiological protection



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Outline

1. **Elements of the context in Switzerland**
2. Radiation protection principles for emergency exposure situations
3. Comments

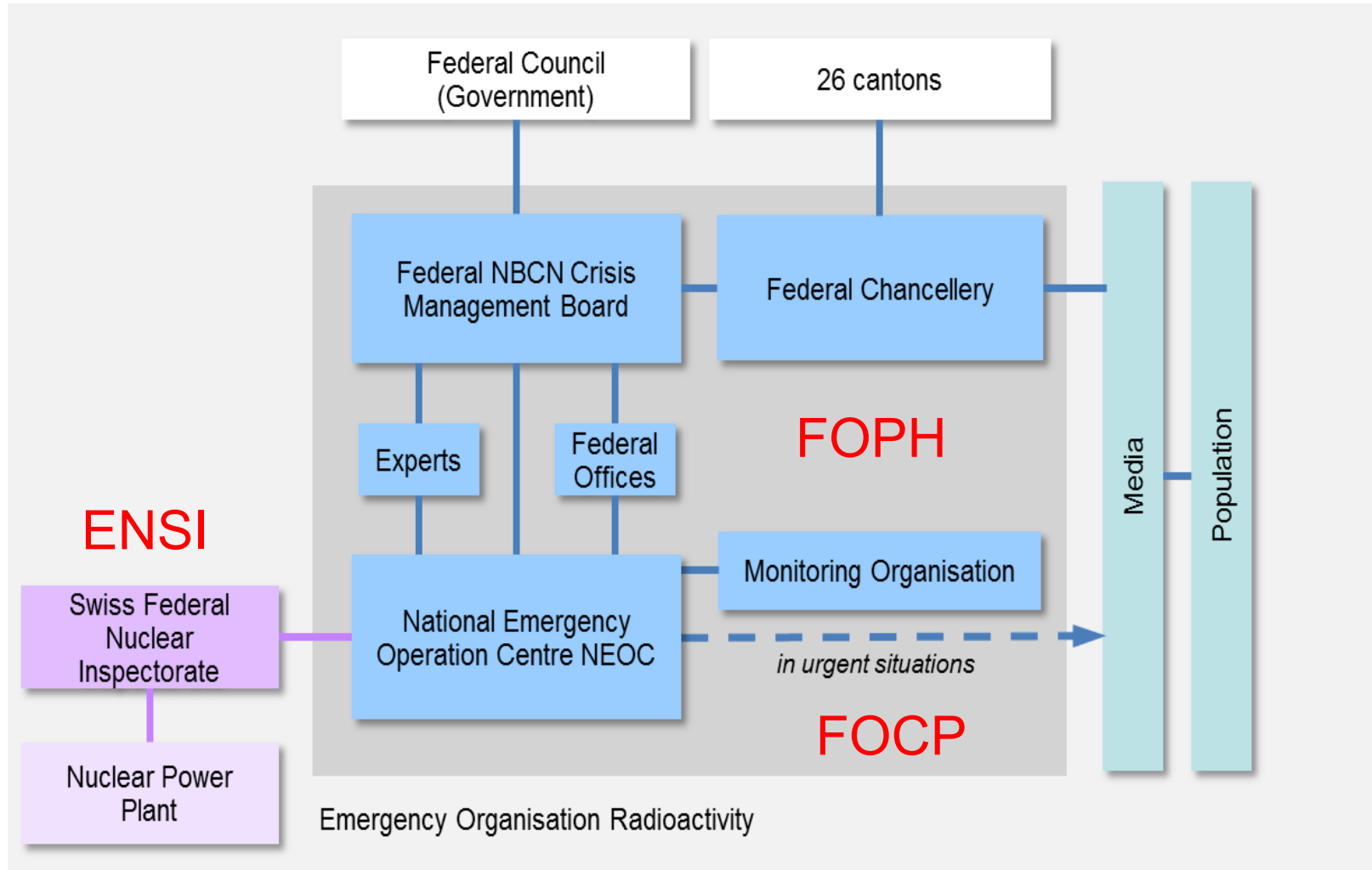


Elements of the context in Switzerland

- Interdepartmental task group IDA NOMEX
 - Organization *Post Fukushima proposition of 56 measures*
 - Legal provisions *http://www.alexandria.admin.ch/27498_F.pdf*
- Revision of the Swiss radiological ordinance (RPO)
- Revision of the emergency prep. ordinance (EPO)
- Revision of the NBCN operations ordinance (NBCNO)
- International
 - HERCA, IAEA, ICRP, WHO, NERIS....
 - **HERCA - WENRA approach (Country factsheets)**



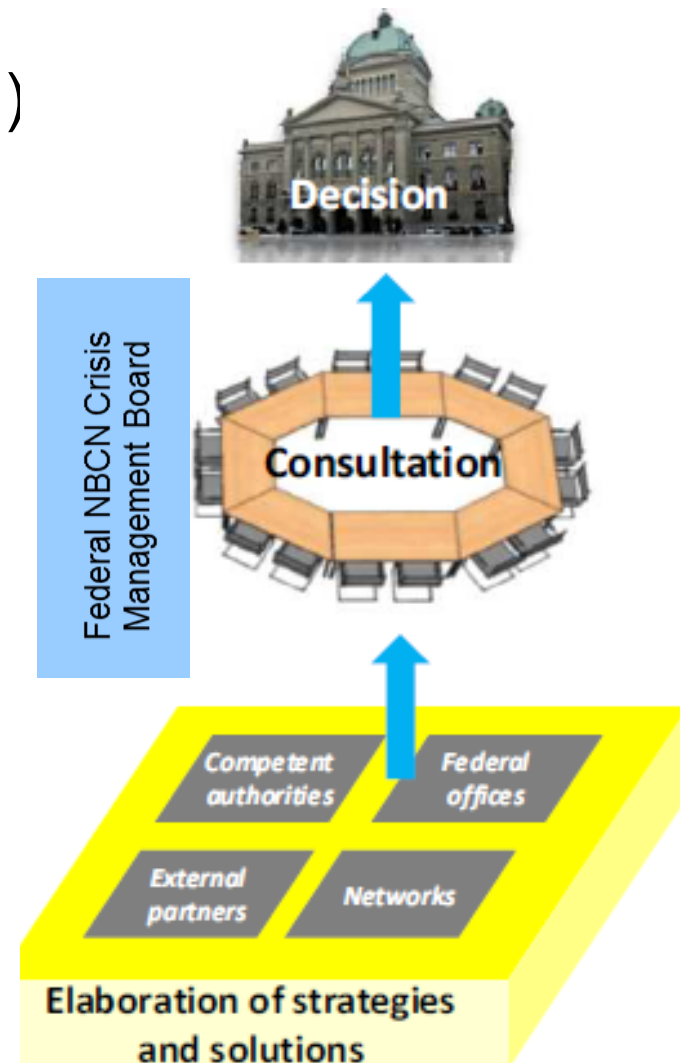
Organizational structure





Legal provisions

- Revision of the Swiss RPO (**FOPH**)
 - Planned exposure situation
 - Emergency exposure situation
 - Existing exposure situation
- Revision of the EPO (**ENSI**)
 - Reference Scenario
 - Planning zones
- Revision of the NBCNO (**FOCP**)
 - Protective actions, IL and OI's





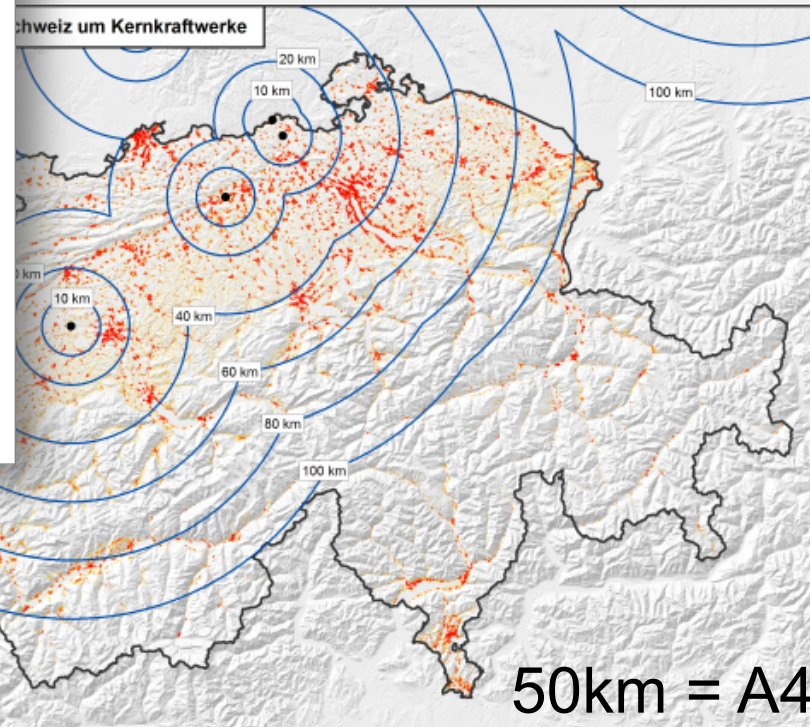
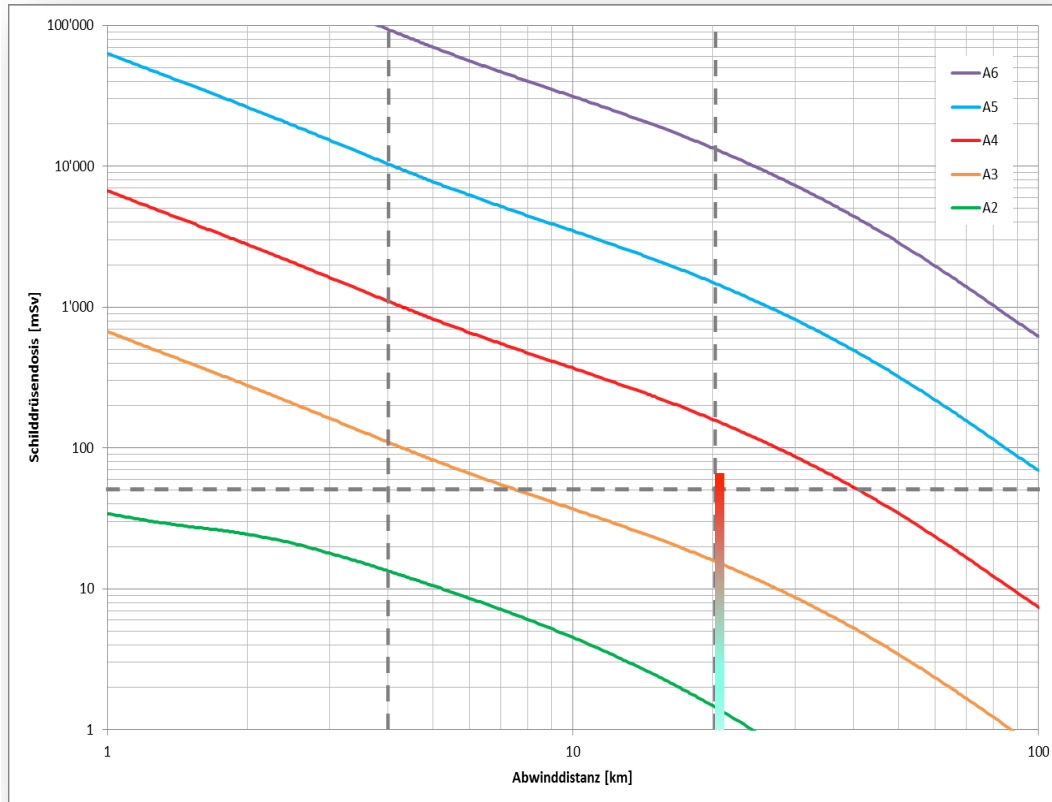
Revision of the RP ordinance (FOPH)

- Introduction of a new provision for the treatment of **radiation victims** (FOPH ↔ WHOCC - REMPAN)
- .
- The Federal NBCN Crisis Management Board is responsible for submission of an application to the Federal Council for **transitioning** from emergency exposure to existing exposure situations
- The FOPH is responsible for the preparation of the **long-term remedial actions** after the transition from emergency exposure to existing exposure situations and for the definition of the RL for the use of contaminated areas



Revision of the Iodine Tablets ordinance (FOPH)

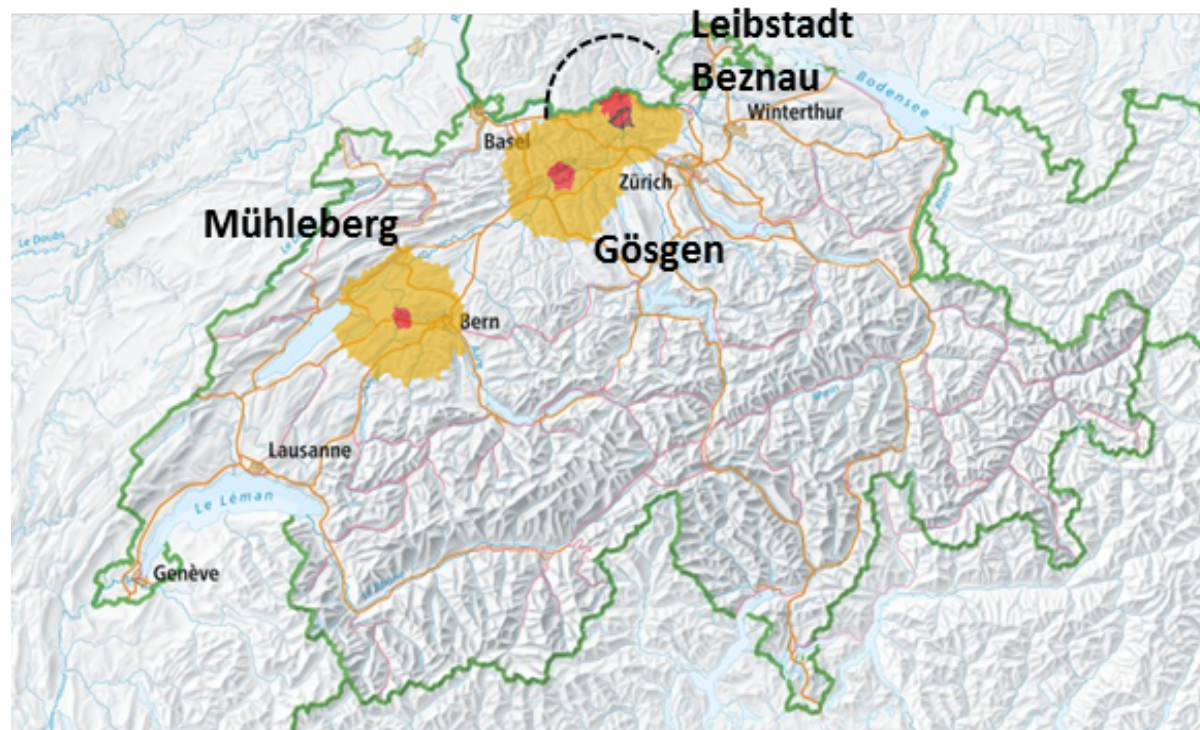
<http://www.iodtabletten.ch/>



Swissnuclear appeal



Revision of the EP ordinance (ENSI)



Planning zone 1 with radius 3 to 5 km and zone 2 with radius of 20 km, divided in 6 overlapping sectors of 120 degrees to be consistent with the emergency classification with GS-R-2.



Revision of the NBCN ordinance (FOCP)

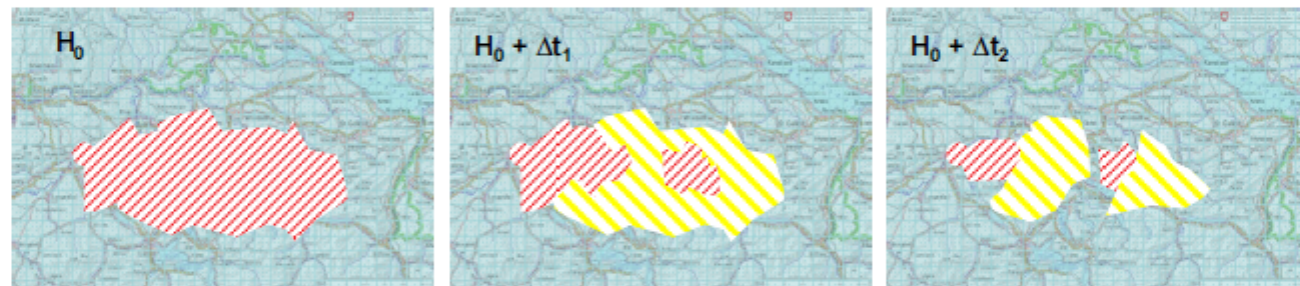
Protective Action	Criteria	Comments
Precautionary evacuation	100 mSv (eff., 2d, ext.+inh.)	Zone 1 (3 to 5 km) as an urgent protective action & if safely feasible, in a second step endangered sectors of zone 2 (20 km) if necessary
Stay indoors for children pregnant women	1 mSv (eff., 2d, ext.+inh.)	?
Sheltering	10 mSv (eff., 2d, ext.+inh.)	If not enough information zone 1 and zone 2 (endangered sectors)
ITB	50 mSv (thy., 2d, inh.)	Pre-distributed to the households up to 50 km
Precautionary harvesting & grazing ban	General Emergency	Where protective actions were ordered and up to the Swiss border and up to the alps

For protective actions not listed in the table a dose level of 100 mSv is set as a criteria. This criteria will serve as a criteria for an evacuation as an early protective action.



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RP doctrine for EES

General Strategy

1. Application of the principles: justification, optimization, graded approach
2. **Establishment of a “ generic reference level “**
3. Risk Identification
4. Establishment of the reference scenarios
5. Establishment of **“specific RL”** per each reference scenario
6. Definition of intervention measures to reduce public exposure
7. Setting a level of intervention for each measure
8. Setting an operational intervention level for each measure



Emergency exposure situations

Application of RP principles

- Justification of intervention measures
("do more good than harm")
- Optimization of protective measures
(RL, main effort above RL)
- Graded approach
(adapt measures to seriousness of situation)



Setting of the generic RL

- ❑ Definition: restriction applied to the dose or to the risk
 - above it is considered inappropriate to allow exposures to occur
 - below the optimization of protection should be implemented
- ❑ Quantity on which a reference level is set:
 - effective dose to the population during the first year after the accident
- ❑ Band according ICRP
 - 20-100 mSv for the first year
 - to be chosen depending on the scenario (**flexibility**)
- ❑ Interpretation of the dose in relation to the reference level
 - not to be considered as a limit
 - useful quantity for the response planning
 - if exceeded, main efforts on the most concerned population
 - provide an opportunity to adjust the reference level



Risk identification

Four major risks

1. **NPP** Accident => radioactive release
2. **Dirty bomb** => spontaneous radioactivity dissemination with contamination
3. **A weapon** use => ground explosion in a neighboring country
4. **Attack** against a train carrying radioactive waste



Reference scenarios

Setting

- Specification **of the capabilities** of the emergency response organization
- Frequency of the non covered scenarios $< 10^{-x} / y$
- **Establishment of a “specific RL” per reference scenario**

Characterization

- **Nuclides** dispersed in the environment
 - Activity & physical and chemical form
- **Time course** of release
 - Start of release from the alarm & duration of the release
- **Dispersion** of nuclides
 - Height of the release, weather and topological conditions



Dose depending on scenario

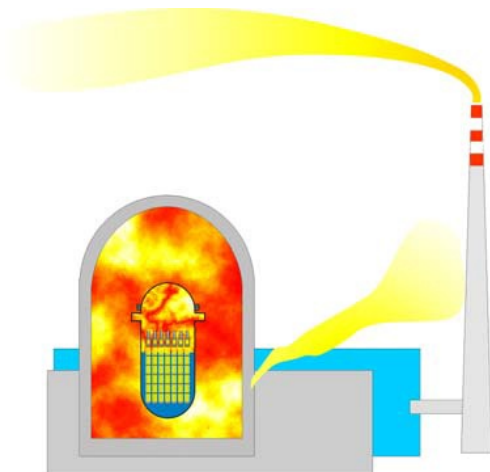
E _{ext+inh} > 1000 mSv
E _{ext+inh} > 100 mSv
E _{ext+inh} > 10 mSv
E _{ext+inh} > 1 mSv

Dose
per
Phase

		Plume		Soil	Sum 1 y
		E _{ext+inh} (bis 2 d)	H _{inh,SD,Iod}	E _{ext+inh} (2 d - 1 a)	E _{ext+inh}
		Dosis (mSv)	Dosis (mSv)	Dosis (mSv)	Dosis (mSv)
A2	500	221	58	0.49	222
	4000	46	13	0.10	46
	20000	7	1	0.01	7
	50000	2	0.19	0.00	2
A3	500	466	1'618	62	529
	4000	57	110	6	63
	20000	9	16	1	9
	50000	2	3	0.18	2
A4	500	2'361	16'180	624	2'985
	4000	247	1'104	57	304
	20000	38	159	7	45
	50000	9	34	2	11
A5	500	12'977	152'800	5'655	18'632
	4000	1'020	10'410	516	1'537
	20000	151	1'497	67	218
	50000	36	322	16	52
A6	500	107'799	1'381'000	47'387	155'186
	4000	7'768	93'910	4'326	12'094
	20000	1'161	13'450	561	1'721
	50000	275	2'879	133	409

Core damage with containment venting

without containment venting



10 times A3

100 times A3

1'000 times A3



Setting of intervention countermeasures

- ❑ Each protective measure also involves disadvantages and risks
- ❑ Application of the principle of justification
 - "Do more good than harm"
- ❑ Differentiated measures according to the phase of the accident and to the geographic area
- ❑ Introduction of areas for which an uniform application of measures is considered



Setting of IL's and OIL's for each measure

- ❑ Definition of a **dosimetric quantity** characteristic to the intervention measure
- ❑ Fixing a value of the dosimetric quantity from which the measure is taken “**intervention level**”
 - during the emergency phase, 10 mSv over two days as an intervention level for sheltering
- ❑ Fixing a quantity easily accessible in emergencies linked in advance to IL on the basis of a model
 - ambient dose rate at 1 m above ground 24 h after the start of the shutdown (**OIL**)
 - T in the reactor core, A in the containment (**EAL**)



Setting of OIL for each countermeasure

- ❑ Need for a model to determine in a given situation, the IL (eg determine before the release, the **expected public dose**)
- ❑ During the emergency phase, the required time of calculation by the model is not precisely available
- ❑ Solution by determining an **OIL**
 - quantity easily accessible in emergencies
 - link between IL & OIL set in advance on the basis of a model
eg, the soil phase: ambient dose rate at 1 m above ground 24 h after the start of the shutdown
- ❑ If the OIL is based on a non-dosimetric quantity (T in the reactor core, A in the containment), it is called “Emergency/urgent action level” (**EAL**)



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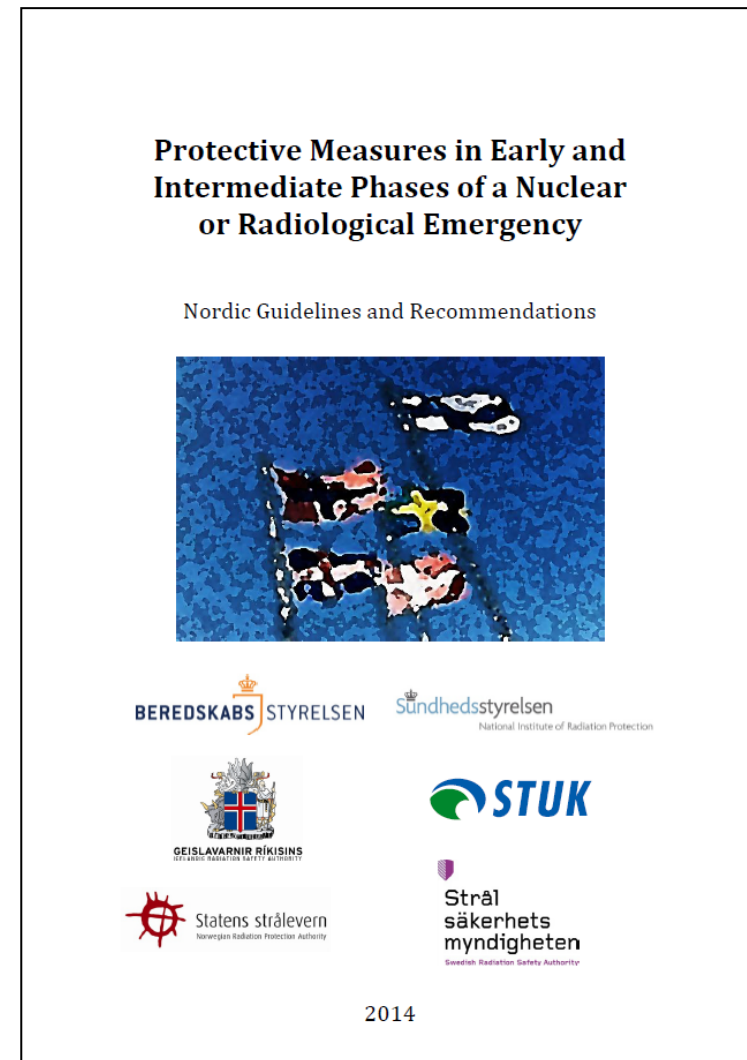
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Bilateral agreements
with
France and Germany





Distinction between prevention and preparation

- prevention (part of the management of **planned exposure situations**)
 - "Reference levels" of prevention: **constraints for operation**

Frequency scenario (year ⁻¹)	Max. exposure of public members
$> 10^{-1}$	compliance with dose constraints
10^{-1} to 10^{-2}	a dose constraint more
10^{-2} to 10^{-4}	1 mSv
10^{-4} to 10^{-6}	100 mSv

- preparation of the intervention (part of the management of **emergency exposure situations**)
 - RL between 20 and 100 mSv

Consistency between the RL, IL & OIL's

- ❑ **Reference level:** concerns the residual dose to the public throughout the first year and by all exposure pathways
- ❑ **Intervention level:** concerns the dose received by the population during a particular phase & by given exposure pathways (those affected by the intervention measure)
- ❑ **Operational intervention level:**
 - quantity easily accessible in emergencies
 - link between IL & OIL set in advance on the basis of a model
- ❑ Overall the **sum of intervention levels** for the same segment of the population should be below the reference level

Final comments

The organization of intervention must be:

- **simple**; the organization is led and carried out by non-specialists in radiation protection
- **robust**; adapting the strategy to the particular situation should be easy (do not regulate details)
- **durable** ("sustainable"); performers are often not those who design the organization
- **shared**; it must be supported by all bodies involved in the intervention



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THANK YOU FOR YOUR ATTENTION

