Operational Intervention Levels (OILs)

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Biography

Experiences

- Study on Environmental Radionuclide Analysis and Instrument Analysis, JAEA, JAPAN, 2006.
- Training on Marine Environment and Coastal Zone Management, Marine Environment Laboratory, MONACO, 2010.
- Regional Workshop on Long Term Issues Following a Nuclear or Radiological Emergency, MALAYSIA, 2014.
- RTC on Emergency Preparedness and Response in Severe Accidents, Fuzhou, CHINA, 2014.
- Regional Workshop on an Effective National Emergency Centre for Radiological and Nuclear Emergencies, Including the Establishment of an Off-Site Centre, REPUBLIC OF KOREA, 2015.
- Regional Workshop on Information Exchange during Radiation Emergencies and Cooperation regarding Coordination of Emergency Preparedness and Response, Vienna, AUSTRIA, 2017.
- Technical Meeting on “Twenty Years of EPREV: Building on Two Decades of Experience”, Vienna, AUSTRIA, 2019.
- IAEA/RCA RTC on Development and Use of Operational Intervention Levels (OILs) for Reactor Emergencies, Bangkok, THAILAND, 2022.
- Mid-term Review Meeting IAEA/RCA RAS9092 Strengthening the Capacity to Respond to Radiological Emergencies of Category II and III Facilities in the RCA Region, MALAYSIA, 2023.

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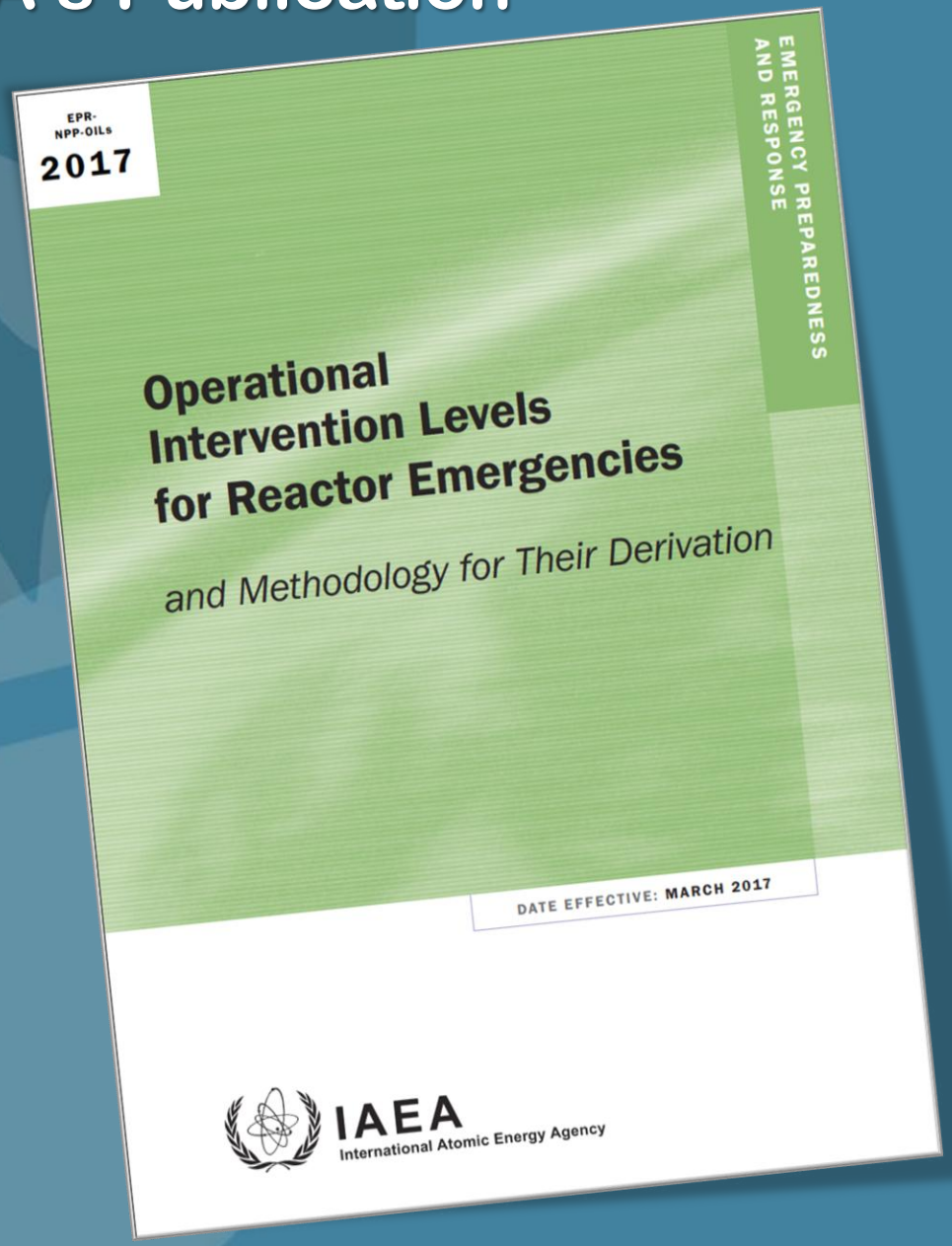
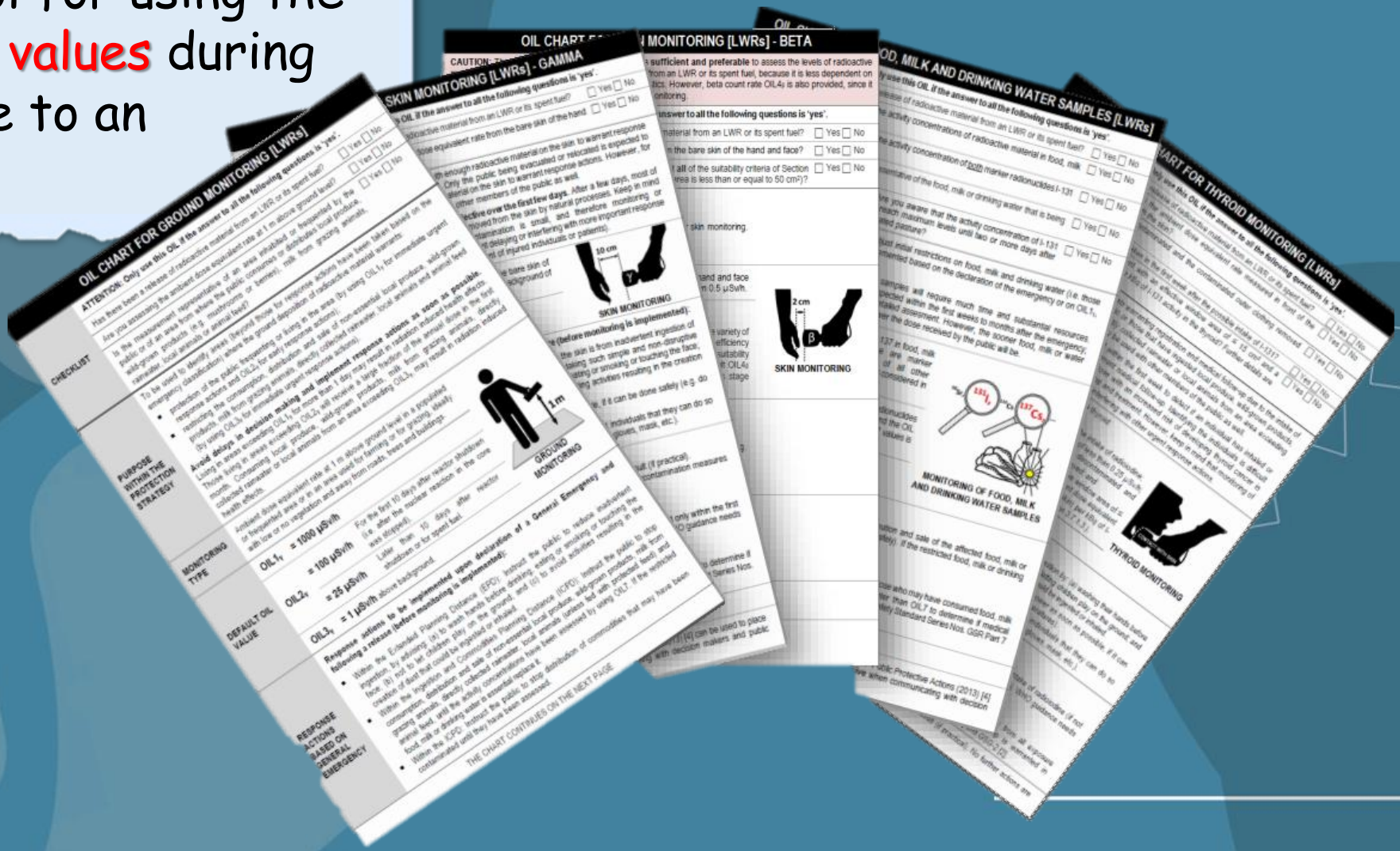
IAEA's Publication

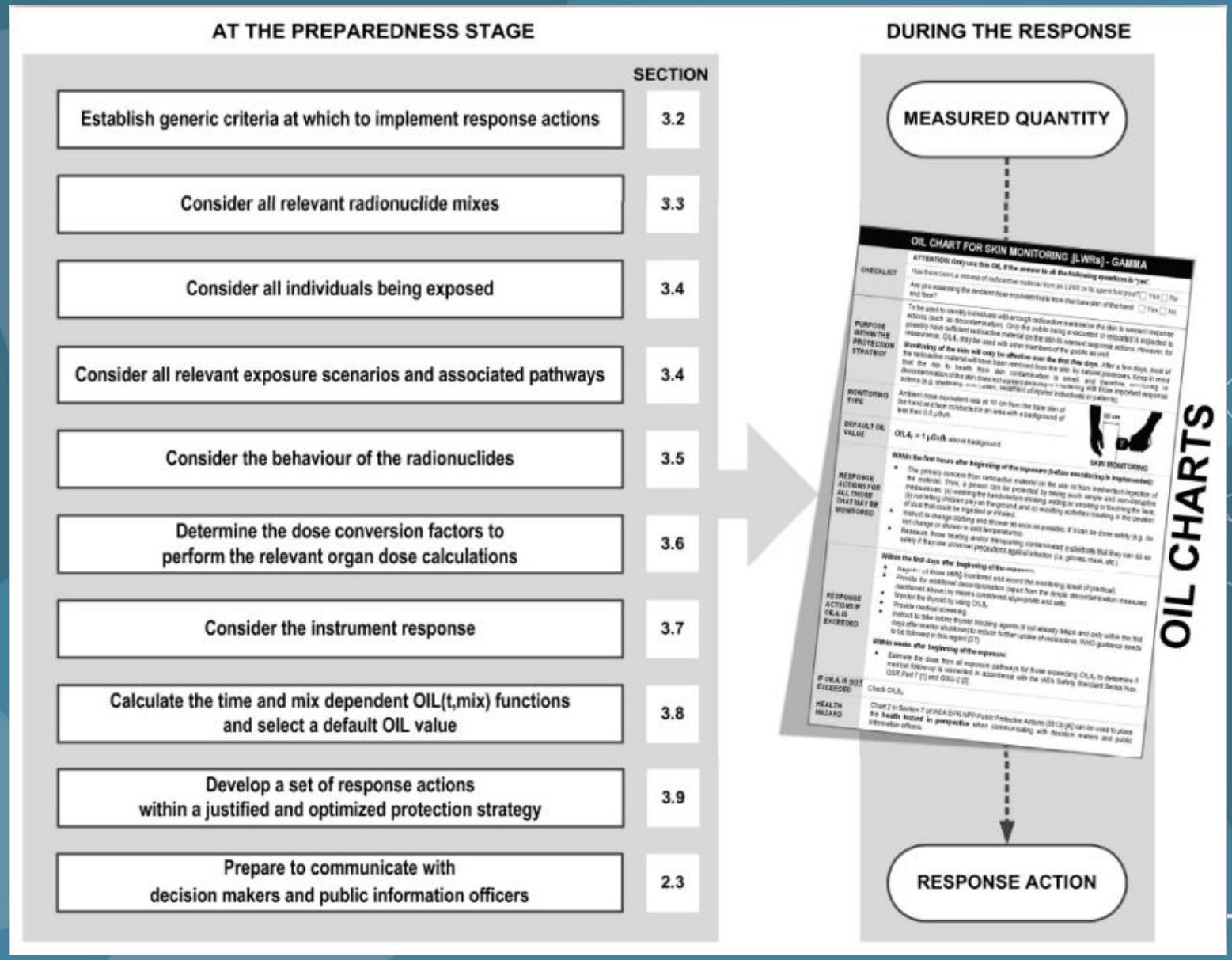


OILs Chart

Practical tool for using the **default OIL values** during the response to an emergency.



Basis for OILs Default Values



Generic Criteria

IAEA's Generic Criteria

Generic criteria		Examples of protective actions and other response actions[a]
Projected dose that exceeds the following generic criteria: Take urgent protective actions and other response actions		
E[d]	100 mSv in the first 7 days	Sheltering[e]; evacuation; prevention of inadvertent ingestion; restrictions on food, milk and drinking water[g] and restrictions on the food chain and water supply; restrictions on commodities other than food; contamination control; decontamination; registration; reassurance of the public
H_{fetus}[f]	100 mSv in the first 7 days	

Generic Criteria

Actions[a]	Generic criterion	Used for	References
Take **urgent** response actions to reduce the risk of stochastic effects	**GC(Urgent,E,7d) = 0.1 Sv** total[d] effective[c] dose to the representative person[b] in the first 7 days	$OIL1_{\gamma}$ $OIL4_{\gamma}$ $OIL4_{\beta}$	Table II.2 of Ref. [1]
	GC(Urgent,H_{fetus},7d) = 0.1 Sv total[e] equivalent dose to the fetus[f] in the first 7 days	$OIL1_{\gamma}$ $OIL4_{\gamma}$ $OIL4_{\beta}$	Table II.2 of Ref. [1]
	GC(Urgent,$h_{thyroid,thy\text{-}burden}$) = 0.1 Sv[g] committed equivalent dose to the thyroid from radioiodine in the thyroid (thyroid burden)	$OIL8_{\gamma}$	Ref. [1][h]

Keeping the dose to the fetus below 100 mSv will ensure that GC for severe deterministic effects for **any** organ or tissue will not be exceeded

Generic Criteria

Actions[a]	Generic criterion	Used for	References
Take early response actions to reduce the risk of stochastic effects	**GC(Early,E,1a) = 0.1 Sv** total[d] effective[c] dose to the representative person[b] in the first year	$OIL2_{\gamma}$	Table II.2 of Ref. [1]
	GC(Early,H_{fetus},9mo) = 0.1 Sv total[e] equivalent dose to the fetus[f] in the full period of in utero development	$OIL2_{\gamma}$	Table II.2 of Ref. [1]

Generic Criteria

Actions[a]	Generic criterion	Used for	References
Take response actions to reduce the risk of stochastic effects due to the **ingestion** of food, milk or drinking water	**GC(Ingestion,e_{ing},1a) = 0.01 Sv[g]** committed effective[c] dose to the representative person[b] from ingestion of food, milk and drinking water during the first year	OIL3$_\gamma$ OIL7	Table II.3. of Ref. [1]
	GC(Ingestion,$h_{fetus,ing}$,9mo) = 0.01 Sv[g] committed equivalent dose to the fetus [f] from ingestion of food, milk and drinking water during the full period of in utero development	OIL3$_\gamma$ OIL7	Table II.3. of Ref. [1]

Generic Criteria

Actions[a]	Generic criterion	Used for	References
Take response actions **under any circumstance** to avoid or minimize severe deterministic effects	**GC(Acute, $AD_{skin-ext}$, 10h) = 10 Gy** RBE weighted absorbed dose to 100 cm^2 of the skin dermis of the representative person[b] from acute external exposure in the first 10 hours	$OIL4_\gamma$ $OIL4_\beta$	Table II.1 of Ref. [1]
Take **urgent** response actions to reduce the risk of stochastic effects	**GC(Urgent, E, 7d) = 0.1 Sv** total[d] effective[c] dose to the representative person[b] in the first 7 days	$OIL1_\gamma$ $OIL4_\gamma$ $OIL4_\beta$	Table II.2 of Ref. [1]
	GC(Urgent, H_{fetus}, 7d) = 0.1 Sv total[e] equivalent dose to the fetus[f] in the first 7 days	$OIL1_\gamma$ $OIL4_\gamma$ $OIL4_\beta$	Table II.2 of Ref. [1]
	GC(Urgent, $h_{thyroid,thy-burden}$) = 0.1 Sv[g] committed equivalent dose to the thyroid from radioiodine in the thyroid (thyroid burden)	$OIL8_\gamma$	Ref. [1][h]

Radionuclide Mixes

Consider all relevant radionuclide mixes

- The OILs are calculated for all the radionuclide mixes expected to be released from an LWR or its spent fuel during a severe emergency.
- These may be significant contributors to the dose of the public or to the instrument response.
- Consider all relevant radionuclide mixes.

Rads.	RF_i(mix1) [unitless]	RF_i(mix2) [unitless]	RF_i(mix3) [unitless]	RF_i(mix4) [unitless]	RF_i(mix5) [unitless]	RF_i(mix6) [unitless]	RF_i(mix7) [unitless]
Rb-86	5.0E-02	2.0E-01	3.6E-01	2.5E-01	4.5E-01	2.0E-03	1.3E-01
Sr-89	0.0E+00	2.0E-02	1.0E-01	2.0E-02	1.0E-01	0.0E+00	5.0E-03
Sr-90+	0.0E+00	2.0E-02	1.0E-01	2.0E-02	1.0E-01	0.0E+00	5.0E-03
Sr-91	0.0E+00	2.0E-02	1.0E-01	2.0E-02	1.0E-01	0.0E+00	5.0E-03
Y-91	0.0E+00	2.0E-04	5.0E-03	2.0E-04	5.0E-03	0.0E+00	1.4E-07
Zr-95+	0.0E+00	2.0E-04	5.0E-03	2.0E-04	5.0E-03	0.0E+00	1.3E-07
Zr-97+	0.0E+00	2.0E-04	5.0E-03	2.0E-04	5.0E-03	0.0E+00	1.3E-07
Mo-99+	0.0E+00	2.5E-03	2.5E-03	2.5E-03	2.5E-03	0.0E+00	2.0E-02
Ru-103+	0.0E+00	2.5E-03	2.5E-03	2.5E-03	2.5E-03	0.0E+00	2.7E-03
Ru-105	0.0E+00	2.5E-03	2.5E-03	2.5E-03	2.5E-03	0.0E+00	2.7E-03
Ru-106+	0.0E+00	2.5E-03	2.5E-03	2.5E-03	2.5E-03	0.0E+00	2.7E-03
Rh-105	0.0E+00	2.5E-03	2.5E-03	2.5E-03	2.5E-03	0.0E+00	2.7E-03
Te-127m+	0.0E+00	5.0E-02	2.6E-01	5.0E-02	2.6E-01	2.0E-03	3.9E-01
Te-127	0.0E+00	5.0E-02	2.6E-01	5.0E-02	2.6E-01	2.0E-03	3.9E-01
Te-129m+	0.0E+00	5.0E-02	2.6E-01	5.0E-02	2.6E-01	2.0E-03	3.9E-01
Te-131m	0.0E+00	5.0E-02	2.6E-01	5.0E-02	2.6E-01	2.0E-03	3.9E-01
Te-132+	0.0E+00	5.0E-02	2.6E-01	5.0E-02	2.6E-01	2.0E-03	3.9E-01
I-131	5.0E-02	2.5E-01	3.1E-01	3.5E-01	3.5E-01	2.0E-03	4.7E-01
I-133	5.0E-02	2.5E-01	3.1E-01	3.5E-01	3.5E-01	2.0E-03	4.7E-01
I-134	5.0E-02	2.5E-01	3.1E-01	3.5E-01	3.5E-01	2.0E-03	4.7E-01
I-135	5.0E-02	2.5E-01	3.1E-01	3.5E-01	3.5E-01	2.0E-03	4.7E-01
Cs-134	5.0E-02	2.0E-01	3.6E-01	2.5E-01	4.5E-01	2.0E-03	1.3E-01
Cs-136	5.0E-02	2.0E-01	3.6E-01	2.5E-01	4.5E-01	2.0E-03	1.3E-01
Cs-137+	5.0E-02	2.0E-01	3.6E-01	2.5E-01	4.5E-01	2.0E-03	1.3E-01
Ba-140+	0.0E+00	2.0E-02	1.0E-01	2.0E-02	1.0E-01	0.0E+00	5.0E-03
Ce-141	0.0E+00	5.0E-04	5.0E-03	5.0E-04	5.0E-03	0.0E+00	1.3E-07
Ce-143	0.0E+00	5.0E-04	5.0E-03	5.0E-04	5.0E-03	0.0E+00	1.3E-07
Ce-144+	0.0E+00	5.0E-04	5.0E-03	5.0E-04	5.0E-03	0.0E+00	1.3E-07
Pr-143	0.0E+00	2.0E-04	5.0E-03	2.0E-04	5.0E-03	0.0E+00	1.4E-07
Nd-147	0.0E+00	2.0E-04	5.0E-03	2.0E-04	5.0E-03	0.0E+00	1.4E-07
Np-239	0.0E+00	5.0E-04	5.0E-03	5.0E-04	5.0E-03	0.0E+00	1.3E-07
Pu-238	0.0E+00	5.0E-04	5.0E-03	5.0E-04	5.0E-03	0.0E+00	1.3E-07
Pu-239	0.0E+00	5.0E-04	5.0E-03	5.0E-04	5.0E-03	0.0E+00	1.3E-07
Pu-240	0.0E+00	5.0E-04	5.0E-03	5.0E-04	5.0E-03	0.0E+00	1.3E-07
Pu-241	0.0E+00	5.0E-04	5.0E-03	5.0E-04	5.0E-03	0.0E+00	1.3E-07
Am-241	0.0E+00	2.0E-04	5.0E-03	2.0E-04	5.0E-03	0.0E+00	1.4E-07
Cm-242	0.0E+00	2.0E-04	5.0E-03	2.0E-04	5.0E-03	0.0E+00	1.4E-07
Cm-244	0.0E+00	2.0E-04	5.0E-03	2.0E-04	5.0E-03	0.0E+00	1.4E-07

Exposed Individuals

Consider all individuals being exposed

Past experience: Not considering all members of the public may result in unwarranted actions being taken that do more harm than good.

All members of the public (including the most sensitive) have been considered in the calculation of the OILs by taking response actions based on the dose projected or received by the representative person.

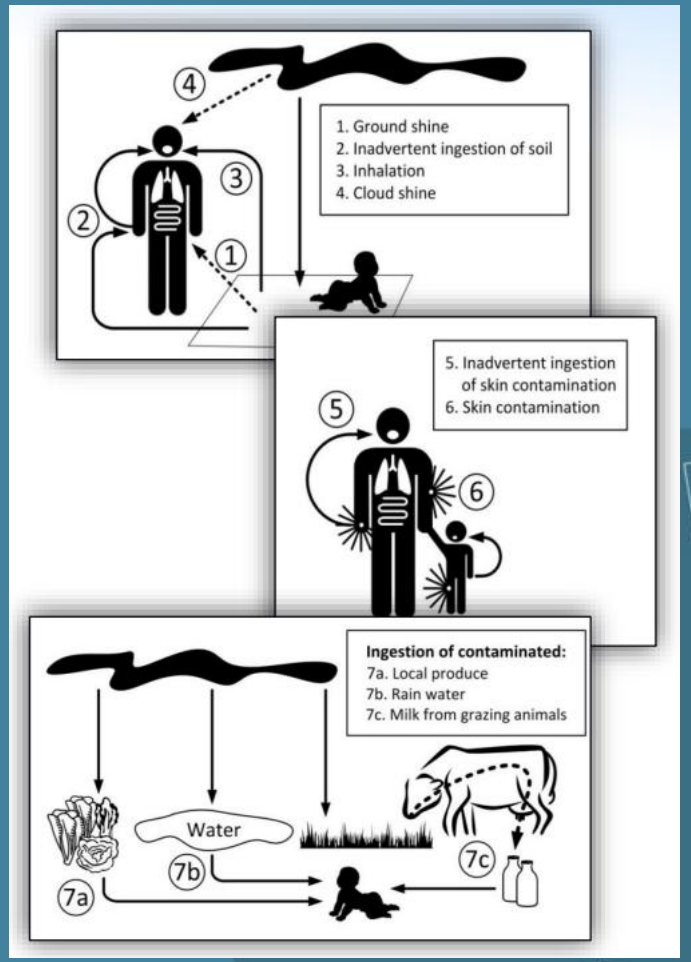
Exposure Scenarios and Pathways

Consider all relevant exposure scenarios and associated pathways.

Five exposure scenarios resulting from deposited radioactive material are considered:

- 'ground' scenario;
- 'food pre-analysis' scenario;
- 'skin' scenario;
- 'food post-analysis' scenario;
- 'thyroid' scenarios;

For each exposure scenario, different exposure pathways are taken into account.



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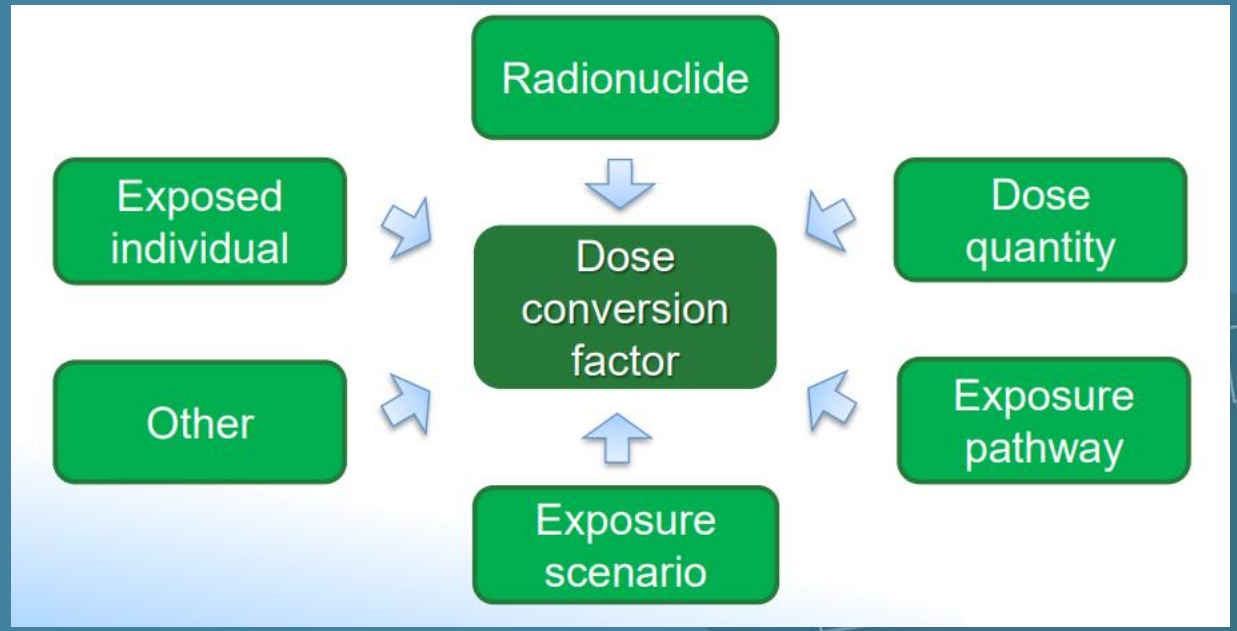
Consider the behavior of the radionuclides

- Decay and ingrowth;
- Weathering (ground, skin, vegetation);
- Resuspension;
- Inadvertent ingestion from the ground;
- Transfer from the skin to gastrointestinal tract;
- Transfer to the food, milk and drinking water.
- Etc.

Dose Conversion Factors

Determine the dose conversion factors required to perform the relevant organ dose calculations

Dose conversion factors relate the activity of a certain radionuclide with the projected dose, which is needed to determine if the generic criteria may be exceeded.



Instrument Response

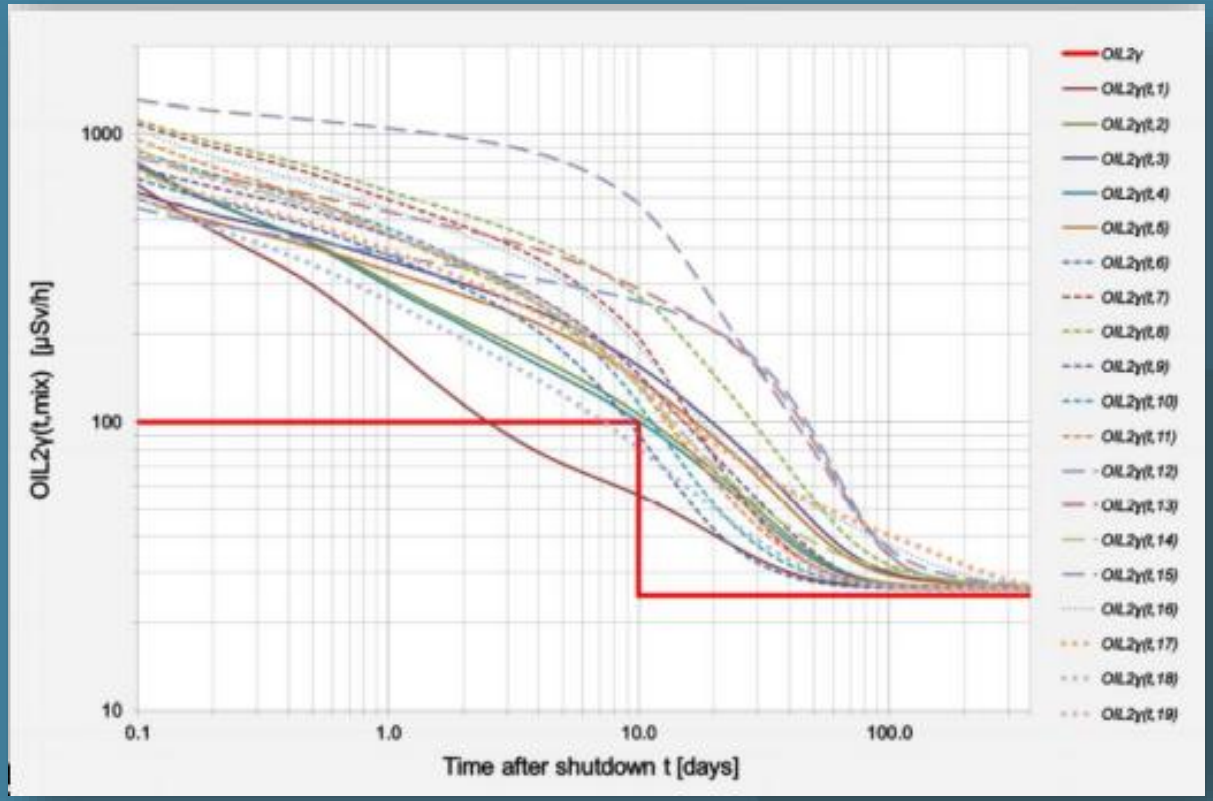
The instrument response will affect the default OIL values and needs to be considered in the calculations.

OIL(t, mix) Functions & Default OIL Values

Calculate the time and mix dependent OIL(t, mix) functions and select a default OIL value.

OIL values depend on the radionuclide mix which will vary over time.

For each OIL a set of time and mix dependent OIL(t, mix) functions is calculated, based on which a default OIL value is chosen.




Discussion

Thank You

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