

Application of Reference Dose Levels for Radiological Emergencies at Forsmark NPP, Sweden

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Agenda

- Introduction
- Aim
- Local Application of Dose Levels for Radiological Emergencies



Reference Dose Levels

- In the event of a Radiological Emergency the normal Radiation Dose Limits are substituted by Reference Dose Levels.
- Sweden has recently implemented a new Radiation Protection Regulation with updated Dose Limits and Reference Levels in order to harmonize with the BSS Directive 2013/59/Euratom.

Forsmark Nuclear Power Plant

- Three BWR units
 - Forsmark 1 (1980)
 - Forsmark 2 (1981)
 - Forsmark 3 (1985)
- Largest nuclear facility in Sweden.



Aim

- The aim of this presentation is to describe how Forsmark NPP has applied these Reference Dose Levels,
 - both in general terms and
 - for task specific optimisation.



Radiological Emergency

- Council Directive 2013/59/Euratom – Definition:
 - “Emergency” means a non-routine situation or event involving a radiation source that necessitates prompt action to mitigate serious adverse consequences for human health and safety, quality of life, property or the environment, or a hazard that could give rise to such serious adverse consequences.
- Forsmark NPP has defined that an event at the NPP automatically transforms from a disturbance to a radiological emergency if we have any, of these two, site alert levels for emergency actions:
 - Off-site alert;
 - General emergency.

In a Radiological Emergency

- The normal dose limit of 20 mSv/year does not apply!
- Instead **reference dose levels** for emergency occupational exposure.
- The reference dose levels shall:
 - in general, not exceed an effective dose of 100 mSv;
 - in exceptional situations, they may exceed an effective dose of 100 mSv, but not 500 mSv, in order to save life, prevent severe radiation-induced health effects, or prevent the development of catastrophic conditions.



Christopher Furlong – Time magazine

Reference Dose Level

Council Directive 2013/59/Euratom – Definition:

“Reference Level” means in an emergency exposure situation or in an existing exposure situation, the level of effective dose or equivalent dose or activity concentration above which it is judged inappropriate to allow exposures to occur as a result of that exposure situation, even though it is **not a limit** that may not be exceeded.



Application of Reference Dose Levels at Forsmark NPP

- Prohibited to employ pregnant or breast-feeding women.
- Women are only allowed to participate if themselves can rule out pregnancy.

- In Sweden, all work in a controlled area with a possible dose > 20mSv must be voluntarily.
 - The voluntariness must be documented.
 - Emergency workers who are liable to undertake actions must be clearly and comprehensively informed in advance of the associated health risks and the available protection measures (PJB).
 - Preferably be > 45 years old.



Reference Dose Levels at Forsmark NPP

- General reference dose level at the whole plant = 20 mSv.
- General reference dose level at the controlled area at the affected unit = 100 mSv.
- Specific reference dose levels depending on the purpose/gain of the action.
- Up to 500 mSv in order to save life or prevent the development of catastrophic conditions.



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Task Specific Reference Levels

| Category | Purpose/gain of measure | Referens Level | Decision by | Conditions | EPD alarm setting |
|----------|--|---|----------------------------------|---|-----------------------------------|
| 1 | <ul style="list-style-type: none"> - Save life - prevent the development of catastrophic conditions | All available protection measures shall be used to prevent the resulting exposure to be < 500 mSv | SED in consultation with the RPM | <ul style="list-style-type: none"> - Volunteers - Not women in fertile age - Informed of risks | Rescue |
| 2 | <ul style="list-style-type: none"> - Prevent serious core damage - Prevent serious injuries - Prevent large collective dose - Restoration of the reactor safety system | < 100 mSv | SED in consultation with the RPM | <ul style="list-style-type: none"> - Volunteers - Not pregnant - Not breast feeding - Informed of risks | Rescue |
| 3 | <ul style="list-style-type: none"> - Prevent the situation from developing severely (eg filtered venting measures) - Short-term / emergency recovery measures -Urgent protective measures | < 50 mSv | SED in consultation with the RPM | <ul style="list-style-type: none"> - Volunteers - Not pregnant - Not breast feeding - Informed of risks | Accident |
| 4 | <ul style="list-style-type: none"> - Other work organised by the emergency organisation – e.g. monitoring or sample collection in the surrounding | < 20 mSv | OM in consultation with the RPM | <ul style="list-style-type: none"> - Not pregnant - Not breast feeding - Informed of risks | Accident |
| 5 | <ul style="list-style-type: none"> - Measures without direct connection to the emergency - Measures during the recovery phase | Ordinary dose limits applies, taking ALARA into account | Ordinary organisation | | Normal (adjusted for the purpose) |

SED = Site Emergency Director

RPM = Radiation Protection Manager

OM = Operation Management

Task Specific Reference Dose Levels

The dose is calculated as external gamma dose

If NO intake of iodine tablets → Reference dose level x 0,2.

Suspicion of airborne radioactivity and no use of respiratory protection → Reference dose level x 0,5.

The risk of severe skin contamination or beta-irradiation of unprotected body parts should be considered. No specific factor can be specified.



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Task Specific Reference Dose Levels

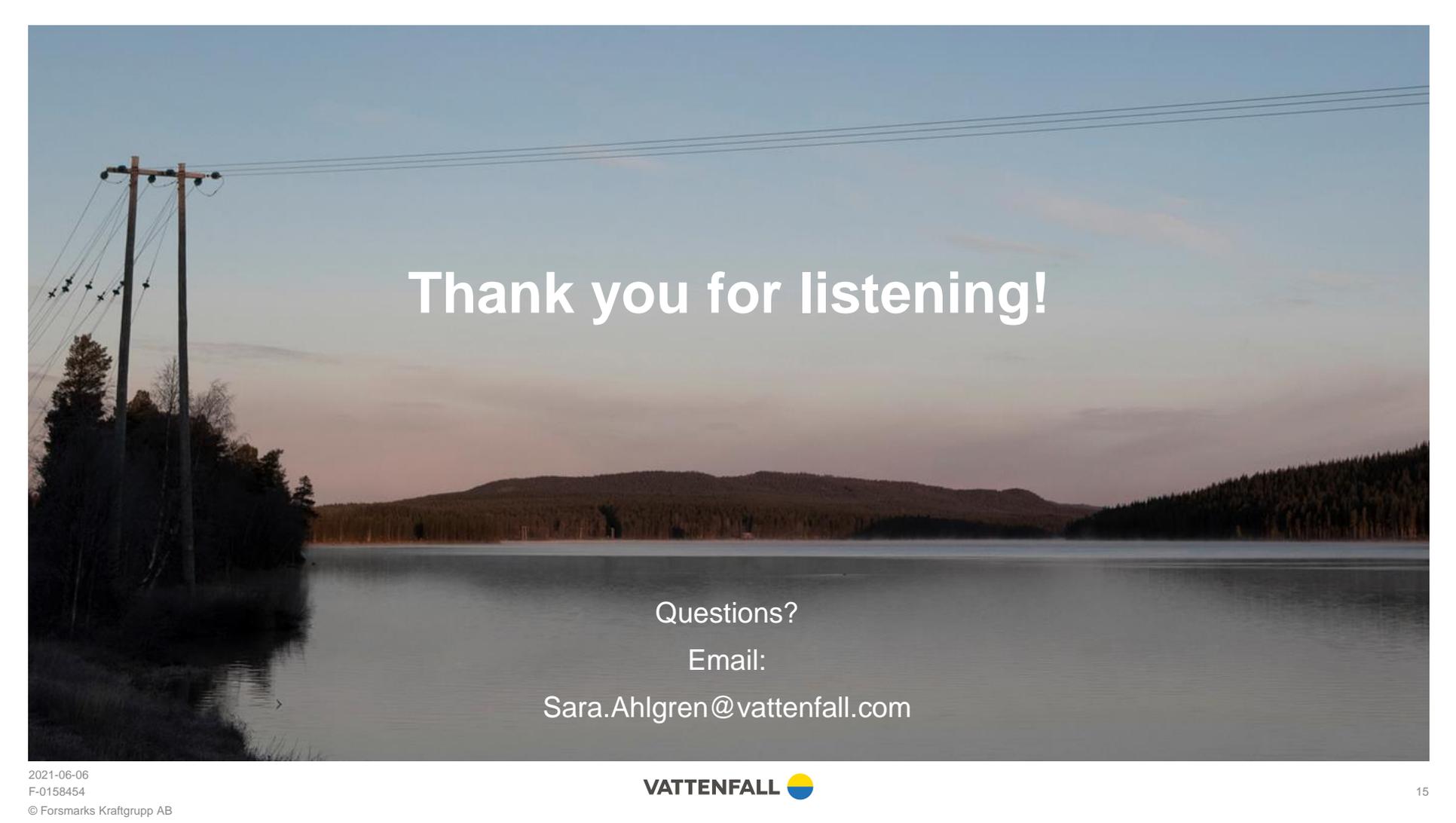
- Based on task specific Reference Dose Levels we have pre-set dose and dose rate alarms on our emergency EPD system.



Reference Levels at Forsmark NPP

- The task specific reference levels has been implemented in guidelines with operational intervention levels (OIL´s) facilitating the work of the Radiation Protection Manager in an emergency situation.





Thank you for listening!

Questions?

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