Supplement of

A tentative useful-for-all definition of “safety” in the context of radioactive waste disposal

Stephan Hotzel

Correspondence to: Stephan Hotzel (stephan.hotzel@bfe.bund.de)

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A tentative useful-for-all definition of ‘safety’ in the context of radioactive waste disposal

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Stephan Hotzel, Federal Office for the Safety of Nuclear Waste Management (BASE)
Why this study/contribution?

1. Motivation #1: The challenge:
   “To communicate the case for safety in plain language”

2. The trigger (2017):
   A test of the clarity of the concept of safety

Core literature study:
Proceedings of WM conference, Phoenix, 2018
Introduction: Looking for a definition

- Most programs pledge overall commitment to safety
- But the term ‘safety’ is hardly defined in these programs
Introduction: Looking for a definition

- Most programs pledge overall commitment to safety
- But the term ‘safety’ is hardly defined in these programs

- Is a definition really needed?
- Don’t we all have a common understanding, what it means that something is safe?
Introduction: Looking for a definition

- Most programs pledge overall commitment to safety
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- Is a definition really needed?
- Don’t we all have a common understanding, what it means that something is safe?
- E.g. a local newspaper headline:
  “Way to school and repository shall be safe”
Introduction: Consider these types of definitions

- **Dictionary-type definitions:**
  - Capture meaning of a term as used in (common) language
  - ~20 words, often including example sentence

- **Encyclopaedia-type definitions:**
  - Capture meaning of a term as used in (specialists) language
  - ~1000 words, including explanations

- **Glossary-type definitions:**
  - Capture controlled meaning of a term as used in a document
  - Short or long, sometimes including commentary
  - Can be correct (or not correct)
  - Can be practical (or not practical)
Outline of this presentation

- Introduction
- ‘Safety’ in international guidance literature, and in a common Dictionary:
  - IAEA guidance
  - ICRP guidance
  - OECD/NEA guidance
- Proposal for a definition of ‘safety’
‘Safety’ in an English dictionary and in DGR context


1. “Safety – the state of not being dangerous or likely to cause harm or injury
   [Example:] Some scientists expressed concern over the safety of the test”

2. “Safety – the state of being safe from danger or harm
   [Example:] The company seemed totally unconcerned about the safety of its workers”

Safety: Of what?
‘Safety’ in an English dictionary and in DGR context


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Safety: Of what?

1. Of the (threatening) object
2. Of the people impacted by this object
‘Safety’ in an English dictionary and in **DGR context**

Compare with standard use in DGR context:

1. Check: “The safety of the facility” (DGR/repository)
2. Check: “The safety of the people” (workers/public)

- Also used as abstract concept somehow between (1) and (2):
  - “Overall commitment to safety”
  - “Safety of Geological Disposal”
‘Safety’ in an English dictionary and in DGR context

• Either way, ‘safety’ relates to the physical integrity of people
• First use more common in DGR parlance
➢ Looking for a definition of ‘(repository) safety’
‘Safety’ in an English dictionary and in DGR context

• Either way, ‘safety’ relates to the physical integrity of people
• First use more common in DGR parlance
➢ Looking for a definition of ‘(repository) safety’

Some examples:
• “We are talking about repository safety”
• “We are assessing the safety of the repository”
• “We are discussing whether the repository is safe”
‘Safety’ in an English dictionary and in DGR context

- Either way, ‘safety’ relates to the physical integrity of people
- First use more common in DGR parlance
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NOTE

Asking what the term ‘safety’ means, i.e. what safety is (in the DGR context), does not contribute to the issue of “How safe is safe enough?”

The latter is usually laid down in national regulation.
‘Safety’ in an English dictionary and in DGR context

- Either way, ‘safety’ relates to the physical integrity of people
- First use more common in DGR parlance
- Looking for a definition of ‘(repository) safety’
‘Safety’ in IAEA references

References analysed:

• “Disposal of Radioactive Waste” (SSR-5, 2011)
• IAEA Safety Glossary (2018, pp. 2/3, 155, 176, 205)
‘Safety’ in ICRP references

References analysed:

• “Radiological Protection in Geological Disposal of Long-lived Solid Radioactive Waste” (ICRP-122, 2013)


➢ “Safety – The achievement of proper operating conditions, prevention of accidents, or mitigation of accident consequences”
Why not using the definitions of IAEA or ICRP?

Consider and distinguish:

• Accessible DGR (~operational phase): Waste handling plant similar to other nuclear source handling plants and even Nuclear Power Plants (NPPs)

• Closed DGR (post-closure phase): Not accessible anymore, and should not be accessed anymore. Hence, facility not amenable to direct control by humans

➢ The IAEA(2007)/ICRP(2007) definitions are framed in the context of an accessible facility. They have a clear real-time focus.
‘Safety’ in OECD/NEA references

References analysed:

• “The nature and purpose of post-closure safety cases for geological repositories” (OECD/NEA|IGSC 2013)

• “Stakeholder Confidence in Radioactive Waste Management – An Annotated Glossary of Key Terms” (OECD/NEA|FSC 2013)

• “Foundations and guiding principles for the preservation of records, knowledge and memory across generations: [...] A Collective Statement of the NEA Radioactive Waste Management Committee” (OECD/NEA|RWMC 2014)
Why not using the definitions of OECD/NEA?

There is none(*). Even though

- “the safety case is a formal compilation of evidence and arguments that substantiate the safety of the repository”

➢ Tempted to define backwards from the definition of the safety case. Like this: Safety of the repository – the state that is to be substantiated by arguments and evidence in the safety case

(*)No explicit one. Found an implicit one, see 4 slides later
Results from reference analysis (1/3)

We recognised three fundamentally different definitions:

1. Technical definitions (IAEA 2007 & ICRP 2007)
   - Meaning of ‘safety’ targeted to nuclear facilities like NPPs
   - Problem:
     They focus on ‘safety’ of an accessible nuclear installations
Results from reference analysis (2/3)

We recognised three fundamentally different definitions:

2. Identification with ‘safety case’ definitions (...)
   ▪ Backward definition from the safety case concept
   ☐ Problem:
     Need to understand techno-scientific and regulatory details of the safety case concept first
Results from reference analysis (3/3)

We recognised three fundamentally different definitions:

Results from reference analysis (3/3)

We recognised three fundamentally different definitions:


“... safety – meaning the absence of significant threats to human health or the environment – ...” (p. 1)
We recognised three fundamentally different definitions:

   - Meaning of ‘safety (of something)’ as used/understood in common language
   - Problem:
     Lacking the particular DGR context, but this could be added…

“… safety – meaning the absence of significant threats to human health or the environment – …” (p. 1)
Proposal:
Dictionary type definition with focus on closed DGR context

- (DGR) **Safety** – the absence of [[significant]] threats (from the DGR) to human health and the environment at any point in time

Example: “Pointing at the latest predictions for changes in groundwater flow over the next millennium, stakeholders expressed new concern over the safety of the DGR.”
To sum up

- Number of references with ‘safety’ in the glossary very small
- Not all definitions found are likely easily understandable and hence acceptable for different parties
- Some examples exist of relatively simple and clear definitions – general enough and yet specific enough to connect to DGR
- Based on these, a new definition is proposed – to support communication between different parties:

- **Safety** (of the repository) – the absence of threats (from the repository) to human health and the environment at any point in time

Thank you for your attention