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Supplement of

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

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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:
Hotzel, S. and Schröder, J.: "To the 'Safety related?' Question: What is Related to Safety?",
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

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- Is a definition really needed?

- Don't we all have a common understanding,
  what it means that something is safe?

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- 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?

- E.g. a local newspaper headline:

  "Way to school and repository shall be safe"

Schulweg und Endlager sollen sicher sein

Die Nagra plant bei Marthalen eine Bohrung neben einem Schulweg. Zurzeit werden Massnahmen diskutiert, um den Weg sicher zu machen – vielleicht mit einer Ausweichroute.

Markus Brupbacher
Aktualisiert: 10.11.2017, 07:30

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'

IAEA – *International Atomic Energy Agency*   **ICRP –** *International Commission on Radiological Protection*

OECD/NEA – *Nuclear Energy Agency of the Organisation for Economic Co-operation and Development*

'Safety' in an **English dictionary** and in DGR context

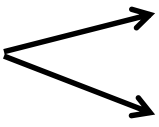Longman Dictionary of Contemporary English (1995):

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

Longman Dictionary of Contemporary English (1995):

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"

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   [Example:] The company seemed totally unconcerned about the safety of its workers"

Safety: Of what?

1. Of the (threatening) object

2. Of the people impacted by this object

'Safety' in an English dictionary and in <u>DGR context</u>

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"

DGR – *Deep Geological Repository*

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'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

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➢ 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

➢ Looking for a definition of '(repository) safety'

> NOTE
>
> Asking what the term 'safety' <u>means</u>, i.e. what safety <u>is</u> (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

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➢ Looking for a definition of '(repository) safety'

'Safety' in IAEA references

References analysed:

- "Disposal of Radioactive Waste" (SSR-5, 2011)

- "Geological Disposal Facilities for Radioactive Waste" (SSG-14, 2011)

- "The Safety Case and Safety Assessment for the Disposal of Radioactive Waste" (SSG-23, 2012)

- IAEA Safety Glossary (2007, pp. 2/3, 133/134, 150, 173/174)

- 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)

- "The 2007 Recommendations of the International Commission on Radiological Protection" (ICRP-103, 2007, p. 32)

➢ "**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 <u>safety case</u>. 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:

3. Dictionary type definitions (Longman 1995 & RWMC 2014)

Results from reference analysis (3/3)

We recognised three fundamentally different definitions:

3. Dictionary type definitions (Longman 1995 & RWMC 2014)

„… safety – meaning the absence of significant threats to human health or the environment – …" (p. 1)

Results from reference analysis (3/3)

We recognised three fundamentally different definitions:

3. Dictionary type definitions (Longman 1995 & RWMC 2014)

- 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