Safety Case as a Tool for Safety Communication

Osamu Tochiyama
Nuclear Safety Research Association

What is safety case?

From: IAEA Safety Requirements for Geological Disposal of Radioactive Waste, WS-R-4, 2006.

- The safety case substantiates the safety, and contributes to confidence in the safety, of the geological disposal facility.
- The safety case is an essential input to all the important decisions concerning the facility.
- It includes the output of safety assessments, together with additional information, including supporting evidence and reasoning on the robustness and reliability of the facility, its design, the design logic, and the quality of safety assessments and underlying assumptions. The safety case may also include more general arguments relating to the need for the disposal of radioactive waste, and information to put the results of the safety assessments into perspective.

Case (Collins COBUILD)
The case for or against a plan or idea consists of the facts and the reasons used to support it or oppose it.

Difference between safety assessment and the safety case

From: IAEA Safety Requirements for Geological Disposal of Radioactive Waste, WS-R-4, 2006.

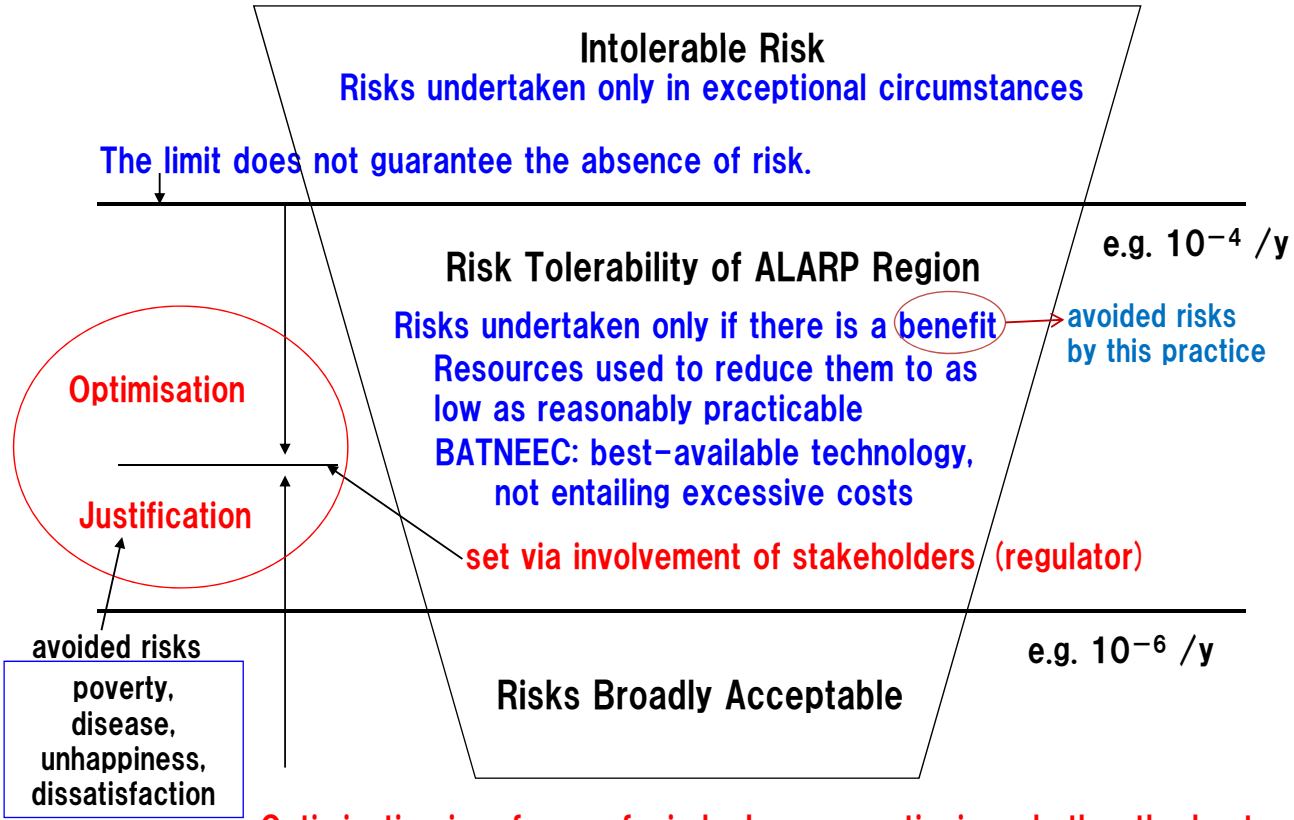
Safety assessment is the process of systematically analysing the hazards associated with the facility and the ability of the site and the design of the facility to provide for the safety functions and to meet technical requirements.

The safety case substantiates the safety, and contributes to confidence in the safety, of the geological disposal facility.

An assessment is a consideration of someone or something and a judgment about them. (Collins COBULD)
Hazard / Risk : quantifiable by using a certain indicator (e.g. dose) → judgment

The case for or against a plan or idea consists of the facts and the reasons used to support it or oppose it. (Collins COBUILD)
Safety = no hazards or no risks; risks and benefits with different measures of safety must be compared.

How safe is safe enough?



Optimisation is a frame of mind, always questioning whether the best has been done in the prevailing circumstances. (ICRP Publ. 101)

Justification and Optimisation (ICRP, IAEA)

Justification

The process of determining whether a practice is, overall, beneficial, i.e. whether the benefits to individuals and to society from introducing or continuing the practice outweigh the harm resulting from the practice.

Optimisation of protection (and safety)

The process of determining what level of protection and safety makes exposures, and the probability and magnitude of potential exposures, "as low as reasonably achievable, economic and social factors being taking account".

Social decision-making

Proposal which may cause risks to the society

↓

Safety case : statement on justification, optimisation

↓

Optimisation
proponent & stakeholders (policy maker, regulator, general public)

↓

Setting the level of protection and safety (regulator)
(The level can be fixed if the prevailing circumstances are not changed)

↓

Safety assessment : judge whether it is safe or not

Imagine the situation.

- You are a member of the society (a stakeholder).
- Geological disposal is proposed as a solution for the management of radioactive wastes among alternatives.
- You must make a decision whether or not to accept the proposal.
- But you do not know the risks and benefits which will be given by this option.

You need to be informed about the risks and benefits.

You need to be informed about the risks and benefits,
but there are uncertainties due to lack of knowledge everywhere!

- You do not know much about the proposal and other circumstances.
- Information you can obtain is limited.
- The proponent may have not enough knowledge for the estimation of the risks and benefits of all possible alternative options.
- The proponent gives you only a part of information. (asymmetric information).
- The information given by the proponent may be inclined (not neutral for the judgment).
- The measure for the safety may not be common to you and the proponent.
- No one can foretell or determine the future.

uncertainties in the technology
uncertainties in the communication
uncertainties in the safety measure
uncertainties in forecasting

→ Uncertainties give residual risks.

"Bounded rationality and Satisficing in decision-making under uncertainty"

By Herbert Simon (1916-2001): psychologist, Nobel Prize in Economics 1986)
"The Sciences of the Artifical",3rd. Ed. (1999)

Substantive rationality: choosing the right course of the action.
Optimization requires that all alternatives must be measurable in terms of a common utility function.

It is impossible to have perfect and complete information at any given time to make a decision.

Bounded rationality = The rationality in situations where the complexity of the environment is immensely greater than the computational powers of the adaptive system.

Procedural rationality: finding a way of calculating where a good course of action lies. Find decisions that are "good enough" (satisficing).

satisfice = decide on and pursue a course of action that will satisfy the minimum requirements necessary to achieve a particular goal. (Oxford)

In the social decision-making under uncertainty (to reach a social consensus), the society follows a rational procedure to find decisions that are "good enough" (satisficing).

There is no true answer in decision-making.
Procedure rather than substance plays a key role.

You (as a member of the society) want to hear not only about the chosen result but also about the reason of the selection. = You require the safety case stating the reasons why the proponent supports the geological disposal option.

説得より納得： satisfying than preaching

You (as a stakeholder) want to hear the justification (statement of confidence) in:

- Safety strategy : nuclear energy & radioactive waste than fossil & CO_2 etc., concentrate and contain than dilute and dispersion, deep underground disposal among possible options, engineering design, stepwise process etc.

Materials which support (justify) the selected strategy

- Assessment basis : system concept, scientific understanding, methods etc.
- Evidences, analyses and arguments

Supporting basis
Substantive rationality

make a story

- The discussion should be based on a sound scientific and engineering basis.
- Assessment basis, evidences, analyses, arguments must be able to be followed or confirmed to be reliable.
- Uncertainties should be properly treated and estimated.
- Final decision should be consistent with your ethical standard (measure of the safety). (Has the best effort been made?)

Using safety case in safety communication
Setting the role of safety case in regulation?

Proposal which may cause risks to the society

Safety case : statement on justification, optimisation

Optimisation (proponent & stakeholders: policy maker, regulator, general public)

Regulator as a representative of stakeholders

Setting the level of protection and safety
(The level can be fixed if the prevailing circumstances are not changed)

Repeated activities in the society.
regulation system hitherto

may change

change

Safety assessment : judge whether it is safe or not

A safety case and supporting safety assessment shall be prepared and updated by the operator, as necessary, at each step in the development, operation and closure of the geological facility. (IAEA WS-R-4)

Using safety case in safety communication
Preparing the safety case by the operator

Safety case is not a simple technical report.

Aim at ⇨ **説得より納得： satisfying than preaching**

Integration/reorganization of the materials.
Presentation of the materials.
Communication with stakeholders.

to overcome asymmetric information ⇧ Keep in mind who is the reader.

Frequent and detailed review not only with scientists but also with writers, editors, educators, communicators etc.

Using safety case in Knowledge Management System

Knowledge [Collins COBUILD]
- Knowledge is information and understanding about a subject which a person has or which all people have.
- Information about someone or something consists of facts about them.

A word has some meanings.
The word in a sentence has more and less meanings than the word itself.
The sentence in a story has more and less meanings than the sentence itself.

Understanding is a dynamic process that information is transformed into knowledge.

understanding
- substantive (deductive, inductive)
- heuristic (connect using reasoning and past experience)

understanding = interaction between integration and analysis

Knowledge Management = understanding and knowledge creating

Knowledge on Radioactive Disposal

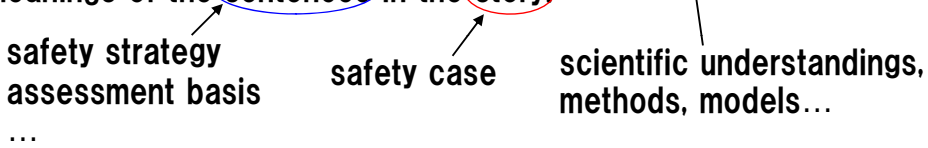
must be socialized to all stakeholders.
(R&D people, implementer, regulator, public)

to overcome asymmetric information

Using safety case in Knowledge Management System

A word has some meanings.
The word in a sentence has more and less meanings than the word itself.
The sentence in a story has more and less meanings than the sentence itself.

Knowledge management = understand the meanings of the words in the sentence, the meanings of the sentences in the story.



KM ⇨ Putting and integrating the information or the knowledge in the context.
Discussing their meanings.
Recreating or reconstructing the words, sentences, or story.

Safety case is a score for members of an orchestra to play a symphony (geological disposal).
Each member plays his part to make the total sound with hearing the total sound made by all members. (socialization, externalization, combination and internalization occur concurrently.)
No member is less important than the others. Let's play the music!