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Lecturing Ethics in Courses on Radiological Protection and Nuclear Technology Assessment

Feedback on 5Y of Academic Experience

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Lecturing Ethics in Courses on RP and Nuclear Technology Assessment - Feedback on 5Y of Academic Experience

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Introduction

Three cases to set the scene

case 1 A worker needs to execute a special task in the controlled area of a nuclear power plant. The group that is 'on shift' consists of two workers, of which one of them is female. The female worker says to her colleague: 'You go into the area to do that work. I want to minimise my risk, as I plan to become pregnant in the near future'.

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Introduction
Three cases to set the scene

case 2 A national radioactive waste agency looks for a candidate municipality to host a RW disposal site. It insists that the siting decision has to be taken democratic, and with the involvement of all stakeholders. Together with the local citizens of two volunteering municipalities, the agency designs a package of socio-economic compensation and a system for the future involvement process and the long-term management of the compensation fund. As the process develops, one can observe that it gets more and more the character of a competition to get the disposal site.

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Introduction

Three cases to set the scene

case 3 A nuclear expert is inquired about the aspects of radioactive waste management of the 4th Generation nuclear power plant technology during a hearing in a parliamentary commission. The expert claims that this future technology will be more 'sustainable', as the waste volumes will be reduced due to optimised use of uranium resources and especially because the decay time can be brought back to a few hundred years with the use of transmutation.

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Rationale and normative framework
What the cases have in common

- The presented cases are realistic examples of situations where ‘responsible acting’ in face of a risk is needed
  - for which responsible actors cannot (fully) rely on theoretical or empirical evidence from out of natural and engineering sciences;
  - that trigger conflicting opinions based on diverse but as relevant value frameworks of concerned actors.

- All situations are marked by uncertainties and complexities that complicate the assessment of the 'risk' involved.

- These uncertainties and complexities emerge with the question on what basis the involved people would be able to ‘justify' their 'act' and its consequences, as a kind of accountability towards others.

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Rationale and normative framework

Rationale for integrating ethics in RP and NTA courses

- Typical uncertainties and complexities hinder the use of rational evidence as basis of justification of risk-inherent practices

  In addition, there exist initial different opinions on the practices *as such*, based on different (but as relevant) value frameworks
- The lack of 'evidence of proof' in radiological risk assessment triggers ethical considerations and value-based discourse that complicates decision making (that would want to rely on straightforward rationalities).
- Dealing with risk-inherent technologies such as nuclear technology requires policy methods that inevitably need to rely on “opinions that cannot be turned into facts”.
- The generation of trust, being the prime quality criterion of good decision making,
  - would need to start with finding consensus in recognising what can and cannot be done with science, and
  - would need to build on the preparedness to generate transparency in the cocktail of concerns and interests of all actors and stakeholders.

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Rationale and normative framework

Rationale for integrating ethics in RP and NTA courses

Aim of the courses: To offer students and professionals a set of ideas and a frame that would enable them

1 ► to gain insight in complexity

- use of science in policy,
- opinion-based discourse,
- risk perception, assessment and regulation (hard & soft law)
- policy agendas (of politics, industry, civil society)
- working of institutes

2 ► to reflect on (and discuss) proposed attitudes in and methods of 'better' knowledge generation and policy making in the interest of fair and effective risk governance

▼ … to gain more confidence in their work and maintain credibility towards colleagues, the stakeholders and the general public (ETRAP2005 declaration)

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Rationale and normative framework

Rationale for integrating ethics in RP and NTA courses

Target audiences

- students, (young) professionals

- fields of application
  - nuclear engineering
  - operational radiological protection
  - medical sector

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Rationale and normative framework

Rationale for integrating ethics in RP and NTA courses

Target audiences

► students, (young) professionals

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- nuclear engineering
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the same philosophical grounds,
different stories of 'justifying the radiological risk'

and the same required skills, attitudes, methods…

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Rationale and normative framework

Rationale for integrating ethics in RP and NTA courses

Especially towards young professionals, we speak of

'E&Tplus' "Transdisciplinarity and inclusiveness as 'tools' to foster reflexivity"

- Through transdisciplinary learning, young professionals should become able to
  - use factual knowledge from sciences and technology in critical analysis;
  - interpret and learn from historical lessons;
  - recognise, state and accept uncertainties instead of trying to exclude them;
  - better understand social mechanisms, also in the working environment;
  - broaden the risk scope to 'multifactorial concerns' in complex situations.

- Taking courses in politics and ethics of technology is not the nuclear student/young professional's duty but his/her right;

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Key themes and ideas

1. Cognitive and normative factors influencing the justification of risk
2. Using science in risk governance
3. Using guiding principles in risk governance
4. Of attitudes and methods: the ethics of risk governance

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Key themes and ideas
informing the basic structure of the course

Course part one

- ► Starting from concrete relevant cases and situations to reflect on
- 1 Cognitive and normative factors influencing the justification of risk
- 2 Using science in risk governance
- 3 Using guiding principles in risk governance

Course part two

- ► Exploring the philosophical ideas behind
  with the aim to trigger contextual thinking and opinion making

Course part three

- ► Assessing a proposed normative approach to ‘good’ risk governance
- 4 Of attitudes and methods: the ethics of risk governance

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Key themes and ideas
Examples of relevant cases and situations

(to trigger your critical mind)

1. Justifying nuclear energy in the context of sustainable development
2. Risk perception in San Francisco, and in nuclear technology assessment
3. The nuclear expert in parliament
4. Sustainable development and intergenerational ethics in radioactive waste management

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Key themes and ideas / examples of cases and situations

Justifying nuclear energy in the context of SD

- Conflicting opinions on nuclear in relation to climate change and sustainable development

'nuclear is sustainable'

'nuclear can contribute to sustainable development'

'climate change is a problem and nuclear is part of the solution'

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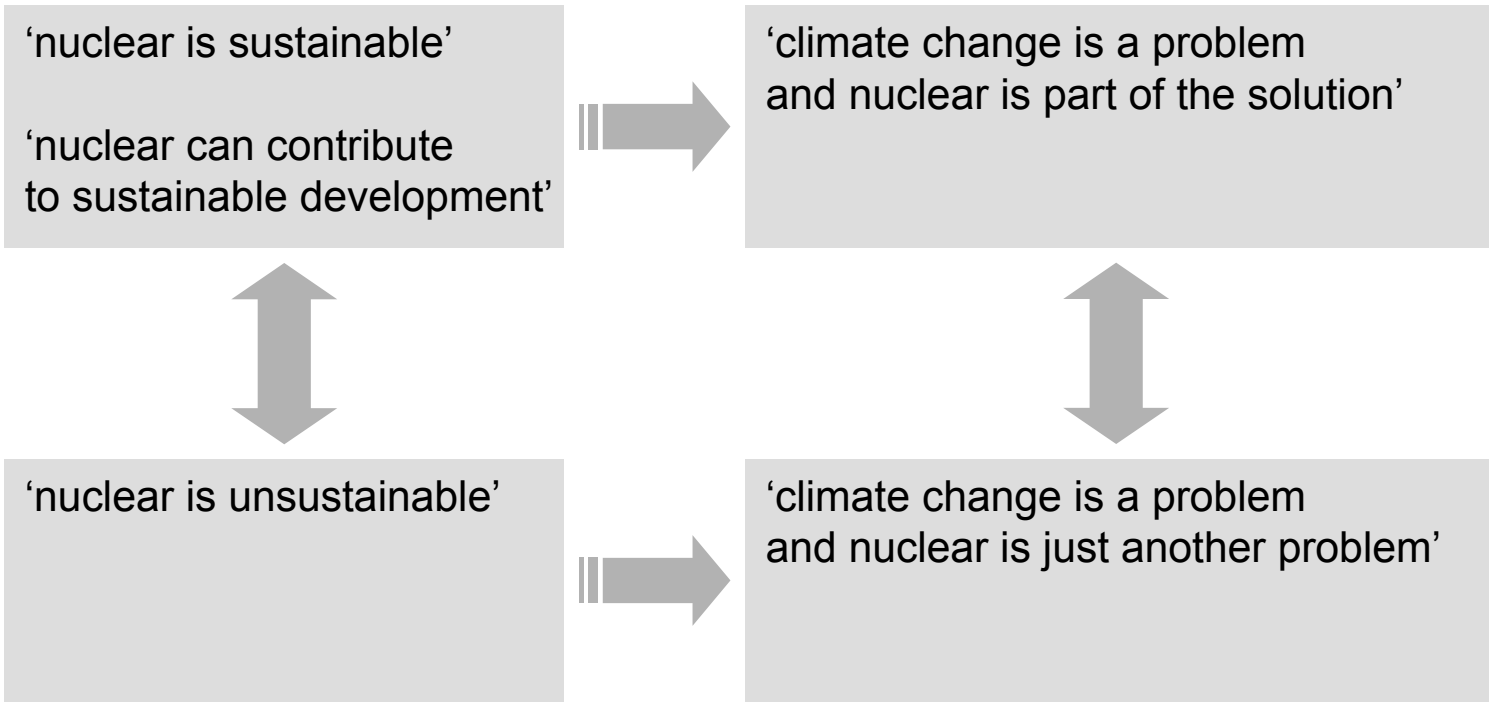

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Key themes and ideas / examples of cases and situations
Justifying nuclear energy in the context of SD

► ‘nuclear is sustainable’

- the stability and reliability of the fuel market
- the low carbon dioxide burden of the nuclear fuel cycle
- the competitive price of nuclear electricity in base load
- good NPP safety records of modern & ‘safer' future plants
- fuel cycles can be made proliferation-safe
- available solutions for radioactive waste disposal

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Key themes and ideas / examples of cases and situations
Justifying nuclear energy in the context of SD

► 'nuclear is unsustainable'

▼ the stability and reliability of the fuel market
▲ limited U resources
▼ the low carbon dioxide burden of the nuclear fuel cycle
▲ significant underestimated CO_2 emissions
▼ the competitive price of nuclear electricity in base load
▲ subsidies, not enough provisions for waste & dismantling
▼ good NPP safety records of modern & 'safer' future plants
▲ Chernobyl, TMI, old plants, human error
▼ fuel cycles can be made proliferation-safe
▲ warfare, irresponsible regimes, proliferation, terror
▼ available solutions for radioactive waste disposal
▲ no available solutions for radioactive waste disposal

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Key themes and ideas / examples of cases and situations

Justifying nuclear energy in the context of SD

which issues **could be** cleared out by referring to 'reality' and good practices in an open and transparent dialogue?

1 ▼ the stability and reliability of the fuel market

▲ limited U resources

2 ▼ the low carbon dioxide burden of the nuclear fuel cycle

▲ significant underestimated CO_2 emissions

3 ▼ the competitive price of nuclear electricity in base load

▲ subsidies, not enough provisions for waste & dismantling

4 ▼ good NPP safety records of modern & 'safer' future plants

▲ Chernobyl, TMI, old plants, human error

5 ▼ fuel cycles can be made proliferation-safe

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6 ▼ available solutions for radioactive waste disposal

▲ no available solutions for radioactive waste disposal

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Key themes and ideas / examples of cases and situations

Justifying nuclear energy in the context of SD

1, 2 & 3: acquiring factual knowledge and applying causal reasoning is possible

1 ▼ the stability and reliability of the fuel market

▲ limited U resources

2 ▼ the low carbon dioxide burden of the nuclear fuel cycle

▲ significant underestimated CO_2 emissions

3 ▼ the competitive price of nuclear electricity in base load

▲ subsidies, not enough provisions for waste & dismantling

→ It would be sufficient to acquire knowledge about the situation, as, from there on, straightforward causal reasoning can be applied (this doesn't mean that acquiring sufficient knowledge is easy)

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Key themes and ideas / examples of cases and situations

Justifying nuclear energy in the context of SD

1, 2 & 3:	acquiring factual knowledge and applying causal reasoning is possible
1 ▼	the stability and reliability of the fuel market
▲	limited U resources
2 ▼	the low carbon dioxide burden of the nuclear fuel cycle
▲	significant underestimated CO_2 emissions
3 ▼	the competitive price of nuclear electricity in base load
▲	subsidies, not enough provisions for waste & dismantling
in addition	We could compare the different views and try to find out why they differ. We could draw conclusions out of this comparison that could inform policy
	It would not be too bad if we would turn out to be wrong
	The consensus can be adapted on continuous basis
	Also comparison of nuclear with alternatives is possible

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Key themes and ideas / examples of cases and situations

Justifying nuclear energy in the context of SD

4, 5 & 6: acquiring factual knowledge and applying causal reasoning is not possible

1 ▼ the stability and reliability of the fuel market

▲ limited U resources

2 ▼ the low carbon dioxide burden of the nuclear fuel cycle

▲ significant underestimated CO_2 emissions

3 ▼ the competitive price of nuclear electricity in base load

▲ subsidies, not enough provisions for waste & dismantling

4 ▼ good NPP safety records of modern & 'safer' future plants

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Key themes and ideas / examples of cases and situations
Justifying nuclear energy in the context of SD

4, 5 & 6: acquiring factual knowledge and applying causal reasoning is not possible

→ The issues are marked by ‘risk’ that needs to be ‘managed’
→ Two essential factors are beyond control: human culture, time
→ It is impossible to prove who is right and who is wrong
→ Comparison of views triggers values deeply rooted in culture
→ All this complicates the comparison of nuclear with alternatives

4 ▼ good NPP safety records of modern & ‘safer' future plants
▲ Chernobyl, TMI, old plants, human error
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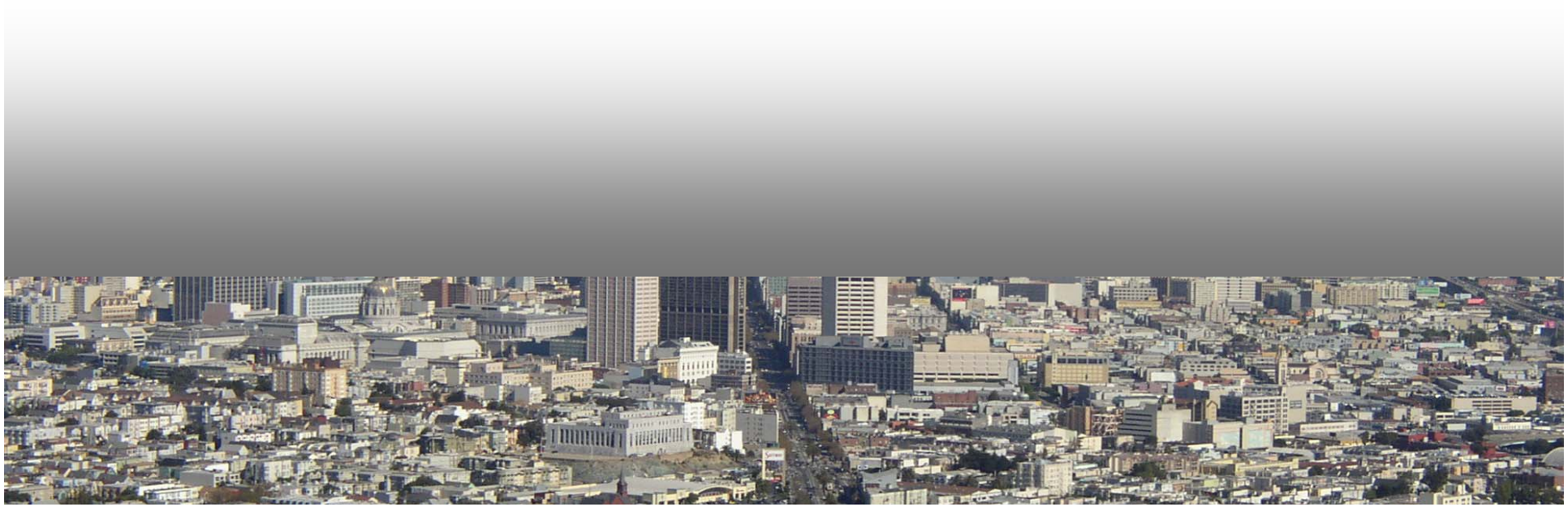
Key themes and ideas / examples of cases and situations

Risk perception in San Francisco, and in NTA

- SF suffered from a serious earthquake in 1906
- 2006 expert report claims that a new earthquake in the area is unavoidable
- Despite this high and predictable risk, the city is in full swing. The 2006 study did not trigger a ‘great escape’, neither protests of concerned citizens



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Key themes and ideas / examples of cases and situations
Risk perception in San Francisco, and in NTA

SF population lives in a state of 'real' risk, however, people 'accept' the risk because

- ► there is a 'transparent' cause-effect relation
  - the 'knowledge about outcome' is clear and unambiguous
  - the 'knowledge about likelihood' is said to be high, but the likelihood is only probabilistic, independent of human factors
- ► there is a simple and fair distribution of benefits and burdens
  - every citizen has the same benefit ('living in SF') and the same risk (the earthquake)
  - and every citizen is free to leave the city

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Key themes and ideas / examples of cases and situations
Risk perception in San Francisco, and in NTA

In many other 'risky' practices, the reasoning is not that simple, and this because of a typical inherent uncertainty and complexity

example: radioactive waste management

1 inherent uncertainty wrt 'cause – effect' relation

- stochastic character of low doses effect
- technical complexity of the disposal system
- time and space dimension, possible intrusion or misuse

+2 complexity of 'distributing the benefits and the burdens'

- complexity of 'impact': radioactive releases of waste
- different visions on solutions: ecological, economical
- justice: "not in my backyard" (NIMBY)

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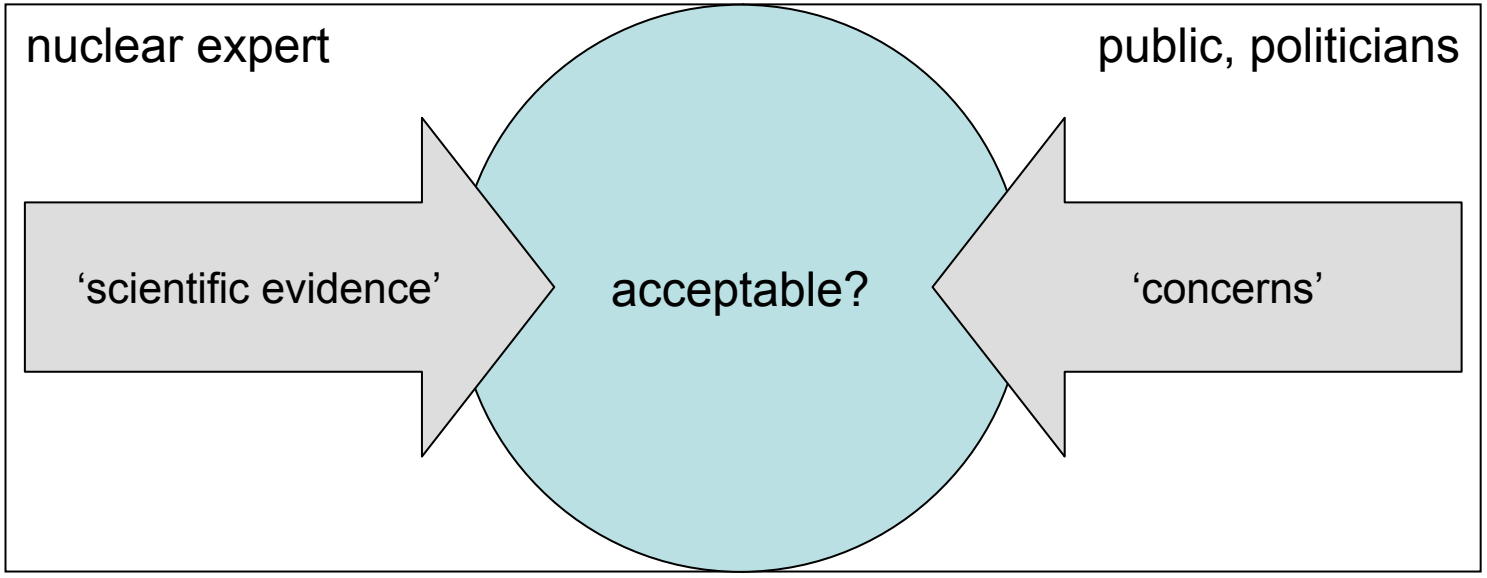
Key themes and ideas / examples of cases and situations

The nuclear expert in parliament

A nuclear expert is asked in parliament to explain why nuclear is an acceptable technology.



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Key themes and ideas / examples of cases and situations

The nuclear expert in parliament

A nuclear expert is asked in parliament to explain why nuclear is an acceptable technology, and makes claims about

→ the safety of the nuclear reactor

→ the protection against (low level) radioactivity

→ the safe disposal of nuclear waste

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Key themes and ideas / examples of cases and situations
The nuclear expert in parliament

A nuclear expert is asked in parliament to explain why nuclear is an acceptable technology, and makes claims about

→ the safety of the nuclear reactor

causality & system complexity ↔ PSA/PRA

→ the protection against (low level) radioactivity

stochasticity & dose-effect radiobiology ↔ LNT

→ the safe disposal of nuclear waste

causality & time dimension ↔ performance assessment

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Key themes and ideas / examples of cases and situations
The nuclear expert in parliament

A nuclear expert is asked in parliament to explain why nuclear is an acceptable technology, and makes claims about

→ the safety of the nuclear reactor

causality & system complexity ↔ PSA/PRA

→ probability

→ the protection against (low level) radioactivity

stochasticity & dose-effect radiobiology ↔ LNT

→ hypothesis

→ the safe disposal of nuclear waste

causality & time dimension ↔ performance assessment

→ prognosis

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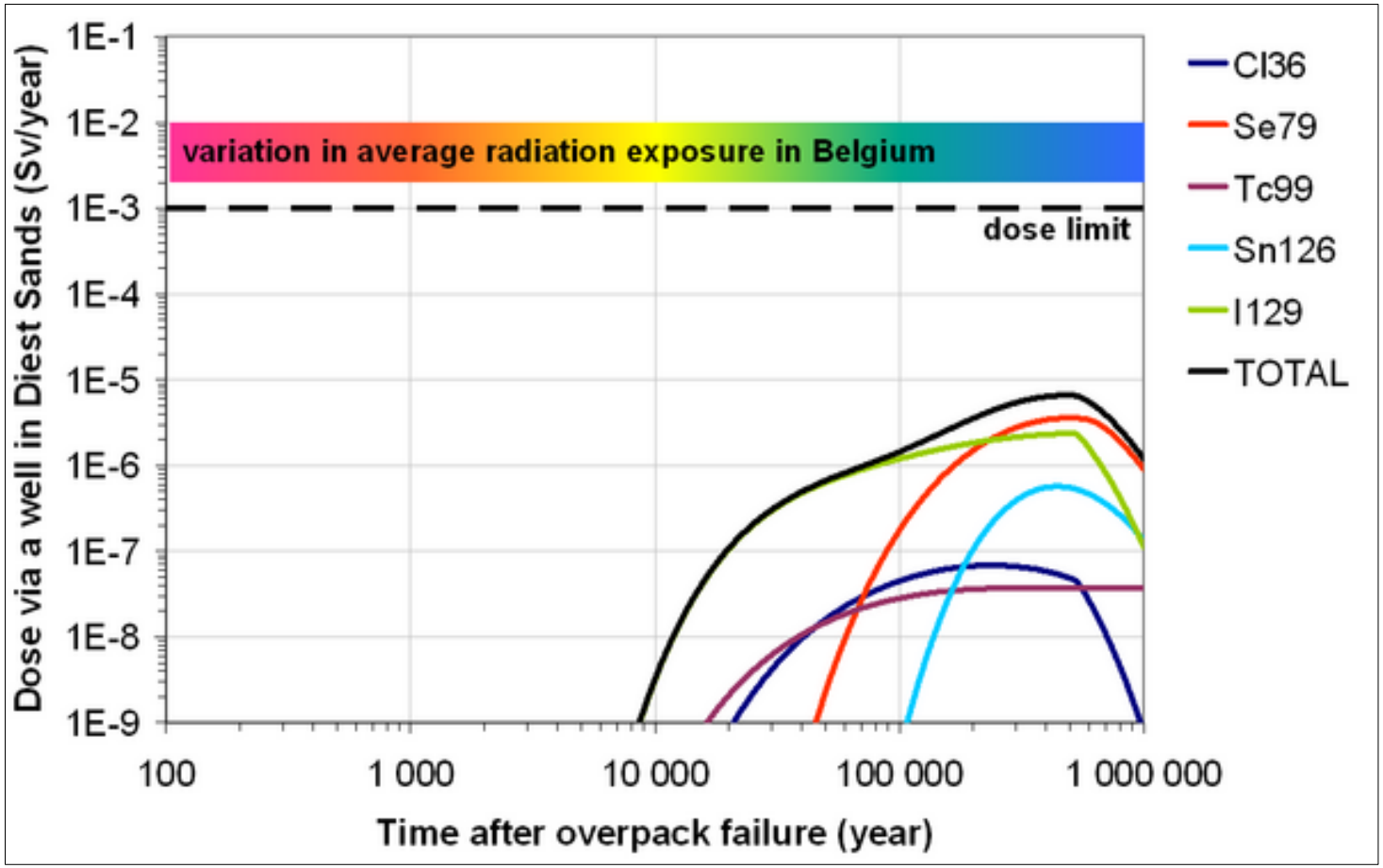
Key themes and ideas / examples of cases and situations

The nuclear expert in parliament



Doses calculated via a water well pathway in the case of disposal of spent nuclear fuel in a repository located in the Boom Clay layer. (source: SCK•CEN)

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Key themes and ideas / examples of cases and situations
The nuclear expert in parliament

In a political arena, or in any other discussion context,

- the nuclear expert cannot show evidence about the acceptance of nuclear technology, not because it is too complex, but because there is no evidence to show.

- (s)he will have to refer to

→ a good scientific practice that can provide a 'phenomenological' evidence based on

- theory ↔ empirical observation feedback processes
- causality and context awareness
- theory robustness (falsifiability resistance and reproducible character)

→ but at the same time explain that this is

what he/she believes but cannot prove

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Key themes and ideas / examples of cases and situations

Sustainable development and intergenerational ethics in RWM

- We cannot step into the future, which means that
  - Our responsibility cannot extend to the far future
  - Speaking of ethics towards future generations is irrelevant

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Key themes and ideas / examples of cases and situations
Sustainable development and intergenerational ethics in RWM

- Sustainable development refers to a process

Brundtland ‘meeting the needs of the present without compromising the ability of future generations to meet their needs’

Brundtland SD definition refers to a process, and not to an overarching ‘ethical’ guiding principle

→ SD is enabling future generations to decide how to distribute ‘their’ benefits and burdens (according to their views, knowledge and values)

- Sustainable development is thus about intragenerational ethics and intergenerational accountability and transparency wrt our approach to long term governance

(next generations should be able to interpret ‘why we thought this was the good approach’)

- Radioactive waste management:

There is no scientific neither ethical proof that irretrievable disposal would be preferable over ‘retrievable storage’ or vice-versa.

The decision is political, with far reaching consequences.

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Key themes and ideas

Of attitudes and methods: the ethics of risk governance

The meaning of “justification beyond facts and concerns”

from	‘explaining evidence’	to generate acceptance
to	joint justification	to generate trust
based on	a new way of knowledge generation	
	a new way of policy making	

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Key themes and ideas
Of attitudes and methods: the ethics of risk governance

"The ethics of risk governance: a new way of knowledge generation"

aim →	to **gain insight in complexity**	
	(in addition to sound natural sciences & technology)	
-	seeing 'the bigger picture' of justification	
-	recognising inherent uncertainties and context shifts	
-	analysing relevant values and the use of guiding principles	
-	mapping what we can(not) know & (don't) need to know	
-	identifying knowledge gaps	
-	understanding (the consequences of) the historical legacy	
method →	transdisciplinarity	synergies of natural, engineering, social and human sciences
	inclusiveness	synergies of interactions: scientists, policy maker and stakeholders
attitude →	reflexivity	awareness of how knowledge is produced
		critical stance towards the own expertise
	transparency (1)	next to facts: communicating what can and cannot be done (yet)

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Key themes and ideas
Of attitudes and methods: the ethics of risk governance

"The ethics of risk governance: a new way of policy making"

aim →	to organise policy processes that, **by design, create trust**	
method →	holistic view	- working from out of the bigger picture
	process thinking	- robust thematic governance processes instead of ad-hoc 'politics of products'
	enabling reflexivity	- cautious use of guiding principles
		- no 'science shopping'
		- liberating recognition of 'incapacities'
	inclusive	- debating justification instead of 'conditions for acceptance ('real participation')
		- involving the (potentially) affected (justice)
		- participation processes to feed into (and taken serious by) representative democracy
attitude →	accountability	- knowing who is accountable for what and why
		- meaning and limits of a 'mandate'
	transparency (2)	- communicating unresolved issues, business-policy connections, real agendas

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Experiences of the Belgian nuclear research centre
Courses on ethical aspects of radiological risk governance

Started as an initiative of the SCK•CEN school for radiological protection isRP

Now organised as a cooperation between two expertise groups of the SCK•CEN

- the Society & Policy Support group

  through its PISA research programme (Programme of Integration of Social Aspects into nuclear research)

  http://www.sckcen.be/pisa;

- the Communication, Education and Knowledge Management group

  through its Science and Society research programme and its school for radiological protection isRP

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Experiences of the Belgian nuclear research centre
Courses on ethical aspects of radiological risk governance

Format 1 1,5 hours (Dutch, English)

"Introduction to ethics and radiological protection"

context As part of the SCK•CEN courses on RP for technical staff and radiological protection officers.

Format 2 4 hours (Dutch; extended lecture with discussions in groups)

"Ethical aspects of radiological risk governance"

context As part of the curriculum of the postgraduate programme "Radiological Protection Expert", organised by the XIOS TU and the Belgian Nuclear Research Centre (since academic year 2005-2006).

Format 3 3 hours (English; extended lecture with discussions in groups)

"Round table discussion on ethical aspects of radiological protection and nuclear technology assessment"

context As part of the SPERANSA and ICARO courses (of the CHERNE Network) for engineer students

(Jülich 2006, Prague 2007, Mol 2008, Lisbon 2009).

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Experiences of the Belgian nuclear research centre
Courses on ethical aspects of radiological risk governance

Basic course structure

Part 1 Theoretical introduction to ethics and risk governance

Part 2 Group work on case studies - investigating questions

- what are the relevant norms involved ?
- what are the relevant values ?
- what are the aspects of justification ?
- where is the uncertainty ? what are the aspects of complexity ? (scientific ? normative ? both ?)
- who is responsible for what ?
- what could be a recommendation ('solution') in this case ?

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Lecturing Ethics in Courses on RP and Nuclear Technology Assessment - Feedback on 5Y of Academic Experience

content

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Feedback / lessons learnt

- Course participants generally consider courses on ethics as very relevant in general sense, even if there is no 'direct' relevance for the own job;

- Skepticism exists, mostly with nuclear engineering students (and their professors…) and regulators;

- Experience shows that the knowledge of students and (young) professionals related to 'the politics of nuclear technology' is little to sometimes non-existing.

- meaning, role and content of the Aarhus Convention
- meaning, role and content of the Nuclear Non-proliferation Treaty
- the limited societal involvement provided by EIA procedures
- the research policy of the EC, in connection with political agendas
- the fact that debating nuclear is strategically avoided on official policy platforms such as the United Nations Framework Convention on Climate Change or the UN Commission on Sustainable Development.

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Feedback / lessons learnt

- International course experience (within the CHERNE network) reveals no significant difference among students
  - in opinion on the relevance of courses on ethics;
  - in individual ethical sense ('moral stance') in relation to the presented cases.

- Reluctance to integrating courses on political, social and ethical aspects of nuclear technology assessment remains with nuclear engineering education networks
  - WNU showed signs of interest;
  - BNEN considers it to be 'too difficult';
  - ENEN ready to consider courses on ethics and NTA?

- other candidates, experiences?