Risk communication in nuclear emergency preparedness: Embracing the complexity

Risikokommunikasjon i atomberedskap: Et innblikk i kompleksiteten

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Philosophiae Doctor (PhD) Thesis

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“It is our choices that show what we truly are, far more than our abilities.”
Albus Dumbledore
SUMMARY

Risk communication is one of the most important challenges of emergency management, as illustrated by past nuclear accidents. Despite decades of research on risk perception, communication and public participation methods, there are still gaps between this research and its application in practice. While multiple guidelines highlight the importance of dialogue and engagement, in reality, the goal of risk communication in the field of emergency preparedness is still all too often seen to be one of educating publics.

The overall aim of this thesis was to offer a more holistic understanding of the risk communication in emergency preparedness that emphasises the relationships between the key actors. This aim was pursued by addressing the following research questions in the four individual papers comprising this thesis:

1. Investigate whether recommendations for communication of radiological risks were followed after the Fukushima accident.
2. Quantify the value of collaborative deliberation in stakeholder seminars as opposed to a one-way information provision.
3. Explore public needs concerns, responses and expectations with regard to radiological emergencies.
4. Explore the applicability of evaluation criteria for assessing the quality of stakeholder involvement.

A range of qualitative and quantitative methods (e.g. content analysis, focus group discussions, in-depth observation) were used as part of this research.

Mass media are an important channel for risk information in daily life and emergency. Although several recommendations are available on communication of radiological risks in the media, it is not clear whether they are being followed. Paper 1, carried out an analysis of media representation of risks in newspaper articles published after the Fukushima accident in five European countries and Russia. This analysis uncovered several misrepresentations and misinterpretations of radiological risks in the media coverage of the accident. A number of measurement units were presented in media without explanation of what they meant, and comparisons used were not always helpful or correct. Information on health effects and visual representation of information were largely absent. The discrepancies between recommendations and the findings in
practice indicated that there were problems with communication of radiological risks in the countries analysed. Based on these findings several suggestions for improvement were formulated, including strengthening the relationships between experts and media. The support for notions of involvement and dialogue is growing, however, experience shows that in stakeholder seminars on emergency preparedness, the opportunities for dialogue can be quite limited. Paper 2 examined the difference between the effect of one-way information provision and collaborative deliberation in stakeholder seminars performed in Norway. In this paper, questionnaires were used to measure the value of collaborative deliberation by investigating its impact on the levels of knowledge, networking, involvement and problem-solving. The results demonstrated that participants considered collaborative deliberation to have had a higher effect on all the above-mentioned aspects as compared to information provision. They also showed a positive impact on the understanding of challenges different sectors will have to address in a nuclear emergency. By demonstrating the value of collaborative deliberation, these results can be used to further promote wider stakeholder involvement in decision-making.

Understanding the factors that influence public attitudes and behaviour will support development of appropriate communication approaches and encourage actions that would reduce the impacts of accidents. A study performed in Paper 3 investigated public concerns, responses, information needs, understandings and expectations with regard to a nuclear accident. The paper used focus group discussions based on two hypothetical accident scenarios. The results of the discussion identified knowledge and trust to be the main factors defining publics’ relationship with emergency management actors. Participants’ willingness to follow official recommendations were affected by the perceived efficiency and safety of the protective actions, participants’ personal networks and trust in the institutions issuing the recommendations. In turn, the public showed ambivalence on the issue of trust in emergency actors. On the one hand, they showed a high degree of trust towards the authorities’ intentions to do what was best, but they were much less trusting in the competence of the authorities to deal with the situation. Finally, several factors that influence the way public forms their perception of radiological risks have been identified. The findings of the study indicate that there are some potential challenges for emergency preparedness in Norway.
The growing popularity of public and stakeholder engagement has triggered a transition from one-way communication to dialogue based approaches. However, there is some concern about current engagement practices and whether they actually contribute to the democratization of the decision-making processes. This highlights the need for rigorous quality evaluation that would focus on the wider social and political context of the engagement activities and the way democratic values are addressed in them. Paper 4 addresses this need by evaluating two stakeholder engagement activities in order to demonstrate the general limitations of already existing quality criteria. The evaluation demonstrated a variety of issues present with both activities and resulted in formulation of extended criteria that pay more attention to democratic values and context of engagement. These criteria are: inclusiveness, independence, flexibility, continuity, influence, transparency and mutual learning. The paper argues that more attention should be paid to the quality of the stakeholder engagement process and that the extended criteria could provide some guidance.

Based on the findings from the individual papers, this thesis identifies several factors that would contribute to improved communication in nuclear emergency preparedness. It argues that there is need for emergency actors to increase their understanding of publics by studying their perspectives, concerns and values, and their understanding of concepts and systems. In addition, there is a need for an extended public participation in deliberations within emergency preparedness, that also pays attention to both the method and process of engagement. Another major factor is that emergency preparedness needs to be aware of and address the various dimensions of complexities. These complexities include multiple actors that would be involved in emergency response and multiple publics with different knowledge and experiences that would affect their attitude towards both the risk and the actors managing that risk. Furthermore, the thesis argues there is a need to view and practice communication as a relationship that both supports and determines the quality of social interactions between all salient actors. Finally, it suggests the need for institutional change that includes acknowledgement of societal aspects, making stakeholder engagement a normal practice in policy and decision-making and critical reflection upon procedures and practices.
SAMMENDRAG

Tidligere atomulykker har vist at risikokommunikasjon er en av de viktigste utfordringene i krisehåndtering. Til tross for flere tiår med forskning på risikooppfattelse, kommunikasjon og metoder for involvering av berørte parter, er det fortsatt et gap mellom forskningen og hvordan den blir brukt i praksis. Selv om retningslinjer fremhever betydningen av dialog og involvering, er risikokommunikasjon innen kriseberedskap fortsatt ofte brukt til å utdanne og overtale publikum.

Det overordnede målet med denne avhandlingen er å tilby en mer helhetlig forståelse av risikokommunikasjonen i beredskap som legger større vekt på forholdet mellom nøkkelaktørene. Dette målet ble forfulgt ved å ta opp følgende forskningsspørsmål i de fire vitenskapelige artiklene som denne oppgaven består av:

1. Undersøke om anbefalinger for kommunikasjon av risiko fra stråling ble fulgt i forbindelse med Fukushima-ulykken.
2. Kvantifisere verdien av diskusjon og refleksjon i medvirkning i motsetning til en enveisinformasjon.
3. Utforske publikums behov, bekymringer, reaksjoner og forventninger med tanke på atomkriser.
4. Utforske anvendeligheten av evalueringskriterier for vurdering av kvaliteten på berørte parters medvirkning.

En rekke kvalitative og kvantitative metoder (for eksempel innholdsanalyse, fokusgruppendiskusjoner, observasjon) ble brukt som en del av denne undersøkelsen.

Massemelding er en viktig kanal for risikoinformasjon i dagliglivet og i krisesituasjoner. Selv om anbefalinger er tilgjengelige for hvordan man skal kommunisere risiko fra stråling i media, er det ikke klart om de blir fulgt. I artikkel 1 ble presentasjonen av risiko fra stråling i avisartikler publisert etter Fukushima-ulykken i fem europeiske land og Russland analysert. Denne analysen avdekket flere uriktige opplysninger og feilfortolkninger av risiko fra stråling i mediedekningen av ulykken. En rekke måleenheter ble presentert i media uten forklaring av betydningen, og sammenligninger med andre risikoer som var brukt var ikke alltid nyttige eller korrekte. Informasjon om helseeffekter og visuell representasjon av informasjon var i stor grad fraværende. Avvikene mellom anbefalinger og det som ble gjort i praksis
indikerte at det har oppstått problemer med kommunikasjon av risiko fra stråling i de analyserte landene. Basert på disse funnene ble flere forslag til forbedring formulert, blant annet å styrke forholdet mellom eksperter og media.


Den økende tilslutningen til involvering av befolkning og berørte parter har utløst en overgang fra enveiskommunikasjon til dialogbaserte kommunikasjonstilnærminger. Det er imidlertid noen bekymringer rundt hvordan medvirkning blir praktisert og om
medvirkningsprosessen som de gjøres nå faktisk bidrar til demokratisering av beslutningstaking. Dette understreker behovet for streng kvalitetsevaluering som vil fokusere på den bredere sosiale og politiske konteksten av medvirkning og måten demokratiske verdier tas opp. Artikkel 4 adverterer dette behovet ved å evaluere to medvirkningsseminarier for å demonstrere de generelle begrensningene av eksisterende kvalitetskriterier. Evalueringen demonstrerte en rekke problemer som var tilstede i begge seminarene og resulterte i utvikling av utvindte kriterier som legger større vekt på demokratiske verdier og kontekst av medvirkningen. Disse kriteriene er: inkludering, uavhengighet, fleksibilitet, kontinuitet, innflytelse, åpenhet og gjensidig læring. Artikkelen hevder at det bør rettes mer oppmerksomhet mot kvaliteten på medvirkning, og at de utvindte kriteriene kan gi noe veiledning i denne prosessen.

Basert på konklusjonene fra de enkelte artiklene, identifiserer denne oppgaven flere faktorer som vil bidra til bedre kommunikasjon innen beredskap. Forfatteren hevder at det er behov for at beredskapsaktører øker sin forståelse av befolkningen ved å studere dens perspektiver, bekymringer og verdier, samt dens forståelse av begreper og systemer. I tillegg er det behov for økt befolkningsdeltakelse i refleksjoner og diskusjoner innen beredskap som også tar hensyn til både metoden og prosessen av denne medvirkningen. En annen viktig faktor er at institusjonene som er ansvarlige for beredskap må være oppmerksom på og adressere de ulike dimensjoner av kompleksitet. Dette omfatter et mangfold av aktører involvert i beredskap samt flere befolkningsgrupper med forskjellig kunnskap og erfaringer som vil påvirke deres holdning til både risikoen og aktørene. Forfatteren argumenterer at det er et behov for å se og praktisere kommunikasjon som et forhold som både støtter og bestemmer kvaliteten på sosiale samspill mellom alle viktige aktører. Til slutt, understrekes behovet for institusjonelle endringer som vil føre til at institusjonene anerkjenner hvor viktig de sosiale aspektene er, vedtar medvirkning som en legitim beslutningstaking og utfører en kritisk refleksjon av deres egne aktiviteter og prosedyrer.
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<tr>
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</tr>
<tr>
<td>DSA</td>
<td>Norwegian Radiation and Nuclear Safety Authority</td>
</tr>
<tr>
<td>EAGLE</td>
<td>Research project “Enhancing education, training and Communication Processes for informed behaviours and decision-making related to ionising radiation risks” (finished)</td>
</tr>
<tr>
<td>ENGAGE</td>
<td>Research project “Enhancing stakeholder participation in the governance of radiological risks” (<a href="http://www.engage-concert.eu/">http://www.engage-concert.eu/</a>)</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>EURANOS</td>
<td>Research project “European approach to nuclear and radiological emergency management and rehabilitation strategies” (finished)</td>
</tr>
<tr>
<td>EURATOM</td>
<td>A complementary research programme for nuclear research and training under Horizon 2020</td>
</tr>
<tr>
<td>FP7</td>
<td>European Union’s Research and Innovation funding programme for 2007-2013</td>
</tr>
<tr>
<td>GMO</td>
<td>Genetically modified organisms</td>
</tr>
<tr>
<td>Horizon 2020</td>
<td>EU Research and Innovation programme (2014 – 2020)</td>
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<tr>
<td>IAEA</td>
<td>International Atomic Energy Agency</td>
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<tr>
<td>ICRP</td>
<td>International Commission on Radiological Protection</td>
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<tr>
<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
</tr>
<tr>
<td>OPERRA</td>
<td>Open Project for European Radiation Research Area</td>
</tr>
<tr>
<td>NEA</td>
<td>Nuclear Energy Agency</td>
</tr>
<tr>
<td>NPP</td>
<td>Nuclear power plant</td>
</tr>
<tr>
<td>STRATEGY</td>
<td>Research project “Sustainable restoration and long-term management of contaminated rural, urban and industrial ecosystems” (finished)</td>
</tr>
<tr>
<td>NERIS</td>
<td>European Platform on preparedness for nuclear and radiological emergency response and recovery</td>
</tr>
<tr>
<td>NERIS-TP</td>
<td>Research project “Towards A Self Sustaining European Technology Platform (NERIS-TP) On Preparedness For Nuclear And Radiological Emergency Response And Recovery” (finished)</td>
</tr>
</tbody>
</table>
PREPARE  Research project “Innovative integrative tools and platforms to be prepared for radiological emergencies and post-accident response in Europe” (finished)

TERRITORIES  Research project “To enhance uncertainties reduction and stakeholders Involvement towards integrated and graded Risk management of humans and wildlife in long-lasting radiological Exposure Situations”

UK  United Kingdom

US  United States

US EPA  United States Environmental Protection Agency

WHO  World Health Organization
1. Introduction

Past nuclear and radiological events have demonstrated that communication is one of the most important challenges of emergency management (Abbott, Wallace et al. 2006, Covello 2011). The Fukushima accident in Japan, in 2011 once more highlighted the difficulties in communicating about radiation risks, as well as the many different types of communication that impact on emergency management. These range from a very narrow understanding of communication that centered on risk messages sent from risk experts to public, to a much broader definition that emphasises the relationships between actors, starting with how the message is framed to ways of involving the public in decision-making. While conventional communication assesses success in terms of the outcome, and focuses on the technical dimensions of risk, other approaches stress the importance of the quality and nature of that communication, as well as the need for a more nuanced understanding of public concerns.

After the Fukushima accident, national and international organizations reviewed their communication plans and updated the strategies (Coates, Webb et al. 2012, IAEA 2013). Nuclear emergency authorities acknowledged the need to include communication aspects into emergency preparedness exercises and training (Perko, Raskob et al. 2016) and several research projects that addressed risk communication in nuclear emergencies were funded (e.g. PREPARE, EAGLE, CONFIDENCE, TERRITORIES, etc). However, even if international guidance shows that there is a need for a complex, multiple way communication process that would take into account views, concerns, expectations, values and questions of different stakeholders, those in positions of authority still seem to be mainly inspired by the idea of educating the general public (Železnik, Marega et al. 2014). There is still a gap between the idea of dialogue and engagement that has been discussed and applied for decades in science and technology studies, and its practical application in the field of emergency management and response.

In part, this gap reflects that emergency management systems are highly hierarchical, instrumental, autocratic and technocratic. The public are removed from the policymaking and decisions are made by a small group of expert-trained bureaucrats, experts and policy-makers. These instrumental technocratic actors also, crucially, impose a framing
of the issue that excludes public concerns or meanings that do not coincide with their own. The exclusion is often easily justified by citizens’ lack of expertise and the classified nature of emergency plans (Baudé, Hériard-Dubreuil et al. 2013, Schmid 2013, Ehold, Perko et al. 2018, Kamaté 2018). Experts assume people are only interested in safety and marginalize their concerns to scientific issues, while a vast amount of research has demonstrated that public concerns are not limited to risk or safety, but influenced by a variety of factors.

Experience from past accidents like Windscale (1957), Three Mile Island (1979), Chernobyl (1986), Fukushima (2011), demonstrated that there are broad societal consequences of such accidents that impact on public response, and that responsible institutions should be ready to address (Bay and Oughton 2005, Murayama 2012, Oughton, Hansson et al. 2013, Liland 2015). Communication has been recognised as a crucial component in dealing with radiological emergencies and one that could alleviate the consequences, especially psychological and social, but also in terms of material deaths and morbidity (Carr, Maeda et al. 2018).

Although improving communication is a step in the right direction, there is a need to pay more attention to how that communication is being carried out. We cannot view the public as the problem while ignoring systemic and institutional issues that require reflexivity about existing procedures and systems. Another issue is the persistence of a top-down approach – although many institutions recognise the importance of dialogue and two-way communication on paper, in practice their structures are not well suited to accommodate such communication. As various analysts have emphasised, genuine communication involves dialogue, and dialogue means listening, as well as talking. This would require experts to take publics of various kinds seriously, be more attuned to their needs and concerns, and consider ways in which communication procedures can be designed to address these aspects.

In order to meet some of these challenges, this thesis aims to promote communication practices that recognise the complexity and rethink the relationship between publics and institutions, by exploring issues centred around four research questions:
• Investigate whether recommendations for communication of radiological risks were followed after the Fukushima accident
• Quantify the value of collaborative deliberation in stakeholder seminars as opposed to a one-way information provision
• Explore public needs concerns, responses and expectations with regard to radiological emergencies
• Explore the applicability of evaluation criteria for assessing the quality of stakeholder involvement

1.1 The goal and structure of this thesis

The overall goal of this thesis is to offer a more holistic understanding of risk communication within nuclear emergency preparedness that goes beyond analysis of the message and messenger, and also considers the relationships between publics and responsible institutions. This should, in turn, enable a more robust emergency preparedness that is capable of addressing public understanding and responses in a more open and engaging process. A secondary aim is to demonstrate how social science can contribute to improving communication in emergency preparedness.

It should be pointed out that the research carried out in this thesis largely concerns radiological risk in a country without nuclear energy production. However, there is a variety of sources of nuclear and radiological risks in Norway, such as nuclear research reactors, contaminated environment due to historical accidents, use of radionuclides in hospitals, industry and research and the global dimensions of nuclear threats (Schmid 2013). Although I will be focusing on radiological emergencies, many of the elements discussed in this thesis could be relevant also for other emergencies.

The research was performed (and funded) through a combination of different projects related to radiation protection and emergency preparedness and response. This approach allowed several communication related topics to be addressed, and reflects the diversity of topics that any emergency actor has to address in their preparedness work, whether it is communicating to media and public or involvement of stakeholders. Another benefit of this approach was that the PhD research was connected to both ongoing research and practice within radiation protection and emergency preparedness.
and response, which increased the potential to have practical impact on policy. However, the constraint of being connected to specific research programs, with specific goals, meant that it was not possible to perform follow up studies to address some of the issues and limitations of the papers. I hope that insights from this thesis may offer actors in emergency preparedness (e.g. radiation protection authorities, emergency managers) ways to create better approaches to communication about radiological risk and other related topics. Four papers constitute the major part of this thesis and the introduction constitutes the general framework within which the papers may be understood and contextualized. Chapter 2 gives the contextual background for the research and introduces the central research problem of the thesis. Chapter 3 discusses the methodological choices including data collection and analysis. Chapter 4 presents a summary of the main research findings from the appended papers. Chapter 5 contains a discussion of findings and linkages between the papers, including their contribution to the theoretical field. Chapters 6 and 7 address limitations of the thesis and suggestions for future research. Chapter 8 closes the thesis with brief concluding remarks.
2. Contextual background

This chapter introduces the contextual background that will help to place the individual papers comprising this thesis into a larger strategic, multidisciplinary and multi-sectorial perspective. It starts by presenting the context in which the research is set - nuclear emergency management, then introduces the theoretical frameworks of risk communication and public participation, and concludes with a summary of the way in which communication is addressed in emergency management today.

2.1. Introducing the context: Nuclear emergency management

The terms nuclear and radiological emergency are used interchangeably to describe “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.” (Council Directive 2013/59/EURATOM, Council directive 2013/59/EURATOM 2013). In some countries, the term “nuclear emergency” is reserved for incidents and accidents at nuclear power plants; while ‘radiological emergency’ is used to describe other types of irregular activities that involve the release of radioactive materials (e.g. radioactive sources that are out of control, dirty bombs, releases from foreign facilities etc.) (CSN 2010). In this thesis I will use the term ‘nuclear’ emergency to cover both cases.

The definition of the term ‘emergency’ alone already indicates some of the characteristics that make emergencies different to routine situations. Emergencies have high stakes, they are urgent and full of contingencies (Leonard and Howitt 2008). They are also unanticipated, dynamic and unpredictable and will always be different from what one has prepared for (Schmid 2013, Charron, Lafage et al. 2016). They can range from those affecting single persons to those that affect large numbers of people such as floods, earthquakes, outbreaks of diseases and accidents. For nuclear emergencies, the significance of an event is expressed in The International Nuclear and Radiological Event Scale (INES) scale that has 7 levels: levels 1-3 are termed ‘incidents’, while levels 4-7 are termed ‘accidents’ (IAEA 2008).
Accidents can cause a good deal of disruption in the economic, social and cultural life of people, which results in physical and psychological damage and dramatically destroys their living environment (Felt and Chhem 2016). They also tend to restructure existing groups of people, objects, institutions so that the world after is never quite the same - causing fundamental changes in the society (Clancey and Chhem 2016). In post-accident situations, what previously seemed like solid knowledge is compromised and tested, and previously reliable frames and structures, references and values collapse (Charron, Lafage et al. 2016, Clancey and Chhem 2016). Expertise and experts become incredibly important, but at the same time, people's ambivalence towards them becomes more visible. Expert ignorance is emphasised, as none of them are able in real-time to say exactly what has happened, what has been released, what might happen next, what will change and how this is going to affect public interests of various kinds. Expertise is challenged and contested (Felt and Chhem 2016) and so is trust towards the institutions responsible. All of these factors add to the complexity of emergency management.

Nuclear emergency management is composed of several phases: assessment, preparedness, response, recovery and evaluation (see Figure 1) (Petak 1985). Each of the phases is associated with specific actions for the actors involved, measures to protect the population, as well as communication needs and strategies.

Emergency response is a critical phase. In routine risk management and decision-making, the actors have detailed knowledge about the situation, there are comprehensive procedures and sufficient time for assessments, deliberation and consultation, while in emergency there is no such luxury. It follows that much of the success of emergency response lies in good preparedness. Therefore, the preparedness phase is the key phase for establishing connections, building mutual understanding, and developing resilient systems.

The Fukushima accident uncovered many gaps in nuclear emergency preparedness, especially the off-site preparedness that goes beyond securing the safety of the reactor on the site of the emergency and focuses on protection of the potentially affected populations and other issues in the wider society (Schneider, Lafage et al. 2016, NERIS 2017). There were no plans for off-site management or communication with affected population, largely because the authorities did not believe such an accident could happen
(IAEA 2015) and lack of awareness of the wider consequences (Baumont 2018). There was lack of coordination and information flow between local and regional actors, protective actions were improvised and uncoordinated (National Research Council 2014), and dose criteria for relocation were absent (IAEA 2015). There was a variety of radiation standards, which were revised in the aftermath of the accident, which contributed to public confusion and distrust (National Research Council 2014). During the first days after the accident, the affected population was unaware of the accident and did not receive evacuation orders (NAAIC 2012). The accident highlighted that communication prior to an emergency plays important role in effectiveness of communication in emergencies (IAEA 2015, Sellnow 2015, Perko, Tomkiv et al. 2016), however, research on communication in preparedness remains underdeveloped (Coombs 2009, Perko, Van Oudheusden et al. 2019).

![Nuclear emergency management cycle](image)

**Figure 1** Nuclear emergency management cycle
The existing literature on communication in emergency preparedness identifies several objectives: to proactively inform people about potential risk (IAEA 2006, Rojas-Palma, Liland et al. 2009); help them to understand pre-event warning signals, prepare them with knowledge about countermeasures and protective actions (e.g., iodine tablets, evacuation, sheltering), and prevent inappropriate or unnecessary actions by the individuals (Callen and McKenna 2018). But its most important task is to establish dialogue between all the stakeholders (including public) and joint problem-solving.

I return to the challenges of communication in the following sections. Since some of my research was performed in the context of Norwegian emergency preparedness, I will first give a short description of how nuclear preparedness systems is organized in Norway.

2.1.1 Nuclear emergency preparedness in Norway

The Norwegian Nuclear and Radiological Preparedness Organisation was established in 1993 as a consequence of the lack of preparedness for managing such types of accidents seen in Norway after the Chernobyl Accident (Royal Decree 2013). It consists of the Crisis Committee for Nuclear Preparedness, the Crisis Committee’s Advisors, and the County Governors (Figure 2). Representatives of the central authorities (e.g., civil protection, food safety, public health, police etc.) constitute the Crisis Committee lead by the Norwegian Radiation and Nuclear Safety Authority (DSA). County Governors are responsible for coordinating preparedness on the regional level and have regional nuclear preparedness committees (Statens strålevern 2012).

The Crisis Committee’s mandate is to deal with any nuclear accident (regardless of probability) and intentional actions that could affect Norway or its interests; to have full responsibility over acute/late response and all preparedness work; to protect lives, health and environment and other societal interests. The Crisis Committee is fully authorised to impose actions upon state and private businesses and to request actions from the Norwegian Armed Forces, to initiate and implement countermeasures, and to decide the content of information to be communicated (Royal Decree, 2013). When an emergency occurs, the leader of the Crisis Committee decides whether the Committee should be summoned. In addition, any of its members can request that the Crisis Committee is summoned.
The Crisis Committee meets twice a year, one of those meetings is an exercise and another one is a seminar that involves regional representatives and advisors (Kriseutvalget for atomberedskap 2015). The Crisis Committee and advisors have been involved in research activities carried out under the EU projects STRATEGY, EURANOS, NERIS-TP. However, these activities involved mainly national actors and experts, and the stakeholders from the Chernobyl affected communities were involved to a minor degree only (Liland, Tomkiv et al. 2017).

![Diagram of the Norwegian Nuclear and Radiological Preparedness Organisation](image)

Figure 2 The Norwegian Nuclear and Radiological Preparedness Organisation (Statens strålevern 2012)

There are six different scenarios of radiological events that constitute the base of nuclear preparedness in Norway (Statens strålevern 2014):

1. Large airborne release from a facility abroad (e.g. Chernobyl)
2. Large airborne release from a facility in Norway (e.g. research reactors)
3. Local incident in Norway - random location (like above but during transport or use of radiological sources)
4. Local incident that evolves over time (e.g. Litvinenko case)
5. Release to the marine environment (e.g. from a submarine)
6. Incident abroad that does not directly affect Norwegian territory (e.g. Fukushima)

The scenarios are based on a systematization of experience from past events and assessments of existing or future activities. For each of the scenarios there is a communication plan that describes communication aims, defines target groups and communication channels, gives overview of relevant countermeasures and key points to include in the main message (Statens stråleværn 2015).

There are number of factors that have changed the nature of radiological threats and hazards in the last years. There is increased likelihood of radiological material being used in malicious act or a such act being directed towards nuclear or radiological facilities; increased activities of naval nuclear-powered vessels in the North as well as civil nuclear-powered vessels and vessels carrying nuclear waste along the Norwegian coastline. In addition, due to recent political and security developments in the world, the Crisis Committee for Nuclear Preparedness is currently developing a seventh scenario that comprises use of nuclear weapons against Norway or close to Norway (Selnæs, Eikelmann et al. 2018).

Norwegian authorities have first-hand experience of how challenging communication about radiological risks can be. They were highly criticized for their communication after the Chernobyl accident when they did not manage to address the high demand for information about accident from the population (Hernes 1986). Their response lacked coordination; information was not complete and contained mistakes (Hernes 1986, Larsen, Evensen et al. 2011). This lead to a crisis of trust between authorities on one side and media and public on the other (Hernes 1986). The Fukushima accident raised new challenges like the relocation of Norwegian embassy from Tokyo, citizens in Norway requesting iodine tablets and organisation of extra flights for Norwegian citizens from Tokyo to Oslo in the weeks after the accident.
Despite the initial problems with communication after Chernobyl, Norway provided an early example of the involvement of local stakeholders in post-accident sampling and mapping of contamination, as well as in development, testing and practical implementation of countermeasures. These actions recognized the value of expertise that local people have and how crucial it is to involve them in the development of recovery strategies (Liland and Skuterud 2013).

To conclude, communication is a key factor for all phases of emergency management, but more attention should be paid to its development within the emergency planning and preparedness phase. In the next subsections, I give some theoretical background on risk communication and participation research before I move to how they are currently addressed in nuclear emergency preparedness.

2.2 Introducing the research field: risk communication and participation

The publics’ perception of risk is often highlighted as one of the main challenges for risk management and effective risk communication. Since historically, perception studies formed the basis of the whole field of risk communication, I will address the field of risk perception first.

2.2.1 Risk perception

“... I see the need to analyse the truly irrational perceptions surrounding issues of risk. ... In particular, I see a need to analyse the irrational perception within the technical community that almost everyone else must be irrational.” (Freudenburg 2001)

The origins of risk perception studies can be traced back to 1960s with the rise in public opposition to certain new technologies. Industry, scientists and authorities were puzzled by the fact that people were alarmed about risks that in the experts’ opinion were safe (Covello and Sandman 2001). Many technical experts believed that this perception gap in the estimation of risk from technologies was caused by a lack of technical education, misinformation and irrationality (Otway and Thomas 1982, Gardner and Gould 1989). Hence, the general idea behind many early risk perception studies was that people's
perceptions are faulty and should be corrected. The growing criticism of this view lies behind the negative association that the term ‘risk perception’ has attained in certain fields, especially if it is used to support the idea that nontechnical publics are irrational and misperceive risks (Otway 1992, Eiser, Bostrom et al. 2012). Several alternative theories and concepts have been developed to explain how risk perceptions are being formed. In this section, I give an overview of some of them.

Some of the first perception studies tried to define the psychological factors that influence individual risk preferences. The main examples here are the heuristics biases and psychometric paradigm. Heuristics are cognitive shortcuts that individuals use to reduce complex judgements to more simple ones, for example when assessing the probability of an uncertain event (Tversky and Kahneman 1974). There are various judgemental heuristics: representability, availability, adjustment from an anchor, affect heuristic, etc. (Tversky and Kahneman 1973, Tversky and Kahneman 1974, Finucane, Alhakami et al. 2000). As an example of availability heuristics, one may assess the risk of getting a cancer among middle-aged people by recalling such occurrences among one’s acquaintances. Reliance on the different heuristics can lead to bias in risk judgements. Heuristics created the foundation for the psychometric paradigm associated with the Decision Research Group in Oregon, USA (Fischhoff, Slovic et al. 1978, Slovic, Fischhoff et al. 1981, Slovic 1987). Research within the psychometric paradigm, found that there is a range of hazard characteristics that influence the way people perceive risks of that particular hazard. These include voluntariness, controllability, familiarity, fairness, benefit distribution, catastrophic potential, delayed effect, and dread. The psychometric paradigm has been criticized for not addressing differences in individual perceptions (Sjöberg 1996, Siegrist, Keller et al. 2005, Siegrist, Keller et al. 2006) and for not including the social context in which perceptions are formed (Otway and Wynne 1989).

Other scholars attempted to address risk as a social construct and demonstrated how risk perceptions can be influenced by people’s social experiences (such as previous interactions with institutions), the values to which they have been exposed and their entire world views (Douglas 1982, Krimsky and Golding 1992). Cultural theory was developed by Douglas and Wildavsky (1982) as a challenge to the psychometric paradigm. It is largely based on anthropological research and emphasises that risk
evaluations are linked to the relationships of individuals and populations and are thus affected by contextual and cultural structures of individuals within the social groups. The theory proposes that differences in risk perceptions between groups of society arise from different social characteristics and patterns of social relationships, rather than that one group is rational and the other is not. Proponents of the cultural theory introduced the concept of ‘cultural rationality’ that gives equal weight to personal experiences and to technical calculations (Plough and Krimsy 1987, Fischer 2005). So consequently, public risk perceptions are shaped by the “the circumstances under which risk is identified and publicised, the standing or place of the individual in his or her community, and the social values of the community as a whole” (Fischer 2005, p.55).

Another prominent paradigm utilising a societal approach to risk perception is the Social Amplification of Risk Framework (SARF) that combines findings from psychology, sociology, anthropology and communication theory (Kasperson, Renn et al. 1988). According to SARF risk signals are transformed when they pass through the social and individual amplification stations which can amplify or attenuate perceptions of risk (Kasperson, Renn et al. 1988, Kasperson, Kasperson et al. 2003). Moreover, amplification can produce secondary or tertiary consequences that will go beyond original impacts of events, for example, market impacts, changes in regulation, stigmatization of particular product or community (Kasperson, Renn et al. 1988, Kasperson, Kasperson et al. 2003). Within SARF, mass media is one of the important amplification stations for risk events (Lichtenberg and MacLean 1991, Renn 1991), increasing coverage of certain risks while neglecting others (Mazur 1990). Filtering of the information, change of the context and framing in media’s reporting about events, can influence public perception of the risks (Renn 1991, Frewer, Miles et al. 2002, Chung and Yun 2013). The framework has been criticized for implying that there is an external ‘objective’ risk signal (Rayner 1988), for being too focused on the expert-lay divide (Merkelsen 2011) and being unable to support more interpretive approaches to risk perception (Horlick-Jones, Sime et al. 2003). In addition, research has shown that public uses different definition of ‘risk’, ‘benefit’ and ‘acceptability’ than the experts (Gardner and Gould 1989). For instance, while experts tend to present benefit in economic terms, the public’s definition of benefit includes aspects like usefulness, pleasure, safety and security (Gardner and Gould 1989), but also
who gets the benefit and what social institutions will be favoured by the particular technology (Otway 1992). Moreover, as Otway (1980) observes, perceptions depend on “information people have been exposed to, what information they have chosen to believe, dynamics of stakeholder groups, the vagaries of the political process, and the historical moment in which it is all happening.”. Lastly, the most important issue that influences public perception of risk is trust to and trustworthiness of the institutions managing those risks (Wynne 1980, Pijawka and Mushkatel 1991, Clarke and Short 1993, Slovic 1999, Wynne, Waterton et al. 2007, Wynne 2013). I will address this issue in more detail in sub-chapter 2.2.2.

This overview of the theories and concepts is not exhaustive, as this thesis does not aim to give a complete history of the risk perception research. Nevertheless, this subchapter demonstrates the complexity of public risk perception and the variety of direct and indirect factors that influence its formation, including societal and institutional relationships. Since this thesis focuses on nuclear risks that are quite controversial and have previously received a good deal of opposition, I will use the example of nuclear technology to illustrate some of the issues that have impacted public attitudes.

2.2.1a Historical aspects of nuclear risks and their impact on public attitudes

“Nuclear power – an exemplar, paradigmatic example capturing the essential features of a technological gridlock: a focus on hardware and technological fix to the neglect of citizens concerns and democratic processes, producing polarisation between citizens, on one hand, and policy-makers, experts, and managers, on the other hand, with the net result being impasse over technological choices.” (Rosa and Clarke 1999)

Much of the original research on risk perceptions (e.g. psychometric paradigm, SARMF and others) appeared in response to public opposition to nuclear energy (Otway 1975, Pahner 1976, Fischhoff, Slovic et al. 1978, Kaspanson, Renn et al. 1988). Paul Slovic and colleagues have shown in their research that nuclear and radiological risks score high on a list of psychometric factors underlying individual risk perceptions. Nuclear risks are often seen by public as involuntary, controlled by others, having little or no benefit, unfairly distributed, man-made, catastrophic, originating from unknown sources, unfamiliar, exotic, and affecting children (Slovic 1987). However, aspects influencing the publics’ attitude to nuclear risks go beyond these psychological factors. Numerous
scholars have noted that social challenges (in this case opposition to nuclear energy) appear when people think that the responsible organisations have not done their job well and that the history of organisation is often intertwined with the problem (Freudenburg and Youn 1999). So what can the history of nuclear industry tell us about the reasons for public attitudes?

Originating from the military sector and the famous Manhattan project in the USA, the nuclear industry inherited not only technology itself, but the centralised, closed structure and culture of secrecy (Rosa and Clark 1999). It has historically been insulated from public scrutiny, public participation and public debate over nuclear policy (Rosa and Clark 1999, Freudenburg 2001). If the nuclear industry was willing to listen to publics, it would have found out that most of the determinants of risk perception discovered by psychometric research had already been brought up by the public during public hearings to explain their opposition to siting of nuclear facilities (Otway in Short 1999). Instead, any public criticism or opposition to nuclear risks were immediately characterised as irrational and radiophobic (DuPont 1982, Daglish 1988, Jack and Sanderson 1995). Although various scholars have repeatedly criticized the use of term ‘radiophobic’ to describe public opposition, saying it should be reserved strictly for psychiatric use (Mitchell 1984, Drottz-Sjoberg and Persson 1993), the term is still common in both the literature and debates about public attitudes (Myslobodsky 2001, Атомная энергия 2.0 2013, McGann, Miaullis et al. 2015, Sacks, Meyerson et al. 2016).

Another key aspect of nuclear technology is that it was born in wartime effort and is strongly associated with mushroom-shaped clouds of nuclear weapons and Hiroshima Nagasaki victims (Grove-White, Kearnes et al. 2006). This association is not just historical either since civil nuclear power is the source of weapons-grade uranium and plutonium. When experts analyse and discuss nuclear risks, they often focus on the reactors themselves while ignoring the other aspects of the fuel cycle. People, on the other hand, recognise that civil nuclear industry has never been fully separated from nuclear weapons technology and materials (Grove-White, Kearnes et al. 2006) and this aspect impacts on their attitude.

The history of radiation risks has also demonstrated how the potential consequences of new technologies can be uncertain, underestimated and unpredictable. Since its
discovery, radioactivity was marketed as a miracle cure for almost anything (Moore 2017). For instance, there were radium baths, a range of beauty products containing thorium chloride and radium, or products like Radithor – diluted radium salts - a patent medicine that was described as a cure for more than 150 maladies (Macklis 1993, Gray 2004). The women that worked in the production of radium-painted dials saw their job as incredibly beneficial – they got exposed to radium for free while others had to buy it as tonic or one of the hundred other above-mentioned treatments that were available on the market (Moore 2017). Little did they know about the health consequences they were going to suffer due to the ingestion of radium paint. As opposed to health and beauty products, use of radium in dial paint was useful application, but the occupational health risks of this particular application were misunderstood.

Another highly publicised example of an unpredicted consequence was the severe exposure of the Japanese fishing vessel Lucky Dragon and its crew to the fallout from the 1954 US Bikini atoll test (Hohenemser, Kasperon et al. 1977). The first citizen opposition to siting of nuclear plants in US appeared in response to this incident and started a period of intense debate over the atomic fallout from nuclear bomb testing (1955-1961) (Kasperon, Berk et al. 1980). The emerging knowledge about the health effects of radiation exposures illustrates the type of uncertainty referred to as ‘unknown unknowns’ – unexpected situations and consequences that were not considered in early assessments (Wynne 1992). The factor of “we just don’t know enough about this risk” can play a role in the formation of perceptions (Tomkiv, Oughton et al. 2019).

After 1965, when nuclear weapons and war decreased as the main issues of nuclear industry, concerns about threats to the natural environment and a general distrust of high technology and its promoters replaced earlier fears (Hohenemser, Kasperon et al. 1977). Already in 1976, the US anti-nuclear activist Ralph Nader and several others (e.g. Langdon Winner, David Dickson, and Brian Easlea) stated that the main ideological issue with nuclear was ‘the democratic control of technology’ (Kasperon, Berk et al. 1980). The issue of nuclear energy became a condensed symbol for many features of industrial and bureaucratic authority (Weart 1991), a symbol of “an effort to reform legal system inherited from the days when kings imposed their will on recalcitrant vassals” (Sweet 1977). Today, the term ‘nuclear paternalisms’ is used to describe the situation when
those managing the nuclear industry believe they are acting in public interest when they are really working in the interest of patrons (Kultgen 2015).

The broad public attitudes of alienation from and mistrust of nuclear industry were strengthened by real radiation emergencies that demonstrated the environmentally destructive effects of the technology and highlighted inadequacies in its regulation and operation. There have been many different kinds of radiation emergencies, but nuclear reactor accidents with off-site consequences have been the most important, and perhaps definitive. Past nuclear accidents differ in reason, scale and consequences, but what connects them all (besides the presence of radiation), is that they in one way or another caused a communication crisis within a much larger and more multidimensional crisis (Fujigaki and Ng 2016). An overview of some of the main accidents and incidents, focusing on issues primarily relevant for communication, are given in Table 1.

Table 1- Selected historical accidents with significant radiological and socio-psychological effects

<table>
<thead>
<tr>
<th>Accident Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The Windscale accident (1957)</strong></td>
<td>Not readily admitted by the British authorities at the time of the accident. The incidence of an uncontrolled and completely unexpected (by the experts) fire in the graphite reactor core of what was an open, air-cooled military plutonium production pile was deliberately not communicated, and no protective measures were taken for the local population apart from banning local milk-consumption nearly a week after the accident started, by pouring the milk away. Despite the radioactive cloud passing over the downwind settlements, full monitoring data were never released (Wynne 1989). Plant operators and authorities denied contamination of the Cumbrian highlands as a result of the fire. Only after the Chernobyl accident over thirty years later deposited radioactive fall-out over the same fells, did the environmental monitoring show that up to half of the contamination in the highlands could be attributed to the Windscale fire and other releases from Sellafield, while the other half was from Chernobyl (Wynne 1989).</td>
</tr>
<tr>
<td><strong>Three Mile Island (TMI) (1979)</strong></td>
<td>The analysis of media coverage of the TMI accident showed that most of the negative statements in the newspapers were about the quality of the information that was being released about the accident (Stephens and Edison 1982). The officials were to blame for not giving regular updates, but journalists did not know what questions to ask either (Friedman 2011). Lack of information caused self-evacuation of the local population, despite initial advice to remain.</td>
</tr>
<tr>
<td><strong>The Chernobyl accident (1986)</strong></td>
<td>Took place in Soviet Union, a country with controlled and censored press. The release of radiation was picked up by Swedish monitoring</td>
</tr>
</tbody>
</table>
stations on April 27th and this led to an international alarm about the event. In the USSR, the first announcement about the accident was made only on April 28th, a day after Swedish authorities, and the town of Pripyat was evacuated days later. The effects of the accident were played down; the town of Pripyat containing 45,000 people was referred to as ‘a settlement’. The media reports in the USSR only provided short undetailed updates on the situation while focusing instead on all the other incidents on American and European nuclear installations, and blaming Western world for their hypocrisy. The Chernobyl accident is the biggest nuclear accident so far and it showed how consequences could affect large territories far away from the country where the accident occurred. It has underlined the difficulty of communicating technical knowledge about risks or lack of thereof (Friedman, Gorney et al. 1987, Friedman 2011), but also highlighted how the behaviour of experts, even individually, affects their credibility as a whole, which in turn influences the effectiveness of communication to publics (Wynne 1989).

The Goiania accident (1987) is an example of radiological accident. It took place in Brazil when a group of metal scrappers illegally removed a Cs-137 radiological source from abandoned radiotherapy hospital (IAEA 1988). The radioactive substance had been spread over a large area, four people died from radiation sickness and over 20 required intensive medical treatment. The accident demonstrated the possible extent of the stigma-induced secondary consequences in the society when sales of agricultural products from Goiânia decreased (although contamination of produce was never found), hotels elsewhere in Brazil turned away Goiânia residents, and cars with Goiânia license plates were stoned (Kasperson, Jhaveri et al. 2012).

The Fukushima accident (2011) happened in the time of internet and social media, so the amount of information available after the accident was immense. Nevertheless, from the resident’s perspective, information was inconsistent, very patchy at best, hard to understand and there were no explanations for the decisions taken (e.g. evacuation or lack thereof, regulatory values for food etc.). Exposed populations experienced lack of communication of accurate information and delayed disclosure (Miyazaki 2016). Lost trust in authorities and widespread public anger towards the plant operator TEPCO and Japanese authorities has been a prominent outcome (Figueroa 2013, NAIIC 2012).

Taking into account that public’s experience of technologies is “rooted in socio-historical context in which they are embedded and experienced” (Grove-White, Kearnes et al. 2004, Fischer 2005) – their scepticism to nuclear can be justified for all the above-mentioned reasons. Nuclear risks are a pertinent illustration of the complexity of the factors that affect people’s perceptions. However, for these and other risks, this understanding of
complexity seems to be largely limited to academia. In practice, many decision-makers still view the public as irrational and phobic towards the various risks, and concentrate their efforts on finding the magic solution to make them perceive risks in the ‘correct’ way (Marris, Wynne et al. 2001, Árvai 2014). In these attempts to find solutions, institutions responsible for managing risks are paying more attention to risk communication.

2.2.2 Risk communication

“Communication begins before a word is said.”
(Fischhoff 1995)

As risk perception research appeared from the attempt to overcome controversy about the societal acceptability of hazardous technologies, risk communication research emerged primarily to solve a very practical problem – that the public needed to be persuaded and educated (Otway and Wynne 1989, Leiss 1996).

The evolution of risk communication underwent several stages and various typologies exist in the literature (see for example Fischhoff 1995, Leiss 1996, Krimsky 2007). In general, the development of the field can be summed up in three main phases. The first phase focused on risk and technical tools for its assessment and management. Professionals assumed that as long as the calculations were correct and numbers were satisfactory, there was no need to talk about the risks, and when information was requested, giving public the numbers (probabilities) was good enough (Fischhoff 1995). Public reactions to such communication were met with open contempt, as Leiss put it – the ‘arrogance of technical expertise’ emerged during this phase (Leiss 1996). In the experts’ opinion, risk assessments were objective, analytic and rational, while the public was subjective, emotional and irrational (Slovic 1999). Numerous risk perception studies followed from this point.

During the second phase, risk communication adopted the approach of persuasion – the messages were supposed to persuade the listener that the point of view presented was correct. The approach was borrowed from marketing and utilized a wide range of techniques for enhancing trust and credibility for messages (Leiss 1996). Experts were still the key participants in the process, and they received a variety of guides, or “etiquette
books” as Otway and Wynne (1989) put it, advising them to use simple language, tailor messages to audience, and pay attention to body language (Palenchar 2009). However, even the perfect messages might not be perceived as such, since they will be impacted by the trustworthiness of communicator (Freudenburg 2001).

Following understanding that trust is an essential element of communication and that lack of trust is ubiquitous in risk issues, the third phase can be characterised by an emphasis on social context and interrelations between different actors (Leiss 1996). According to Otway (1992) “risk communication requirements are a political response to popular demands... the main product of risk communication is not information, but the quality of the social relationship it supports. Risk communication is not an end in itself; it is an enabling agent to facilitate the continual evolution of the relationships”. This and other more recent approaches highlight the importance of communication approached that support dialogue and relationship-building (Palenchar 2009, Bieder 2018).

Although this progress can be viewed in terms of successive phases, the reality is that both one-way and two-way communication approaches co-exist in current practices (Irwin 2014, Bieder 2018). This is reflected in the definitions of risk communication adopted by the different organizations. For example, US EPA defines risk communication as “the process of informing people about potential hazards to their person, property, or community.” (EPA 2019) adopting a one-way communication approach. WHO, on the other hand refers to it as “an exchange of real-time information, advice and opinions between experts and people facing threats to their health, economic or social well-being.” (WHO 2019) or “two-way and multi-directional communications and engagement with affected populations so that they can take informed decisions to protect themselves and their loved ones.” (WHO 2014). Moreover, the approaches to risk communication in practice also differ. Risk communication is still often seen as means of educating people about risk assessments and to correct their misperceptions by aligning them with that of experts (Árvai 2014). Wynne argues that the term ‘risk communication’ itself is problematic as organisations that are responsible for risks and for communicating about them rarely explain what they actually mean by risk. Neither do they investigate whether their meaning corresponds with those of people they are communicating with. This highlights the importance of reflexive risk communication as a dialogue between multiple
participants aiming at mutual understanding of issues for all the parties involved (Hampel 2006, Árvai 2014, Bieder 2018, Bourrier 2018)

Risk communication is complicated by several aspects, one of them being the differences in perceptions that were discussed in the previous sub-chapter. Another challenge is that many of the risks, whether they are nuclear, nano- or biotechnology related, are complex scientific topics that people in general are not acquainted with. Getting the content of the message right, which was a focus of this field in the beginning, is still an important task that requires significant analytical and empirical effort (Fischhoff 1995). A vast amount of research has been carried out that investigates how to explain numbers and use comparisons, the benefits of narrative communication and visual presentation of data (Covello, Sandman et al. 1988, Lipkus, Samsa et al. 2001, García-Retamero, Okan et al. 2012, IAEA 2012, Gonzalez, Akashi et al. 2013, Bodemer, Meder et al. 2014, King 2015, Murakami 2018). For example, the guidelines on how to communicate about radiological risk recommend to be careful with the use of quantities and units of radiation and to compare exposures in an accident to background radiation, medial exposures and flying (Slovic, Fischhoff et al. 1981, IAEA 2012). At the same time, one cannot simply assume that people are only interested in scientific information. After the Fukushima accident, the population were not primarily interested in radiation factors, instead, they wanted to know whether they could eat locally produced food and let their children play outside (Bieder 2018). It is important to answer the questions that people want answers for. However, there is evidence that responsible organisations rarely investigate the information needs, understanding, or knowledge of public (Mays, Valuch et al. 2016)

Another aspect that complicates risk communication is the effect of the communication channels. A lot of risk information reaches public through various media (traditional or social) and not directly from the organizations responsible for managing the risks (Wählberg and Sjöberg 2000, Covello and Sandman 2001). Mass media are important actors in the communication process, and risk communicators often rely on them to reach general public (Latré, Perko et al. 2017). While they can play important role in framing and interpretation of risks (Vyncke, Perko et al. 2016, Latré, Perko et al. 2017), they may have their own agendas and interest that do not necessarily coincide with those of organizations that manage (and communicate) risks. The explosion in popularity of social
media (e.g. blogs, social network websites, photo- and video-sharing websites, microblogs, etc.) also offer both challenges and opportunities for risk communication. Social media provide the ability to effectively disseminate information and potential for audience interaction; at the same time, it raises concerns with credibility and accuracy of the information (Rains, Brunner et al. 2015, Perko, Tomkiv et al. 2016).

Finally, as already mentioned the importance of trust has been repeatedly identified as a key factor influencing public compliance with recommendations, the effectiveness of risk communication efforts, and successful risk management (Slovic 1999, Sjöberg 2001, Renn 2003, Trumbo and McComas 2003, Viklund 2003, Earle and Siegrist 2006, Wray, Rivers et al. 2006, Löfstedt and Six 2008, Slovic 2010). It is especially important when people lack the knowledge needed to make decision (Siegrist, Cvetkovich et al. 2000). The risk communication and engagement literature stresses the importance of restoring and building trust, believing it can be solved with more information, transparency and explanation (Kasperson 2014). However, as some scholars have discussed – the issue is not of trust but of the trustworthiness of the institutions that are making decisions about risk (Wynne 1992). So one needs to first reflect upon what or who is there mistrust of and for what reason (Wynne 2006) and how does it influence the quality of social relationships between the various actors. Trust is complex as it is influenced by the degree of ambivalence, powerlessness and dependency that people feel towards experts and institutions that manage risks (Krimsky and Golding 1992, Wynne 1992).

Effective communication requires sustained effort, and so does trust (Kasperson 2014). There is need for the institutions to make a commitment to communicate responsibly, paying attention to actions as well as words, and to daily practice as well as emergencies (Leiss 1996). This means that a more pluralistic set of participants should take part in risk communication and deliberation processes should be expanded and upgraded (Kasperson 2014). Since public and stakeholder participation play an important role both in establishing of the trust and in fostering two-way communication approaches, next sub-chapter describes the development of the field and some of the issues.
2.2.3 Public and stakeholder participation

“… we have always had an uneasy relationship with people, tending to treat them as a variable to be considered in analysis, but not as legitimate contributors to decision.” (Otway 1987)

There is certain ambiguity in the terminology of public participation. The variety of participatory methods are usually distinguished based on the degree of information flow, degree of commitment of the parties involved, and the power among these parties and fall under four general categories: information, consultation, collaboration and empowerment (Kemp, Bennett et al. 2006, Chilvers 2007, Krüti, Stauffacher et al. 2010). ‘Involvement’, ‘engagement’ and ‘participation’ belong to the category of collaboration and although, there are some subtle differences between these terms (Woolley, McGowan et al. 2016), they will not be addressed in this thesis and terms will be used interchangeably. However, I feel it is important to address the distinction between the terms ‘public’ and ‘stakeholder’. Public engagement is usually used to describe processes where the members of general public are involved in decision-making or issue deliberation. Stakeholder engagement can be defined in a similar way, and the public is clearly a key and legitimate stakeholder. But in practice it is often limited to the parties that have a more direct stake in the decision or issue, and often excludes the broader and more diffuse public at large. In this thesis I refer to ‘public involvement’ when activities are aimed primarily at the general public and ‘stakeholder involvement’ for processes aimed at public and other stakeholders as representatives of the various institutions.

Participation emerged in the 1950-60s to express opposition of the marginalized and often oppressed members of the society (Arnstein 1969). Since the late 1990s, it became popular in science and technology and this popularity has been growing (Hagendijk and Irwin 2006, Irwin 2006, Attar and Genus 2014). The development of public engagement has been fuelled by the criticism of the deficit model (Irwin and Wynne 1996) and by the deepening crisis of trust between public and experts and crisis of legitimacy of the governance of science and technology (Attar and Genus 2014). Public engagement is now replacing the traditional one-way process of educating public, although this process has been varied and uneven. It is often mistaken for simply being a more dialogue-based method of communication (Abelshausen et al 2018). While dialogue is a an important
part of the process, engagement is also condition of democracy and democratic decision-making for a stable and responsible society with legitimate institutions (Held 2013).

Scholars distinguish three distinct types of imperatives, rationales and motivations for participation: normative, instrumental, and substantive (Fiorino 1989, Stirling 2005, Stirling 2008). Normative imperatives are based on “principles of democratic emancipation, equity, equality and social justice” (Stirling 2005, p.220) otherwise known as ‘the right thing to do’. Substantive motivations focus on achieving better decisions through participation, through engaging citizens as subjects in pursuit of more robust solutions (Grove-White, Macnaghten et al. 2000, Stirling 2005). Instrumental motivation for participation aims at ‘securing the end point’ either through enhancing social credibility of the particular decisions, or through fostering more public trust towards institutions by demonstrating their track record of public engagement (Stirling 2005). It can also be used to inform decision-makers, although the outcomes of such deliberations (e.g. recommendations made), often remain ignored (Renn, Webl er et al. 1995).

Not only the imperatives for participation vary, so do perspectives on who is the appropriate public for the particular participation process. Shall participants be representative of the wider population or shall processes only include those that are especially interested or potentially affected by the particular decision (Marris and Rose 2010)? For instance, Wynne (2007) argues that stakeholder exercises often become obsessed with whether participants are representative enough of society. However, they do not recognize that the innovation processes to be discussed are not representative of wider societal concerns and needs, as they are developed long before any public involvement occurs. This means that stakeholder process come “too far downstream in the life-cycles of innovation, regulation and impacts” (Wynne 2007). Moreover, as Wynne also argues, many public engagement exercises do not necessarily need a fully representative sample of ‘the public’ to be involved. In order to improve a public policy or corporate innovation trajectory, it might be enough that central actors reflect more upon concerns and impacts that they have neglected or overlooked.

Another important question to address in participation is who gets to engage. In controversial situations, powerful parties often become entrenched and dogmatic, and not open to reflection or change. The participatory process, then, typically occurs through
specialist forms of ‘engagement’ and not representative public mobilization. This and
related points also caused Wynne to emphasise the important differences between
invited and uninvited forms of engagement (Wynne 2007). While invited participation
nearly always introduces a frame (not necessarily deliberately), the uninvited forms of
engagement are usually about challenging those frames and normative social
commitments (Wynne 2007).

The development of public engagement has not been without problems. It has been
occasionally criticized for ignoring participants’ advice and using them mainly to add
credibility to decisions already taken (Cooke and Kothari 2001, Kothari and Cooke 2001,
Oughton 2004, Sundqvist and Elam 2010). There are tendencies in public involvement to
predetermine and pre-frame the issues, constructing them in primarily technical way and
to use involvement to educate public about the real as opposed to perceived risk (Wynne
short of the democratic ideal, fail to address fundamental issues of economic power, and
are restricted in content, structure, and intention (Wynne 2005, Goven 2006, Wynne

Finally, the popularity of participation led to the development and application of
hundreds of participation methods (Rowe and Frewer 2005), including within nuclear
emergency preparedness. However, less attention has been paid to the quality of
stakeholder involvement and evaluation of that quality.

2.3 Risk communication and engagement research in nuclear
emergency preparedness

“The main challenge for (radiological protection and others)
experts in the next 50 years could well be to change their own
perception, instead of trying to change public’s perception.”
(Smeesters 2013)

“We must take the population’s insecurity and information needs
seriously and work to curb irrational fear.” Extract from a
communication plan (Statens strålevern 2015)
Several legal documents define requirements for communication and involvement in emergency preparedness and response. Basic requirements for involvement of different interested parties, including the public, in emergency preparedness and response are set in the Aarhus convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention 1998):

“In the event of any imminent threat to human health or the environment, whether caused by human activities or due to natural causes, all information which could enable the public to take measures to prevent or mitigate harm arising from the threat and is held by a public authority is disseminated immediately and without delay to members of the public who may be affected”.

Another example can be seen in the ICRP’s recommendations for the protection of people in emergency exposure situations (Clarke and Valentin 2009):

“During planning, it is essential that the plan is discussed, to the extent practicable, with relevant stakeholders, including other authorities, responders, the public, etc. Otherwise, it will be difficult to implement the plan effectively during the response. The overall protection strategy and its constituent individual protective measures should have been worked through with all those potentially exposed or affected, so that time and resources do not need to be expended during the emergency exposure situation itself in persuading people that this is the optimum response. Such engagement will assist the emergency plans by not being focused solely on the protection of those at greatest risk early in an emergency exposure situation.”

After the Chernobyl accident in April 1986, the European Commission accepted several legal requirements dealing with early exchange of information, on informing the general public about health protection measures in the event of a radiological emergency and other basic safety standards for radiation protection (Council decision 67/600/Euratom 1987, Council Regulation 2218/89/EURATOM 1989, Council directive 2013/59/EURATOM 2013). These basic safety standards as well as the amended Nuclear Safety Directive focus on increased transparency and public information. They oblige Member States to inform the public during normal operation and in the event of emergency. The requirements are quite minimal, but the directives don’t limit the additional measures that can be decided by member states. A recent study deployed by
European Commission shows that on paper, current arrangements for information and transparency are compliant with the EU legislation (Perko and Martell 2019). However, this and other studies also point out that there is a gap between announced provisions and the reality, which is absence or poor implementations of those provisions (Železnik and Klemenc 2015, Perko and Martell 2019).

Nuclear emergency authorities acknowledge the need to include communication aspects in emergency preparedness exercises and training (Perko, Raskob et al. 2016). There are also citizen-science initiatives in the radiation protection field, for example radiation mapping solutions provided by Safecast in Japan (Brown, Franken et al. 2016). In addition, European Commission and EUROATOM have recently financed a number of research projects focusing on communication and involvement in emergency preparedness (e.g., FP7 projects EAGLE, PREPARE, OPERRA and H2020 projects CONFIDENCE, ENGAGE, TERRITORIES). These projects often include partners from national emergency management actors, thus, establishing a link between research and practice. However, these project activities are not without flaws. For instance, in the PREPARE project, ten national panels were organised to discuss emergency preparedness on how to handle contaminated food and goods after an accident (Charron, Lafage et al. 2016). The types of stakeholders that were invited to participate differed from country to country and almost none of them included general public (PREPARE 2015). In addition, each of the countries used different methods and procedures for stakeholder involvement and no evaluation of the quality of those exercises have been performed.

Despite the fact that both researchers and emergency actors take part in the above-mentioned research projects, it is hard to say whether and how this research is affecting the actual policies in those countries. There is some evidence about practical implementation of the recommendations produced (Pölzl-Viol, Turcanu et al. 2018), but no systematic follow up has been carried out. More importantly, there is no agreement on why stakeholders, including public, should be involved. A recent review of stakeholder engagement in emergency preparedness and response for the ENGAGE project showed that stakeholder engagement is rarely organised in response to the normative
imperative. The motivation is rather providing acceptance of the decisions and finding better solutions by including more stakeholders (Abelshauser, Perko et al. 2018).

While international guidelines stress the importance of multi-directional communication that will take into account expectations, views, concerns and questions from different stakeholders, communication about emergencies and emergency preparedness is currently still interpreted as a one directional transfer of information (Zeleznik, Marega et al. 2014) and legal documents do not require two-way communication (Perko and Martell 2019). In addition, many documents are not legally binding and exist in the form of recommendations or guidelines (e.g. IAEA, OECD, ICRP). For example, IAEA recommendations for development of communication plans states that responsible organisations should collect public opinion, attitudes, issues and concerns in order to understand public environment and context in which the communication strategy is to be implemented (IAEA 2015). However, a 2014 EAGLE survey of regulators, R&D organisations, radiological protection organisations, nuclear industry and other institutions and organisations involved with the radiological risks, showed that the majority of them provide information or education/training to public, but almost none of them systematically investigate their information needs, knowledge and interpretation of the issues (Daris, Kralj et al. 2015, Mays, Valuch et al. 2016). The majority of preparedness actors have communication departments, although those departments mostly carry out public relation activities and keep webpages and social media accounts up to date. The research activities performed by emergency management organisations (e.g. radiation protection authorities) include, information campaigns and quantitative perception surveys (see for instance Raitio 2018), but as noted by Löfstedt (2018), these tasks are often outsourced to communication consultancies that lack academic background and risk communication expertise. A survey of participants at the IAEA’s communication workshop in 2018 demonstrated that only one third of them seek feedback on the messages prior to posting them (IAEA 2018).

Those in position of authority often retain the view that public perceptions of risk are inadequate and differ from the ‘real’ risk (IAEA 2015):

“the demand for public communication may be high in an emergency regardless of the actual risk, as the public tends to react to its perception of risk rather than the actual risk.”
Another persisting idea is that public should be “educated” (Bourguignon, Bérard et al. 2017, Ehold, Perko et al. 2018, Panteleev, Segal’ et al. 2019). Both of these views impact on the way communication strategies are devised and implemented.

To conclude, despite decades of research on risk perception, communication and public participation methods, there are still gaps between this research and its application in practice within emergency preparedness. The key issues for this thesis are related to factors influencing the relationships between the different communication actors. The work carried out explores several aspects of communication in emergency preparedness: the presentation of radiological risks in media and its compliance with recommendations; public needs and concerns in radiological emergencies; and the value and quality of stakeholder involvement.
3 Methods

In order to answer the research questions, the research papers comprising this thesis employ both quantitative and qualitative methods, and sometimes a combination of the two (Table 1). This chapter will give a short description of the selected research methods, as well as an overview on the type of data they produced and their appropriateness for the research purposes. The detailed description of the methods used can be found in the appended papers.

### Table 1 Methods of data collection and analysis applied in the papers

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3.1 Media content analysis

Content analysis can be used to analyse written, verbal or visual communication messages and can be performed in both a qualitative and a quantitative way (Cole 1988, Elo and Kyngas 2008). It is a common method for analysing media coverage (Krippendorff 1980, An and Gower 2009, Manganello and Blake 2010, Penta and Baban 2014). For paper 1, this method was applied to analyse newspaper articles from five European countries (Belgium, Italy, Norway, Slovenia, Spain) and Russia, published after the Fukushima accident (11.03-11.05.2011). Two quality newspapers were chosen in from each country. News articles (N=1340) directly and indirectly related to Fukushima were coded using a system of codes developed to determine whether the radiation information in each article was presented in a quantitative and/or qualitative way. Each
article was coded by two trained coders, and inter-coder reliability was >0.84 as calculated by Krippendorff’s alpha (Krippendorff 2011). After the coding had been carried out, direct quotations of relevant information were collected from the newspaper articles containing radiation units and risk comparisons. These quotations were analysed qualitatively and examined for misinterpretations and mistakes. All articles were also checked for the presence of visual information on radiation doses and effects.

Our content analysis produced two types of data. The first set of data was a frequency distribution of the various ways risk information was presented in the newspaper articles. This allowed us to identify the differences in the approaches utilised in the analysed countries and follow how these approaches varied over analysed time periods. However, this data could only tell us what was said in the newspapers, but not how it was said. The second set of data was a collection of the text segments, where risk information was mentioned. Using this data, we were able to see how risk-related information was formulated, which examples were used, what kind of context this information had or lacked, and uncover instances of misleading information. The combination of quantitative and qualitative analysis provided a deeper insight into the quality of media coverage of radiological risk.

3.2 Questionnaires

In paper 2, a questionnaire was used to measure the extent to which collaborative deliberation increases learning, networking, involvement and problem solving when compared to information provision alone. Two questionnaires were developed to address this—one was distributed after the first day of information provision (26 January 2015) and the second after the collaborative deliberation follow-up on the third day (10 March). The questions asked were similar or identical for the two questionnaire surveys. The participants had the same participant number in both surveys to enable direct comparison of the results after the first and last day for each respondent. The questionnaires contained both close- and open-ended questions. The closed-ended questions were developed to be able to quantify the added value of the collaborative deliberation element compared to the information provision. The open-ended questions were used to explain the quantitative answers given and to capture the viewpoints of the participants on the seminar itself and emergency preparedness in general.
This study attempted to measure the effect of discussion with a questionnaire, which is challenging since it is hard to develop a questionnaire that would fully capture the effect of discussion. However, the use of open-ended questions avoided framing of participants’ answers and allowed us to gather even non-anticipated answers (Geer 1991, Gaskell, Hohl et al. 2016). The questionnaires were administered 6 weeks apart so the participants were probably not able to remember exactly what they answered previously, which strengthens the results, although their self-assessment could be prone to bias. We did not deliberately attempt to cross-corroborate the quantitative results of this study. However, some of the feedback we received from participants through open-ended questions and personal communication supported our overall conclusions.

3.3 Focus groups

In paper 3 we used the method of focus group discussions that collects data through semi-structured or focused group interactions on a given topic (Morgan 1996). A total of 48 participants were divided into 6 focus groups and received a progressively developing scenario of a hypothetical nuclear accident as a basis for discussion. The two proposed scenarios differed in terms of potential consequences for Norway and countermeasures that would be applied. The recordings of the discussions were transcribed and analysed for emerging topics.

Focus groups are a well-established method that is used in a variety of disciplines (Morgan 2010, Morgan and Bottorff 2010, Barbour and Morgan 2017). As the purpose of our study was to explore public reactions, concerns and understandings, focus groups were a natural choice as this method can provide “valuable insights into the processes through which opinions are constructed, expressed and, subsequently, hardened into attitudes.” (Macnaghten 2017). The resulting rich body of qualitative data we obtained further confirmed our choice of method as interactions within the group stimulated participants’ reflection producing more data than could be achieved had we interviewed them separately. The participants were not familiar with the topic of nuclear emergency management, but as the aim was to gain insight into their immediate responses to emergency situations, we deliberately did not include a more general warm-up conversation. The discussion guide was also broad enough to allow for a wide range of responses and concerns to take place. As in any hypothetical discussion, we cannot
assume that that in a real emergency situation, the participants would behave in the ways they reported, but our aim was to understand what influenced their decisions and attitudes. We aimed for a typical rather than a representative public, trying to include a variety of backgrounds and perspectives. In general, this study can be characterised as a pilot study and more concrete and systematic research building on our results should follow.

3.4 Stakeholder engagement seminars
Both paper 2 and 4 used stakeholder engagement seminars and the method utilised in both cases concerns organization of such stakeholder seminars. However, while in paper 2 we describe how the seminars were organised practically, paper 4 uses in-depth observation to focus on more contextual issues in organisation of engagement processes and looks into how democratic principles were followed and considered when making organisational decisions.

There is a variety of methods for stakeholder engagement (Rowe and Frewer 2005), but while some of them (e.g. consensus conferences and citizen juries) have more or less rigid procedures, others, like stakeholder seminars can be adapted to every particular situation. This allows organisers to create tailored fit-for-purpose approaches. However, as stressed in the two papers, it is also important to reflect upon the way engagement process is designed to ensure that quality is not compromised.

3.5 Ethical considerations
It is important to include ethical considerations in any research performed, especially if human subjects are used. One of the most important issues here would be voluntary participation, informed consent and privacy of the personal information (NESH 2016).

The condition for voluntary participation was met in the studies. The participants of the focus groups (paper 3) were informed about the way data would be collected, analysed, reported and stored and gave their verbal consent (see Annex 2). They were also given the freedom to withdraw their consent at any time. The results of the focus group discussions were anonymised. With regard to participants of the stakeholder seminars (paper 2 and 4), the agreement to participate is often assumed as consent. In addition, the seminars were organised under the Chatham house rule. This rule states:
“participants are free to use the information received, but neither the identity nor the affiliation of the speaker(s), nor that of any other participant, may be revealed”\footnote{https://www.chathamhouse.org/chatham-house-rule}. The reports did not contain any personal information about the participants and all the quotes were anonymised.

The focus group study was also submitted to and approved by the Norwegian centre for research data\footnote{https://nsd.no/nsd/english/index.html} (NSD).
4 Research findings

This chapter will provide short description of key research findings from the four individual papers included in this thesis focusing on challenges and key findings.

4.1 Paper 1 How did media present the radiation risks after the Fukushima accident: a content analysis of newspapers in Europe?

Paper 1 investigated the way radiological risks were represented in European newspapers during the two months after the Fukushima accident in March 2011. As summarised in Chapter 2, there is a vast amount of research on how to communicate about radiological risk so that it is easily understood, meaningful and provides information about things the public is interested in hearing about. This research has, in turn, been used as a basis for numerous recommendations directed towards those responsible for communication about risks related to radiation exposures. Typical recommendations warn against the use of quantitative information and radiation measurement units, suggest comparing exposures in emergency to those received from medical treatments and flying, and recommend paying extra attention to communication of health effects. However, despite the availability of the recommendations, little is known about whether they are being followed. Bearing in mind that traditional media have been and still are an important information source for the public, the main objective of the paper was to investigate the degree to which the above-mentioned guidelines were followed in the media coverage of the Fukushima accident.

The newspaper articles were analysed using a combination of quantitative and qualitative content analysis methods. The results found several misinterpretations and misrepresentations of radiological risks in the newspaper articles, and demonstrated the need for more clear communication of radiological risks. Many newspaper articles contained more than one measurement unit and there was a lack of explanation about what these units mean or how they relate to each other. The comparisons used were not the ones recommended and were not always helpful or correct in the context of the information presented. Health effects were rarely discussed and, when they were mentioned, these were almost always related to very high doses of radiation that were
not relevant for Fukushima. There was little use of visual material to explain radiation
doses and effects. We also identified a number of mistakes and misrepresentations of
radiological risks, such as comparison with norms that did not exist or that were not
correct in the context (such as comparing seawater levels with drinking water
standards), and oversimplifications of the rationale behind those norms.

Based on the results we formulated several recommendations for improvement.
Information should be presented in several ways, with both results of measurements and
several benchmarks for context and comparison. Estimations of health effects that are
expected to occur (or not occur) at the relevant radiation levels should be included.
Expert risk communicators need to be pro-active in building relationships with the media
and in developing both textual and visual material already in the preparedness phase.

The findings from this paper lay the foundation for some of the work carried out in the
rest of the thesis. Firstly, discrepancies between recommendations and practice show
that there are problems with communication of radiation risks in many countries,
including Norway. Many factors could have impacted the quality of reporting. It could be
related to changes in the dynamics of the media world and how it impacts the quality of
reporting. Competition with social media puts pressure to get something out
immediately. The media tended to sensationalise the Fukushima news (such as
comparison with Chernobyl or health effects at very high doses), but this could have been
done consciously – to sell more newspapers or due to the lack of any other frame in which
to present it. There are few science reporters meaning journalists are dependent on
experts and authorities. Did the mistakes reflect difficulties in finding information that
would help contextualise radiological risks or in getting in contact with relevant people
that could provide such context? To what degree are the institutions responsible for
communication to public and media to blame here? Overall, the results point to the need
for a more systematic review of what goes wrong in emergency response and the
relationships between different actors.

These findings are also important because news media are often the main source of
information for the public, especially, as was shown in Paper 3 in the initial phase of the
accident. Although this first paper study did not give insight into the way risk information
presented in newspapers impacted on the way public perceived those risk, follow up
4.2 Paper 2 The power of collaborative deliberation in stakeholder dialogue seminars

Paper 2 examines the use of collaborative deliberation in stakeholder seminars as opposed to information provision. There is an increasing amount of support for involvement of a wider variety of stakeholders in the decision-making processes, and a general agreement that two-way communication should be used instead of one-way communication. In practice, however, the dialogue aspect of communication in stakeholder seminars can be quite limited. Stakeholder involvement seminars in Norwegian nuclear preparedness are usually organised in the form of information provision – the participants receive a number of lectures covering a variety of relevant topics while discussions (if present) are limited.

Building on a series of nuclear emergency preparedness seminars carried out in Norway, Paper 2 deals with the quantification of the effect of dialogue and discussion (collaborative deliberation as we called it in the paper) against one-way communication – information provision. The study used questionnaires to quantify the value of collaborative deliberation as seen by the national, regional and local actors participating in the seminars. In doing this, the study contributes to the ongoing academic and practical discussion of how to demonstrate that engagement is worth the effort, time and resources and whether the process has paid off in terms of result achieved.

Results demonstrated that discussions were more useful than one-way information provision. Participants deemed that collaborative deliberation contributed significantly to knowledge gaining, networking, involvement and problem solving than information
provision, mainly through discussion within and across the different sectors present and informal communication between participants. Collaborative deliberation also had a positive impact on the understanding of the challenges different sectors would face in a nuclear emergency and the roles the participating actors would play in it.

An important result of Paper 2 was that home reflection on the issues did not work for the majority of the participants, only for the few people from institutions that were interested in working with the issue to begin with. This highlights another important issue in the engagement discussion – that it is often dependent on active individuals that see the value and importance of engagement and common deliberation on issues and will show initiative.

These findings are relevant for two different reasons. Firstly, there are few studies that have tried to quantify the benefit of dialogue for knowledge, networking, involvement and problem solving. My personal view is that the benefits of this type of dialogue actually go beyond these outcome-based factors, and the approach has value in itself, as does stakeholder involvement in decision-making. However, those with a more pragmatic approach, like decision makers and politicians, often need a more tangible demonstration of benefits. Hence our study could be valuable material to demonstrate that dialogue and deliberation pays off.

Secondly, the findings give an indication of problems that are present in the Norwegian emergency preparedness system. One of the most apparent challenges is both the lack of and need of stakeholder involvement in nuclear emergency preparedness. At the same time, there is a clear challenge of how to get people to participate in stakeholder engagement when it is not part of their immediate tasks. This concern was also brought up in Paper 3, where one of the worries that public representatives expressed was whether a coordinated response to an event can be achieved with all the different actors involved. The public also questioned whether all relevant actors/people are indeed included in this type of decision-making. Again, a systematic analysis of what is currently being done in emergency preparedness, what kind of stakeholders are being involved and how is needed. These factors are also raised in paper 4, which discusses what a quality stakeholder involvement process is and how important it is that such stakeholder
involvement initiatives are open about their purpose and impact and who would benefit from it.

4.3 Paper 3 Embracing the complexities: the value of listening to public in nuclear emergency preparedness

In Paper 3 we wanted to investigate public concerns, responses, information needs, understandings and expectations with regard to radiological accidents. This study was motivated by the need to understand attitudes and behaviour of public in order to develop appropriate protection and communication strategies and to encourage actions that would reduce the impacts of accidents. In emergency preparedness practice, public opinions are usually collected through quantitative surveys, where the majority of questions are close-ended. Although such surveys provide some indication of public attitudes, they fail to answer what motivates people to act in certain ways, what factors they take to be relevant when deciding how to act and why they respond to and perceive risk in the ways they do.

The study was based on scenario-based focus group discussions with representatives of Norwegian populations. Two scenarios were presented: an accident during transport of a reactor off the coast of Norway and an accident at the Sellafield reprocessing plant, both leading to deposition of radionuclides on Norway.

Results from the focus group discussions were analysed according to four main topics: a) how the publics involved define their relationships with emergency preparedness actors; b) what factors influence public responses to countermeasures; c) how publics construct their risk perceptions of radiation; and d) what kind of questions they asked about the scenarios.

We identified two main factors that heavily influenced the public’s relationship to emergency actors. One of them was knowledge – the majority of participants had no idea that there was any preparedness for radiological accidents in Norway, nor who would be responsible for managing it and making decisions should an in incident occur. They did not know who to go to for information and acknowledged that they had forgotten about the old routines that used to be part of civil defence. The other factor was trust towards authorities and official institution. Discussions uncovered that although the general levels
of trust are high; it is topic-dependent and is affected by historical experiences with governmental decisions and actions (in both positive and negative way). The public would appear to trust more in the intentions of the authorities to act for the public’s best, than their competence to deal with the emergency situation. With regard to official recommendations, our findings showed that formulations play an important role. Personal networks influenced the readiness for following recommendation, as people would naturally want to make sure their loved ones were safe. Participants were generally more positive towards recommendations they saw as effective and safe. We also observed that a range of factors contributes to the way publics construct their perception of radiation. Things like lack of control over exposure, persistence of contamination, lack of knowledge about effects of radiation and responsibility for potential effects on their children played a big role in this process. The questions people asked demonstrated a variety of aspects that public would be interested to know about and that responsible authorities should be ready to answer.

Although the findings of this study cannot be generalised to the whole population of Norway, since we did not have a representative sample, they do indicate some of the existing issues with and potential challenges for emergency preparedness. First, they demonstrate the kind of useful insights into the ways public construct: i) their perceptions of risk; ii) their relationships with emergency actors and sources of knowledge; and iii) their responses to emergency management.

4.4 Paper 4 Assessing Quality of Stakeholder Engagement: From Bureaucracy to Democracy

Paper 4 addresses the lack of quality evaluation of stakeholder engagement activities and frameworks (criteria) for such evaluation. The rapid increase in popularity of stakeholder engagement in research and practice has been applauded as symbolizing the transition from one-way communication practices to a dialogue. Stakeholder engagement was a shift towards a more democratic process that was expected to remediate the crisis of trust between public and experts. However, not everybody shares this enthusiasm about stakeholder engagement and there have been questions about whether it has any actual impact on the democratization of practices, or whether it is used simply to add credibility to decisions already taken. There is evidence that stakeholder engagement has not
resulted in the change of attitude of experts and decision-makers towards the role of public and stakeholders in those activities, making it often just another bureaucratic exercise. The existence of hundreds of participatory methods and mechanisms only emphasize the need for thorough evaluation. But how does one evaluate stakeholder engagement? Those who view it as a way to get their decision accepted, aim for outcome-based evaluation although this view and approach have been criticized for not adhering to democratic principles. Others focus on evaluating whether the method used is efficient and works. However, in our opinion, there is a need for a third type of evaluation – one that is context based and focuses on the ways democratic principles are followed, that examines power relationships between the participants and investigates how issues and decisions are framed. The aim of this study was two-fold: we wanted to explore the applicability of the existing evaluation criteria for assessing quality of stakeholder engagement or broader public engagement. At the same time, we wanted to use our two cases to highlight existing limitations and issues in stakeholder involvement and evaluation frameworks, demonstrating the need for a deeper analysis that goes beyond simply methodological considerations.

The paper uses two stakeholder engagement activities, one in nuclear emergency preparedness and one in nanotechnology to demonstrate limitations of existing criteria in assessing the quality of the stakeholder involvement process. Evaluation of the cases demonstrated that there was a variety of issues: lack of representation of relevant stakeholder groups, which resulted in experts constructing opinions about public concerns; conflict of interests and possible bias in choice of participants; lack of flexibility to be able to take issues that appeared during the discussions aboard; lack of influence on both results of the process and limits for the discussion and stakeholders’ unawareness of what was going to happen with feedback. Another observation that we made while evaluating the exercises was that both activities tended to put a lot of focus on expert knowledge and “education” of participants.

Based on the findings of the study, we concluded that existing criteria could be used for systematic comparison of stakeholder engagement activities, but they were not sufficient to address the democratic issues of the quality. Therefore, we proposed to expand the criteria so that more attention is devoted to democratic values and context evaluation of
the engagement processes. Our proposed framework suggests to focus on inclusiveness in terms of ensuring a diversity of perspectives and opinions (including those that are usually excluded) and joint reflection on the ways the different parties might be affected. Independence of stakeholder engagement processes should not be limited to the economic independence from sponsor, but also independent deliberation on framing of issues to be discussed. This is important since framing is something which is usually fixed early in or even before multi-actor engagement and deliberation begins, and has a tendency to focus only on risk, as if this were the only public concern. Inclusiveness and independence are also in line with the call for upstream as distinct from downstream engagement (Wynne, 2001). Attention should also be paid to minimize bias in selection of participants. Instead of focusing only on timing of involvement, one should ensure flexibility of the process so that issues that emerge in discussions with stakeholders could be taken aboard. In addition, we think it is important to consider adding some continuity to the engagement process, whether it is done by organizing it in stages or by acknowledging and picking up on what was done before in the area/topic. Authentic engagement cannot be achieved if it is assumed that it is founded in one-off events only. Previous and expected future social interactions matter far more than normally recognised. Since evaluation of genuine impact stakeholders had on the outcomes of the process is hard when it is not connected to a specific policy-making, one should evaluate influence based on the possibilities stakeholders had to co-frame and choose issues, question the underlying assumptions of those organizing the engagement. The engagement process should be transparent in terms of not only how the process is conducted, but also why it is being organized, what is going to happen with results and who will benefit from it. We also proposed an additional criterion - ‘accountability and learning’ to stress that the essence of stakeholder engagement is mutual learning for all sides and should not merely educate stakeholders about various issues of a project or policy.

To conclude we argue that these criteria will ensure a more critical and reflective contextual evaluation of stakeholder involvement, and that addressing these should be a formal requirement to anyone who is organising it. More attention should be paid to the quality of the involvement processes and what role they actually play in the decision-
making (if they play any role at all). In this way the more lasting and important dimension of social relationships is included. I suggest this is needed not only on theoretical grounds, but also on pragmatic ones, to help make emergency responses more effective.

Even though the stakeholder engagement activities that we analysed were stand-alone events, they did highlight for research and decision making, the general problems that exist in participation and engagement. These findings are novel and relevant because although many excellent scholars have been raising the question of democratic deficits in stakeholder involvement, little of these concerns have been put into practice. Also, although we were aware of these discussions and were actively involved in organization of both cases, we found it hard to meet quality criteria. There is little understanding on the part of sponsors and organizers of predominantly technical projects of what does it actually mean to involve stakeholders and why those more demanding and ambitious criteria need to be followed.

In practice, institutions are being applauded merely for doing any involvement, while I believe by now we should have progressed further. It is not about just doing it, it is about constant reflection, re-evaluation of current procedures and processes in order to learn and improve.
5 Discussion

The overall goal of this thesis was to offer a more holistic view of risk communication in emergency preparedness that goes beyond analysis of the message and messenger, and also addresses the relationships between publics and responsible institutions. In this chapter I discuss the theoretical contributions made by this research to risk communication, stakeholder involvement and emergency preparedness by showing the relevance of this research to these fields. I also highlight the practical implications of this research to academic and managerial discussions about emergency preparedness to nuclear or radiological accidents.

5.1 Linking the papers

The papers in this thesis share a common topic as they all address communication aspects in relation to a real or hypothetical nuclear accident. They are primarily linked together by their contributions towards gaining a better understanding of the different components within communication in nuclear emergency preparedness:

- Who are the communicators in emergency and emergency preparedness and their roles in the communication process;
- What should communication content be in terms of message and expectations; and
- How this should be done – process of communication.

Moreover, the papers highlight the multiple directions of social relationships that exist between the key communication actors (Figure 3) and indicate at least some of the factors that affect these relationships.

5.2 Theoretical contribution to the research field

The papers are linked together by their interrelated contribution towards a more holistic understanding of risk communication, but the individual papers also contribute to the theoretical frameworks they are grounded within.
Paper 3 demonstrated that publics were basing their perception of nuclear risk on their knowledge, values and experiences of those who control this risk. These findings support the research within the socio-cultural theory of risk, which argues that risk is inseparable from the wider societal and political context and both expert and public approaches to risk are logical and rational, but merely based on consideration of different factors than results of technical assessments (Douglas 1982, Plough and Krimsky 1987, Tansey and Rayner 2009).

Another theoretical contribution of Paper 3 was made to the pluralist theory in the interpretation of Thompson and Rayner, whose cultural theory of risk approach follows their anthropologist teacher Mary Douglas. This approach is based on the way dynamic social constructions affect risk perception, resulting in plurality of rationalities in the sense that “each of these sets of social constructions provides those whose form of social solidarity it supports and makes viable, with the criteria for deciding what counts as
rational and what as irrational.” (Thompson and Rayner 1998, Thompson, Rayner et al. 1998). The findings of Paper 3, in particular, demonstrated this multiplicity of publics (Irwin 1995, Wynne 2005), and how these publics construct their perception of radiological risk and institutions managing it, based on their knowledge, values, experiences, and their whole web of social relationships. In addition, stakeholder engagement seminar analysed in Paper 2 highlights the plurality of actors within the emergency preparedness system and their perspectives and challenges with regard to emergency response. Thompson and Rayner (1998) also argue that by embracing the plurality, improved flexibility and resilience of institutions could be achieved to respond in a more robust way to ever-changing and unpredictable circumstances of emergencies. The research findings from Papers 2 and 4 contribute to the ongoing discussion on the democratic theory that focuses on the need to shift from representative to deliberative democracy (Benhabib 1996, Biegelbauer and Hansen 2011). The basis of legitimacy in democratic institutions is that their decisions represent “an impartial standpoint in the interest of all.” (Benhabib 1996, p.69). This can only be true if such decisions “are in principle open to appropriate public processes of deliberation by free and equal citizens.” (Benhabib 1996, p.69) It is important to give citizens legitimate voices in the technical policy processes and steer these processes away from the technocratic mode of decision making towards democratization (Chilvers 2005). However, there is still a long way to go before this democratization can be fully achieved (Chilvers 2005, Chilvers and Kearnes 2016, Tomkiv, Liland et al. 2019). There is need for more attention to wider social and political contexts that participatory processes are organised within, with focus on the ways democratic principles are respected (Goven 2006, Goven 2006, Chilvers and Kearnes 2016). We respond to this need by proposing extended quality evaluation criteria for stakeholder engagement in Paper 4. These criteria go beyond the more common methodological evaluations and address democratic issues.

5.3 Communication in emergency preparedness: a step towards holistic approach

Based on the research findings from the papers, I have defined four factors that would contribute to improved communication for nuclear emergency preparedness. These are
“listening to people”, “embracing the complexities”, “communication as a relationship” and “need for institutional change”.

5.3.1 Listening to people

A first step towards better communication processes would be listening to (and hearing) the audiences. Listening to public is not only a “normative” requirement of being ‘the right thing to do’ in a truly two-way communication. Understanding the publics, their perspectives, concerns and values, their understanding of concepts and systems can provide valuable input to both research and practice. The importance of audience research has been known and stressed for decades (Fischhoff 1995), however, evidence shows that both research and practice often work with assumptions of what we think public concerns and needs are (Marris, Wynne et al. 2001, Marris 2015, Mays, Valuch et al. 2016). The reasons for such an approach are many, from a devotion to deficit model (Simis, Madden et al. 2016), disregard of social research (Van Oudheusden, Turcanu et al. 2018) or a paternalistic “we-know-it-better” belief (Sundqvist and Elam 2010, Kultgen 2015).

Starting with the basic level of communication related to content and format, the first question we must ask our audience is: Are our messages appropriate? Are our communication channels adequate – are people using them the way we assume they do? Is an article on a webpage a good communication format or should we go for something more interactive? Are the recommendations and other communication content understood the way we intended? Are we speaking the same language with people? Are we answering the questions they are asking? Are we responding to the concerns they are having? Do we know the factors that will influence their response? - these are just few examples of the questions any communicating institution will need to know answers to. There is of course a vast amount of scientific literature internationally, addressing all of these different aspects (see e.g. (Lipkus and Hollands 1999, Lipkus, Samsa et al. 2001, Fagerlin, Ubel et al. 2007, Perko, van Gorp et al. 2013, Bodemer, Meder et al. 2014, Perko, Thijssen et al. 2014, Perko, Adam et al. 2015, Vyncke, Perko et al. 2016). However, the point I would like to make here is that every responsible actor in each country needs to know their particular audience. Generic research needs to be applied and put into
practice in each country, and to date little has been carried out in Norway. The results of studies need to tested in different countries, since the answers are unlikely to be the same for all the people in the world, as there are political and social contexts that are specific to each country, which would require different communication approaches (Aerts, Impens et al. 2014).

Another important sphere where audience research is very useful and important is to investigate the connection between media coverage and public risk perception. The influence of media on publics’ risk perception is a popular assumption especially promoted by the Social Amplification of Risk Framework. There is a lot of research on the influence of different media types on risk perception, but this only provides limited support for the hypothesis that media sources can have influence on risk perception (Coleman 1993, Sugimoto, Nomura et al. 2013, Utz, Schultz et al. 2013, Vyncke, Perko et al. 2016). However, this influence cannot be taken for granted, as media might have more influence on risk perception via availability of information (more information – stronger effect) rather than being a strong causal factor (Wählberg and Sjöberg 2000). As Urquhart and colleagues have noted, decision-makers may look for media as a proxy of public concerns, however, while media certainly has a role of informing public and impact their degree of awareness (on a particular issue), it cannot be equated to public concerns (Urquhart, Potter et al. 2017). I am not trying to deny the potential effect of media coverage, I only want to stress that, however interesting the results of media coverage analysis are, if we don’t actually investigate how people would – or did - respond to the information they received through media, we cannot assume what kind of effect it had. Although in Paper 1 we demonstrated a number of mistakes and lack of context for radiological information found in the newspaper articles, we cannot say how those impacted on the opinions people formed about radiological risks. We also lack understanding of how they actually use media in the constantly changing media landscape and how do they treat it as a source - all of these aspects can only be studied by asking or observing, or both, the potential readers. For example, the participants of our paper 3 study considered online newspapers to be a good source of fast information updates. But at the same time, they differentiated between the tabloid and more serious papers and acknowledged existence of sensationalism, click-baiting, lack of quality
coverage and money interests in media world – demonstrating that they are not merely passive receivers of information.

The past decades have seen an evolution in our understanding of the variety of factors that impact the way people construct their perception of the risks. The issue of risk perception has been addressed in many different disciplines and using different methods, but in the end, the perception triggers that emerged from psychometric research (Slovic 1987, Slovic 1997) or those that emerge from qualitative data based on discussions with people (Short 1999, Tomkiv, Oughton et al. 2019), are very similar. For example, participants of the focus group discussions in Paper 3 revealed that in the case of radiological contamination, their perceptions of radiological risks would be affected by the feeling of disempowerment and having lack of control over exposure, its persistence and effect on future generations. People’s response to risk is not phobia or irrationality, it is grounded in their values (societal, moral, ethical) (Wynne 2001, Wynne 2013, Oughton and Engel-Hills 2016). However, emergency actors often lack this understanding of public perception and act upon their assumption of a misunderstanding and hysterical public that has to be reassured and ‘sedated’ (Hernes 1986, Irwin 2014) – behaviour that also resonates well with my own personal experience. There are few if any studies that would have systematically analysed whether emergency preparedness actors actually use the results of social research for guiding them in the decisions and strategies and if yes, how and to what extent?

Listening to people should not be limited to audience research only. Many scholars have been advocating for inclusion of public as a stakeholder in the decision-making processes (e.g., Wynne 1992, Sundqvist and Elam 2010). There has also been increasing recognition of the importance of public involvement in recovery after the nuclear accidents (Oughton, Forsberg et al. 2004, Liland, Lochard et al. 2009, Ando 2016, Rollinger, Lochard et al. 2016). However, public involvement in emergency preparedness is not so widespread, although involvement of other stakeholders is slowly becoming accepted. The reason for that could be that this field is still dominated by technical experts and arguments against public involvement usually focus on their lack of scientific expertise (Sundqvist and Elam 2010) or secrecy. This prioritization of scientific knowledge and power and control to experts only discourages knowledge exchange and mutual learning. It also limits the
dimensions of issues that are thought to influence public concerns to only scientific ones (Hirakawa and Shirabe 2015). However, we know from Chernobyl experience that the local context and knowledge are crucial for successful implementation of the countermeasures (Skuterud 2006, Liland and Skuterud 2013). The focus group participants (Paper 3) hoped all the people with relevant knowledge are included in the decisions, some said they would like to be included as well.

As important as it is to promote participation, it should be done properly with attention to both method and process. As discussed in Paper 4 a quality stakeholder engagement process should be supported by democratic values and pay attention to the context in which it is organised. It should be inclusive, allow for joint deliberation on framing of the process and mutual learning, be clear about aims and purposes, and flexible to take issues that emerged aboard.

5.3.2 Embracing the complexities

There several dimensions of complexities that emergency preparedness need to be aware of and address. Firstly, responding to a nuclear accident is a complex task – it will affect multiple parts of society and involve a vast variety of actors (Oughton and Howard 2012, PREPARE 2015, Charron, Lafage et al. 2016), and requires mobilization of all institutions and power (Clancey and Chhem 2016). Achieving a coordination of so many actors is very challenging and can only be done if everyone’s roles and responsibilities are understood by all of the groups involved (Charron, Lafage et al. 2016). However, as clearly illustrated in Paper 2, reality shows that roles and responsibilities are a big source of confusion for many actors, especially those that are not usually involved in exercises and discussions (Liland, Tomkiv et al. 2017). In the actors’ opinion, only the common deliberation on issues made them realize the full picture of potential consequences of a nuclear emergency and challenges it was going to bring to the various sectors (Liland, Tomkiv et al. 2017).

Moreover, as several scholars have already pointed out, there are not only multiple actors, but also multiple publics (Irwin 1995, Wynne, Scoones et al. 2005, Kerr, Cunningham-Burley et al. 2007). These publics will apply a variety of rationalities in the construction of their attitudes towards risk and actors managing this risk. Each time they
make a judgement about risk or actor, they will weigh the evidence presented, their background knowledge and experience with similar situations and actors, etc. The focus group discussions (Paper 3) gave a good illustration of this plurality: some of the participants that had personal experience with emergency exercises, and knew about weaknesses that exist in preparedness systems expressed less confidence in the ability of Norwegian emergency preparedness. Other participants, whose experience with emergency preparedness and response was limited to the knowledge about post-Chernobyl recovery, were more positive towards the competence of the authorities.

Another dimension of complexity I would like to mention is the difference between the theoretical (i.e. emergency plans) and the actual emergency response. Countermeasures tend to be planned by the responsible actors centrally, but will need to be implemented locally. The differences in local context will have an impact on the implementation, but it is often unclear how, or whether, these are considered in this type of planning. The Rogaland seminars discussed in paper 2 and 4 were a one-of-a-kind activity, with invited participation from all levels of decision-making, as the involvement does not usually go further than the regional, county level, while implementation of the countermeasures would fall onto municipalities’ table. If we also add here the dimension that every emergency is going to be different, it seems only logical that response systems should aim for flexibility and resilience rather than fixed rigid solutions, emphasising on the ability of the system to adapt (Britton and Clark 2000, Clancy and Chhem 2016). For achieving flexibility and resistance, strong healthy relationships between all the actors in the preparedness system will be beneficial.

The final complexity has paradox right through it. A clear requirement for much of the above-discussed improvements in emergency response, and preparedness, is that regular rehearsals take place involving the various actors in their distinct roles and functional relationships. A problem with such rehearsals for many authorities is that they risk provoking the very public anxiety and exaggeration of the risks of the accident scenarios rehearsed, which are the officials’ greatest lament – and fear. Focus group participants (Paper 3) acknowledged this as one of the challenges with making emergency preparedness more visible. At the same time, some of them acknowledged that knowing what to do and who to contact in an emergency would make them feel safer.
So some sort of middle ground solution that would attend to the concerns of the different publics should be possible.

5.3.3 Communication as a relationship

The topics discussed above stress the importance of listening to the public and embracing the variety of complexities that are inherent in an emergency preparedness and response. These arguments lead towards a necessary change in the way we think about the communication process. Here I will present the argument for why we should move away from understanding communication in terms of single events, campaigns and emergencies, and view and develop risk communication as a dynamic network of social relationships (following (Otway 1992) involving all salient actors including publics who may be uninterested and unwilling.

There is a lot of guidance on how to set up emergency communication in response to an accident, but there is still lack of understanding with regard to the impossibility of just pushing a button to get communication going once an emergency occurs. This does not just refer to practical arrangements like activating an emergency webpage, call line or SMS warnings, but the challenges of reaching out to actors and publics that have never been engaged in emergency response and do not have the trust with which to credit emergency managers. Emergency preparedness needs to develop in line with societal changes and changes in nuclear threat assessments – there is a need for regularity and continuity of communication and involvement.

Starting with the issue of trust, which is of crucial importance for risk perception and successful communication and engagement. Many scholars have pointed out that trust needs to be built a long time before it’s actually needed (Slovic 1993, Slovic 1999, Siegrist, Cvetkovich et al. 2000, Larson and Heymann 2010) and it is something responsible institutions should always keep in mind. We need to keep in mind that no communication is in fact communication, as it is a form of institutional body language, actions and lack of actions (Otway and Wynne 1989). Focus group discussions (paper 3) showed that people do not judge any emergency in a vacuum; they use their experiences from other instances, other accidents, other decisions, and the previous behaviour of those in power. Therefore,
all the experiences they have – and have had over a long time past - with experts and institutions that engage in the emergency response will be having an impact on trust.

To continue the discussion on experiences with institutions – transparency, openness and accountability should be the guiding principles of any communication and involvement. These principles were highlighted as important both by participants of the focus group discussions (Paper 3) and by evaluations of the stakeholder engagement activities (Paper 4). However, inclusion of transparency and openness into modern policies is currently grounded in a utilitarian argument that it will help in convincing sceptical publics and restore trust (Irwin 2006, Lofstedt and Bouter 2013). At the same time, the “possibility that openness might create further grounds for criticism and concern is not considered.” (Irwin 2006). A recent study confirmed this possibility when transparent communication was tested in Canada during the H1N1 pandemic and found to create more public confusion and provoke negative opinions on the abilities of public health authorities (Driedger, Maier et al. 2018). As we argued in Paper 4, transparency should focus less on how the communication or engagement process is conducted, and more on why and in what context. A fundamental reappraisal of the relationships is needed (Irwin 2006).

The mistakes and misrepresentations of radiological risks in media that were revealed in the Paper 1 led us to suggestion that there is a need to build a relationship with media as well. This idea was supported by the journalists present at the RICOMET3 conference, where the results of the study were presented (Perko, Tomkiv et al. 2016). The pro-active approaches bringing together journalists and scientists help improve quality of scientific debate in society (Tanaka 2015).

Every stakeholder engagement process needs to continue beyond the particular lifetime of the issue or decision. This means that organisations responsible for the decision need to maintain their existing relationships with the various other organisations which exist and act in the social or policy environment in question, and this includes interactions with others who may be ‘stakeholders’ in the specific issue as well as stakeholders in more

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3 First International Conference on Risk Perception, Communication and Ethics of Exposures to Ionising Radiation (RICOMET 2015), which was held from 15th to 17th of June 2015 in Brdo Castle, Slovenia. http://ricomet2015.sckcen.be/
general and broader-ranging issues. This idea is supported by the findings of Paper 2. Stakeholders that participated in the emergency preparedness seminar said that they felt it would be easier for them to reach out to organisations in an emergency situation, now that they had actually met people (Liland, Tomkiv et al. 2017). The positive effect of continuous involvement has also been demonstrated in the Swedish nuclear waste discussion (Sundqvist and Elam 2010).

We attempted to address stakeholder involvement as a process in the nuclear preparedness seminars described in Paper 2 and Paper 4. The two seminars were deliberately held 6 weeks apart to allow for participants to reflect upon the knowledge they received, their roles and responsibilities. This endeavour had limited success as difficult to achieve a relationship and stimulate collaboration as an exercise, there has to be a focused purposeful process. The seminars, however, had an impact on the responsible emergency preparedness authorities, who gained an understanding of how important stakeholder involvement is for their work. We developed this argument further in paper 4 where we highlighted continuity and flexibility of stakeholder processes as one of the criteria of quality involvement.

A first step towards continuity would be creating a database of all the stakeholder involvement experiences available so far – a suggestion that was originally made by (French and Bayley 2010). Although a technical solution, it would enable actors to learn from previous activities and processes and build on them, particularly if the database contained quality evaluations of those activities. There have already been attempts to create such a database within the NERIS-platform and currently the work continues in the ENGAGE project, however, it will be carried out only to a limited extent due to lack of funding (e.g. the physical development of database is not included as a part of the project).

The last argument for developing communication as a relationship is the dynamic and cyclic nature of perceptions already mentioned. People have ambivalent attitudes to risks and institutions. These attitudes will be constantly renegotiated based on the information

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4 Personal communication the authorities also decided to rethink the way they conducted stakeholder engagement
they receive, their knowledge, previous experiences and current social and political context of the events.

5.3.4 Need for institutional change

Despite the extensive research in fields of communication and participation, the same mistakes were repeated after Fukushima (Ng and Lean 2012, Prezelj, Perko et al. 2016). If one looks back at the old communication manuals (e.g., Covello, Sandman et al. 1988), the points raised there were already good: accept and involve the public as a legitimate partner, listen to your audience etc. But it seems that policy-makers continue to simply apply the deficit model, attribute all the problems to public ignorance and assume that all problems can be eliminated with education and information (Simis, Madden et al. 2016). According to Hadden (1989), dialogue-based approaches are often disrupted by institutional barriers. This section proposes that the problem is that these things cannot be addressed in the way institutional frameworks are currently set and there is need for more global changes (as already noted by Wynne 2006). So while the previous subchapters focused on what should be done and why, this section addresses how the proposed changes should be implemented at the higher level of preparedness systems, which is after all where continuity and continual readiness to deal collectively with what will be by-definition unpredicted but drastic events, are all paramount.

The first step towards an institutional change would be an acknowledgement on the part of responsible institutions and experts that societal aspects are as important and should receive attention on the same line as technical and economic aspects, which would also mean that social science research should be included into the radiological protection to the same extent as natural science. The importance of the social dimension and public involvement in radiation protection and emergency preparedness has been stressed since the Chernobyl accident (Bay and Oughton 2005, Liland, Oughton et al. 2010), but although SSH researchers are getting more and more involved as partners in the research projects on nuclear emergency preparedness (Van Oudheusden, Turcanu et al. 2018) there is still room for improvement. Take, for instance an example of the new Norway’s challenge of decommission of the Halden nuclear research reactor and construction of a
nuclear waste disposal. A recent presentation of this project\textsuperscript{5} went into a great detail about all the technical and safety challenges and potential costs of this process. Social aspect was mentioned on one slide towards the end, where presenter explained that they are expecting challenges with regard to sitting of the nuclear waste disposal (Johannesen 2018). That only confirms, unfortunately, that social aspects are often mentioned in relation to issues of potential public opposition with an aim to overcome it. Institutions need to come to terms with the fact that neither communication nor involvement is quick and easy fix for whatever problems they have with public. Communication and involvement are not tools for achieving acceptance – they are key components that should be at the core of the emergency preparedness and response, and if the social aspects took their rightful place in the institutional structures, this idea would not be so uncomfortable to the institutional actors anymore.

We have left behind us the time, when electing representatives that would debate our interests and make decisions on our behalf was enough, and the only accountability they would face was the election for the next term. Public engagement is a new norm and institutions need to learn to live with it. However, as we learned from nuclear preparedness seminars in Paper 2 – many participants needed an obvious benefit and economic support to be willing to participate in such events - do institutions value involving and being involved? Reviews of institutional practices in stakeholder involvement reveal that it is rarely done using the normative motivation, because it is ‘the right thing to do’ (Abelshausen, Perko et al. 2018). Inviting stakeholders simply to provide (silent) approval for a decision (Di Nucci, Brunnengräber et al. 2017) or to achieve a ‘better’ decision are more common motivations. And if the first one is absolutely unacceptable (Hansson and Oughton 2013), the second one is a common trade-off. Given that participatory processes take a lot of time and resources it is hard to ‘sell’ it to the funders if you can’t at least promise them a ‘better’ decision. The utilitarian approach common in policy making almost requires a sort of measurement that would demonstrate the value. But what is a definition of ‘better decision’, really? Wouldn’t a decision that includes or at least acknowledges the perspectives of the widest variety of stakeholders

\textsuperscript{5} The presentation was given at the meeting of the Norwegian Academy of Science and letters that discussed nuclear challenges in Norway
be a better decision? If we adopt this definition, doing stakeholder involvement because it is ‘the right thing to do’ would be a natural choice. A change of attitude is in order – stakeholder involvement is decision-making.

Another important, even crucial change is that institutions need to critically reflect upon their activities, procedures and practices. Everybody is talking about importance of two-way communication and dialogue, but what do they really mean? What should they be doing for it to be a dialogue and what are they actually doing? The majority of the participants in the focus groups (Paper 3) had no idea there was any nuclear emergency preparedness in Norway, let alone who would be responsible for informing them if anything was to happen. This indicates that current communication practices are not working and need to be improved. Everybody is talking about importance of involvement, but how is it carried out? Paper 4 highlights multiple limitations in current involvement practices and argues that there is a need for proper quality evaluation of the involvement processes focusing on context and how the democratic values are addressed. This evaluation has to be imposed by higher authority until we reach the point the institutions accept the value of it and stop treating it as another bureaucratic event.

Any communication and involvement will have effects beyond that particular activity and process as every one of these instances will have impact on the peoples’ perception and trust. It is up to the institutions whether it will be positive or negative.
6. Limitations

There were several limitations of the work performed within this thesis.

A clear limitation of Paper 1 was the lack of audience research that would make results of the media analysis more meaningful, namely by examining the links between the media presentation of radiological risk and public responses towards that presentation. This type of study was developed during the course of this thesis, but was postponed due to the lack of time. Another limitation of the Paper 1 is that we can only speculate on the reasons for the highlighted problems with the media presentation of radiological risks. Did it result from ignorance or time pressure? Was information not available or not researched? A follow-up study with journalists and responsible organisations would help to shed light on the reasons for these communication problems.

The seminars in Rogaland, presented and discussed in Papers 2 and 4, had several objectives and had to satisfy wishes of research projects and institutions involved in the organisation while at the same increasing competence of the participants and demonstrating the value of stakeholder engagement. Managing these various objectives took some attention away from ensuring the quality of the engagement process. The purpose and concrete aims of the seminar were not clear for the participants. The topics of the discussions were to certain extent pre-framed because some of the organisers insisted on including a lot of technical and scientific information. They also neglected the aspect of mutual learning. These are just some few examples, but every organiser faces similar issues.

A limitation of the Paper 3 is lack of triangulation with other methods to see if responses received would be similar. A survey with a representative sample of the Norwegian population could be used here. This would allow us to investigate whether citizens in general support the concerns raised by focus groups. Performing a survey would also address the other limitation – the lack of representativeness. Alternatively, a data triangulation could be performed at different time, place and with different participants.
The review of the communication practices in Norway and other European countries presented in Chapter 2, was hampered by the fact that much of the literature on emergency management practice was grey literature and reports, often only available in the language of the country, and very little has been published in peer reviewed journals.

Some of these limitations should be addressed in the future research.
7. Future research

The results of this thesis suggest several directions for further multidisciplinary research within risk communication and participation in emergency preparedness. First, there is need for more audience research in Norway that follows from both paper 1 and 3. This work would focus on several aspects: investigating how publics respond to existing emergency communication content; exploring appropriate formats and channels for risk messages; performing a joint reflection on whether nuclear emergency preparedness should be more visible. It will build on the existing literature and examples from media analysis (paper 1) and focus groups discussions (paper 3). The DSA has already showed interest for such research project and it will begin in autumn of 2019.

The results of Paper 1, 2 and 3 indicate that there is a need to perform a systematic review of the Norwegian emergency preparedness focusing on the existing communication and engagement practices and activities. What are the existing communication plans, how are they developed, how are they tested? What are the conditions for communication as a continuous relationship and can they be improved? This could be part of a wider international evaluation of communication in emergency preparedness.

Research in other fields has demonstrated how actors often work with mythological public concerns rather than the real ones (Marris, Wynne et al. 2001). Future research could investigate how the responsible institutions in Norway and other countries perceive public concerns, what that knowledge is based on (empirical evidence or assumptions), and the way they operationalise public perceptions about radiological risks in their work. Paper 3 demonstrated the complex ways in which publics construct their attitude to risks and their ambivalent trust towards the institutions that manage this risk. The paper also showed that despite the lack of knowledge on certain things related to radiation and radiological protection (i.e., its effects and protective measures), the public showed a good understanding of uncertainties and risk management practices, demonstrated their ability to judge complex situations and expressed a wish to be involved in the decisions. Comparing these insights to those of the responsible institutions, and highlighting the discrepancies if and where they exist, would give concrete indications of where improvements of the social relationships are needed. It
could also stimulate a more critical reflection by institutions about their responsibilities and relationships with publics.

Finally, Paper 4 developed extended quality criteria for stakeholder engagement activities. Future work on this topic should focus on application of these criteria in more cases in order to demonstrate how they can be applied in practice during organisation of various stakeholder activities. Such applied research is important to promote a more critical and reflective evaluation in the field of participation and work towards making it a part of formal practices.
8. Conclusions

This PhD research investigated risk communication within nuclear emergency preparedness by addressing several factors: media representation of radiological risks and compliance with recommendations; public needs and concerns in radiological emergencies; and the value and quality of stakeholder involvement. The overall goal of the thesis was to offer a more holistic understanding of risk communication that goes beyond evaluation of the message and messenger, and considers the complex relationships between publics and responsible institutions.

The studies revealed that recommendations for communication of radiological risk by the media were not followed and there is need for improvement in this field. Assessment of stakeholder engagement activities demonstrated the value of the dialogue, but also identified a number of limitations. A series of quality criteria were proposed that could contribute to improving the overall quality of stakeholder engagement. Finally, audience research indicated that some problems exist in the current emergency preparedness system in Norway, and that several factors influence the way people build their relationships with emergency preparedness actors, and form their attitudes to risk and protective actions. The findings highlight the need for further systematic and multidisciplinary research in the field.

The thesis defined several factors that would contribute to improvement of risk communication within emergency preparedness. These factors include reiterating the importance of listening to people and including them in the decision-making processes. In doing this, we need to embrace the many dimensions of complexities, and change the way we think about communication to focus more on the dynamic social networks it should create and support. Above all, these factors stress the need for institutional change that would lead institutions to recognize importance of the social aspects, adopt stakeholder involvement as a legitimate decision-making process and perform a critical reflection of their activities and procedures.

To conclude, there is a need to assess any risk communication practice based on the way they contribute to the overall quality of the relationships between the multiple actors in
emergency preparedness. Improving the quality of these relationships should foster societal resilience to potential future nuclear emergencies.
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Annex 1 – Other scientific publications

Scientific Articles in International Peer Review Journals


Project reports


Annex 2 - Consent and information document for the participants of the focus group discussions

Forespørsel om deltakelse i forskningsprosjektet «Publikums bekymringer, forventninger og informasjonsbehov i forhold til atomulykker»

Bakgrunn og formål

Dette prosjektet er en del av en PhD-grad i risikokommunikasjon om stråling ved Norges miljø- og biovitenskapelige universitet (NMBU). Formålet er å utforske folkets bekymringer, forventninger og informasjonsbehov i forbindelse med ulykker som involverer radioaktiv forurensning.


Hva innebærer deltakelse i studien?

Datainnsamling skal foregå som gruppeintervjuer med en varighet på ca 2 timer. Spørsmålene skal omhandle synspunkter om myndighetenes kommunikasjon om risiko fra ståling, eksisterende beredskapsplaner og diverse konsekvensereduserende tiltak.

Hva skjer med informasjonen om deg?

Alle personopplysninger vil bli behandlet konfidentsielt. Kun prosjektansvarlig vil ha tilgang til personopplysningene.

Analysen av diskusjonene vil publiseres i en PhD avhandling og en vitenskapelig artikkel. Deltakerne vil anonymiseres, men vil kunne kjenne igjen egne sitater.


Frivillig deltakelse

Det er frivillig å delta i studien, og du kan når som helst trekke ditt samtykke uten å oppgi noen grunn. Dersom du trekker deg, vil alle opplysninger om deg bli anonymisert.
Dersom du har spørsmål til studien, ta kontakt med Yevgeniya Tomkiv, PhD student ved NMBU (46969768).

Studien er meldt til Personvernombudet for forskning, NSD - Norsk senter for forskningsdata AS.

**Samtykke til deltakelse i studien**

Siden rekrutteringen skal foregå ved hjelp av et rekrutteringsfirma, bare de personen som vil være med på studiet kommer til å stille opp som deltakere. De vil bli informert om at personopplysningene vil bli behandlet konfidensielt og bedt om lov til at diskusjonene blir tatt opp. Etter at gruppeintervjuene tar slutt, får alle deltakerne et dokument som beskriver hva som kommer til å skje med informasjonen fremover og skal inneholde kontaktninformasjonen til prosjektansvarlig.
Paper 1
How did media present the radiation risks after the Fukushima accident: a content analysis of newspapers in Europe

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Abstract
Any activity that might result in exposure of a population to contaminants requires communication of the associated risks. This communication is complicated by several factors including public perceptions, distrust, uncertainties in risk assessment and news media. These factors are especially prominent in communication of risks from ionizing radiation. A number of guidelines about the communication of risks related to radiation exposures have been made by national and international authorities and other stakeholders. The present paper investigates whether those guidelines were followed and evaluates how the radiation risk related information was presented in European newspapers and Russia in the aftermath of the Fukushima accident. It examines the use of measurement units and risk comparisons, the quality of the statements on radiation risk related issues and the use of visual materials in 1340 newspaper articles from Belgium, Italy, Norway, Russia, Slovenia and Spain. Our results indicated several misinterpretations and misrepresentations of radiological risks in the newspaper articles. We also show an inconsistency in the information that was reported with advice provided to risk communicators (e.g. authorities and experts) in the guidelines. The results suggest that risk communicators should improve their communication practices regarding radiological risks, in order to improve emergency management response.
Keywords: radiation risks, risk communication, media analysis, Fukushima

(Some figures may appear in colour only in the online journal)

1. Introduction


Radiation risk communication is further confounded by the fact that the public’s perception of radiation risk differs from that of experts (Hämäläinen 1991, Slovic 2012, Perko 2014, Perko et al 2014a). For example, Perko (2014) confirmed that general population had higher perceptions of natural radiation, but lower perception of medical x-rays compared to the experts.

Since the late 1970s, when risk communication research began (for an overview see Fischhoff 1995), a number of recommendations have been made concerning communication of risks related to radiation exposures. According to the International Atomic Energy Agency (IAEA) one should be very careful in the use of quantitative information and radiation units when communicating with public about radiological events (IAEA 2012). Numerical information is often hard for the public to comprehend (Fagerlin et al 2007) and when this is combined with unfamiliar radiation units (Perko et al 2012b), it can lead to confusion. It has been suggested that the relation between different units (e.g. how activity concentrations relate to doses) should be presented and explained (Shore 2013), if quantitative information is to be disseminated. But this might simply add another layer of confusion about the message to be conveyed.

In general, comparisons are considered to be a more effective and meaningful way of communicating radiation risks, although that should also be done with caution (Covello 1989, Covello 2011, Slovic 2012). Comparisons that are only similar by virtue of statistical significance, such as comparing radiation to smoking or driving a car, are not considered useful. In the case of a radiological emergency, exposures related to the accident would be better compared to a legal standard (Covello 2011), to exposures from other sources of radiation (e.g. background radiation, medical exposures, flying) or to exposures of workers in nuclear industry (Slovic et al 1981, IAEA 2012).

Finally, the presentation of risks via measurement units and comparisons of exposures alone does not provide all necessary information to the public (Health Physics Society 2013). People are often more interested in the health effects that can be caused by exposure to radiation.

The media have a very important role in delivering risk information to the public (Wählberg and Sjöberg 2000, Covello and Sandman 2001). The mass media reach a large number of people simultaneously. This gives the media an important role in risk communication, as they allow individuals to take an informed decisions and a swift action to ensure safety measures for those who could be affected in case of an emergency. Those who are responsible for the welfare of the public must communicate openly and transparently about the risks during an emergency situation. Misinformation and contradictory messages should be avoided, since
they would evoke distrust to the institutions responsible for the public safety. In most cases, people are not aware or knowledgeable about the specific threats or risks. Mass media can play a major role in framing and interpreting certain risks and can directly or indirectly affect risk perception (Vyncke et al. 2016). The theory of social amplification of risk (Kasperson et al. 1988, Renn 2008, pp 214–7) suggests that certain elements of hazardous events may be intensified by mass media. Research on media reporting about nuclear emergencies proves that even without radiological consequences, those events are considered newsworthy. For instance, the event at Krško nuclear power plant in Slovenia (2008) was classified as level 0 on International Nuclear Event Scale, however, it was reported in all major European media (Perko et al. 2012a). Another aspect of media effect on communication to public is that journalists work under constant pressure of deadlines, competition with other reporters (Slovic 1986, Cottle and Ashton 1999, Scott 2005) and expectations of little margin for errors. This has only increased since the development of the digital production system (Saltzis and Dickinson 2008). Although the journalists themselves claim that such work conditions do not influence the quality of the reporting (Saltzis and Dickinson 2008) it is interesting to see how they handled a complex issue of radiological risks. In a complex situation like a radiological emergency, the media has to depend primarily on the available expert sources (Slovic 1986), and trust that these would provide them with accurate and understandable radiation risk related information.

The accident at the Fukushima Daiichi nuclear power plant received immense media coverage throughout the world and it provides a unique opportunity to analyse what kind of information related to radiological risk is reaching the public through media in a case of radiological emergency. It also offers a possibility to investigate the way in which quantities and units related to ionizing radiation were used in public communication and whether they were correctly interpreted.

The present paper investigates and evaluates how the radiation risk related information was presented to public in different European newspapers in the aftermath of the Fukushima accident. It examines the use of measurement units and risk comparisons in the articles, the quality of the statements on radiation risk related issues and the use of visual materials. We also discuss the possible implications that these results could have on radiation risk related communication practices. Finally, we make suggestions for improvement to the risk communicators, specifically, nuclear emergency authorities, experts and other stakeholders.

2. Theoretical background

There is a considerable body of knowledge about the way people process risk related information (McGuire 1973, Shiffrin and Schneider 1984, Chaiken and Stangor 1987, Eagly 1992, Lang et al. 1999, Trumbo 2002, Eysenck and Keane 2005, Lang 2006, Zaller 2006). Research shows that people use two ways of information processing: heuristics and systematic (Shiffrin and Schneider 1984, Petty and Cacioppo 1986, Griffin et al. 1999, Trumbo 2002). Heuristic information processing stresses the mental shortcuts individuals use when they have to deal with information, for instance, previous experiences or associations, or simply trust in the information provider. Systematic information process is effort-intensive and deep. Petty and Cacioppo (1986) suggested that low prior knowledge leads to heuristic information processing, while high prior knowledge leads to systematic processing. Risk communication is often related to heuristic information processing (Tversky and Kahneman 1974, Visschers 2007, Visschers et al. 2009, Perko et al. 2013), and support for this comes from the ‘risk-as-a-feeling’ theory (Loewenstein et al. 2001) and the ‘affect heuristic’ theory developed by Slovic.
et al (2004). These theories explain that individuals’ risk perception is also based on what they feel about the risk and not only on what they know about it. Moreover, extremely negative emotions such as strong fear stimulate heuristic information processing (Jepson and Chaiken 1990). This suggests that people respond to risk based on direct emotional influence rather than on facts (Renn 2008).

These studies showed that the content of the text should be tailored to the individual’s knowledge and that it is useful to use visuals and associations in risk communication. Associations of one risk with another have ‘a spontaneous role when people respond to an unknown risk or interpret a risk communication: people often associate unknown risks with known risks’ (Visschers et al 2007, p 726). Since it is known that the public lacks knowledge about ionizing radiation and has only rarely (acknowledged) experiences with radioactivity (Kuklinski et al 1982, Miller 1998, Van Aeken et al 2007, Perko et al 2010), dissemination of information should use associations of known radiological risks (e.g. use of radiation in medicine) with unknown risks (e.g. radioactive residues in food products).

Providing information about radiation doses is not usually sufficient as they are only a transition between exposure and risk (Gale and Hoffman 2013), and additional information is needed on the health risks associated with the exposures. However, there is also a debate about the best way to present the health risks from ionising radiation to public. It has been proposed that health risks should be put into context with the general cancer risk in human life; furthermore, the excess or additional risks arising from the exposure from the accident should be compared with the baseline cancer risks expected in the exposed populations (Gale and Hoffman 2013). In other words, one can present both the absolute risks (e.g. the number of cancers expected in the population) and/or the relative or excess relative risks (e.g. the relative increase in baseline rates). For instance, the World Health Organisation (WHO) report on health effects of the Fukushima disaster states that there will be no observable increase of the baseline cancer rates in the general population, but that an increase in specific cancers can be expected, and that these will vary with age, gender and cancer type (WHO 2013).Expressing of such risk information in a comprehensive form to the general public has its difficulties, even if the content of a message is defined (Ancker et al 2006). Previous studies showed that mass media can have an influence on risk perception (e.g. Coleman 1993). More specifically, the influence of mass media on radiological risk perception was recognised also in studies related to media communication during and after the Fukushima nuclear accident (e.g. Sugimoto et al 2013, Vyncke et al 2016). Although the inter-media-agenda setting research shows an influence of one media to other media (e.g. Boomgaarden and de Vreese 2007, Vliegenthart and Walgrave 2008, Wien and Elmelund-Præstekær 2009), different audiences interpret media messages differently, in accordance with local context or culture (Morley 2006). Visual presentation of risk information is considered an effective way to inform public about the risks and help them understand the data in a given context (Lipkus and Hollands 1999) and, therefore, should be actively used in risk communication.

Based on these theories, the overarching aim of the study was to investigate the degree to which the above-mentioned guidelines were followed when information about radiation risks were provided to the general public through the mass media. Specifically, whether:

- recommendations on the use of radiological measurement units were followed,
- associations of known radiological risks with unknown radiological risks were provided
- explanations of health issues related to reported exposures were mentioned,
- visual representation of radiological risks were used in media,
- and whether the information about the radiological risks due to the nuclear accident were factually correct.
3. Materials and methods

The study was based on an analysis of newspaper articles from five European countries and Russia, published between 11.03.2011 and 11.05.2011. Two quality newspapers were chosen in each country: ‘Le Soir’ and ‘De Standaard’ in Belgium (N = 260); ‘Corriere della Sera’ and ‘La Repubblica’ in Italy (N = 270); ‘Aftenposten’ and ‘Dagsavisen’ in Norway (N = 133); ‘Komsomolskaya Pravda’ and ‘Izvestiya’ in Russia (N = 172); ‘Večer’ and ‘Delo’ in Slovenia (N = 158) and ‘El País’ and ‘El Mundo’ in Spain (N = 315). The countries for the analysis were chosen based on their different status with regard to the production of nuclear energy. Belgium is in a process of phasing out of nuclear energy production, Slovenia, Russia and Spain produce nuclear energy to different extent, while in Italy all nuclear power plants were closed as result of the referendum in 1987. Norway does not produce nuclear energy and has two research reactors only, but was significantly affected by the Chernobyl accident. All newspapers chosen are representative of the high quality press within each country.

News articles (N = 1340) directly and indirectly related to Fukushima were selected using the search words ‘Fukushima’ and ‘nuclear’ or synonyms in accordance to linguistic properties of each language. Articles were assessed through the online databases or the official archives of the newspapers in Belgium, Norway, Slovenia, Italy and Spain. In Russia, a manual search of the library was undertaken, as there were no electronic database of newspapers available. Repeated articles or articles, which contained the search words, but did not report about the accident, were excluded from the analysis.

A system of codes was developed to determine whether the radiation information was presented in a quantitative and/or qualitative way in each article. Examples of quantitative representation of information related to radiation risk include data on activity concentrations or dose rates; while qualitative representation involved a comparison between different radiation risks, such as a comparison with medical or background exposures, or a comparison to limits or norms. A list of the variables coded in these two categories is given in table 1.

After the coding had been carried out, direct quotations of relevant information were collected from the newspaper articles containing radiation units and risk comparisons. These quotations were analysed qualitatively and examined for misinterpretations and mistakes. All articles were also checked for the presence of visual information on radiation doses and effects.

Each article was coded by two independent coders for each language, plus a master coder who made decisions on the code in the case of disagreement. All the coders received training prior to the start of the coding procedure. The intercoder reliability was calculated using Krippendorf’s alpha, which was >0.84 for both variables.

Data for this study was collected as a part of bigger media study and the current article addresses only two of the 12 different variables coded (risk units and comparisons). Articles analysing other aspects of the media coverage of Fukushima accident in European and Russian newspapers are under review.

4. Results

4.1. Measurement units

The results of the study showed that only 16% of the articles across all the countries contained numerical radiation data. The percentage of articles containing quantitative information varied among the countries, being lowest in Italy (7%) and highest in Spain (27%). The quantitative information was expressed in the form of radiation measurement units such as
activity, activity concentration, dose rate, ground deposition etc. (full list of coded measurement units is given in table 1). The most commonly used measurement units were dose and dose-rate related (millisievert and millisievert per hour, and microsievert per hour respectively). For detailed results on the types of the units in the articles see (Perko et al 2015). The analysis showed that globally 28% of articles mentioning radiation measurement units (with a variation of between 5 and 50% depending on the country) reported more than one unit at a time.

4.2. Risk comparisons

Newspapers were more likely to use a qualitative representation of radiation data, such as a comparison to natural background radiation, risk from medical exposures (e.g. x-ray), etc. (see table 1), than a presentation of units. One in four articles across all counties presented information this way (figure 1). Newspapers in Spain and Russia used comparisons the most (36% and 33% respectively) while in Norway, such way of presenting was least frequent (14%). Note that some comparisons included radiation units, while others did not.

Half of the articles containing risk comparisons referred to legal norms and limits, probably because information on these are the most commonly available (Example 1). Second most
popular comparison (38%) was to use historical accidents (Chernobyl, Three Mile Island) as a reference (Example 2), followed by comparisons with natural radiation levels (27%) (Example 3). Very few comparisons related to workers’ exposure in nuclear institutions (Example 4) or to medical exposures (like x-ray) (Example 5).

**Example 1** ‘...the amount of radioactive iodine is 10,000 times the legal limit’—Corriere della Sera, 02.04.11

**Example 2** ‘Fukushima is a slow-motion Chernobyl’—El País, 13.04.11 ‘Japan’s Chernobyl’”—El Mundo, 14.03.11

**Example 3** ‘Reuters measured 0.16 microsievert per hour in the center of capital (Tokyo), this is lower than natural background radiation in the world, which varies from 0.17 to 0.39 microsievert per hour’.—Dagsavisen, 28.03.11

**Example 4** ‘According to some reports, the technicians were exposed to 400 millisieverts of radiation per hour, which is 20 times more than the allowable annual limit for workers in nuclear power plants and uranium mines!’—De Standaard, 16.03.11

**Example 5** ‘The levels of radiation are very low—0.5 miliroentgen. This is less than the dose one receives while taking an x-ray at dentists’.—Komsomolskaya Pravda, 16.03.11

Some differences were observed in the types of comparisons that were predominantly used in each country (figure 2), although there was general similarity with the most and least used comparisons. For instance, although for the other countries, a most widely used comparison was with legal norms and limits, in Italy, more comparisons were made with the historical nuclear accidents. In Russia, on the other hand, journalists often used other comparisons than those included in the codebook. For example, they would often present doses in a form of ‘dangerous/safe’.
4.3. Use of measurement units and comparisons together

From the articles containing numerical information on radiation units, 81% also included comparisons, although not necessarily related to the numerical unit itself. On the other hand, half of the articles containing information in form of risk comparisons, included information on actual units.

One out of five articles presenting radiation units, failed to provide an explanation of how those numbers should be understood (Example 6).

**Example 6** ‘Some 50 kilometres northwest of the center, 0.8 mSv per hour have been recorded this week’—El País, 03.04.11

Half of the articles presenting information as risk comparisons provided no information on actual measurement data or limits (Example 7), while some of the articles provided no numerical information at all, just a qualitative statements (Examples 8–10).

**Example 7** ‘Spinach, grown a hundred kilometres from Fukushima, contains 27 times more radioactive iodine and four times more radioactive caesium than allowed’—De Standaard, 22.03.11

**Example 8** ‘… exposed to significant levels of radiation that would be harmful to health for a long time’.—El Mundo, 8.04.11

**Example 9** ‘WHO reported that radiation in food (for example in milk and vegetables) was anyway higher as initially assumed’—Vecer, 22.03.11

**Example 10** ‘Radioactivity way beyond permitted levels was measured in all together eleven types of vegetables in Fukushima’.—Aftenposten, 24.03.11

The results also showed that only 6% of articles presented information using more than one risk comparison and even fewer (4%) were providing information on measurements at the same time. However, analysing whether more than one comparison was present was complex, as comparisons were often present in different parts of the articles and referred to different exposures.
4.4. **Representations of health risks**

Although the articles contained information related to radiation risks, only one in ten article mentioned possible health impacts arising from the exposures they were reporting. In 44% of the cases, these health impacts were provided for very high doses only. These refer to the types of tissue damage and fatalities caused by doses in the order of Sieverts (Examples 11–13).

**Example 11** ‘Irradiation dose of 1–2 Sievert per hour (which means 1–2 million microsievert) can cause acute radiation syndrome. One-time dose of 3–5 Sievert damages bone marrow so that every second person exposed will die within month or two if not treated appropriately. Even higher doses will damage lungs and gastrointestinal tract, the death will occur after 10–20 d. A dose higher than 15 Sievert can kill a man in some few days’.—Izvestiya, 17.03.11

**Example 12** ‘The radiation dose of 500 000 microsievert can cause dizziness and fatigue after some hours. A dose of 750 000 microsievert will cause hair loss within two–three weeks and a dose of one million will result in bleedings. The deadly dose is 4 million microsieverts’.—Aftenposten, 17.03.11

**Example 13** ‘Radiation sickness appears from a dose of 1000 millisieverts, said Bastin. At 4000, 50% of irradiated persons die’.—Le Soir, 16.03.11

One in three articles reporting on health impact mentioned cancer risks, but the quality of those statements differed. The articles mostly mentioned cancer as a possible health consequence and expressed the risks of getting it in a qualitative way without giving any concrete estimates (Examples 14–18).

**Example 14** ‘Since the beginning of the crisis at the nuclear plant, 17 workers have been exposed to more than 100 millisievert, the level at which the risk of getting cancer exists’.—De Standaard, 28.03.11

**Example 15** ‘If people ingest too much contaminated foods, it might lead to cancer in the long term’.—De Standaard, 08.04.11

**Example 16** ‘… level⁶, which rose from 370 to 1000 Becquerel per kilogram, significantly increases the risk of diseases such as cancer’.—El País, 03.05.11

**Example 17** ‘… these limits were set to 250 millisieverts in Fukushima, which is within the international recommendations (that amount up to 500 mSv). These doses are still under the limits for serious and acute health consequences, the risk for cancer increases only slightly… According to available data, the current doses of the Fukushima workers are lower from those, where instant death effects would appear…’—Delo, 25.03.11

**Example 18** ‘Workers were exposed to radioactivity levels between 170 and 180 millisieverts. An exposure of 100 millisieverts per year is considered the value above which there is a risk of developing cancer’.—El País, 25.03.11

Only a few articles attempted to explain what kind of increase in cancer rates can be expected from a given radiation exposure (Example 19) or how cancer risks from radiation exposure could be calculated (Example 20).

**Example 19** ‘Japanese specialists have been observing the 87 500 survivors of the atomic bombing of the two cities during all the years since. The average radiation dose then was 240 millisievert. With this, increased cancer rates in the

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⁶ Referring to EU’s increase in maximum permitted levels of Cs-134 and Cs-137 in dairy products imported from Japan. THE EUROPEAN COMMISSION 2011. COMMISSION IMPLEMENTING REGULATION (EU) No 297/2011 of 25 March 2011 imposing special conditions governing the import of feed and food originating in or consigned from Japan following the accident at the Fukushima nuclear power station. Official Journal of the European Union L80, 25.11.2011, pp 5–8 (EN).
following years constituted 9%. No difference between cancer rates (expected and observed in reality) at doses less than 100 millisievert were established in the world. —Izvestiya, 17.03.11

**Example 20** ‘… if 10000 people were exposed to a dose of 10000 microsievert in small doses spread through their whole life, an additional five–six people in this group would die from cancer compared to if they were not exposed to radiation’. —Aftenposten, 17.03.11

4.5. **Misrepresentations and mistakes in the text of newspaper articles**

In as many as 19% of the articles, where radiation risk related information was mentioned, a number of mistakes and misrepresentations were identified. One of the most common misinterpretations was referencing to norms, which do not exist (like norms for radionuclide content in the seawater) (Example 21–22) or using the wrong norm (Example 23). In addition, articles often referred to ‘norm’ or ‘normal level’ without explaining what is meant by a normal level (Example 24).

**Example 21** ‘The water streams are also mixing the cards: the iodine-131 is heading South, cesium-137 follows a route toward east: in the sea at 300 meters from the plant, an amount equal to 20 times the normal level has been found. And the list can be enriched, going as far as a mile and a half from the shore, this time toward North, to once again find radioactive iodine in the seawater samples, 1155 times the permitted maximum level’. —Corriere della Sera, 2.04.11

**Example 22** ‘Monday, in the sea water near Fukushima, levels of iodine-131 and caesium-134 were measured to be 126.7 times and 24.8 times higher than official standards, respectively’. —Le Soir, 21.03.11

**Example 23** ‘The level of iodine-131 to less than 350 meters from the nuclear plant has reached 180000 Becquerel per litre, the legal maximum for freshwater consumption for adults is 300 Becquerel per litre’. —El Mundo, 01.04.2011

**Example 24** ‘At the moment that I’m writing these lines, radiation level beside Kolskaya NPP by Murmansk is 0.07 microsievert per hour and beside Leningradskaya NPP—0.1 microsievert per hour. Both parameters are well below the norm’. —Izvestiya, 29.03.11

Another mistake was mixing up of the allowed levels for the population and for the emergency workers. It is clear from Example 25 that people, receiving dose inside the power plant, must have been workers, but the accepted dose for the general public is used in this comparison.

**Example 25** ‘Radiation in the turbine section of “Fukushima” was 10000 times higher than normal. There are first victims too—17 people received dose of more than 100 millisievert (the accepted limit in Japan is 1 millisievert per year)…’ —Komsomolskaya Pravda, 25.04.11

Journalists were often mixing up dose and dose rate or simply did not present the difference between them (Example 26–28).

**Example 26** ‘The picture shows one of the measurements—2.23 microsievert per hour on the dosimeter. The dangerous dose starts from 1.2 microsievert’. —Komsomolskaya Pravda, 22.03.11

**Example 27** ‘After the Japanese Government started to fight Fukushima, the legal limit/dose of radiation was increased to 250 millisieverts per year, which is five-times more than the allowed limit in USA. Health experts claim that negative consequences cannot be avoided if a person is exposed to more than thousand millisieverts’. —Delo, 6.05.11
Example 28 ‘Level of radiation which is dangerous for people is 120 microroentgen per hour’—Izvestiya, 21.03.11
Another issue found was misrepresentation, or oversimplification, of the rationale behind the official norms and limits. In some of the articles, permitted levels of radiation were referred to as safe (Example 29–31)

Example 29 ‘Radioactive iodine was found in the tap water in Tokyo, in quantity of 210 Becquerel per liter, although its safe level is 100 Bq’.—Komsomolskaya Pravda, 24.03.11

Example 30 ‘210 Becquerel per kilo was measured in one of the water samples (drinking water). The Japanese limit for what is considered to be safe for children is 100 Bq per kg’.—Aftenposten, 24.03.11

Example 31 ‘Another Greenpeace-team have tested spinach and other vegetables in the gardens of Minamisoma inhabitants. The tests have shown radioactivity levels that are much higher than the official levels of what is considered safe’.—Dagsavisen, 7.04.2011:

4.6. Visuals

The majority of articles (72% on average) contained some visual information in the form of photos of the accident affected power plant, affected inhabitants, maps of how contamination was distributed in air and sea, etc. However, almost no articles (<2) from the whole sample in each country used visual material in order to present radiation data in a more effective way. The examples of such material are given in figure 3. The illustration on the left provided information on effects of various doses from low to high, while the picture on the right presented effects of high doses, which was irrelevant for the situation, since as mentioned before, no one has been exposed to such doses in Fukushima.

5. Discussion

Despite the recommendations of IAEA, every fifth article on the Fukushima nuclear accident presented information on radiation data together with radiation measurement units. Moreover, a third of those articles, mentioned several units in the same text, without explanation about their relationships. This can be confusing to readers, who cannot distinguish different measurement units and how they relate to each other (Miller 1998). On the positive side, the majority of the articles (3/4) presenting information on radiation units did attempt to put them into context by providing a benchmark for comparison. However, the comparisons given were not always helpful or were given in a different context than units.

Overall information in the form of risk comparisons was more frequent, being present in one third of the articles. Nevertheless although presenting unknown radiation risks in association with already known risks is a preferable way of risk communication, our analysis indicates that this is not without complications. The three main types of comparisons used were legal norms and limits, background radiation and historical accidents.

The frequent use of comparisons with legal norms and limits can be explained by their availability for use as a reference point. However, the reference to such norms (e.g. permitted levels of exposure or permitted radionuclide concentration in foodstuffs) should include some explanation about what they mean or how they are derived. Permitted levels were sometimes deemed to synonymous with being a level of what is safe, which is not the case. This is also related to the problem of assuming that levels above limits are dangerous, as discussed below.
Data on the natural background radiation levels are easily available, which might explain their frequent use in the media articles, and they are also recommended as a good source of comparison. However, the public perceives radiation from natural and anthropogenic sources in the different ways (Hämaläinen 1991, Sjöberg 2007, Sjöberg and Drottz-Sjöberg 2008, Perko et al. 2015a) and it should be remembered that such comparisons should be used with caution.

Comparing Fukushima to other historical accidents like Three Mile Island and Chernobyl is probably logical in the eyes of the journalists, but it also carries a heavy negative emotional charge. The memory of Chernobyl in particular is a strong image, and using it as a benchmark for comparison could be perceived as sensationalism. This is particularly problematic if the differences between Fukushima and Chernobyl are not made clear. Chernobyl had deaths from radiation sickness in firefighters and widespread direct environmental impacts (e.g. forest death) due to the high doses. This was not the case in Fukushima, but the type of heuristic information processing used by the public might create the impression that a similar situation existed at Fukushima.

Surprisingly, comparison of risks from the nuclear accident with the risks of medical use or risk from flying were rarely presented in the media, although these types of comparisons are recommended by IAEA. This may suggest that either media were not interested in publishing such a comparison or perhaps there was no such comparison offered to them by the scientific community.

The most common type of risk comparisons were made in connection with exposure levels (doses) or activity concentrations rather than with estimates of health risk following the exposure, although this is an important societal concern (Samet 1997). This might be explained by the more readily available information on the various exposure levels (legal norms, background
radiation, etc.). Additionally, when health risks were mentioned, they were often related to the types of effects that can be seen after exposure to high doses of radiation, in order of Sieverts. Such high doses were nowhere near the actual doses received by the Japanese population or emergency workers (UNSCEAR 2013) and presentation of those detrimental health impacts could cause fear and panic. As mentioned above, these types of exposures and effects were seen in emergency firefighters after Chernobyl and comparisons to the Chernobyl in media could have further fuelled use of such information as an example. Another reason might be that the knowledge about the effects of high doses of radiation is well established, while information on health effects, which can be caused by low dose exposures, is much more complex and arguably more difficult to communicate, even by professionals.

We share the opinion of Covello (2011) that comparisons of legal limits are relevant and legitimate for the use as a reference point. However, the textual analysis of articles has shown that journalists did not always possess knowledge about what the permitted levels meant, or they presented these limits in ways that could result in misinformation of the public. The articles referred apparently to maximum permitted levels for radionuclides in drinking water and foods, but the presentation is misleading (or perhaps the author misunderstood how the legal norms for radiation contamination are set). While it might be acceptable to communicate that activity levels below maximum permitted levels should be considered ‘safe’ (even though this is a point of debate among radiation protection experts), it is another matter to imply that levels above these limits are dangerous. Although authorities do not recommend consumption of food and water that is contaminated above the permitted levels, the limits are conservative and cancer risks would be expected to remain low. Again, some additional information to put the numbers into context would be helpful. Moreover, results indicate that radionuclide concentrations in seawater were at times compared to permitted level for drinking water in Japan, which is not a correct benchmark for comparison in this case as drinking water is directly consumed by people. It is difficult to discern exactly why these mistakes were made, but the multiple references to limits for radionuclide content in the environment when such regulations do not exist, could suggest that journalists were searching for comparisons without sufficient information on radiation protection norms being available. A similar situation was observed in the use of the measurement units as doses and dose rates were sometimes mixed up. The seriousness of the consequences from certain dose of radiation would depend on the time of exposure; therefore, the difference between these units should be explained.

Reporting radiation measurements without providing some reference level to put those numbers in context is meaningless to a reader, and does little to support an adequate judgment of the situation. Although comparisons are considered a better way of representing radiation data, they should also be used properly. They should be supported by the results of measurements in order to be perceived trustworthy and transparent. As both quantitative and qualitative statements found in the sample had their weaknesses, our results suggest that using only one way of presenting the risk related information is not sufficient. One comparison will not always give the full picture, and presentation of several comparisons with the measurement results can help to put information into context. An example here is taken from an article in Dagsavisen on 26.03.11. It started with: ‘Reparation works by the reactor 3 in Fukushima Daiichi were stopped yesterday after three workers were exposed to radiation 10000 times higher than normal level’. The following statement presents the radiological situation in the form of a comparison with ‘normal level’, but it does not specify what one should understand as a normal level. In addition, this statement carries limited information and it does not give any explanation on what the health impact of such levels could be. However, further on in the article the level was compared to the exposure limits for nuclear emergency workers, which provided reader with more context to evaluate the situation: ‘...All three of them were exposed
to radiation up to 180 millisievert, which is three times higher than levels allowed for workers at the nuclear power plant and close to limit of what is allowed in an emergency situation’. While the exposures were undoubtedly of concern, three times ordinary limits and only close to emergency limits sounds arguably less alarming than ‘… 10000 times higher than normal level’.

Finally, although visual material was expected to dominate in the representation of radiation related risk, very few of them were found in our sample. In addition, even when presented, this visual information was of varied quality. This suggests that this type of information was either not prepared by the actors responsible for the communication or that it is not easily available. Friedman et al in the evaluation of the media coverage of three major nuclear accidents (Three Mile Island, Chernobyl and Fukushima), praised many of the US media organizations for using infographics and multimedia on their websites to present information about the Fukushima (Friedman 2011). Our study contained printed articles only; however, we think that even in this case more visual presentation of the risks should be expected.

The number of mistakes that appeared in the newspapers suggest that communication coming from experts was not clear and lacked context. It also suggests that journalists did not have the necessary knowledge on radiation issues, to be able to explain that information in the correct way or time to check whether information they presented was correct. This was partly confirmed in the statements given by journalists, who reported about Fukushima in different countries in Europe (Perko et al 2014a).

Findings, similar to ours were observed in the other media studies of the Fukushima coverage. For instance, Tollefson in his study of The Daily Yomiuri’s coverage of the accident, found that technical information about radiation was presented with little context or explanation, making it difficult for public to understand the actual significance of it (Tollefson 2014). The same study showed that radiation risks were sometimes compared with the risk of getting cancer from smoking or from not eating vegetables, neither of which are considered as good benchmarks for comparison. A two year study of US news on Fukushima showed presence of claims without context and little specifications (Pascale 2016). An example given in the article states: ‘The radiation levels reported so far by the Japanese authorities are far above normal but still too small to pose a hazard to human health if the exposure continued for a brief period’. Such statement raises more questions than it gives answers and is not considered an example of good communication.

6. Conclusions

There is clearly room for improvement in the way radiation risks are communicated to the media, and a more rigorous analysis of exactly why the advice for risk communication was not followed, would be highly useful. It is not clear whether the advice was simply not known or deliberately not followed. Nevertheless, the analysis underlines the importance of being clear when communicating about the risks from ionizing radiation. Information should be presented in several ways, giving both the results of the measurements and several benchmarks to compare those levels to. This will help journalists and reader to put this information into context and evaluate the seriousness of the situation. Providing additional information on the health effects that are expected to occur (or not occur) at the levels communicated, will give a clearer picture of the possible consequences of the radiological accident. As no agreement exists on how to communicate the health effects of ionizing radiation, especially in the low dose range, more research should focus on this topic.
The dynamics of the media environment and the time pressure journalists are exposed to, limits their capability to double check the information and search for context to put it into, especially when dealing with such complex issues as radioactivity. This only reinforces the need for clearer communication from experts and authorities.

Given the above: expert risk communicators should be pro-active and attempt to build relationships with the media during ‘peace times’. The journalists should be able to know whom to contact for reliable information if an accident occurs, or if there is another need for coverage of radiation related issues. An example of such a proactive approach can be establishment of Science Media Centres like those already existing in UK and Japan. Such centres help establish connections between journalists and scientists and improve the quality of scientific debate in society (Tanaka 2015). Training courses and workshops are also good, although a more complex way of building relationships with the media and providing information about radiation and risks could also be explored.

‘A picture is worth a thousand words’ is a known adage and this principle is widely used by media for attracting attention and emotional response of the readers. This principle can also be utilized in risk communication. Tables, schematics, pictures and graphs presenting and explaining different measurement units, what they mean and how they are connected with each other, what kind of effects can various radiation doses cause and how are they put in perspective of existing doses and sources public gets exposed to in the normal life, offer a more effective and understandable way to reach public and deliver relevant information to them. However, development of such material requires time and expertise and can hardly be done by journalists who will be under time pressure in case of an accident. These materials should be prepared beforehand by the responsible authorities and research organizations and made easily available for public and media on a general basis (e.g. on their web pages). Analysis of how such material are received by both the media and the public would be another activity that could be explored as part of ‘peace time’ emergency preparedness.

Acknowledgments

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The power of collaborative deliberation in stakeholder dialogue seminars

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ABSTRACT
This paper quantifies the added value of using collaborative deliberation as an engagement element in a stakeholder dialogue seminar arranged over 3 days in Norway in 2015 with a wide range of national, regional and local stakeholders. The topic addressed was the possible impacts in western Norway from a hypothetical nuclear accident in the UK. The first day included information provision while the following 2 days were devoted to collaborative deliberation on the issue. Two questionnaire surveys were used to measure the degree of learning, networking, involvement and problem solving reported by the participants after the first day and the third day. The results from the surveys clearly suggest that collaborative deliberation gave an added value compared to information provision alone in our stakeholder dialogue seminar.

1. Introduction

1.1. Rationale and aims

Nuclear emergency preparedness has long been dominated by physicists and other natural scientists with predominantly technical views on challenges and solutions. However, a severe nuclear accident will affect all parts of society—health, environment, food production, industry, economy, culture and traditions (Liland 2015). The impacts are usually long-lasting, i.e. for years or decades. These societal challenges in post-accident recovery should thus be addressed from multiple perspectives and with a variety of methods to capture the complexity of the issues at stake. Both qualitative and quantitative research methods can be used, along with participatory methods such as focus groups, citizens’ juries and stakeholder dialogue seminars.

We organised a stakeholder dialogue seminar with a wide range of actors who might play an important role in post-accident management in a selected county of Norway. The aim of the seminar was three fold:

(1) To increase the competence in nuclear emergency preparedness and crisis management at the regional level;

(2) To evaluate stakeholder dialogue seminars as a methodology to improve nuclear emergency preparedness and response at the regional level; and
(3) To measure the extent to which collaborative deliberation increases learning, networking, involvement and problem solving when compared to information provision alone.

This article focuses on the third aim, namely to quantify the added value of using collaborative deliberation as part of the aforementioned stakeholder dialogue seminar. The results discussed here were obtained from two questionnaires distributed to participants during the seminar. As for the second aim, a critical evaluation of stakeholder dialogue seminars as a methodology is under way, see Tomkiv et al. (n.d.).

1.2. Background

Several types of public participation are described in the literature (Nelkin and Pollack 1979; Rowe and Frewer 2005; Kemp, Bennett, and White 2006; Chilvers 2007; Krüti et al. 2010). Although this means that no unique classification exists, the above-mentioned scholars agree that public participation covers a range of approaches, from information provision and consultation, to collaboration or empowerment (Krüti et al. 2010). Information provision and consultation are both based on the one-way communication, but in different directions: from sponsor/authority to the public, or from the public to sponsor/authority, respectively. It is usually non-committable and offers the public little influence over the process. Collaboration, on the other hand, works both ways, aiming for an equal footing between parties and some degree of co-determination (Krüti et al. 2010).

Nuclear emergency preparedness seminars in Norway have usually been organised as information provision—mainly presentations on risks, national preparedness, roles and responsibilities and protective actions. They might also include small table-top exercises where participants discuss the challenges of a selected nuclear or radiological scenario and which protective actions would need to be implemented, when and by whom. There is generally a predominance of national authorities/actors and county (prefecture) governor representatives taking part in such seminars. Based on the previous experience we know, however, that many local and regional actors will have an important role to play in implementing protective actions in case of radioactive fallout (Liland, Lochard, and Skuterud 2009; Liland and Skuterud 2013). Stakeholder dialogue seminars, therefore, appear suitable to discuss the complex issues of nuclear accident preparedness and response with a broader audience, as has been conducted in many countries more recently (e.g. Charron et al. 2016; Liland and Raskob 2016). However, few studies have attempted to systematically quantify the value of different engagement elements in such a process.

1.3. Nuclear and radiological crisis management in Norway

The Chernobyl accident in 1986 caused radioactive fallout over large areas of Norway and many protective actions were implemented to counteract negative impacts on health and agriculture (e.g. Strand, Strand, and Baarli 1987; Brynildsen et al. 1996). At the time of the accident, there was a lack of preparedness systems and the management of the accident was heavily criticised by a governmental committee afterwards (NOU 1986). Improvements in nuclear emergency preparedness were later suggested by a new governmental committee (NOU 1987) leading to the establishment of the Norwegian Nuclear and Radiological Preparedness Organization in 1993 (see Figure 1). It was established to make all necessary expertise available in case of nuclear and radiological events, and to secure the swift implementation of actions to protect life, health, the environment and other important public interests. This organisation features the Crisis Committee, its Advisors and Secretariat and the County Governors as the regional representatives. (Royal Decree 2013). The Crisis Committee is a cross-sectorial body headed by the Norwegian Radiation Protection Authority (NRPA) with the mandate to impose protective actions, the responsibility to coordinate their implementation and to ensure coordinated information to media, authorities and the public (Royal Decree 2013). The
structure, competences and authorities of the Crisis Committee were judged as best practice by the International Atomic Energy Agency during a mission to Norway in 2015 (http://www.nrpa.no/filer/04da8ae297.pdf).

The County Governors have the responsibility to coordinate preparedness, response and recovery at the regional level in cooperation with the municipality administrations and local offices of various authorities. Each County Governor has a regional nuclear emergency preparedness committee that can be summoned on a short notice when necessary.

The NRPA has involved the Crisis Committee and its Advisors in previous research activities in the Euratom projects STRATEGY\(^1\) (Howard et al. 2004), EURANOS\(^2\) (Liland et al. 2010; Raskob et al. 2010), and NERIS-TP\(^3\) (Liland and Raskob 2016). These activities involved mainly national actors from authorities and expert organisations. Stakeholders from municipalities affected by the Chernobyl accident were involved only to a minor degree, although previous experience had suggested that their knowledge and risk perception is higher than in the general public (Reitan et al. 1999).

2. Methodology

2.1. Setting up the stakeholder panel

Rogaland county was selected as our regional study site. The seminar was arranged as a cooperation between the NRPA, the Office of the County Governor of Rogaland, the Centre for Environmental Radioactivity (CERAD)\(^4\) and the Euratom project PREPARE.\(^5\) The list of invitees included administrative officials from all 26 municipalities in Rogaland, representatives from the regional nuclear preparedness committee and employees from various departments of the Office of the County Governor. In addition, representatives from fisheries, aquaculture, farming, food industry, tourism, various NGOs, national authorities and expert organisations were invited to join. The stakeholder dialogue seminar was divided into two parts: one day of information provision and 2 days of collaborative deliberation, see Table 1. The list of potential participants was larger than the funds available. Therefore, the first day of information provision was open to all interested, while a smaller number of participants were invited to the full stakeholder seminar over 3 days. A larger participation the first day addressed the
first aim of the seminar, namely increasing the competence in nuclear emergency preparedness and crisis management at the regional level.

Collaborative deliberation in stakeholder dialogue seminars is a process. We deliberately chose to divide the seminar into two parts 6 weeks apart. We aimed at giving participants the time to reflect upon the issues learned and discussed before they met again, hopefully contributing to an even more fruitful collaborative deliberation on the last day.

The invitation was sent by email to 134 different representatives with the title: ‘Nuclear accident at Sellafield—how could it impact Rogaland?’ accompanied by more detailed information about the aims of the seminar and the Sellafield scenario (see Chapter 2.2). The number of distributed invitations was quite large since experience has shown that response rates for such invitations tend to be low. We adopted a proactive approach to ensure all sectors were represented sufficiently. We contacted key participants by personal email and phone to encourage participation. The chief emergency planner at the Office of the County Governor in Rogaland also emailed several groups of invitees and recommended them to join the seminar. These actions allowed us to increase the response rate to 43%. In the end, 62 persons participated the first day, 48 people on day two and 41 people on day three, including four facilitators between CERAD and NRPA. All sectors and levels were represented, see Table 2.

The first two seminar days were organised at a hotel in Hjelmeland, a small rural town in the middle of the county. Participants were provided with free transportation between the county capital and the meeting venue, and those invited for the whole seminar were provided with a free overnight stay between the first and second day. A common dinner was organised for everyone the first day to allow participants to communicate in an informal way, to get to know each other and to establish useful contacts. The third day of the seminar was held 6 weeks later in a conference hotel in the centre of Stavanger, the county capital. The attendance was free for all participants all 3 days.

Table 1. Overview of the full stakeholder seminar with its different engagement elements.

<table>
<thead>
<tr>
<th>Date</th>
<th>Venue</th>
<th>Type of engagement</th>
<th>Number of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>26 January</td>
<td>Hjelmeland</td>
<td>Information provision (lectures)</td>
<td>62</td>
</tr>
<tr>
<td>27 January</td>
<td>Hjelmeland</td>
<td>Collaborative deliberation (discussions within and across sectors)</td>
<td>48</td>
</tr>
<tr>
<td>10 March</td>
<td>Stavanger</td>
<td>Collaborative deliberation follow-up (partly lectures, partly discussions across sectors)</td>
<td>41</td>
</tr>
</tbody>
</table>

Table 2. Participants at the seminar in Hjelmeland and Stavanger.

<table>
<thead>
<tr>
<th>Regional actors</th>
<th>National actors</th>
<th>Local actors</th>
</tr>
</thead>
<tbody>
<tr>
<td>County governor administration officers</td>
<td>Norwegian Radiation Protection Authority</td>
<td>Agricultural chief officer</td>
</tr>
<tr>
<td>Food Safety regional office</td>
<td>Norwegian Food Safety Authority</td>
<td>Fisherman</td>
</tr>
<tr>
<td>Fisheries</td>
<td>Directorate for Civil Protection</td>
<td>Farmer</td>
</tr>
<tr>
<td>Health Corporation Fonna</td>
<td>Directorate for fisheries</td>
<td>Mayor</td>
</tr>
<tr>
<td>Health Corporation Stavanger</td>
<td>Centre for Environmental Radioactivity</td>
<td></td>
</tr>
<tr>
<td>Norwegian Sheep and Goat Association</td>
<td>National Institute of Nutrition and Seafood Research</td>
<td>Municipality officials from:</td>
</tr>
<tr>
<td>Aquaculture industry</td>
<td>Marine Research Institute</td>
<td>Eigersund</td>
</tr>
<tr>
<td>Farmers Union Rogaland</td>
<td>University of Oslo</td>
<td>Hjelmeland</td>
</tr>
<tr>
<td>TINE dairy producer</td>
<td>Farmers Union</td>
<td>Randaberg</td>
</tr>
<tr>
<td>Drinking water producer</td>
<td>Seafood Council</td>
<td>Sandnes</td>
</tr>
<tr>
<td>Civil Protection Rogaland</td>
<td>Consumer Council</td>
<td>Sola</td>
</tr>
<tr>
<td>Red Cross Rogaland</td>
<td></td>
<td>Stavanger</td>
</tr>
<tr>
<td>County medical officer</td>
<td></td>
<td>Tysvær</td>
</tr>
<tr>
<td>Fire department</td>
<td></td>
<td>Vindafjord</td>
</tr>
<tr>
<td>Police force</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friends of the Earth Rogaland</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2.2. Scenario framing

Rogaland is the fourth most populated county in Norway and it consists of 26 municipalities. It is a significant agricultural county with high production of milk, lamb, pork, poultry, fruit and vegetables. Fisheries, aquaculture and the petroleum industry are other important economic sectors. The county has spectacular scenery and several areas of natural beauty visited by both inhabitants and tourists from around the world. A radioactive fallout in Rogaland would thus have substantial negative impacts on inhabitants, agriculture, aquaculture, fisheries and tourism in particular.

The Chernobyl accident hardly affected the Rogaland county. Hence, the practical experience in management of radioactive fallout is limited in this area. To frame the issue of radioactive contamination for the participants, a hypothetical accident scenario was used. It was based on a hypothetical accidental release of radioactive caesium (Cs-137) from the Sellafield reprocessing plant in the UK with the subsequent fallout in Norway. Figure 2(a) and (b) show the modelled deposition of Cs-137 in Norway based on the real weather conditions on 19 October 2008 for a release of 1% of the estimated inventory in the highly active liquor (HAL) tanks at the Sellafield site (Ytre-Eide et al. 2009). According to the scenario, the western counties of Norway would receive most of the radioactive fallout. Rogaland county was chosen as the focus area for modelling the human and environmental consequences of this fallout. Its magnitude would be comparable to the Chernobyl fallout in Norway, i.e. so large that it necessitates protective actions in several food producing sectors, a large monitoring and control programme for food, feed, people and the environment, and a good communication strategy with the public, producers, consumers, tourists and media. Direct protective actions for people such as evacuation or sheltering would not be necessary. For further description of the scenario and modelled consequences, see Liland et al. (n.d.).

2.3. Seminar structure

2.3.1. First day—information provision

On the first day of the seminar, a range of presentations took place using a conventional information provision approach, covering nuclear emergency preparedness, nuclear risks and roles and responsibilities. In addition, the Sellafield scenario was described with possible consequences for the Rogaland county. Other presentations gave an overview of the existing challenges in key sectors of the county (Regional and local administrations, Fishery/Aquaculture, Agriculture, Outdoor Life/Recreation). To break up the information provision, we organised a game for the participants, ‘Will you risk it?’ to increase their perception of individual risk behaviour. Here, seminar participants took part in several mock lotteries and other activities to get more aware of their own risk preferences. The day finished with presentations on possible protective actions for different ecosystems (agriculture, freshwater areas, marine areas). Before leaving, we asked the participants to complete the first questionnaire, see Appendix 1. Participants who left early completed the questionnaire at a later stage and emailed it back to the organisers.

2.3.2. Second day—collaborative deliberation

The second day of the seminar was dedicated to collaborative deliberation. After a few introductory presentations, the participants were divided into four groups according to the sectors they were representing (Regional and local administration, Fishery/Aquaculture, Agriculture, Outdoor Life/Recreation). Each group had a facilitator from NRPA/CERAD. The groups appointed a rapporteur for the plenary session. Facilitators received an instruction beforehand explaining the rules for discussion (the Chatham House Rule,7 open and free discussions, all participants at the same level) and containing a list of questions they were to bring up in the groups:

• Expected consequences of the accident for their particular sector;
• The challenges their sector will face and the most sensitive areas that exist within the sector;
• Information needs; and
Other experience with emergency preparedness planning, which could create a basis for nuclear and radiological emergency planning.

After presentations of group discussions in plenary and an exchange of opinions, the participants were divided into mixed sectorial groups for new discussions following the same structure and rules as before. The division was not random as we tried to make sure that there was a similar mix of representatives from different sectors in each group to address:

- Which topics they found most important in the reports from other groups;
- What was most surprising from what they had heard;
- Which challenges look like they need to be addressed jointly; and
- What can be solved within the sector itself and what will need cooperation with other sectors.

The rapporteur from each group provided a summary of the cross-sectorial group discussions in plenary (see PREPARE 2016 for details). At the end of day two, participants identified four main topics to be addressed the third day of the seminar: Roles and responsibilities, Measurement capacities, Health effects and Information/communication.

2.3.3. Third day—collaborative deliberation follow-up

Six weeks separated the first collaborative deliberation from the follow-up to give participants time to reflect upon the knowledge gained and their roles and responsibilities should an accident occur. As a preparation for the deliberation follow-up, we provided the participants with links to various reports and information that could be useful. We also asked each sector to jointly reflect upon the most important challenges for their sector, what they could solve within their sector, and what needed cooperation with other sectors (called ‘Home reflection’).

The programme for the collaborative deliberation follow-up on the third day concentrated on the four main topics identified by participants as the most important to address in more detail. We chose to

Figure 2. Modelled deposition (kBq/m² of Cs-137) in Norway from a hypothetical accident at the Sellafield reprocessing plant. On the left (a): deposition across Norway; the county of Rogaland framed on the bottom left. On the right (b): deposition in Rogaland county. Source: Courtesy of M.A. Ytre-Eide, NRPA.
approach the topics of Health effects and Measurement capacities in form of presentations. The topics of Roles and responsibilities and Information/communication were first addressed in presentations, followed by cross-sectorial group discussions for each topic. In the group discussions on Roles and responsibilities, participants were asked to address:

- Possible countermeasures suitable in Rogaland;
- Who is responsible and who implements?;
- Measurement needs and priorities; and
- How can regional/local actors and experts cooperate to improve prognoses for Rogaland?

In the group discussions on Information and communication participants focused on:

- Who are the target groups regionally?;
- What kind of information material is needed, and which information channels should be used? and
- In peacetime, what kind of assistance and from whom would regional/local actors need to produce good information material?

The collaborative deliberation follow-up ended with plenary presentations of group discussions, and a plenary discussion where participants evaluated the seminar and exchanged opinions on (i) how sectors can work on issues raised, and (ii) what kind of contribution they would need from national authorities and experts (see PREPARE 2016 for details). Before leaving, the participants were asked to fill in the second questionnaire, see Appendix 2. Participants who left early completed the questionnaire at a later stage and emailed it back to the organisers.

2.4. Questionnaires

An important aim of the stakeholder dialogue seminar was to measure the extent to which collaborative deliberation increases learning, networking, involvement and problem solving when compared to information provision alone. Two questionnaires were developed to address this—one was distributed after the first day of information provision and the second after the collaborative deliberation follow-up on the third day. The four main areas targeted by the questionnaire surveys were included for the following reasons:

The general public and civil servants usually lack knowledge and understanding of nuclear and radiological issues (Liland and Skuterud 2013). With increased knowledge, the various actors will be better suited to perform the right protective actions and to communicate to various affected groups in a good way, should an accident occur. Increased knowledge empowers the actors that the society depends upon in emergency preparedness and recovery. Thus, questions were developed to measure the degree of learning and which parts of the programme contributed most to this.

However, knowledge is not enough. A large number of actors need to cooperate in crisis management. It would be an asset if these actors were familiar with each other before an accident happened, so that cooperation and actions could be initiated quickly when necessary. Questions concerning to which degree the seminar had contributed to increased networking were thus developed.

Emergency preparedness, response and recovery is based on a combination of duty (for responsible authorities) and willingness (from other actors) to engage in necessary actions. A clearer view of risks and challenges and the role that individual actors must or can play might encourage more involvement in the preparedness phase.

Finally, a successful recovery depends on a variety of actors who cooperate well in finding the best solutions for the full spectrum of challenges faced by their society. For problem solving to be adequate, the challenges for all sectors have to be acknowledged and the feasibility of implementing protective actions at the local level assessed. Possible obstacles for successful recovery must be shared by all actors, if these are to be solved.
The questions asked were similar or identical for the two questionnaire surveys. The participants had the same participant number in both surveys so we could directly compare the results after the first and last day for each respondent. Some questions were closed-ended, where respondents had to answer using predefined alternatives or a scale e.g. ‘To which degree did the various parts of the programme contribute to new knowledge’ on a scale from 1 (no degree) to 10 (very large degree). Other questions were open-ended e.g. ‘What do you consider the largest challenge to achieving a strengthened nuclear emergency preparedness and recovery in Rogaland in the future?’. The closed-ended questions were developed to be able to quantify the added value of the collaborative deliberation element compared to the information provision. The open-ended questions were designed to shed light on the quantitative answers given and to capture all viewpoints not covered by the closed-ended questions. It would not be possible for the organisers to anticipate all answers to a given question from such a large group of stakeholders; only quantitative questions might thus omit important aspects/viewpoints of some participants (e.g. Geer 1991).

Appendices 1 and 2 contain the English translations of the questionnaires.

3. Results

3.1. Questionnaire response rate

The response rate for the surveys was 93% the first day and 97% the third day, after excluding one questionnaire that was hardly completed. Participants involved as facilitators or in the preparation of the questionnaires were not among the respondents. A total of 51 questionnaires were analysed from day one and 30 from day three.

3.2. General questions

From the answers to the first questionnaire, we see that approximately half of the participants had attended similar seminars earlier (see Table 3). Table 4 shows to which degree they worked with emergency preparedness on a daily basis. There is no statistically significant difference in the answers given in Table 4 between all respondents the first day (n = 51), and those who participated all three days (n = 30) at the 5% level (two-tailed t-test). Comparisons of the answers to similar or identical questions given by the full group of participants on the first day (n = 51) and the reduced group that participated in all 3 days (n = 30) show a similar distribution of answers between the two groups. However, a cleaner comparative test of participation 1 day versus 3 days is to compare the responses only from the 30 respondents that participated in both surveys (i.e. participated all 3 days). Thus, this is the approach taken in the remainder of this section.

When asked about their motivation to join the seminar, almost half of the participants named their wish to learn about radioactivity, radioactive contamination and organisation of nuclear emergency preparedness in Norway. The same number of participants joined for work-related reasons, which ranged from considering participation in such seminar a work task or thinking it would help in their work, to simply being assigned to the meeting. Some of the participants were motivated by a general interest in the topics to be discussed, a wish to build networks, to meet a wide variety of actors, or to be involved in the information exchange. Some participants answered that they would not have joined had it not been for the persistence shown by the organisers.

3.3. Questions related to learning

All the respondents, in both surveys, stated that they had gained new knowledge from the seminar. Participants reported learning most about radiation, risk perception, emergency preparedness in Norway, measurement capacities, health effects, communication plans and information needs. The degree of learning was measured by asking the participants what their level of knowledge was before
the meeting, after 1 day (information provision) and after 3 days (information provision and collabora-
tive deliberation) for four topics:

1. Nuclear threats and potential consequences in Rogaland;
2. Roles and responsibilities in nuclear emergency preparedness;
3. Mitigating actions; and
4. Significance of information/communication.

The results are shown in Figure 3. For the first topic, day 1 contributed more to new knowledge
(from median score 4 to 7) than days 2 and 3 (from median score 7 to 8). For the other three topics, the
stepwise increase in scores was equal for day 1 (information provision) and for day 2 + 3 (collaborative
deliberation) suggesting that the latter contributed significantly to new knowledge.

Figure 4 shows the results from the question on which parts of the programme contributed most to
the new knowledge they gained. For the choice ‘large degree’ the three parts that scored the highest
were (in decreasing order): group discussions between sectors, conversations with other participants,
and group discussions within sectors. Plenary discussions scored lower than discussions in smaller
groups. The game ‘Will you risk it?’ and the ‘Home reflection’ scored the lowest.

Since emergency preparedness and response involves a large number of actors from various sec-
tors, the participants were asked to which degree their understanding of the challenges faced by the
respondent’s own sector and by other sectors had increased (see Figure 5). It is clear that the under-
standing was higher after the collaborative deliberation (days 2 and 3) than after the information
 provision (day 1). For instance, the number of responses ‘to a large degree’ increased with 50% for their
own sector and with 70% for other sectors from day 1 to day 3.

3.3. Questions related to networking

Figure 6 shows the number of respondents who confirmed that they had made contact with persons/
organisations that they were likely to contact in an emergency situation, or for cooperation beyond an
emergency. The number of respondents who answered ‘yes’ increased by 23 and 33% points, respec-
tively, after 3 days. Linking this to the results in Figure 4, it is reasonable to assume that this is due mostly
to formal and informal discussions during the seminar, i.e. the collaborative deliberation element that
took place on days 2 and 3.

3.4. Questions related to involvement

The participants were asked if their understanding of their own role in nuclear emergency prepared-
ness and response had increased. The results given in Figure 7 show that the seminar increased the

Table 3. The percentage of respondents who had participated in similar seminars earlier (results from the first questionnaire).

<table>
<thead>
<tr>
<th>Answer</th>
<th>All respondents the first day (n = 51), (%)</th>
<th>Respondents who participated all 3 days (n = 30), (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>41</td>
<td>43</td>
</tr>
<tr>
<td>No</td>
<td>55</td>
<td>53</td>
</tr>
<tr>
<td>No response</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 4. Respondents’ degree of work on emergency preparedness on a daily basis (results from first questionnaire).

<table>
<thead>
<tr>
<th>Degree</th>
<th>All respondents the first day (n = 51), (%)</th>
<th>Respondents who participated all 3 days (n = 30), (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Small</td>
<td>20</td>
<td>7</td>
</tr>
<tr>
<td>Some</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>Large</td>
<td>22</td>
<td>23</td>
</tr>
<tr>
<td>Very large</td>
<td>29</td>
<td>33</td>
</tr>
</tbody>
</table>
understanding for 70% of the participants to a large or some degree. For those who answered yes, 62% answered that the second and third day of the seminar contributed most to the increased understanding while 29% reported that the first day contributed equally to days two and three. Only 10% felt the first day contributed most to an increased understanding of their own role.

When asked to which degree the seminars had contributed to a larger willingness to work with emergency planning, the participants’ answers were inconclusive as to whether 3 days of the seminar (information provision and collaborative deliberation) increased the degree of willingness compared to
1 day of information provision. Both average and median scores were comparable, as well as individual scores (not shown).

3.5. Questions related to problem solving

Figure 8 shows the answers to the question to which degree the seminar had changed the respondents’ view on emergency preparedness planning. We included this question because we anticipated that the full dialogue seminar would increase the knowledge and improve the understanding of the challenges, roles and responsibilities, which in turn could make them see things differently. There is a shift towards larger degrees after 3 days. Investigation of individual responses confirms this as 40% of the respondents gave a higher score after 3 days and only 17% gave a lower score.

To get a more insight into this shift, an open-ended follow-up question was how this view had changed. Less than half of the participants answered this question, but those who did, reported getting a better understanding of the importance of and need for the preparedness system, the magnitude of possible consequences and realising the importance of cooperation between various stakeholders with a clear view of roles and responsibilities.

The participants were asked to which degree the seminar had been useful for them in their work/organisation, see Figure 9. There is an apparent shift towards larger degrees and more ‘Don’t know’ answers after three days. When comparing the individual answers we see that 14 of the 30 participants
did not change their answer from day 1 to day 3. Five participants gave a better score and seven gave a lower score, while the number of ‘Don't know’ answers increased from one to five after day 3.

The question ‘What do you see as the biggest challenge to strengthening the nuclear preparedness and response in Rogaland in the future?’ revealed the following answers (in decreasing order of importance):

- Communication/information—both between all the different actors and with the public;
- Coordination—of information, activities, protective actions;
- Resources—time, budget, measurement capacity, prioritisation;
- Exercises—involving all levels and actors;
- Cooperation—between authorities, sectors and levels; and
- Increased knowledge.

Figure 7. Answers to the question whether the seminar have increased the understanding of the participant’s own role in emergency preparedness and response (left, n = 30). 70% answered ‘yes’ to a large or some degree. For those who answered yes (right, n = 21), 62% answered the second and third day of the seminar contributed most to the increased understanding while 29% reported that the first day contributed equally to days two and three.

Figure 8. Responses to the question to which degree the seminar had changed the respondents’ view on emergency preparedness planning, after 1 day and 3 days (n = 30).
Other issues mentioned were: further work (keep the momentum), roles and responsibilities, measurements (methods and strategies), good plans and guidelines, keeping in contact, operative warning systems, involving first responders and other various stakeholders and initiative from the regional authorities.

3.6. Other questions

In the survey on day 3, participants were asked to consider what they would remove from the seminar programme if they were to make it half a day shorter. We received a variety of answers to this question. This may indicate that no specific parts of the seminar were perceived as unnecessary by the participants in general. Some wanted more group discussion, some less; some suggested we cut-down presentations that were too specific, others that we should remove general introductions. These opinions might be specific for participants' preferences and background. For instance, one of the representatives from first responders considered research-related topics unnecessary.

Participants were also asked what they would have added if they had another half day of the seminar. They suggested that we could add some concrete discussions on the practical issues, like the development of communication plans and protective actions, and challenges related to this. Several persons mentioned the need to have more discussions, whether they would be in groups or plenary, after each presentation or after each topic.

4. Discussion

The need for meaningful interaction between experts of different disciplines, decision-makers and affected citizens in cases involving radioactive contamination stems, in our view, from the fact that all these persons are related to various systems that affect, and are affected by, such complex challenges and by the outcomes of decisions taken to resolve them (Bergmans 2008). However, the problem with getting people to participate ‘for the greater good’ has been highlighted in the literature (e.g. French and Bayley 2010). The response rate to our invitation was 43% which is satisfactory considering the

![Figure 9](image-url)

*Figure 9.* Responses on the degree of usefulness of the stakeholder dialogue seminar in their work/organisation when surveyed after the first and third day (n = 30). Five people (17%) answered 'Don't know' after day 3 because they were unsure about their own role in emergency preparedness (one person), or about the role of their organisation in emergency planning (three persons), or due to a combination of lacking knowledge and being unsure about their own role in emergency preparedness (one person).
generally low response rate to such events. Some participants answered that they would not have joined had it not been for the persistence shown by the organisers. This implies that seminars need to provide some obvious benefit for the participants and that a proactive approach should be undertaken to encourage participation. Transportation, meals and accommodation should preferably be free of charge to increase net benefit for the participant and their employer (if any).

The use of paper questionnaires distributed at the meeting and handed in before leaving, was very successful with a response rate of 93 and 97%, respectively. Internet surveys distributed as a link in an email usually have much lower response rates (see e.g. Lindhjem and Navrud 2011). The closed-ended questions were answered more frequently than the open-ended ones (i.e. higher item response rate).

Several interesting results were deduced from the questionnaire results. They clearly suggest that the seminar contributed to all participants gaining new knowledge (Figure 3), an increased understanding of challenges faced by both their own and other sectors (Figure 5), and a better understanding of their own role in nuclear emergency preparedness and recovery (Figure 7). Another strong finding is that the networking among participants increased (Figure 6).

Related to the importance of the different parts of the programme (Figure 4), it is our interpretation that discussions, whether they were within or between sectors, in plenary, or more informally as conversations between participants outside of the official programme, were key to increasing this knowledge and understanding. Information provision will of course contribute to new knowledge, but it is our view that only through discussions with others (collaborative deliberation) can the participants grasp the full view of the challenges faced by a community impacted by radioactive fallout. Discussions in smaller groups clearly scored higher than plenary discussions.

The game ‘Will you risk it?’ and the ‘Home reflection’ was not well rated compared to the other parts of the programme. This is not surprising as the game was not meant to increase the knowledge, but rather seen as a break to activate the participants. The home reflection only worked for a few participants in the agricultural sector, and not at all for the other sectors. Comparing the scores for ‘Will you risk it?’ and the ‘Home reflection’ with the other parts, clearly suggests that the participants have reflected on the different parts before giving their answers, instead of randomly scoring them all the same. This adds weight to the paragraph above.

The ‘Home reflection’ was only successful for the agricultural sector. We were probably too optimistic to assume that the sectors would take the intiative themselves to do a joint reflection between day 2 and 3 of the seminar. Participation in the seminar was already quite time-consuming for the participants, and they might neither have the time nor desire to engage in such a reflection. For the agricultural sector, the seminar sparked off a very fruitful cooperation between the Food Safety Authority and the Farmers Union who have continued a close cooperation to prepare plans for protective actions in case of radioactive fallout.

The question on the usefulness of the seminars for participants’ work/organisation (Figure 9) revealed that the number of ‘Don’t know’ answers increased from one to five after day 3 and that two participants scored lower on day three than after the first day. This might reflect that for some participants the full seminar contributed to a greater appreciation of the complexity and uncertainty of the situation, and that the roles and responsibilities are not as clear-cut as one might think. Our findings also suggest that a confusing mix of responsibilities among different actors cause problems for the effective decision-making process as also reported by Hocke and Renn (2009). Indeed, the participants who answered ‘Don’t know’ after the third day stated it was because they were unsure about their own or their organisation’s role in emergency preparedness.

The 40% who gave a higher score on the question to which degree the seminar had changed their view on emergency preparedness planning (Figure 8), gave a range of answers to the open-ended follow-up question on why the view had changed. In our view, this reflects the varying background, knowledge and interests among the participants. This is also reflected in the respondents’ different views on the content of such a seminar, with a variety of topics mentioned in the answers and the wish for more discussions. Our results suggest that there is an apparent need for more stakeholder
dialogue seminars on nuclear and radiological emergency preparedness issues, and that collaborative deliberation should be an important engagement element.

Our study could not prove that collaborative deliberation increased the respondents’ willingness to work with nuclear and radiological emergency planning. Many of the participants already work with emergency preparedness on a daily basis, and there might not be room to increase the amount of time spent on this given their work situation. Others might not have the available means or power of influence to engage in such issues if they do not already have this as part of their daily work.

Throughout the surveys, the participants expressed that the seminar, in general, was well organised and useful. Among the positive aspects mentioned, was the possibility to meet a wide spectrum of participants, the good quality of presentations and the discussions. Participants felt the seminar contributed to increased understanding, knowledge and expertise. We received, however, some critique regarding the length of the seminar and a very intensive programme with few breaks. One participant stated that there were too many days, and several others expressed the opinion that we could have compressed the seminar a bit allowing for shorter days. After the feedback from participants, this was improved for day 3, but some still mentioned ‘long days’ as a criticism in the last survey. One participant stated that having 6 weeks between the first and the second part was particularly valuable. It gave her the time to reflect on these issues before discussing them again with various stakeholders.

Some participants said they would have liked a clearer definition of the main purposes of the seminar, as well as discussions on specific problems. Several presentations turned out to be too technical, and should have been made more accessible to a wider audience. Some respondents suggested involving more representatives from municipalities as well as healthcare workers, teachers and representatives from the local population.

5. Comparison with other experience

Multiple studies have already discussed the benefits of collaborative deliberation. However, they have not necessarily attempted to measure or quantify the value of this approach compared to information provision. For instance, the FARMING project\(^8\) organised stakeholder panels to discuss strategies for maintaining agricultural production and safe food supply after a nuclear accident in the UK (Alexander, Burt, and Nisbet\(^{2005}\)), Finland (Rantavaara et al.\(^{2005}\)), Belgium (Vandecasteele et al.\(^{2005}\)), France (Jullien et al.\(^{2005}\)) and Greece (Ioannides et al.\(^{2005}\)). FARMING demonstrated how collaborative deliberation with a wide number of stakeholders who have valuable experience from different sectors, contributed to establishing missing lines of communication and helped to assess the applicability of different management options (Nisbet et al.\(^{2005}\)). The importance of involving local and regional stakeholders in the rehabilitation of living conditions after an accident has also been demonstrated in Belarus (e.g. Lochard\(^{2004, 2007}\); Averin\(^{2016}\)), Japan (e.g. Ban\(^{2016}\); Liland, forthcoming) and Norway (e.g. Skuterud\(^{2006}\); Liland and Skuterud\(^{2013}\)). Stakeholder involvement is valuable for finding the best locally adapted solutions for protective actions. A higher degree of acceptability of the protection strategy is achieved when stakeholders are involved in the elaboration and implementation of the strategy. Collaborative deliberation is a key element to achieving this.

The PREPARE stakeholder panels (Charron et al.\(^{2016}\); PREPARE\(^{2016}\)) used in 10 European countries in 2014–2015 all included both information provision and collaborative deliberation elements. Additional methods such as scenario discussions, delphi studies, multi-criteria decision analyses and in-depth interviews were used in some countries. However, only the Norwegian one (this study), tried to quantify the value of the different engagement elements used. They all report, though, that the dynamic and fruitful discussions that took place were very valuable for the national process of strengthening the nuclear emergency preparedness and response. Our results support this by quantifying a clear added value of using collaborative deliberation in the Norwegian stakeholder dialogue seminar. A weakness in the PREPARE approach, was the lack of consistency in the methodologies used in the various countries. Due to the range of different methodologies applied, it was neither possible to directly compare the outcomes of the dialogue seminars across countries, nor to assess the added value of different
engagement elements. Future studies, where nuclear stakeholder dialogue initiatives are used across countries, would benefit from a unified methodology, and an assessment of the importance the various engagement elements have for reaching the aims of such seminars.

6. Conclusions

The use of questionnaires to quantify the added value of collaborative deliberation in our stakeholder seminar proved useful. Distribution of paper copies at the meetings ensured a very high response rate.

The questionnaire survey results clearly suggest that including a collaborative deliberation element in stakeholder dialogue seminars contributes more to learning, networking, involvement and problem solving than information provision alone. The wide range of Norwegian stakeholders who took part in the discussions was particularly useful to get a more holistic view for all the participants of the challenges facing society in the case of large-scale radioactive contamination. The increased networking achieved is another positive result, where the collaborative deliberation was instrumental. In the PREPARE project, the stakeholder panels used in nine other countries show similar results as ours (although qualitative) on the importance of engaging a large number of stakeholders, and using collaborative deliberation as one element in stakeholder dialogue seminars.

Based on the feedback from participants, there seems to be an apparent need for more stakeholder dialogue seminars on nuclear and radiological emergency preparedness in Norway, and that collaborative deliberation should be an important engagement element in such seminars.

The planning and organisation of stakeholder dialogue seminars is demanding in terms of time and resources, both for organisers and participants. Care should be taken to ensure that the seminars give added value to participants on the issues addressed. For future seminars, it would be important to balance the information provision element against the collaborative deliberation element, preferably providing more time for the latter including more breaks where informal networking can take place. Based on the feedback received in the surveys, we think such seminars could be made more useful for participants by having a more concrete product envisaged, such as guidance documents for emergency response or information material for various sectors, in particular, if the same stakeholder group is invited back.

Notes

2. European Approach to Nuclear and Radiological Emergency Management and Rehabilitation Strategies.
6. The historic and, to a lesser degree, actual discharges from Sellafield to the marine environment have contaminated the Norwegian coastline for many years (Heldal et al. 2015). This has been of concern to Norwegian authorities and NGOs and it is well known by the public. In addition, recent media reports and NRPA reports (Ytre-Eide et al. 2009; Thørring, Ytre-Eide, and Liland 2010) have focused on the risk of accidents at the site with possible consequences in Norway. Sellafield Ltd as a risk site is thus well known in western Norway.
7. When a meeting, or part thereof, is held under the Chatham House Rule, participants are free to use the information received, but neither the identity nor the affiliation of the speaker(s), nor that of any other participant, may be revealed http://www.chathamhouse.org/about/chatham-house-rule.

Disclosure statement

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References


Appendix 1. Questionnaire after the first day

In English—original in Norwegian can be provided, if requested, by the corresponding author.

1. What was your motivation for participating?

2. Have you participated in similar seminars earlier?
   □ yes □ no

3. Which topics, if any, have you learned more about during the seminar?
   □ radioactivity and radiation □ nuclear emergency preparedness in Norway
   □ threat assessment □ risk perception □ Rogaland county
   □ County Governors duties □ municipality duties □ agriculture
   □ fisheries □ aquaculture □ tourism
   □ outdoor life □ the environment
   □ other, please specify:_____________________________________

4. To which degree did you gain this knowledge through:
   a. presentations?

   b. conversations/discussions with other participants during the day?

   c. Other means of communication, please specify_________________________________

5. What were you most surprised by during the day?

6. To which degree have you gained larger understanding of the challenges faced by your own sector in case of radioactive fallout over Rogaland?

7. To which degree have you gained better understanding of similar challenges in other sectors than your own?

8. In your daily work, to which degree do you work on emergency preparedness?
9. To which degree has the seminar contributed to an increased willingness for you to work with emergency planning?

6. Do not know, because:
   a. ☐ I lack knowledge
   b. ☐ I am uncertain about my role in nuclear emergency preparedness
   c. ☐ I am uncertain about my organisation’s role in nuclear emergency preparedness
   d. ☐ other reason, please specify:______________________________

10. To which degree could what you have learnt today be useful for you in your work/organisation?

6. Do not know, because:
   a. ☐ I lack knowledge
   b. ☐ I am uncertain about my role in nuclear emergency preparedness
   c. ☐ I am uncertain about my organisation’s role in nuclear emergency preparedness
   d. ☐ other reason, please specify:______________________________

11. Have you made new connections that you might contact in case of emergency?
☐ yes ☐ maybe ☐ no

12. If you answered yes or maybe, in which sectors?
☐ County Governor ☐ the municipalities ☐ national authorities
☐ agriculture ☐ fisheries ☐ aquaculture
☐ research institutes ☐ environment and outdoor life
☐ NGO’s ☐ other, please specify:______________________________

13. Have you made connections that you might contact for cooperation beyond emergencies?
☐ yes ☐ maybe ☐ no

14. If you answered yes or maybe, in which sectors?
☐ County Governor ☐ the municipalities ☐ national authorities
☐ agriculture ☐ fisheries ☐ aquaculture
☐ research institutes ☐ environment and outdoor life
☐ NGO’s ☐ other, please specify:___________

15. To which degree has the seminar changed your view on emergency planning?

6. Do not know, because:
   a. ☐ I lack knowledge
   b. ☐ I am uncertain about my role in nuclear emergency preparedness
   c. ☐ I am uncertain about my organisation’s role in nuclear emergency preparedness
   d. ☐ other reason, please specify:______________________________
16. If so, what has changed?


17. Which topics, if any, would you like to hear more about?
- radioactivity and radiation
- nuclear emergency preparedness in Norway
- threat assessment
- risk perception
- Rogaland county
- County Governors duties
- municipality duties
- agriculture
- fisheries
- aquaculture
- tourism
- outdoor life
- the environment
- other, please specify: ______________________________________

18. Anything you would like to add about the seminar?


19. What is your participant number? _________
Appendix 2. Questionnaire after the third day

In English—original in Norwegian can be provided, if requested, by the corresponding author.

1. What is your participant number? _________

2. Which topics, if any, have you learnt more about during the full seminar (26/1, 27/1 and 10/3)?
   - radioactivity and radiation
   - nuclear emergency preparedness in Norway
   - threat assessment
   - risk perception
   - Rogaland county
   - County Governors duties
   - municipality duties
   - agriculture
   - fisheries
   - aquaculture
   - tourism
   - outdoor life
   - the environment
   - information needs
   - communication plans
   - measurement capacity
   - mitigating actions
   - roles and responsibilities in nuclear emergency preparedness
   - health effects
   - other, please specify: ______________________________________

3. If you consider the whole arrangement (26/1, 27/1 and 10/3) to which degree did the various parts of the program contribute to new knowledge?

3a. Presentations
   1. No degree
   2. Small
   3. Some
   4. Large
   5. Very large

3b. Will you risk it?
   1. No degree
   2. Small
   3. Some
   4. Large
   5. Very large

3c. Group discussions within the sector
   1. No degree
   2. Small
   3. Some
   4. Large
   5. Very large

3d. Group discussions across sectors
   1. No degree
   2. Small
   3. Some
   4. Large
   5. Very large

3e. Plenary discussions
   1. No degree
   2. Small
   3. Some
   4. Large
   5. Very large

3g. Home reflection
   1. No degree
   2. Small
   3. Some
   4. Large
   5. Very large

3h. Conversations with other participants during the seminars
   1. No degree
   2. Small
   3. Some
   4. Large
   5. Very large

3i. Other means of communication, please specify: _________________________________

4. Three days of seminars is resource demanding for both participants and organisers. It is thus important that the benefit is proportional to the resources used. If we had to reduce with half a day, which part(s) would you suggest to cut?
5. If we increase the duration by half a day, what would you like to add?

6. To which degree have you gained larger understanding of the challenges faced by your sector in case of radioactive fallout over Norway?

7. To which degree have you gained better understanding of similar challenges in other sectors than your own?

8. All in all, to which degree do you feel that the seminars have been useful for you in your work/organisation?
   6. Do not know, because:
      a. I lack knowledge
      b. I am uncertain about my role in nuclear emergency preparedness
      c. I am uncertain about my organisation’s role in nuclear emergency preparedness
      d. other reason, please specify:______________________________

9. To which degree have the seminars contributed to an increased willingness for you to work with emergency planning?
   6. Do not know, because:
      a. I lack knowledge
      b. I am uncertain about my role in nuclear emergency preparedness
      c. I am uncertain about my organisation’s role in nuclear emergency preparedness
      d. other reason, please specify:______________________________

10. To which degree have the seminars changed your view on emergency preparedness planning?
    6. Do not know, because:
       a. I lack knowledge
       b. I am uncertain about my role in nuclear emergency preparedness
       c. I am uncertain about my organisation’s role in nuclear emergency preparedness
       d. other reason, please specify:______________________________

11. If yes, how did it change?


12. Have you made new connections that you might contact in case of emergency?
☐ yes  ☐ maybe  ☐ no

13. If you answered yes or maybe, in which sectors?
☐ County Governor  ☐ the municipalities  ☐ national authorities
☐ agriculture  ☐ fisheries  ☐ aquaculture
☐ research institutes  ☐ environment and outdoor life
☐ NGO’s  ☐ other, please specify:_________________________________

14. Have you made connections that you might contact for cooperation beyond emergencies?
☐ yes  ☐ maybe  ☐ no

15. If you answered yes or maybe, in which sectors?
☐ County Governor  ☐ the municipalities  ☐ national authorities
☐ agriculture  ☐ fisheries  ☐ aquaculture
☐ research institutes  ☐ environment and outdoor life
☐ NGO’s  ☐ other, please specify:_________________________________

16. How will you assess your level of knowledge on the following topics prior to the seminars on a scale from 1 to 10, where 1 is no knowledge and 10 is very high knowledge?

Nuclear threats and potential consequences in Rogaland 1 2 3 4 5 6 7 8 9 10
Roles and responsibilities in nuclear emergency preparedness 1 2 3 4 5 6 7 8 9 10
Mitigating actions 1 2 3 4 5 6 7 8 9 10
The significance of information/communication 1 2 3 4 5 6 7 8 9 10

17. How will you assess your level of knowledge after the first day (26/1) of the seminar?

Nuclear threats and potential consequences in Rogaland 1 2 3 4 5 6 7 8 9 10
Roles and responsibilities in nuclear emergency preparedness 1 2 3 4 5 6 7 8 9 10
Mitigating actions 1 2 3 4 5 6 7 8 9 10
The significance of information/communication 1 2 3 4 5 6 7 8 9 10

18. How will you assess your level of knowledge after three days of seminar?

Nuclear threats and potential consequences in Rogaland 1 2 3 4 5 6 7 8 9 10
Roles and responsibilities in nuclear emergency preparedness 1 2 3 4 5 6 7 8 9 10
Mitigating actions 1 2 3 4 5 6 7 8 9 10
The significance of information/communication 1 2 3 4 5 6 7 8 9 10
19. Have the seminars increased the understanding of your own role in nuclear emergency preparedness and recovery?
- yes, to some degree
- yes, to a large degree
- no, already knew it
- no, still uncertain

20. If you answered yes, to which degree did the different days contribute to this?
20a. First day (26/1) (competence building)
- No degree
- Small
- Some
- Large
- Very large

20b. Second (27/1) and third (10/3) day (discussion days)
- No degree
- Small
- Some
- Large
- Very large

21. What do you consider the largest challenge to achieving a strengthened nuclear emergency preparedness and recovery in Rogaland in the future?

22. What was successful about the seminars?

23. What are the most important potentials for improvements?
Embracing the complexities: the value of listening to public in nuclear emergency preparedness

Tomkiv, Y., Oughton D. H., Wynne, B.

Abstract
Aging nuclear power plants in Europe, transport of nuclear waste along the Norwegian coast and heightened risk of terrorist attacks, increase the probability of nuclear accidents affecting Norwegian territories. In order to improve the governance of nuclear or radiological accidents, it is crucial to understand people’s concerns, motivations, beliefs and value judgments that underlie individual decision-making in an emergency situation. In this study we present the results of 6 focus groups discussions that were conducted with members of the general public in a relevant locality. The discussions were based on two hypothetical scenarios of nuclear accidents that would affect the areas where participants resided. The paper presents the results of discussions and points out potential challenges that would need to be addressed by the emergency preparedness actor(s) as well as recommendations for possible change in the current practices.

Introduction
Norway is a non-nuclear country, however, recent analysis of the threats from radioactive accidents conducted by Norwegian authorities showed that the probability of nuclear accidents or incidents with radioactive emissions potentially affecting Norway has increased (Selnæs, Eikelmann et al. 2018). The reasons for this are aging nuclear power plants in Europe, increased transport of nuclear waste along the Norwegian coast, and increased risk of terrorist attacks. Therefore, more attention to nuclear emergency preparedness is needed.

Norway is not alone in this regard. There has been increasing attention towards nuclear emergency preparedness in many European countries, especially after the accident in Fukushima, Japan in 2011 (Železnik and Klemenc 2015, Schneider, Lafage et al. 2016, NERIS 2017). A number of European research projects (e.g. PREPARE\textsuperscript{1}, CONFIDENCE\textsuperscript{2},

\textsuperscript{1} Innovative integrative tools and platforms to be prepared for radiological emergencies and post-accident response in Europe
\textsuperscript{2} Coping with uncertainties for improved modelling and decision making in nuclear emergencies
https://resy5.iket.kit.edu/CONFIDENCE/
SHAMISEN\textsuperscript{3}) have been funded to focus specifically on nuclear emergency preparedness and management. Communication to (or with) publics has been acknowledged as both the biggest challenge of emergency management and a key to its success (IAEA 2015, Sellnow 2015, Perko, Tomkiv et al. 2016). International organizations like IAEA, OECD-NEA have published recommendations and organized multiple seminars and conferences focusing on the topic (IAEA 2012, OECD-NEA 2017, IAEA 2018). Nevertheless, there is a need for more research on exactly how communication in preparedness should be implemented (Coombs 2009, Perko, Van Oudheusden et al. 2019).

One of the main problems with current institutional views on public communication in emergency management is that it is seen primarily as a mean to get publics to follow the advice of authorities. This is in turn motivated by experience of challenges with public not complying with advice in nuclear emergencies. In Three Mile Island people self-evacuated against recommendations (Houts, Lindell et al. 1984). In France after the Fukushima accident, the public ignored official recommendations and purchased what they thought to be preventive drugs (iodine containing) (Crépey, Pivette et al. 2013). A similar response was observed in Japan (Kanda, Tsuji et al. 2012). People were also requesting iodine tablets in pharmacies in Norway, Denmark and Sweden. However, if authorities are to develop appropriate protective and communications strategies, and encourage actions to reduce the consequences of a potential nuclear accident, they need to understand why the public is responding in certain ways.

The need to understand importance of understanding people’s concerns, motivations, beliefs and value judgments in emergency management has not been recognised as necessary until perhaps the last decade. Up until that time, the dominant institutional approaches were focused on technical tasks such as how to estimate the distribution of exposures and risks correctly, develop the practical measures that should be applied, and communicate this clearly to public. However, the public or rather multiple publics (Irwin 1995, Wynne 2005, Kerr, Cunningham-Burley et al. 2007) will - in such an emergency situation, which is by definition radically abnormal, and unprecedented - typically act not only on the instructions and information they hear from ‘the experts’. Their behaviour will be affected by their own priorities and values, and their understanding of what is

\textsuperscript{3} Nuclear Emergency Situations - Improvement of Medical And Health Surveillance
practical in the particular circumstances; they will bring in their own networks - of
knowledge, and questions, and of trust and mistrust (Joffe 2003, Larson and Heymann
2010). This is consistent with a concept of ‘cultural rationality’ that tells us that people
give equal weigh to personal experiences and technical calculations (Plough and Krimsy
1987, Fischer 2005) and other work that follow a cultural theory of risk (Douglas 1982,
Krimsy and Golding 1992). Following this approach, Fischer (2005, p.55) states that
publics’ perceptions of risk are shaped by the “circumstances under which the risk is
identified and publicized, the standing or place of the individual in his or her community,
and the social values of the community as a whole.”. Listening to public and taking their
interests and concerns into account is critical for building trust relations (Larson and
Heymann 2010, Dupras and Williams-Jones 2012). Therefore, there is a need to
understand these civic networks, including cognitive and affective networks, and work
out what practically this means for better emergency plans and communications.

A 2014 EAGLE survey of a variety of institutions and organisations involved with the
radiological risks showed that majority of them provide information or
education/training to the public, but almost none of them systematically investigate their
information needs, knowledge and interpretation of the issues (Daris, Kralj et al. 2015,
Mays, Valuch et al. 2016). Those that do, often use surveys for these purposes, but this
method has some limitations. For instance, in a recent survey, performed in Belgium,
Norway and Spain, respondents were asked about sheltering indoors, taking iodine
tablets or giving them to children (Turcanu, Perko et al. 2018). The results showed a large
variability in willingness to follow the advice of authorities between the countries
(Turcanu, Perko et al. 2018). Unfortunately, this and other quantitative studies cannot
explain what makes people follow or not follow the different advice. This is because
quantitative social or psychological survey methods have to use simple YES/NO, or Likert
scale, questions, so that large sample-numbers of responses can be combined. Thus, while
representative population-group responses can be elicited by such methods, they can
only do this in a valid way for limited kinds of behavioral questions.

In order to understand why people do what they do, qualitative open-ended methods are
needed, because meanings are brought into play. Open-ended survey questions, or open-
ended discussion-groups that focus on issues of relevance to the researchers can help
generate a more complete and complex overview of real civic concerns and conditions,
and in terms that people choose themselves. These data could help develop understandings, communication contents and approaches that would be more likely to encourage actions that reduce the damaging consequences of an emergency.

In this paper, two different hypothetical scenarios were used to qualitatively investigate public reactions to a radiological accident, and the factors that would influence their reactions. The aim of this study is to explore public needs, concerns, understandings, expectations and responses with regard to communications from authorities about radiation risks.

Method
Focus group discussions were used as the research method for the paper, to collect data through semi-structured or focused group interactions on a given topic (Morgan 1996). Qualitative methods such as focus groups are more open-ended can facilitate expression of more ambiguous or complex public responses (Macnaghten 2017). They are dynamic, facilitated usually by one of the research team members, and last up to about two hours. Typically, they are recorded with permission of participants, and a verbatim transcript is used for later analysis. Such groups are usually composed of 6 to 10 voluntary members of a relevant social group or public, which can be quite loosely or tightly defined according to different criteria depending on the research. Typical criteria might be; location (for site-dependent questions, as with radiation emergency-preparedness); age; gender; occupation; parenthood or not; educational training; etc). Often no such criteria are employed, and focus groups can be random cross-sections of general publics.

Participants
A total of 48 participants took part in the focus group discussions. These were divided into six groups consisting of 5-10 participants (with an average of 8 participants) in the age range of 20-65. The participants had various backgrounds, education levels, and income. All participants resided in Bodø and area, but were not necessarily born and raised there.

Participants were recruited by the social research recruiting company Norstat4. They were approached by phone and asked if they were interested to join. After the end of the focus group sessions, they received a gift card for their participation.

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4 https://norstat.no/
Procedure

A three-part discussion guide with a progressively developing accident scenario was used as a base for the focus groups. One scenario (transport of a nuclear reactor) was focused on an accident that would require immediate countermeasures like sheltering indoors and iodine tablets; the other scenario (Sellafield) focused on an accident that would require more long-term countermeasures: control of contaminated food, dietary advice and intervention limits. Three focus groups discussed each of these scenarios. The discussion guide can be found in Table 1.

Table 1 Discussion guide for the focus groups

<table>
<thead>
<tr>
<th>Sellafield case</th>
<th>Transport of floating nuclear reactor</th>
</tr>
</thead>
<tbody>
<tr>
<td>There has been an accident at the Sellafield reprocessing facility in the UK with release of radioactivity. The extent of the accident is unknown, but it can have potential consequences for Norway. The authorities will keep you updated on the development of the situation.</td>
<td>There has been an accident on a floating nuclear reactor that was transported along the coast of Norway. The extent of the accident is unknown, but it can have potential consequences for Norway. The authorities will keep you updated on the development of the situation.</td>
</tr>
<tr>
<td>The radioactive fallout has contaminated big areas of Norway, including Northern Norway. The authorities have performed measurements and the estimated external doses to population will not exceed 1 mSv/yr, which is a legal annual limit for the general public. No direct health implications are expected.</td>
<td>The radioactive fallout is moving towards Northern Norway. It will cause local contamination with short-lived radionuclides in the area where you reside. Authorities recommend that you stay indoors for the next 24 hours to minimize your exposure.</td>
</tr>
<tr>
<td>Although the radioactive fallout is not expected to cause direct health impact, there will be need controlling radiation levels in the food that is produced in the affected regions or sectors.</td>
<td>The release of radioactivity from the floating reactor is still ongoing. The fallout of radioactive iodine is expected in the coming days. Iodine tablets have been distributed to all households. Authorities recommend that all the residents in the Bodø municipality give iodine tablets to their children under 18 yrs old. Women that are pregnant or are breastfeeding should also take iodine tablets.</td>
</tr>
</tbody>
</table>

Following each part of the progressively unfolding scenarios, the participants were asked about their reactions to information, what they were going to do, what would they want to know, and to whom they will turn for information. Also, different probe questions were
asked, such as Would they leave their children to shelter at school for 24 hours? or How they would react to the self-evacuation of their neighbor?

Data analysis
The analysis of the transcripts was performed using Atlas.ti version 7 (ATLAS/ti 1999), a qualitative analysis software. The transcripts were analysed in two rounds, first using an inductive approach - letting prevailing themes emerge from data through the repeated reading and categorizing of data. Further, the data were coded to analyse the identified themes and develop theoretical explanations for the data. All coding and preliminary analysis was performed by the first author with discussions with all authors on each step.

Results
Four main themes emerged from the data in the process of analysis: a) how the publics involved define their relationships with emergency preparedness actors; b) what factors influence public responses to countermeasures; and c) how publics construct their risk perceptions of radiation. The following subsections will discuss these more fully.

a. How publics define their relationships with emergency preparedness actors

"Think about this question of preparedness: if Norway had good preparedness, wouldn’t we as residents know that?" Participant from Group 4

When faced with such an unusual scenario, participants were struck by a realization of how little they knew about the existing emergency preparedness for nuclear accidents. There was a general confusion about who would be responsible for managing emergency response, who would be making decisions, who they should listen to, and where to get information. Participants questioned whether there were emergency plans at all levels of government and at all institutions that would be involved in emergency response.

There was a general concern about how old routines are forgotten: fewer and fewer people know what the ‘general alarm’ signals mean. Participants were also very critical about changes that had happened within civil defense, such as decreased financing and disappearing bomb shelters, which they felt would have a negative impact on the country’s ability to react to emergencies in general, and to nuclear emergencies in
particular. There was a general concern about the younger generation and their media
routines (e.g. their overreliance on the social media as an information source).

The participants were divided on the question of what kind of emergency preparedness
system Norway should have. Responses varied from wanting to be “blissfully ignorant
and taken care of”, through demanding more visibility and transparency about the
nuclear preparedness, to actually wanting to be a part of the decision-making process.

“If you look at what we like to feel ourselves safe: we like that defense has
exercises, we like to see police holding exercises on the streets, but nuclear
preparedness is just an illusion. We believe it exists. We don’t even know
what it’s called. So it would be nice if it was bought into the open, so we
would know that we actually have a plan for nuclear accidents.” Participant
from Group 5

“If you know what you should do to extinguish the fire, you do it. If you don’t
know – you mess around finding out what to do. How scary is it to give us
the information in advance about how we should cope? … One feels safer
when one knows what one should do.” Participant from Group 6

“People should be allowed to be a part of that decision. If you are uncertain
about the basis you have got for your decisions, it is my opinion that people
have the right to know that, because we can also make our own decisions.”
Participant from Group 3

At the same time, participants understood that increasing the visibility of nuclear
emergency preparedness in everyday life is not easy due to a range of issues: it is
problematic to interest people in this topic in the preparedness phase; there is a lack of
culture for nuclear preparedness exercises (as opposed to fire drills), and there is always
a risk of alarming people too much. There was also a general understanding that the
probability of nuclear accidents in Norway is low and that it would be unnatural to have
extensive drills to prepare for such accidents. But participants believed a middle ground
could be found here between “nothing and full emergency exercises”. A minimum
requirement being that people know the preparedness systems exists, how it works and
what they should do if something happens.
Participants expressed a high level of trust towards the authorities and official institutions. However, some nuances appeared in the discussions. Trust was almost absolute in terms of “they have our best interest in mind”. At the same time, trust seemed to depend on the topic (see quote below) and past experience with governmental decisions, including those that were not related to radiation. Participants also acknowledged that lobbying and politics could influence the emergency response.

“Is it possible to grade your trust towards the public authorities depending on the topic? For instance, for me, trust towards food that I buy in the shop is very high, while trust in the fact that we have a fair tax system is more in the middle; and when we get to a collective ability to handle such emergency, my trust is very low, especially after this discussion here.” Participant from Group 2

Participants questioned the ability of the responsible institutions to handle an emergency, and the existence of preparedness plans and emergency exercises at all levels played a big role in the formation of trust. Many of the participants had a feeling that Norway usually learns from accidents rather than prepares to handle them. An example of the way responsible authorities failed to handle the terrorist actions on July 22, 2011 was often mentioned in this context. The fact that many of the municipalities were slow to order iodine tablets from central storage was also seen as a lack of preparedness.

“Since there has been so much silence about this topic, we have high expectations for what authorities should be able to do and we never get to test it, to ask questions about whether they have managed to build that knowledge base and are able to give us the best advice.” Participant from Group 5

Importantly, participants questioned whether those responsible for making decisions have competence to evaluate a situation in the right way (e.g. whether there would be any health effect), whether all necessary research is available to them, and whether those decisions would be science-based or rather political and influenced by lobbying.

There were several examples of decisions taken by the government in the past that seemed to have big impact on respondents’ trust. Among them was a decision to recommend purchase of diesel cars (in 2007) as it was considered beneficial for the environment, while later the fees for these cars were increased, and now diesel cars are almost banned in Oslo. Another example that was often brought up was swine flu
vaccination, which was later shown to be unnecessary, and caused side-effects in some of
the people who took it.

"Some years ago, there was a discussion about very high radioactivity levels in
Finnmark in 60s. Authorities said that it was safe and still ok for children to
drink milk. However, the facts were that there were high levels of radioactivity
in milk, but they fed children with it anyway. So the question is whether
authorities knew about it and the book implied that they did, but wanted to
keep it quiet or maybe they didn’t know about consequences and didn’t want
to stir up trouble before they knew whether it was harmful.” Participant from
Group 3

Some of the participants considered preparedness in Norway as not satisfactory based
on their personal experience, often because they participated in emergency exercises at
work and experienced the weaknesses in the system. Similarly, those who had
predominantly positive experiences with the way government handled Chernobyl (e.g.
measurements, clean feeding and follow up of the sheep and reindeer, dietary advice
about gathering) had a more positive attitude towards the ability of Norwegian
authorities to be prepared and to respond to an incident involving radioactivity.

All participants stressed the importance of timely, relevant, easily available and
understandable information. However, the majority of the participants would not know
where to find the official information and struggled to remember the names of the
institutions that should be responsible for providing it. Almost all participants would go
to media to get information, since authorities would not be able to update news as often
as media would, media would be collecting input from all the relevant organisations
anyway. As already mentioned, they would not know which official webpages to turn to
find information and assumed the links to those webpages would be communicated
through the media channels. Many of them would go to the Norwegian Broadcasting
Corporation (NRK)\(^5\) as it is a governmental channel and they perceive it as more
trustworthy. Several participants in every group expressed the view that immediately
after the accident, they would not consider announcements in media to be sufficient and
they would expect to be contacted in a more direct way, for example by SMS.

\(^5\) [https://www.nrk.no/about/a-gigantic-small-broadcaster-1.3698462](https://www.nrk.no/about/a-gigantic-small-broadcaster-1.3698462)
Participants also acknowledged the changing media landscape, increasing role of social media and challenges it could pose for the flow of the correct official information. Society is very fragmented in relation to where they get their information from, therefore, it is very important that clear instructions are given for where to go to get the correct information.

“Isn’t it a paradox that we live in an information society and we know so much, but we are more uncertain than ever before, we don’t have an answer. And emergency preparedness is not like «we do this because we discovered that this is a correct thing to do». It is not like that anymore, there is no one answer.”

Participant from Group 3

Lastly, participants acknowledged the major role uncertainty would play in a complex situation like a nuclear emergency, and how hard it would be for responsible authorities to make decisions. They did not have an unanimous opinion on whether uncertainties should be disclosed to the public. All participants agreed it is important that decision-making is transparent, including information about what those decisions were based on, however, in the initial phase of the accident, many would just want to receive clear directions.

b. What influences public’s response to countermeasures

In general, participants were positive towards following advice given by authorities as they felt they had little knowledge on how to deal with a nuclear accident and they would expect authorities to tell them what to do. However, during the discussions, a more nuanced picture of the response emerged.

First, the word ‘recommendation’ gave an impression that the action is not obligatory, so many of the participants felt there would be room for personal judgement. Also, in their opinion, there is a variety of already existing recommendations that not everyone follows and this “weakens” the message (e.g., flu shots everyone is recommended to take every winter). Similarly to the question of trust, participants recalled previous recommendations issued by authorities that had some negative effect for those who followed them (e.g., side effects of vaccination) or were showed to be unnecessary in hindsight. This also contributes to public skepticism towards advice.
“I believe we judge much harder if they gave us advice and there was some few
who got harmed ... we learn from it and don’t do it again [follow advice], we
don’t listen next time.” Participant from Group 3

If recommendations are given in form of a dietary advice (i.e., owing to radioactive
contamination of food), this adds to the already existing list of various dietary advice
health authorities have come up with that people, in general, are not that good at
following. The participants did recognise that when it comes to radioactive
contamination of food, people might take it more seriously, but still thought that many
would eventually stop following such dietary advice.

Another topic where wording seemed to play a big role was sheltering indoors. Many
participants did not feel that a recommendation to shelter implies it has to happen
immediately. For them, it was important to make sure their families were safe and, if
possible, gathered at home. One of the typical responses would be “I would take a car, go
pick up kids, stop by a grocery store and go home”, which would pose challenges for the
emergency response. The responsibility over one’s children was the main factor here,
however, participants also mentioned responsibility over pets and types of work where
one cannot just leave or not show up (e.g. caring for patients). However, parents would
let their children stay and shelter in school or kindergarten if they knew children would
be kept indoors, there was food available and there were adults present to take care of
them. Otherwise, participants did not mind staying indoors as they perceived it as an
effective measure, on the condition that all infrastructure was functioning (e.g. internet,
electricity, availability of drinking water etc.).

All participants were willing to take iodine tablets if that was recommended, and had no
objections against giving them to their children. They were in favour of iodine tablets
being administered to children at school if it was recommended by authorities.

“I trust the teachers to take care of my children 8 hours per day until they
become 18, so I trust teachers to give them iodine tablets when they are told to
do so.” Participant from Group 3

The reasons for such a positive attitude towards iodine tablets are that they are not seen
to be dangerous and without negative consequence for those taking them. Iodine is a part
of dietary supplements people take normally, and some participants had heard that levels
of iodine in Norwegian population are too low, so there would be benefits of taking more. They also perceived iodine tablets as an effective countermeasure, something they felt was immediately connected to nuclear accidents, although only a couple of them knew what exactly how the iodine tablets work. In addition to perceived effectiveness, the participants had never heard about situations when people overdosed on iodine, which contributes to their confidence in this protective measure.

Interestingly, the exact same reasons that would make participants take iodine tablets if recommended, would make some of them go against the recommendation of authorities and take them when iodine tablets are not recommended⁶. This attitude seemed to prevail in younger participants <50 yrs old. Participants felt “it was safer that way” and could be taken as a precaution, unless there were not enough tablets to go around, in which case they would agree that sensitive groups should be prioritised. Some participants said they would give iodine tablets to children even if iodine was not recommended as a countermeasure at all.

Another reason for not following recommendations was conflicting information from authorities. For instance, if it was recommended to take iodine in one area, but not in another without good justification being given for such a decision. In addition, the perceived competence of whichever organization or official was to make decision about countermeasures, would contribute to the way participants responded.

The time perspective also plays a role on peoples’ response to recommendations. Immediate, one-time countermeasures (e.g., sheltering, iodine tablets) were seen as easier to follow as these happen during the emergency phase when everyone’s attention is turned to the accident and its management. Long-term countermeasures like those related to food restrictions are harder to follow, because as time passes, people would start to forget, especially when it comes to the food traditions they have had for a long time or when change of diet requires a lot of adjustment. The way people experience radiation as something abstract and very remote was brought up to support both following and ignoring recommendations.

⁶ According to the Norwegian emergency plans, iodine tablets are recommended only for children under 18, pregnant and breastfeeding women.
At least in the initial phase after the accidents, participants stated they would follow restrictions for self-gathered food. Some said they would be skeptical to local food or food from areas that have been impacted if any contamination of produce was detected. At the same time, the majority of the participants reported high trust towards food safety authorities and assumed that food in the shops would be safe. There were only few participants that mentioned the factor of loyalty towards local producers and that they might choose to consume a particular product of high quality despite it containing higher levels of radiation. In a similar way, a few people said they would still pick cloudberrys for Christmas (against a recommendation) since it is just one meal. At the same time, even if the person itself would not mind consuming somewhat contaminated food, they would not give it to children, because they did not want to bear the burden of possible long-term health consequences for those children.

Another aspect related to food contamination and following dietary advice would be the economic factor. Many families living in the area get a lot of their food from nature and some are heavily dependent on it. Those who cannot afford to stop hunting and gathering and buy clean food in the shop, would have trouble following dietary advice unless they received support or compensation from the government.

Although evacuation was not included in the list of protective action for any of the scenarios, some of the participants expressed a wish to flee the area upon receiving the news about nuclear accident.

Finally, during the course of discussions participants raised a range of questions about the accident scenarios (Table 2). In addition to giving an indication about the kind of information the public is interested in, they would also impact on both the response to recommendations as well as the way the public constructs their perceptions of radiation risk.

Table 2 Questions about the accident scenario that participants posed during the focus groups discussions

<table>
<thead>
<tr>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where exactly did the accident happen? (how close to me)</td>
</tr>
<tr>
<td>What exactly happened?</td>
</tr>
<tr>
<td>Was the release into water or air?</td>
</tr>
<tr>
<td>What is the weather like/wind direction/where would ocean currents lead?</td>
</tr>
<tr>
<td>How likely is it to hit us?</td>
</tr>
</tbody>
</table>
c. How people construct risk perceptions of radiation

One of the main issues participants had with radiation was the “can’t see it, can’t smell it” factor. A typical, conventional expert reading of this quality of radiation is that it causes publics to exaggerate its risks as compared those ‘real’ risks known to science. However, the key issue for the participants was that this factor made it impossible for them to assess whether they were being exposed and how much they were being exposed to; there was no way to avoid or influence the level of exposure. It was thus an issue of lost control, of disempowerment, which gave them a feeling of resignation. This also made them completely dependent on the information from authorities and experts.

Participants considered radiation to be different from other contaminants like heavy metals that you also cannot see or smell because radiation would be present everywhere and not only in a certain product, and it would be hard to avoid it. For instance, there is an existing problem with high Cd levels in blue mussels in Nordland County, but local people know they just need to avoid that particular seafood.

Besides potentially being everywhere, another major factor that influenced participants’ perception of radiation was the issue of permanence and persistence of the contamination and potential long-term consequences for people, nature, and economy. They pointed out that there is still need for countermeasures in Norway as a result of the 1986 Chernobyl accident.

“When you hear such accidents happen, there is a room you can go into. And you can sit there and be protected, but if you come out of that room, it is as bad outside as it was before.” Participant from Group 4
For people who live very close to nature, like the population of Northern Norway, it would be detrimental if the areas were contaminated so you could not fish, hunt and gather food. Also, even if gardens could be cleaned up from radiation, this cannot be done in the forest and mountains.

“Most of the food we eat comes from the outside of Bodø, we have the possibility to gather a lot of the food we eat, especially meat since we hunt quite a lot. And that would be a big question then, to get ... all of that. How would it be?” Participant from Group 4

In addition, participants associated radiation with a “health damage you cannot see until it’s too late”:

“Health is more than to be able to stand up and move. It is also about whether there is any increased illness or mutations, or other types of genetic changes.”

Participant from Group 4

Participants that had small children expressed a lot of concern in regard to the potential health damage to them. One of the biggest burdens for them in the scenario situation would be having to make decisions for their children and bearing the responsibility for the potential consequences of those decisions in the future.

Lack of knowledge about how radiation works is seen as one of the main reasons for people’s attitude to risk from radiation. People do not hear or learn about it unless they take a specialist education. However, participants pointed out it was not only their own lack of knowledge that worried them. They were not convinced the topic has been studied enough and that there was any conclusive research that would determine how much radiation was completely safe (e.g. see quote below). Participants felt there had not been sufficient studies on the individuals exposed after Hiroshima or Chernobyl (including those who ate contaminated reindeer meat) and especially individuals that were exposed in routine exposures. It was important for them to know what the individual-specific risk from exposure to radiation was. Lack of this knowledge contributed greatly to their scepticism and their fear of radiation.

“When I think about the intervention limits, it’s clearly a risky sport because radiation does something with the genetic material on a cellular level. Whether it’s one time irradiation or several irradiations or several exposures over
longer time... I don’t know whether there is [research] material that can say something for sure about it.” Participant from Group 4

However, uncertainty about the dose-effect relationship, and about differential effects of variable dose-rates, and lack of concrete knowledge on the radiation risk sometimes had an opposite effect on the participants’ perception of radiation. For instance, when discussing personal dosimeters they could have worn to be aware of the doses they are exposed to when living on the contaminated territories, uncertainty about how much radiation over how long time would give any health effect was named as one of the reasons to not wear a dosimeter in one of the groups. If there was nothing to be done with it and it was anyway uncertain, it was not practically useful to them as citizens, so better just not to think about it.

Lack of factual knowledge and misinformation also plays a role in the way respondents formed their perceptions of radioactive risk. For instance, the majority had no idea whether one can produce clean food products on contaminated territories, which made them even more concerned with how long-term this problem can be. Several participants mentioned that the way radiation risks are framed in media reports impacts on public perceptions. They expected media to use dramatic pictures and scary headlines, but they also understood that media have their own agenda to follow and thus tend to overdramatise. Thus, they acknowledged the need to be critical about the information found in media articles.

Despite reporting a lack of knowledge on radiation issues, participants demonstrated a good general understanding of how the limits for radiation in food are set and about the safety margins. They believed that the food authorities would make sure contaminated food was not on the market, although several of them reported they would still be more attentive to the labels on food products and if possible avoid food produced in the affected areas. Participants knew that “over the limit is not necessarily dangerous” and that it was the amount and consumption-frequency of contaminated food that mattered. However, because of the need to constantly calculate in their heads how much they already had and how much they could still have, as well as concern for more sensitive groups (e.g. children), they would refrain from consumption of contaminated food. One exception from this general attitude was the very specific products that people eat rarely, making it
easy to control the intake\(^7\) (e.g., reindeer meat, cloudberry at Christmas). Several
participants said they would still eat those products even if they contained higher levels
of radioactivity or were above the regulatory level.

On several occasions, participants compared food slightly above regulatory limit with
food past the sell by date, referring to the “often just as good after” campaign\(^8\) that was
ongoing in Norway at that time, and which was focused on reducing food waste. Similar
to food past its sell-by date, food containing radiation slightly above the intervention limit
was illegal to sell, but not necessarily bad or dangerous. However, due to the lack of
knowledge about how radiation affects organisms and how it accumulates (danger of
delayed effects), the participants admitted they would still be more sceptical towards and
scared of radioactivity in food. Some participants suggested that if these issues were
properly explained, people might be more relaxed about it.

They also noted that people might exceed recommended doses when having and x-ray or
CT scan, but that is not dangerous since it happened seldom. At the same time, they do
understand that those who perform those examinations need to use extra protection to
avoid being overexposed.

Additionally, the discussions on radioactivity in food seemed to point towards a more
general feeling participants had about having less and less control over what is in their
food nowadays (e.g. chemicals, pesticides, additives, and increased processing, by
increasingly concentrated and ‘distant’ food-production industries). In relation to this,
one of the participants pointed out that although all of the diverse additives and
contaminants present in food were – presumably - under the regulatory limit, nobody
seemed to be considering what total effect the sum of those compounds could have.

**Discussion**

The results demonstrate the useful insight into the ways public construct their
perceptions of risk that can be generated by talking directly, in a structured way, to
representatives of the public. This includes their relationships with emergency actors;
with sources of knowledge; and their responses to emergency management. This is true

\(^7\) Consumed once or twice a year
\(^8\) [https://www.holdbart.no/informasjon/best-foer-ikke-daarlig-etter](https://www.holdbart.no/informasjon/best-foer-ikke-daarlig-etter)
for issues involving complex technical questions and practices, and includes dimensions that are often only implicit in authorities’ communications.

Previous research demonstrated that the way public responds to risk and risk information is based upon their experiences and judgement of credibility and trustworthiness of the institutions that are in charge of that risk (Wynne 1980, Wynne 1992). Moreover, trust in the institutions and their expert representatives is influenced by the degree of dependence, ambivalence and powerlessness people feel about the information they receive from those institutions (Wynne 1996). The participants in this study expressed ambivalent attitudes towards emergency preparedness actors. This ambivalence was especially evident in the way they reflected upon their trust to and confidence in those actors – on the one hand trusting the intentions of the authorities, but at the same time questioning their competence. By bringing up their personal and social experiences with emergency actors and their actions, their concerns and expectations, participants demonstrated the importance of these factors for their attitudes (Dupras and Williams-Jones 2012). Although ambivalence often is referred to as a limitation in decision-making (Gaskell 1997, Luján and Todt 2000), and something that needs to be reduced (by increasing education) in order to increase acceptance of certain technologies (Costa-Font and Mossialos 2005), some scholars argue that it might bring reflexivity and should be actively fostered (Wynne 1992, Kerr and Cunningham-Burley 2000, Kerr, Cunningham-Burley et al. 2007). Trust is a complex concept and even in a country like Norway, where levels of trust towards authorities are quite high (SSB, 2016), trust can be easily lost. It is important that emergency management actors work on preventing this loss of trust towards and confidence in all the interacting levels of emergency management. Our findings confirm research in other fields in showing that public knowledge and confidence in authorities influences their compliance with protective measures (e.g. evacuation orders) (Kim and Oh 2015). It is therefore a crucial condition of effectiveness for emergency planning and preparedness.

The results demonstrated how little typical publics knew about the existence, organization and functioning of the emergency preparedness system for nuclear accidents in Norway, and this made some of them more concerned. Although the Norwegian Nuclear and Radiological Preparedness Organization has existed in various forms since 1993 (see e.g. Liland, Tomkiv et al. 2017), and organizes emergency exercises,
stakeholder seminars and preparedness campaigns, our results indicate that their
strategies of involving publics in these processes have not been successful.

The study also demonstrated that even in the relatively small number of people
participating in the discussions there was a variety of responses, reminding us that there
is no single homogeneous public, but rather multiple publics that have different opinions,
experiences, rationalities and degrees of perceived empowerment. They base their views
on different factors, and they will be responding in different ways for different reasons.
The point of multiple publics has already been raised by various scholars (Irwin 1995,
Irwin and Wynne 1996, Wynne 2016), nevertheless, in emergency preparedness one
often focuses on a population as a whole, and on developing a single management and
communication strategy. Insight into both the various different concerns in populations,
as well as factors influencing those concerns, would improve the ability of authorities to
tailor their management to better suit the expectations of the public.

Many participants would use media as their primary info and follow the
recommendations given there. According to a large body of research literature, this
would be combined with dependence upon personal informal social networks of trust,
both for knowledge of what is happening in the emergency situation, and for deliberation
about what actions to take, as info and understanding of events unfold, in all their
contingency. Therefore, it is important that authorities prepare generic information
sources – and tested its credibility - together with strategies for promoting this as a valid
information source. This cannot be left until an emergency erupts, but has to be
painstakingly defined, enacted and established in the preparedness phase.

The way participants chose to respond to the imagined accident and some of the
protective actions can create challenges for the emergency management. For example, it
is reasonable to suppose that many participants in an emergency situation would want
to make sure their family members are safe and would try to gather the family by picking
up children or calling everyone to make sure they made it home. This could potentially
result in a transport collapse, or an overload of mobile networks. A survey study by
Turcanu et al (2018) found that over 50% of respondents would not follow authorities’
recommendations not to use mobile phones. However, the focus group discussion
revealed that this could be partly counteracted if parents knew that their children would
be taken care of. As the trust in Norway towards schools and teachers is high, many
respondents did not mind leaving children at school if they knew that there is an emergency plan and there will be trained personnel and food, water, etc. available. They would not mind if teachers distributed iodine tablets to children.

It was not the aim of the study to check how publics react to the information/messages from authorities, but the focus group discussions highlight the importance of testing the emergency messages on publics and redeveloping them with their help. They also confirm that the way people perceive, and judge risk is very complex. Furthermore, there are other dimensions of public issues, which animate publics besides only their risk dimensions; and these cannot be ignored as if all that matters to people is safety or security. Such issues include differences in expert and public attitudes to the acceptability of the technology, disagreements about the sizes of the risk, both between experts and between public and experts, and questioning the need for the technology in terms of the benefits and alternatives.

The participants’ unease with radiation shows similarities to other new or emerging technologies. The lack of knowledge about the potential consequences of radiation exposure, not only their own lack, but also that of research experts, make them reluctant to accept the situation. Uncertainties about potential consequences also play a significant role here. Similar issues are raised in the GMO debate (Marris, Wynne et al. 2001). If, as becomes apparent only when they are challenged, the experts supposedly in control of such commitments do not know as much as they claim about the effects (Felt and Chhem 2016), why should we be practising such technology, especially when this only makes us even more dependent upon those seemingly untrustworthy experts?

Besides wanting to know their personal risk, participants were clearly concerned about other issues like impacts on nature, and the potential burdens on the already unfortunate and less resourceful parts of society – people who are dependent on getting their food from nature and can’t afford to change their diet.

Inter alia, in addition to the complex, often ill-defined, and shifting instrumental questions relating to risk, people also typically want to know: Why? Why is this decision made? Why is this considered safe? They want the background, the range of possibilities and options, and justifications. These are not unreasonable demands, in a scientifically well-resourced democratic society.
A key take home message from the focus group discussion is that public perceptions are not as simplistic as they are often presented. One important follow up to this study would be to turn the tables and examine what kind of views public authorities have about public perceptions, what is the evidence on which these are based, and how do they operationalize these into the official emergency management strategies?

Limitations

There are some limitations in this study. Firstly, participants can be described as a typical, but not representative sample of the Norwegian population. Only one of our focus group participants was not ethnic Norwegian, so the views of minorities were not represented in the results. Secondly, those that agreed to participate in the study might be more interested in the topic than the more general population. Thirdly, this study was based on two hypothetical abstract scenarios and although the scenarios were realistic, we cannot assume that people would respond to an emergency situation in the ways they indicated in the abstract. However, the aim of the article is not to predict how they would behave, but rather to illustrate what would influence their decisions to behave in a certain way. Lastly, some of the findings are specific for Norway, although we expect some of the issues and reasoning to be common also for people in other countries.

Conclusion

This study demonstrates that in case of an emergency, the responsible authorities will be dealing with multiple complex publics that have different life-world situations, opinions, knowledge, ways of relating to risks, and relationships to and expectations from the emergency actors. Therefore, it is important that the responsible authorities are aware of these complexities. This can be fostered by establishment of dialogue processes with public groups, and development of the appropriate involvement processes as regular and continuing relationships between institutions and their publics.

Developing communication in preparedness is not only about being ready to communicate if an emergency occurs. It is important to build more robust and continual relationships with publics during non-emergency time. The very least publics need to know is that preparedness systems for radiological accidents are in place, and there are resources, knowledge and competent people that know what to do. They need to know where to go for the information on what to do, including about how to help develop better intelligence and capacities.
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References

Claiming Citizenship: Rights, Participation and Accountability. B. Wynne, I. 


Paper 4
Assessing Quality of Stakeholder Engagement: From Bureaucracy to Democracy

Yevgeniya Tomkiv¹,², Astrid Liland²,³, Deborah H. Oughton¹,², and Brian Wynne⁴

Abstract
The idea of public or stakeholder engagement in governance of science and technology is widely accepted in many policy and academic research settings. However, this enthusiasm for stakeholder engagement has not necessarily resulted in changes of attitudes toward the role of stakeholders in the dialogue nor to the value of public knowledge, practical experience, and other inputs (like salient questions) vis-à-vis expert knowledge. The formal systems of evaluation of the stakeholder engagement activities are often focused on showing that the method is efficient and works. In this article, we argue that every stakeholder engagement process should be evaluated beyond a simple assessment of the methodology and that the wider context of the stakeholder engagement activity should also be addressed. We evaluate two different stakeholder engagement activities against the existing method evaluation criteria and demonstrate their limitations for assessing the quality of a stakeholder engagement. We argue that these criteria need to be extended so that engagement processes will have a chance to improve not only policies but also their democratic legitimacy.

Keywords
stakeholder engagement, stakeholder involvement, evaluation criteria, nanotechnology, nuclear preparedness

Introduction
The popularity of stakeholder engagement in science and technology has increased rapidly since the late 1990s and it has now become commonplace in Europe (Attar & Genus, 2014; Hagendijk & Irwin, 2006; Irwin, 2006), the United States (Freudenburg, 2004), and Canada (Magnan, 2006). It is widely used in the field of environmental management (Burger, 2002), radioactive waste management (Andersson, 2013; Krütli, Stauffacher, Flüeler, & Scholz, 2010), development policy and supportive studies (Gaynor, 2014), emerging technologies (Bowman & Hodge, 2007; Grieger, Wickson, Andersen, & Renn, 2012), and many others. The development of more transparent and inclusive processes has been fueled by the criticism of the deficit model rationalization of public divergence from science-informed policy commitments (Irwin & Wynne, 1996). Although the overall process is varied and uneven, stakeholder engagement is now replacing the traditional one-way process of educating the public with whichever expertise they were thought to need. Moreover, this shift toward a more democratic process has been largely due to the deepening crisis of trust between publics and experts and a widespread sense of crisis of legitimacy in the governance of science and technology (Attar & Genus, 2014). The appearance of deliberative models of democracy was also fueled by the same factors (Dryzek, 2000; Durant, 1999), as reflected by similar developments in broader democratic theory (Benhabib, 1996; Bohman & Rehg, 1997; Dryzek, 2000). Thus, deliberative stakeholder engagement is also recognized as a condition of democracy, a practice central to building a stable and responsive society, with legitimate institutions, in a globalized world (Held, 2013).

Nowadays, even the most science-centered governmental report is incomplete without a section on public engagement (Irwin, 2006), and most European Union activities require some stakeholder involvement (EC, 2017). This has also resulted in the rapid development, and continual review, of a variety of participatory methods and mechanisms. The clear need for evaluation of stakeholder engagement methods, combined with the growing realization that they require a lot...
of resources, time, and new skills for proper practical conduct, fostered the development of systematic criteria and frameworks (Schroeter, Scheel, Renn, & Schweizer, 2016). However, the question remains: Are the current evaluation criteria sufficient for assessing the quality of the stakeholder engagement activity?

This article uses two stakeholder engagement events to explore the applicability of existing evaluation criteria for assessing the quality of stakeholder or broader public involvement. It will also highlight existing limitations and issues of stakeholder involvement and its evaluation frameworks, and demonstrate the need for a deeper analysis, which goes beyond methodological questions alone.

**Issues in Stakeholder Engagement**

There is a certain ambiguity in the terminology of public participation. Many typologies for public participation are available in the literature, starting with Arnstein’s ladder of eight steps from “manipulation” to “citizen control” (Arnstein, 1969), to more recent ones, which distinguish public participation methods based on information flow, degree of commitment of the parties involved, and the power among those parties (Chilvers, 2007; Kemp, Bennett, & White, 2006; Krüti et al., 2010). In general, these four widely recognized categories are information, consultation, collaboration, and empowerment. “Involvement,” “engagement,” and “participation” are all considered under the collaboration group and its evaluation frameworks, and are often used interchangeably. Some subtle differences are recognized between these terms, but these will not be addressed here. However, in these uses, it is important to address the distinction between the terms public and stakeholder. Public engagement, or participation, is used to describe practices involving members of the public in shaping public issues and agendas, decision-making, and policy-forming activities of organizations or institutions responsible for policy development. Stakeholder involvement can be defined in a similar way, but is normally limited to only those parties who have a more direct and concrete stake in the above-mentioned activities. In this case, other publics are often excluded. Alternatively, stakeholder engagement can be expanded to include a wider range of stakeholder—from public through to expert—who have some relation, interest, or part in the issue under debate. Ultimately, the definition of “the issue” in public policy processes is ambiguous, dynamic, and itself contested; therefore, in democratic policy systems, broader publics can also be legitimately described as stakeholders. In this article, we use the term stakeholder engagement to describe a range of different stakeholders, including the general public.

The literature on stakeholder engagement covers a wide range of different issues and reflects the spectrum of attitudes from “euphoria” to “profound skepticism” (Renn, 2005). Stakeholder involvement has been occasionally criticized for being too sensitive to public opinion and also for ignoring stakeholders’ advice (see review in Oughton, 2004). It has been questioned whether stakeholder exercises have any concrete impact on the democratization of technoscience (Ureta, 2016). Some scholars argue that a tyranny of participation is emerging, which exploits the dominance of a method to maintain the power of decision control at the top, and uses participation simply to add credibility to the decisions already made (Cooke & Kothari, 2001; Kothari & Cooke, 2001).

The tendency to predetermine or pre-frame the issues within the engagement process has an impact on the relations of power among participants, and the role of public and expert knowledge in the decision-making process. A study performed by Simis, Madden, Cacciato, and Yeo (2016) demonstrated that scientists often see publics as non-scientific, and do not see the public as a part of scientific dialogue and debate. A considerable amount of attention in public engagement is devoted to educating the public about “real risks” versus “perceived risks” (Goven, 2006a). This supports the growing body of evidence that the popularity of stakeholder involvement has not necessarily resulted in any change of attitude by “experts” or decision makers toward the role of stakeholders and stakeholder activities. And it is often seen as a bureaucratic exercise rather than a democratic process. As Wynne (2007) has noted, this is largely because scientists and the policy makers they advise, often dogmatically assume the public issue to be exclusively a scientific issue, for example, of risk (as defined by science), when other important democratic concerns and questions are also crucial for legitimate nonscientific parties. Neglect of these only exacerbates public mistrust of “science.”

**Assessing the Quality of Stakeholder Engagement**

Rowe and Frewer (2005) summarized the typologies of participatory mechanisms and acknowledged the existence of over 100 different methods and this number is constantly growing. Engagement methods are flexible and can be adapted or combined with other methods to achieve specific goals of the concrete activity. The diversity of methods only emphasize the need for thorough evaluation of stakeholder engagement activities.

There are three possible ways to evaluate stakeholder engagement activities. The first one would be the outcome-based evaluation—did we receive the “right” result? This type of evaluation is still quite popular with those who view stakeholder involvement as a way to achieve acceptance for a preselected decision. It is also highly criticized for promoting processes that “do not fulfil the functions of the participatory procedure in a democracy” (Hansson & Oughton, 2013, p. 339).

The second is the method-based evaluation. The majority of evaluation criteria and frameworks developed so far have often focused on showing that the method is efficient and works (Bogner, 2012), or to “check if a contractor meets
best practice guidelines, to demonstrate the quality of the process, or to defend its credibility and legitimacy” (Chilvers, 2013, p. 298). However, even if one follows the “best practice” guidelines, stakeholder engagement cannot be reduced to a mere technical or methodological exercise and cannot be separated from its purpose and context (Goven, 2006a; Jensen, 2005). Therefore, there is a need for a third type of evaluation: the context-based evaluation. This type of evaluation should look beyond methodology used, to focus on further questions, such as the following: How are basic democratic principles being respected, what are the relationships of power between the stakeholders involved, and how are decisions made about the framing of the issues to be discussed.

The evaluation framework developed by Rowe and Frewer (2000) has become almost a “standard tool” for evaluation of stakeholder engagement. This framework was the first attempt to bring together and systematize various characteristics of the engagement processes. It was, however, developed and used only for the evaluation of participatory methods; but are these criteria by themselves suitable for contextual evaluation of stakeholder engagement activities, when democratic legitimacy of such processes is also at issue? The framework is divided into acceptance criteria and process criteria. Acceptance criteria are the ones that would influence public acceptance of the outcome: representativeness, independence, early involvement, influence, and transparency. Process criteria evaluate efficiency of the engagement process: resource accessibility, task definition, structured decision making, and cost-effectiveness. In this article, we focus on the acceptance criteria, because they are the ones that reflect the democratic principles always in play but often neglected in the interests of greater efficiency.

The next sections present two different stakeholder involvement activities from the fields of nanotechnology and nuclear emergency preparedness. The cases were chosen primarily because the authors of the article were involved in at least one activity directly as participants and/or organizer. The two fields have some differences: one is a well-known controversial issue; the other is an emerging technology, but often neglected in the interests of greater efficiency.

The first stakeholder engagement activity evaluated here is a workshop organized by the EC-funded research project NanoRem (Taking Nanotechnological Remediation Processes from Lab Scale to End User Applications for the Restoration of a Clean Environment). This project focused on facilitating practical, safe, economic, and exploitable nanotechnology for in situ remediation of contaminated environments. The aim of the workshop was to

**Context and Description of Stakeholder Engagement Activities**

**Seminars on Nuclear Emergency Preparedness**

The nuclear industry has a long history of exemption from public scrutiny (Freudenburg, 2001). Stakeholder involvement became widely used in the nuclear industry during the 1990s, mainly over radioactive waste disposal plans, often with the aim of overcoming public opposition to the technology (Drew et al., 2003; Krüttel et al., 2010).

The first stakeholder engagement activity evaluated here was a series of two dialogue seminars on nuclear emergency preparedness. These seminars were organized in Rogaland County, Norway, in 2015 as a collaboration between the Norwegian Radiation Protection Authority, the office of the County Governor of Rogaland, and the Centre for Environmental Radioactivity (CERAD)\(^1\). The seminars were a part of a CERAD research project that looked at potential impacts from a hypothetical radiological accident at the Sellafield reprocessing plant (in the United Kingdom) on Norwegian territories and was also a part of the EC PREPARE\(^2\) project. The seminars involved a wider range of local, regional, and national actors than is traditional for such preparedness seminars (see Table 1) and was divided into two parts: Day 1, which was based on one-way information provision, and Days 2 and 3, which were structured to foster collaborative deliberation. Given the involvement of multiple organizers, there were several aims to the seminars (see Table 1). More detailed description of the methodology and the results of the seminars themselves can be found in Liland et al. (2017).

**Workshop on Sustainability of Nanoremediation**\(^3\)

Nanotechnology is an emerging technology that receives a large amount of funding due to its promise of innovation (Doubleday, 2007). There is an international drive to develop regulations and policies for the use of nanotechnologies, and public engagement processes are seen to be a crucial part of this development (Kyle & Dodds, 2009). A consensus is that the public should be involved in the deliberate discussions and assessments of nanotechnology, express their hopes and fears, issues, and concerns in order to avoid negative social response as in case of biotechnology (Doubleday, 2007; Rip, 2006). The assumption being, as with agricultural biotechnologies, that such concerns are false (Lyons & Whelan, 2010) and should be “corrected.”

Like agricultural biotechnologies, nanotechnology has been accused of being driven by premature commercialization of products (Goven, 2006a), for focusing on downstream consultation (Lyons & Whelan, 2010), and for “facilitating partnerships between frontrunners, entrepreneurs, and representing their elite/specialist knowledges, to the exclusion of many potentially affected actors in civil society and the wider public” (Chilvers & Longhurst, 2016, p. 8).

The second stakeholder engagement activity analyzed in this article is a workshop organized by the EC-funded research project NanoRem (Taking Nanotechnological Remediation Processes from Lab Scale to End User Applications for the Restoration of a Clean Environment). This project focused on facilitating practical, safe, economic, and exploitable nanotechnology for in situ remediation of contaminated environments. The aim of the workshop was to
build a cross-sectoral view of key sustainability issues, ethical concerns, and market development opportunities (Tomkiv, Bardos, Bartke, Bone, & Oughton, 2014). The workshop lasted 1.5 days and consisted of three sessions: generic sustainability discussion, discussion of sustainability based on a field trial example, and exploration of market opportunities. Some introductory presentations were given at the beginning of workshop, but it mainly consisted of group discussions in the World Café™ format. The workshop was organized and facilitated by the members of one of the working groups of the project, which was responsible for dissemination and dialogue with stakeholders. NanoRem project partners included not only research organizations but also industry and service providers. Therefore, half of the participants were project-related and represented different working groups of the project. The other half were invited external stakeholders (Table 1).

### Table 1. Details of the Stakeholder Engagement Activities.

<table>
<thead>
<tr>
<th>Name</th>
<th>Date</th>
<th>Aim</th>
<th>Number of participants</th>
<th>Type of participants</th>
<th>Context</th>
</tr>
</thead>
</table>
| **Stakeholder dialogues in Rogaland** | 26th and 27th of January and 10th of March 2015 | **County Governor:** To strengthen emergency preparedness system through increasing participants' knowledge  
**Radiation protection authority:** To involve regional and local stakeholders in development of emergency preparedness plans  
**Social scientists:** To demonstrate and measure value of collaborative deliberation with wider circle of stakeholders  
**Natural scientists:** To collect local site-specific information for adaptation and improvement of models and their predictive abilities | Day 1—62 | National, regional, and local authorities, representatives of industry, agriculture, farming, fishing, aquaculture, recreation, NGOs, and researchers | Nuclear and radiological emergency preparedness seminar co-organized by research project and authorities |
| **NanoRem Sustainability and Markets Workshop** | 3rd and 4th of December 2014 | To build a cross-sectorial view of key sustainability issues and ethical concerns as well as market development opportunities in the medium to longer term related to nanoremediation across a range of stakeholder opinions | 36 | Regulators, contractors, remediation consultants, social scientists, and project representatives | A part of stakeholder dialogue activities of a work package within an EU project |

### Results of the Evaluation and Discussion

When Rowe and Frewer (2000) proposed their evaluation framework, they used the criteria to evaluate different generic methods for public participation. This article applied the evaluation criteria to actual cases to examine whether they are sufficient to address the quality of a concrete stakeholder engagement activity.

The stakeholder engagement activities analyzed in this article were different in topic, context, and participant composition. Both of the activities were considered to be successful by the organizers. However, can they be considered successful from a stakeholder engagement point of view?

#### Representativeness

According to the criteria of representativeness, participants should represent the broadest possible sample of the affected population and take account of the relative distribution of different viewpoints. This could be achieved by selecting a random stratification sample of the population. The importance of representativeness is often questioned in the literature, and critics state that representativeness is not equally important in all cases and is context specific (Wynne, 2007). The original criteria mention that methodological representativeness is more important if one wants to collect views of general public (e.g., by questionnaire) than in other situations, although it will in any case influence the credibility of the process.

Nuclear preparedness seminars in Norway usually involve only national and regional authorities. The seminars in Rogaland went beyond the traditional setup and gathered a much wider variety of participants including local...
representatives, also those who would not typically be involved in decision making in nuclear preparedness. The general public was not involved, but most participants could be defined as people that could possibly be affected by radioactive fallout from an accident and its resulting mitigating actions. Although participants at the event suggested that other stakeholders could have been involved to broaden the discussion (e.g., school teachers), the event achieved a quite broad representativeness. The organization of the nanoremediation workshop, on the other hand, raised more criticism.

The nanoremediation workshop had the advantage of including actors who were directly involved in nanoremediation, but lacked representation from lay participants. The justification was that the project wanted to collect opinions from land managers, consultants, technology contractors, planners, and regulators—those somehow involved in remediation. Almost half of the participants were project-related, which included, for instance, producers of the nanoparticles used for remediation. Besides these, few, if any, participants in this workshop could be defined as people that would be directly affected by prospective nanoremediation activities.

Expert workshops are a valid approach, particularly for cases exploring differences between expert opinions (Oughton & Strand, 2004), and a lack of lay participants could be easily justified. However, during one of the exercises at the workshop, the participants were given a list of roles as local stakeholders and were asked to perform an assessment of nanoremediation versus other remediation technologies at one of the projects’ test sites from the point of view of the local stakeholders listed (Tomkiv et al., 2014). While this might have been a useful exercise in evaluating what experts assume the public’s concerns are, it also highlights the problem of not including, or even asking in some other setting, the actual local stakeholders’ opinions regarding remediation of their local site. The case is interesting as an illustration of a wider phenomenon of “folk theories” in nanotechnology, namely, nanotechnologists operating under their own view of what they think public concerns are (Rip, 2006). However useful such an exercise is in terms of putting experts in someone else’s shoes and pushing them to think differently, in the absence of actual lay public, those “imagined concerns” remain uncontested. They get recorded and reported as the “views of the stakeholders” and contribute to creation of the mythological public concerns (Marris, Wynne, Simmons, & Weldon, 2001). Several times during the workshop, expert participants stressed the importance of public concerns about nanotechnology. However, public concerns were taken to be a generic mistrust of nano, and calls from some of the participants for a more nuanced view of what exactly the public were concerned about and why were largely overlooked or thought to be irrelevant. For instance, some participants cited a negative influence of science fiction representation of nanotechnology on the public’s perception, but were not able to provide reference to any evidence of science fiction inducing a negative image of nanotechnology. Such cases of conjuring “imaginative publics” can be observed in other spheres too, like synthetic biology (Marris, 2015). Another common issue here is when social scientists participating in the involvement activity are assumed to represent the public (Calvert & Martin, 2009), while the voices of the lay people are excluded.

The nanoremediation workshop was good in representing different experts, but at the exclusion of the opinions of those likely to be affected. Given the above, rather than the criteria of representativeness, in its sense of attempting to procure the presence of a spokesperson for each of the perceived stakeholder groups, it seems more important to focus on inclusiveness. Inclusiveness puts weight on ensuring a diversity of concerns and opinion across stakeholders, taking care to include groups that are often excluded, and stimulating reflection on the way in which different parties may be affected. It is also included as a dimension of the framework for responsible innovation (Stilgoe, Owen, & Macnaghten, 2013), which has inter alia been taken up in the European Union’s 70 billion Euro Horizon 2020 (2014-2020) R&D program.

**Independence**

In order to be seen as independent according to the original criteria, the participation process should be conducted in an unbiased way: facilitators of the process and the public representatives should both be (and be seen as) independent from the sponsoring body.

From the beginning, the participants in the emergency preparedness seminars were informed that they were organized (and sponsored) in collaboration between authorities and researchers. Given the topic of the seminars, a strong link to the authorities responsible for emergency preparedness was logical, but it was stated that the radiation protection authority and the county governor office were participating as stakeholders, just like other participants. The facilitators in the group discussions were researchers connected either to the research center or to the radiation protection authority, but with a clear role to facilitate discussions among stakeholders and not participate themselves. Although the independence criteria was not strictly met, the combined organization and sponsoring by both researchers and authorities ensured that there was no one particular sponsor/organizer framing the workshop or limiting the issues discussed. Also, the seminars were focused on discussing challenges related to a hypothetical accident. Had the seminar been part of an actual decision-making process following the nuclear accident, the role of authorities could have influenced the legitimacy of the process in the public’s eyes.
The nanoremediation workshop was part of a research project and did not have any industrial sponsor. Almost half of the nanoremediation workshop participants were project related. Although they could be defined as stakeholders in this case, their interest (and possibly dependence) on results (or success) of the project could be interpreted as a conflict of interests. The possible conflict of interest should have been acknowledged and reflected on by both participants themselves and those who organized the event. However, even when this issue was raised by one of the participants with a social science background, it was discarded as nonexistent, or at most not relevant.

Because of the possible conflict of interest, this stakeholder activity could be perceived as pro-nanotechnology, thus having a bias. Consistent with the research-funding aims of the European Commission R&D programs, the project positions itself as “a major initiative, which supports the effective deployment of nanoremediation technologies in Europe” (Bardos, Bartke, Harries, & Limasset, 2015, p. 2) and could, therefore, be seen as promoting nanoremediation and, thus, aiming to overcome existing concerns about it.

The question of how and why participants are selected is as important as who was participating. Participants of the seminars on emergency preparedness were invited through emails to individuals or organization. Some of them were already known by the organizers through previous involvement activities, but the seminars were open to anyone from the invited organization, who showed interest. One of the organizers from regional level used their networks to inspire participation from both regional and local actors. The majority of external experts in the nanoremediation workshop were either already part of the project’s network or were acquainted with workshop organizers. In both cases, such invited participation introduces possible bias in participant selection. The basis for such selection is often due to purely practical reasons, as it is not easy to get people to participate in the various activities. At the same time it opens up for selection of those who are considered reasonable with the exclusion of those with extreme views (Irwin, 2006; Ureta, 2016). It also supports a closing-down approach, when selected experts are chosen to represent a particular mix of disciplines and perspectives (Stirling, 2008).

The above-mentioned issues of conflict of interest and bias in selection of participants could have a negative impact on the perceived independence of stakeholder engagement activity. Additionally, the framing of issues plays an important role in the perceived independence of the process, even if the representatives and facilitators are deemed to be independent from the sponsoring body or contractor. If a sponsoring body has imposed a rigid framing of the discussions and pre-identified the issues to be discussed, to the extent of dismissing any alternative framings, the process will not appear (and would not be, in fact) independent even if organized by an external party.

Early Involvement

Criteria of early involvement states that the public should be involved as early as reasonably practical, when value judgements are needed. However, as too much involvement of all standpoints can be confusing, appropriate timing is needed for the involvement in each stage. Also, “public debate should be allowed on underlying assumptions and agenda-setting and not just on narrow, predefined problems” (Rowe & Frewer, 2000, p. 14).

None of the stakeholder involvement activities presented here were part of an actual decision-making process. Therefore, it is difficult to assess whether involvement of stakeholders was early enough.

The emergency preparedness seminars endeavored to involve stakeholders in Rogaland to prepare for a possible nuclear accident with radioactive fallout in the future. As an incentive for the county to be able to cope with a possible future accident, this seminar was organized early enough. However, in the broader context of nuclear emergency preparedness in Norway, the question of timing is harder to pinpoint. A Norwegian nuclear emergency committee has existed for more than two decades, but this was the first time that local stakeholders were involved in such an event. Discussions during the seminar highlighted many relevant issues for the regional and local emergency preparedness in Norway. Participants pointed to an uncertainty about the roles and responsibilities of various actors in emergency response, and the need for more seminars like this both in Rogaland and in other areas of Norway. At the same time, emergency preparedness and response arrangements need to develop in line with societal changes and changes in nuclear threat assessments so it is legitimate to ask whether early involvement is enough or if regular involvement should be the criterion for this specific topic.

As part of the research project, the seminars were initiated by the social scientists with a plan to discuss the societal impacts of radioactive contamination and public concerns related to it. However, organizing a meeting to simply map public concerns was not considered sufficient to justify funding by the project managers. The latter were eager to show their assessment capabilities and establish connection with local people in order to get their support in organizing fieldworks in the region and for getting access to specific local data (CERAD Annual Report 2015, p. 41). The results of those fieldworks would then be used to improve prediction capabilities of the risk assessment models. Therefore, the seminars had to be postponed until there was sufficient technical data available in order to perform a hypothetical scenario, which would serve as a base for discussions. There was no mechanism by which the project leaders would adjust research priorities based on the feedback from seminars.

The NanoRem workshop was the second in a series of planned workshops and was scheduled in the middle of the project. Timing was early enough, so the outcomes...
still could have been used to adjust research priorities, plans, goals, and so on (despite not being the aim of the stakeholder involvement activity). However, some of the participants commented that due to the many existing uncertainties related to the use of nanotechnology for the remediation, the workshop should have been organized later in the project. An opposing view was that one did not need to know all the technical details in order to explore issues of sustainability of nanotechnology. Those participants noted that one should rather have explored the appropriateness of discussions on sustainability in relation to remediation technology. Therefore, while it is hard to conclude that the involvement was not too late, it did seem that some of the issues could have been addressed earlier. It would have probably been beneficial for the project and workshop if the involvement process had been structured in several stages, possibly with different actors at each stage to give a chance for prior input.

There is an overall concern with public engagement being disconnected from policy-making processes (Bogner, 2012; Lyons & Whelan, 2010). Both the nuclear preparedness seminar and the nanotechnology workshop were set up to at least partially benefit the research and neither of them were a part of a deliberate policy making or decision making. However, both activities discussed relevant topics for policy making and, thus, procedures for taking aboard the feedback should have been in place. Therefore, rather than focus on the timing of engagement, any stakeholder engagement process should allow for flexibility to address the issues that will come up during its course.

**Influence**

The criteria of influence states that public involvement should have a genuine impact on the policy and not be used as simple legitimization of the decision or as consultancy.

There were several aims to the seminars in emergency preparedness (Table 1), but decision making or policy making was not one of them. The initial intention was that feedback from the stakeholders could be used to improve the regional and local response plans for dealing with nuclear and radiological emergencies. Results of the seminars were reported to the PREPARE project and, together with the results from other countries, contributed to a set of recommendations for the use of national stakeholder panels in nuclear emergency preparedness (Charron et al., 2016; PREPARE, 2015). However, no evaluation of the quality of the different activities and methods used in each country was performed. There was also no investigation of whether and how national outcomes of the panels were implemented in the different countries.

The outcomes of the NanoRem workshop were used to frame sustainability assessments for the trial site of the project. The session discussing market opportunities of nanoremediation was a part of a broader scenario development process and the feedback generated during the workshop was used for this scenario development. Hence, one might argue that the outcomes influenced future decisions.

Stakeholder activities that are organized by research project are often not connected to a particular decision or policy, making it hard to fulfil the original criteria of influence. They are often criticized for being structured as “lab experiments,” which proceed under controlled conditions and are organized by professionals (Bogner, 2012). However, there are other ways for participants to execute influence. For instance, they could (and should) influence the framing of the engagement activities and topics to be discussed and contribute to formulation of research agenda and priorities.

As mentioned before, the natural scientists among the organizers of the emergency preparedness seminars did not plan to let discussions influence the formulation of the research agenda or research priorities (see also the discussions in Accountability and Learning). The original NanoRem proposal had suggested that stakeholder involvement could influence the research, but there was no recognition of the value of this by the project leaders. The nanoremediation workshop was reported by the project managers as a successful stakeholder engagement activity and the issues raised in the course of discussions were largely presented as already confirming the research aims of the projects.

With regard to framing, participants of the emergency preparedness seminars could to a certain degree influence the agenda of the event as they chose which topics would be addressed during the second seminar. They were also given a “home reflection” between the two parts of the seminar to think about the challenges their sector would face following a nuclear emergency and how they would tackle it. The purpose of this was to foster cooperation on preparedness plans within the sectors themselves and encourage participants to influence that. This was not successful as only the agricultural sector completed the exercise. The reason was probably lack of time or engagement from the participants in the other sectors.

During the nanoremediation workshop, the discussion on sustainability was introduced with a presentation on “The concept of sustainable remediation being applied in NanoRem” (Tomkiv et al., 2014, p. 5). It assumed nanotechnology to be acceptable and discussed how to make it publicly and regulatory successful and able to compete with other remediation technologies. Other questions, like reasonability of the existence of such technology, were not discussed. The same thing happened with regard to the question of whether one can talk about sustainability of nanoremediation, if this would imply a continuous source of pollution. In other words, would the successful development of remediation technologies mean that one could then justify further contamination of the environment? When some participants raised those questions in the discussion, organizers claimed them to be irrelevant. The social scientists in the organizing group also had to fight to ensure that those questions were
noted in the final report. It is a paradox that even a research project workshop involved a quite closed commitment to a pre-framed issue, with not much openness to alternative framings. Bogner (2012) described it as “expertization” of the process, when alternative approaches are not critically examined or refuted, but just not seen as relevant. This results in lay people judgements becoming a copy of expert judgements in the end of the day. This brings back another issue of representation—it is not only about whether those who were participating are representative of the society, but whether issues discussed and highlighted are representative for societal views (Wynne, 2007). Framing influences outcome!

The evaluation of the two stakeholder activities according to the criteria of influence demonstrated a general lack of influence. If the issues for discussion are already pre-framed and limits are established, this will undermine both independence and influence.

**Transparency**

In order for stakeholder involvement activity to fulfil the criteria of transparency, publics should be able to see what is going on and how decisions are being made, including issues like the reasoning behind the choice of participants.

It can be hard to get sufficient participants for large stakeholder seminars, especially if one aims to gather representatives from many various sectors. Although the emergency preparedness seminars were not open to the wider public and there was a predefined list of organizations to invite, the organizers were open to suggestions from initial invitees for other participants. A local press representative was welcomed when he showed interest in participating.

In the invitation phase and during the emergency preparedness seminar, participants were informed about the aims of the seminars. However, organizers received some critique at the end of the seminars because the participants would have liked to see more concrete aims and tasks, for instance, contributing to emergency plans and information material. The seminars were open about objectives and processes beforehand, but less transparent with respect to the outcomes. The participants received very little information about what was going to happen with the feedback generated in the discussions. No explanation was given on how the data about what was going to happen with the feedback generated comes. The participants received very little information beforehand, but less transparent with respect to the outcomes, contributing to emergency plans and information material.

The seminars were open about objectives and processes beforehand, but less transparent with respect to the outcomes. The participants received very little information about what was going to happen with the feedback generated in the discussions. No explanation was given on how the data generated from questionnaires were going to be analyzed, other than guaranteeing anonymity. No minutes or report were shared with the participants after the seminars, even if the results were reported to the research projects, and one journal article about the results of the questionnaire was published (Liland et al., 2017).

The nanoremediation workshop did produce a report; a draft of this was sent to all participants twice in the course of preparation and their comments were incorporated into the text. This workshop was less clear about objectives and processes upfront, but more transparent regarding the outcome.

Stakeholders who take part in involvement activities need to know the purpose of the engagement process. When it becomes a mere exercise, and the people participating in the process realize that they have no possibility to affect anything, it could have a negative impact for the future of stakeholder involvement, in particular, if the same stakeholders are to be invited again.

It is also important to consider how the results of stakeholder involvement are presented to the wider audience. It is acceptable to have an expert workshop rather than include wider public, but it should be presented this way to begin with. Also, one has to be cautious when drawing conclusions from the results of stakeholder activity. In the aftermath of the nanoremediation workshop, some conclusions from the regulatory perspective on the development of the technology were generalized to a European Union level, although only few participants from regulatory body were present there.

**Accountability and Learning**

Accountability and learning are not criteria addressed in the original framework by Rowe and Frewer (2000), but we consider these aspects to be very important and necessary for evaluation. The essence of stakeholder engagement is mutual learning for both sides: those participating and those sponsoring. However, both activities had a lot of focus on the expert knowledge.

The workshop on nanoremediation was scheduled in the middle of the project, so some of the results could be presented. It consisted of mostly natural scientists and technical experts. The workshop aimed to explore complex issues like sustainability and ethics, but those complicated concerns were reduced to technical issues. This type of involvement could be characterized as an “evidence gathering exercise” (Chilvers, 2013), since it did not include any reflective learning. Only a few social scientists participated and there was a clear conflict of understanding between them and more technical experts, when it came to the issues that were being addressed and discussed. As mentioned on several occasions earlier in the article, some of the questions and concerns raised by predominantly social scientists were deemed as irrelevant by the organizers and excluded from further discussion. This highlights the need for accountability of all views and opinions, not just those that match the views of organizers.

For the nuclear emergency preparedness seminars, the natural scientists thought it very important that discussions were based on the hypothetical scenario and that they were there to answer technical questions. They did not show any interest in including the stakeholders and their concerns into the scenario assessments. Feedback from participants, on the other hand, revealed that regional and national authorities clearly saw the added value of discussing nuclear response issues with a large group of stakeholders.

The value of stakeholder involvement is viewed differently by natural and social sciences. Both cases resulted in
Expanding the Criteria for Context-Based Evaluation

In this article, we analyzed two stakeholder involvement activities using the criteria developed for quality evaluation of participatory methods developed by Rowe and Frewer (2000). This evaluation framework is a good tool for systematic comparison of the different methods. But following the critical commentaries of STS scholars (Goven, 2006a, 2006b), more substantial questions than purely methodological ones come to the fore. Those critiques open up important questions that go beyond the self-referential methodological concerns of the social sciences. These methodological questions cannot address the far more challenging democratic issues of the quality of stand-alone stakeholder engagement processes, even though they are often equated. Use of these criteria alone imply that evaluation of such engagement processes is itself purely a scholarly exercise, when it is also in important part, itself political. More recent literature on engagement has attempted to address this further agenda (Chilvers & Kearnes, 2016) as has the work on RRI (Responsible Research and Innovation in Europe; Stilgoe et al., 2013), which stresses inter alia the qualities of inclusiveness and responsiveness. It has to be recognized, however, that this more politically oriented research and policy agenda remains as-yet embryonic.

Our analysis has highlighted some general limitations on both the engagement exercises and the methodological criteria. The latter are too focused on the acceptance of the outcome and evaluation of efficiency of the process. We argue that quality of stakeholder involvement should focus on the acceptance of the whole process rather than only outcomes. Moreover, as Wynne has argued in a critique of a social scientific evaluation of the ambitious 2002-2004 UK GM Nation? engagement exercise, the obsession with representativeness, and capturing in such terms a silent, disengaged public, may be misconceived, if previously routine forms of governance have been deeply exclusive (Wynne, 2007). One would first need to bring advisory or decision-making cultures to public account by requiring them to address new questions, including their own assumptions. Correspondingly, we also insist that one cannot isolate stakeholder involvement from the wider political and political-economic context in which they are held. Therefore, we would like to highlight the principles for good stakeholder engagement and propose to extend the evaluation criteria to address the above-mentioned limitations. Given that the purposes of evaluation itself may legitimately be policy oriented as much as scholarly, this must mean that such evaluation can never be final, or singular. It is, after all, ultimately standing in for, or helping to structure, domains of democratic politics.

As noted above, representativeness in terms of having a representative from each part of population is not necessarily equally important in all cases. Instead, we propose to shift focus to inclusiveness of voices, opinions, and groups that are usually excluded. We also stress the need for inclusive deliberation when framing issues and questions, which usually occurs at an exclusionary upstream phase.

The timing of stakeholder involvement seems to be a major focus of early involvement. We suggest that “an early involvement” should be focused more on the continuity and interactivity in relations involved. As ideal continuity of involvement might not always be achievable, due to the limitations in resources, involvement could be organized in several stages and give some possibilities for prior input. But this specific problem, it should be remembered, only arises because of the democratic deficits that exist as the context of any deliberate engagement process. Given the intensifying political-economic anxieties about global competitiveness and about subjecting more and more dimensions of social life to market relations only, these democratic deficit starting points for any engagement process are unlikely to be alleviated in the near future. However, they should at least be acknowledged and perhaps for any given domain, critically analyzed, as the starting point for both engagement design and also for evaluation.

Another issue related to the temporal aspect of involvement is flexibility. The involvement process should be open to accommodation of new issues, or new needs for research, which might arise from hitherto unrecognized stakeholders. Again, there are key questions here concerning the democratic and political-economic context for any specific public or other stakeholder engagement process.

The criterion of influence focuses on a genuine impact of output on policy. Stakeholder involvement is often neither part of the policy making, nor is it in the power of the proponents of the process to influence that. Therefore, when evaluating influence of stakeholder involvement process, we should pay more attention to the framing of issues and possibilities stakeholder had to influence the framing and choice of issues. It is important that stakeholders are...
enabled to question the underlying assumptions of the stakeholder involvement process’s proponents. Framing is mentioned in Rowe and Frewer’s (2000) framework under the criterion of early involvement, but it does not come across at all strongly enough. In our view, reflecting a longstanding current of STS and related research, this issue is of central importance and, therefore, should be addressed together with assessment of influence. Reflection on who frames the given issues, and whether alternative framings were considered (and if rejected, why?), should be also included in the evaluation of independence. This was seen to be fundamental for the two case studies.

Existing criteria on transparency have too much focus on how the process is conducted; less on why and in what context. One should be open about the purposes, aims of the process, and any confusions or ambiguities in these, and be very clear about who will benefit from that particular stakeholder involvement activity. This is especially relevant when stakeholder engagement is a part of a predefined research project—even more reason to be clear and honest about the purposes.

Yet another aspect that we chose to highlight as a possible criterion on its own is accountability and learning. Too many involvement activities focus on educating stakeholders about various issues of the project, but the essence of stakeholder involvement is mutual learning for all the participants, including organizers and sponsors. Any concerns or issues that originate during an engagement activity should be recorded and responded to, not ignored or refuted. If this generates contestation and dispute, this can be taken in a constructive and mutual learning direction, rather than the typical presumption that established views are prima facie legitimate, and dissenting views therefore unworthy of respect.

Conclusion

The general increase of broader public and other more specific stakeholder engagement in what have previously been closed processes of expert deliberation, has, at least partially, opened up those issues (Stirling, 2008). While it is difficult to argue that this is not a positive development that contributes to informed democratic policy making, one needs to be careful to not exaggerate how well this is going. If no attention is paid to the quality of public participation, in particular, how the democratic values are respected and ensured in any involvement process, stakeholder involvement might be reduced to managerialism and become just another bureaucratic exercise. Recognizing—and acting upon—the need to take hitherto excluded public voices into account is a positive development. However, letting the public speak—and question—for themselves as far as this is possible, is a continuous, inherently relational, and emergent process.

To conclude, there is a need for a more critical and reflective contextual evaluation of stakeholder engagement. This requires not only an evaluation of the criteria themselves but also consideration of how to ensure that they are addressed in engagement processes.

Despite us, as organizers, being aware of criteria for assessing the quality of stakeholder engagement, and reflecting upon these before the two events, the resulting engagement activities had a hard time meeting those criteria. This was largely because the sponsors and contractors showed little appreciation of why these criteria should be followed. Perhaps the quality of stakeholder engagement would be improved if both sponsors and organizers of research projects that were planning to, or already engaging, with stakeholders knew that they would undergo a formal independent evaluation of how the democratic criteria were followed.

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Notes

1. See http://cerad.nmbu.no
2. PREPARE (Innovative integrated tools and platforms for radiological emergency preparedness and post-accident response in Europe). The latter project had a research activity dedicated to the use of stakeholder panels in 10 European countries to contribute to the development of strategies, guidance, and tools for the management of contaminated products after nuclear accidents (PREPARE, 2015).
3. Nanoremediation involves the use of nanoparticles to degrade a wide range of environmental contaminants on site (meaning leaving the remediated soil and groundwater in place as opposed to excavating contaminated soil/groundwater and treating it off-site).
4. Participants were divided into four sectors: County Governor office/Municipalities, Fishery/Aquaculture, Agriculture, and Outdoor Life/Recreation.
5. Only in the autumn of 2018 did participants of the emergency preparedness seminars receive a summary of the published paper in Norwegian and a link to where they could download the article if interested.

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