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Enhancing Stakeholder Participation in the Governance of Radiological Risks

Findings and recommendations from the ENGAGE project
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**STAKEHOLDER ENGAGEMENT IN RADIOLOGICAL PROTECTION RECOMMENDATIONS FROM THE ENGAGE PROJECT**

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**Medical exposures**

1 Engage initiatives to develop and promote radiological protection culture for the health professionals who are not directly involved in medical procedure using ionizing radiations but may be occupationally exposed and/or interact with patients.

2 Integrate or reinforce radiological protection culture as part of medical practices for the medical professionals who are directly involved in medical procedures using ionizing radiations.

3 Create spaces and tools for patient engagement in the medical use of ionising radiations.

These recommendations were developed on the basis of research conducted in the ENGAGE project and feedback from a wide range of stakeholders, notably during roundtables and stakeholder workshops (Athens, 13-15 February 2019; Bratislava, 11-13 September 2019). ENGAGE is part of CONCERT. This project has received funding from the EURATOM research and training programme 2014-2018 under grant agreement No 662287.

ENGAGE investigated participation prescriptions and practices. The objectives were to: i) Clarify why, when and how stakeholders are engaged in radiological protection; ii) Develop novel approaches to analysing stakeholder interaction and engagement; iii) Investigate processes for enhancing radiological protection culture and their role in facilitating stakeholder engagement; iv) Develop guidelines for meeting the challenges identified and build a knowledge base for stakeholder engagement in radiological protection.

[www.engage-concert.eu](http://www.engage-concert.eu)
Introduction

STAKEHOLDER ENGAGEMENT has become a key topic in the governance of radiological risks.

Alongside legal requirements, generic guidelines and recommendations for stakeholder engagement have been elaborated by researchers, practitioners, radiological protection policy makers, civil society organisations and citizens. These seek to engage wider publics in the context of specific exposure situations, recognise governance challenges and opportunities, and suggest potential approaches to do so (e.g. Nisbet et al 2005; HERCA 2008; IRPA 2008; CIP 2009; IAEA 2014; OECD 2015; NTW 2015; SAFECAST 2016, pp. 12; Baudé et al 2016; NERIS TP 2016; PREPARE 2016).

These developments reflect the increased recognition of, and demand for, stakeholder engagement in radiological protection decision-making, from both policy-makers and experts, as well as civil society organisations and potentially affected publics.

However, there are multiple challenges in the practical implementation of policy and legal requirements. For instance, there are divergences on what the outcome of participation should be, or how to ensure resources for sustainable engagement. Moreover, in both research and practice, considerably more attention has been given to “invited participation”, initiated by governmental actors or research institutions, rather than to other forms of bottom-up or citizen-led engagement (Wynne, 2007).

THE EUROPEAN PROJECT ENGAGE, funded under H2020 CONCERT, investigated which formal or informal demands and expectations for stakeholder engagement exist, and how these are translated into practices at national and local levels. It highlighted what the standing challenges are, and suggested which new research and development avenues might be pursued to address these challenges.

ENGAGE compared and contrasted three contexts of exposure to ionising radiation: i) nuclear emergency preparedness, response and recovery; ii) exposure to indoor radon; and iii) medical exposures to ionising radiation.

The project took into account that invited participation by institutional actors is only one part of a more complex relational system. This includes also other forms of engagement, such as citizen-led initiatives.

"ENGAGE investigated participation prescriptions and practices"

The objectives of ENGAGE were to:

- Clarify why, when and how stakeholders are engaged in radiological protection;
- Develop novel approaches to analysing stakeholder interaction and engagement;
- Investigate processes for enhancing radiological protection culture and their role in facilitating stakeholder engagement;
- Develop guidelines for meeting the challenges identified and build a knowledge base for stakeholder engagement in radiological protection.
Reader’s guide

**The Objectives** of this report are to summarise the main findings from the ENGAGE project, to propose a number of recommendations and to formulate perspectives for future developments. These results are presented for each of the three exposure contexts considered in the project.

To set the scene, this document contains introductory sections on stakeholder engagement concepts and the focus points for analysis.

**Recommendations** capture key points identified through case studies and through interactions with various representatives of radiological protection communities during roundtables and workshops.

- **Recommendations should be seen as complementary, and used as such, as they relate to inter-connected aspects.**

Recommendations reflect a synthesis of findings, across all case studies and are therefore of a more general nature.

- **Examples are used to illustrate some aspects of the recommendations.**


**The main audience** for this document are the radiological protection communities, in general, and the policy makers, researchers and practitioners involved in the three exposure contexts addressed by ENGAGE, more specifically.

**Throughout this report,** the term “institutional actors” is used to denote governmental actors (e.g. radiation safety authorities or crisis management organisations), and other organisations with a governmental mandate to manage radiological risks in the exposure situations considered.

The project considered both formal and informal stakeholder engagement. “Formal” engagement is organized along the lines of policy prescriptions, whereas “informal” refers to those forms of engagement which come into existence in their own way, independent of such prescriptions or requirements. Furthermore, the project took into account that invited participation by institutional actors is only one part of a more complex “ecology of participation”, alongside citizen-led initiatives (Chilvers and Kearnes, 2016).

We believe that the document may inform research, policy and practice towards more robust stakeholder engagement and improved radiological protection.
Stakeholder engagement: setting the scene

STAKEHOLDER ENGAGEMENT is conceptually framed within, and stems from theories and practices on, stakeholder participation. Participation was conceptualized in the 1960s during a time influenced by the powerlessness of the “have-nots”, i.e. those that were excluded from democratic decision-making processes (Arnstein, 1969).

Particularly as public concerns over new technologies amounted in the 1960s-1970s, new social and civil rights movements demanded a say in technological decision making. These social movements, as well as sociologists of science, pointed out the necessity of broadening the spectrum of actors in technological decision making (Palm & Hansson, 2006). Many of these actors also invoked science participation on a commitment to democratize science and technology culture, based on the right for all affected parties to have a say in decisions that could affect them (Cass, 2008: 6).

In the 1980s and 1990s a first link was made with development and sustainability; this resulted in an institutionalization of participation. Environmental Protection Agencies in many countries placed citizen involvement high on the agenda of their current programmes. This resulted in a move towards social participation, citizen participation and participatory methods. In the 20th century a shift can be noted from conceptualizations to methodologies, placing more importance on how participation should be done, rather than why ( Abelshausen et al., 2015).

Concerning THE CONCEPT OF STAKEHOLDER, little to no consensus exists. More specifically, there is no consensus on “who” has a stake. For instance, an ecocentric perspective argues that the environment (animals, plants, air) should be considered as a stakeholder in itself, whereas an anthropocentric perspective would limit itself to human stakeholders, and argue that environmental damage should be prevented due to the danger it may pose to current or future generations. Furthermore, the question is raised of “what” is at stake as well. This lack of consensus in what a stakeholder is, is however also an asset as it leads to in-depth discussions on why, who and how stakeholders should, can and will be involved in decision making processes (Miles, 2012).

ENGAGE ADOPTED A BROAD UNDERSTANDING OF STAKEHOLDERS as: actors (individuals or groups, institutional and non-institutional) with a tangible or intangible (yet to be shaped or discerned) interest in the radiation exposure situation and the related radiological protection issues. These may be affecting decisions, be affected by the formulation and resolution of a problem or challenge, or represent an affected party (humans or the environment). In this perspective, stakeholders are constructed in interaction with actors, issues, contexts.

VARIOUS MODELS OF PARTICIPATION exist. Throughout the last decades these models have evolved from hierarchical models to models wherein each type of participation has its own merit. For example, in the often referenced ladder of participation developed by Arnstein (1969), “informing” is considered as a tokenism of participation that should not be strived for. The ladder of participation argues that the end-goal of participation is the achievement of citizen control, while the other steps in the ladder are a means to this specific end.

Other models adopt a more horizontal approach to participation, wherein each type may have its own merit depending on the context in which it is used. For instance, Health Canada’s Public Involvement model (Health Canada, 2000) describes the continuum of public involvement by means of five,
partially overlapping levels: providing information, gathering information, discussing, engaging, partnering.

Recognising the plurality of engagement concepts and the continuum between institutional and citizen-led participation, lower and higher levels of involvement and influence on agenda-setting and decision making, ENGAGE did not adopt a predefined definition of engagement. Instead, it traced the meanings, prescriptions and practices for “engagement” in the three exposure contexts considered, and discerned the participatory practices associated (or not) with these prescriptions.

No a priori value judgement is thus made within ENGAGE on which type of participation is considered more valuable or better than another; the various forms may be applicable in different contexts and used complementarily. In most participation models “engagement” refers however to levels of involvement that can have a real impact on decisions.

Given the complexity inherent to the issue of stakeholder participation, the ENGAGE project has tried to maintain an open and broad view on what stakeholders and stakeholder engagement are and could be. ENGAGE directs for example attention to both “FORMAL” AND “INFORMAL” stakeholder engagement. “Formal” refers to those forms of engagement organized along the lines of policy prescriptions. “Informal” refers to those forms of engagement which come into existence in a more bottom-up manner, independent of such prescriptions or requirements (Hassenforder et al., 2018). In formal engagement, requirements and guidelines set the impetus to initiate participation, and define the frames in which participation takes place. Informal participation instead entails self-organizing initiatives, along the frames set by the involved stakeholders. In this sense, the distinction formal/informal partially runs along the lines of “invited” versus “uninvited” public participation as described by Wynne (2007). Uninvited public participation refers to the ways in which “citizens independently mobilize themselves, according to their own concerns, meanings, resources and issues” (Wynne, 2007, p104). An example of “informal” participation can be found in grassroots citizen-science initiatives.

ENGAGE also recognizes that engagement can be motivated by different rationales, and explored the various -existing or aimed for- rationales for engagement in radiological protection.

RATIONALES FOR ENGAGEMENT include substantive, instrumental and normative motivations (Stirling, 2008). A substantive motivation highlights the improvement of decisions, policies, and assessments by including as many viewpoints as possible. An instrumental motivation has the intent to support preconceived, often short-term policy commitments (e.g. educating citizens about science). Finally, a normative or democratic motivation encompasses the rationale that participation is the morally right thing to do.

ENGAGE recognised that participation is not merely a right that can be executed by stakeholders. It is a reality that occurs in different forms (e.g. active participation, passive participation, non-participation) depending on the participatory process and the restrictions, assumptions, and expectations involved (Turnhout 2010).

Stakeholder participation should also not be considered as a mere tool for decision making processes, but as an intrinsic aspect of these processes.

“Stakeholder participation should be considered as an intrinsic part of decision-making.”

Finally, stakeholder participation does not know a “one-size-fits-all” solution. There is no “fit-for-purpose” solution and stakeholder participation depends on the context in which it occurs.

“Stakeholder participation does not know a “one-size-fits-all” solution.”
Radiological protection Culture

**Radiological Protection Culture** is a still evolving concept. It is a concept of composite nature, characterized by a set of perceptions, values, attitudes, beliefs and expectations related to radiation risk; an assembly of knowledge, know-how, skills, experience, and practices related to radiological protection (RP); and a dynamic building process based on multi-stakeholder interactions.

From a general point of view, radiological protection culture should:

- favour the understanding of radiological protection norms and standards;
- enable individuals, where relevant:
  - to reflect on their own protection and/or that of other individuals;
  - to consider consciously radiological protection aspects in their activities or decisions;
  - to participate and contribute to decision-making processes related to the management of radiological exposure situations.
- enable professionals in radiological protection and other stakeholders to participate in a dialogue, to share a common language, with a view to enhance decision-making processes associated with the implementation of the radiological protection system and to answer the concerns of all stakeholders.

For wider publics an important question is how citizens exposed to ionising radiation risks can become aware of the choices they have, the potential outcomes of these choices, and how they can include their personal values in decisions concerning radiological protection. In this perspective, mutual recognition between stakeholders and informed decision-making are crucial to the development of robust radiological protection actions and culture, and the proper implementation of the justification and optimisation principles.

Radiological protection culture is a key element to foster the engagement of stakeholders in decision-making processes associated with the management of radiological risks. In such processes, RP culture is necessary for a mutual understanding of what is at stake in the management of the exposure situation and for the elaboration of relevant protection action plans. Furthermore, engagement processes usually favour a co-construction of RP culture, as the participation of various actors, including RP experts and non-experts, encourages the sharing of views, knowledge and concerns and allows to elaborate decisions combining science, expertise and practical experience.

The development of radiological protection culture is needed at different levels: at the level of individuals (i.e. resulting in individual knowledge and behaviour regarding radiological protection) as well as within groups or organisations (i.e. resulting in organisational structures and management actions favouring radiological protection). It requires a certain level of knowledge on radiation risk and protective actions, adapted to the type of exposure situations as well as to the stakeholders. This knowledge can be gained in various ways, including education and training (E&T), the objectives being not only to raise risk awareness but also to develop competences, informed attitudes and behaviours regarding exposure situations. As individual behaviours are being based on values, practices and experiences, it is also essential in a RP culture building process, to consider the direct contribution of the people involved, -with the support of scientists and professionals-, as well as the sharing of experiences.

From a practical point of view, the specific elements characterizing RP culture, the aim of RP culture and the tools or methods of dissemination will depend on the exposure situations as well as on the stakeholders involved in the management of the situations. These specificities have been analysed and identified within the ENGAGE project and are presented in the sections dedicated to each exposure situation.
Research aims and guiding questions

1. To analyse the **formal discourses** prescribing or recommending engagement, as formulated in international and national legislation and guidelines.

   *How are stakeholders and stakeholder engagement defined and understood? What are the underlying rationales? What is included or excluded from these frames?*

2. To highlight, through case studies, the **forms of real or potential stakeholder engagement** that can be observed in practice.

   *How do actual practices relate (or not) to prescriptions and guidelines? How are participation processes shaped? What are the main challenges and opportunities? What outcomes are crafted through engagement?*

3. To investigate through case studies the **role and potential benefit of radiological protection culture in facilitating stakeholder engagement and informed decision-making**.

   *How is radiation culture characterised? What is its role? What tools, methods and processes can be identified to build and transmit radiological protection culture?*

4. To identify through case studies **opportunities, approaches, and factors supporting more robust stakeholder engagement** in radiological protection, in better accordance with the broader values and goals of the communities into which they are introduced.

Methodology

**Prescriptions and expectations** for stakeholder engagement were identified based on document analysis of legal requirements, guidelines from different international organisations (e.g. ICRP, IAEA, HERCA, Greenpeace), interviews with their representatives and moderated discussions in different venues.

**Case studies** aimed at capturing diversity in terms of stakeholders engaged, motivations for, and forms of, participation, and this across the three exposure contexts to ionising radiation, and in different national settings. The case studies had various focus points: transposition in practice of regulatory aspects related to stakeholder engagement, participatory actions initiated by institutional or non-institutional actors, specific processes for building radiological protection culture.

The Annex includes links to posters summarising the case studies.

**Novel approaches** were also adapted and tested, including but not limited to: i) mapping formal and informal participatory practices related to emergency preparedness, response and recovery; ii) the analysis of radon websites’ features supporting stakeholder engagement in radon management.
Emergency Preparedness, Response and Recovery (EPR&R)

The field of emergency preparedness, response and recovery (EPR&R) is a complex field, where many stakeholders may have a stake or interest in a specific situation. This can be for many different reasons, for instance because they are affected by an accident, or live in areas potentially affected, or have a legal role in emergency management, or act as proxy for other stakeholders (e.g. NGOs representing the environment as a stakeholder), among others.

STAKEHOLDER ENGAGEMENT IN EPR&R gained prominence, particularly in the aftermath of the recovery efforts after the accidents in Chernobyl and Fukushima.

Recent international guidelines call for higher levels of stakeholder participation in all aspects related to emergency preparedness, as this can improve plans, enable concerned stakeholders to prepare themselves to a post-emergency situation, and reinforce the potential for co-operation, communication and co-ordination in an actual crisis or during recovery. Civil society organisations advise that national authorities should allocate appropriate resources to local municipalities, civil rescue teams, medical staff, civil society organisations and civil initiatives to participate in planning for emergencies.

STAKEHOLDER ENGAGEMENT REQUIREMENTS are less elaborated in existing legal frameworks compared to guidelines and recommendations. This allows for flexibility in the implementation of such requirements, “as appropriate”, in each Member State (European Commission, 2014). However, it leaves some uncertainty and potential mismatch of expectations on issues such as: when to initiate stakeholder engagement, who to involve at which stage and what to expect from it.

While in the European Basic Safety Standards directive participation of the public is mostly defined in terms of communication about protective actions in case of an emergency, the Aarhus convention established a framework granting the right for public participation in decision making concerning environmental matters.

In both prescriptions and practice, public engagement in the preparedness phase is often seen by institutional actors as a means to raise public awareness, to convey information. This is in contrast with more participative forms of engagement of/with professionals and authorities.

THE LEVEL OF INVOLVEMENT OF NON-INSTITUTIONAL STAKEHOLDERS is foreseen in some national emergency plans analysed within ENGAGE, to gradually increase from lower or no engagement in the early phase of an emergency, towards higher levels of involvement in the transition and recovery phase. However, how the involvement of non-institutional stakeholders should be practically organised, is left undetermined in these prescriptions. Previous experience has shown that non-institutional stakeholders are organizing themselves in the aftermath of a nuclear emergency. Citizen science initiatives after the Fukushima accident are a clear example. Citizens started making measurements and gathering data on radiation levels in their everyday surroundings. While different citizen-science initiatives have often pled for recognition of their work and data in institutional decision-making, current frameworks do not specify the potential role and contribution of involving such non-institutional stakeholders in EPR&R management.

ENGAGE CASE STUDIES pointed out several good approaches proposed in different countries, as well
as gaps that should be addressed by the responsible authorities.

When initiated by actors at a higher authoritative level (e.g. governmental agencies), stakeholder engagement is largely understood as engagement of emergency management institutions (e.g. radiation safety authorities, crisis centres, civil protection, first responders), local authorities (municipalities and local responsible bodies) and other officials. In several countries, the extent of engagement is then limited to the participation of a number of actors in emergency exercises or activities related to research projects. Only in very few cases are NGOs, local populations, or other potentially affected citizens, involved as stakeholders, although this would be beneficial for emergency and recovery preparedness.

Most stakeholder engagement initiatives in the EPR&R field are organized in this top-down manner. However, bottom-up participation also takes place, for instance when local actors initiate participation related to the issues, needs and goals they deem important. Examples include -but are not limited to- citizen scientists organizing their own measurement networks, or residents living close to nuclear facilities setting up local information campaigns.

The application of a novel method for mapping participation in EPR&R allowed identifying forms of participation and stakeholders that are not widely known or recognised. They may be specific in terms of who initiated engagement (e.g. an NGO, inhabitants of neighbouring countries or market actors); the objects or media used (e.g. art, market commodities, social media) ; or the objectives of participation (e.g. independent assessment, memory keeping, protest), among others. These forms of participation incite reflection on possible futures of engagement.

Some case studies provide evidence that focus in the preparedness phase is gradually being broadened from dealing only with the immediate response phase, towards consideration of the transition and post emergency phases. The revised BSS directive and its transposition in national legislations provides possible triggers in that regard.

Case studies also suggest that stakeholder engagement requires a common language (the capacity to interact across disciplines, as well as with different actors), which can be co-constructed through continuous interaction and a sustained participation process.

**Radiological Protection Culture** is essential for various stakeholders to build capacities to participate, to interact in radiological protection decision processes and take informed decisions. This should respond to their needs, e.g. knowing how and being able to protect themselves in case of an emergency. The aim of RP culture is thus to allow the stakeholders to reflect on what is at stake in case of a nuclear accident, not only from a radiological point of view, but also concerning the disturbances and consequences in the daily life of affected populations. It is also helps them identify which role they may have to play during emergency and/or recovery situations and what would be the consequences of their actions/decisions from the radiological protection viewpoint.

A key question is which tools and methods could be employed to build such radiological protection cultures for these stakeholders. Case studies highlighted various processes contributing to the development of RP culture related to EPR&R. In most cases, these are integrated into participatory processes set up for the preparation of emergency, response and recovery. Specific forms include working groups, seminars, training sessions, nuclear emergency exercises. Initiatives to develop practical RP culture within the population have also been highlighted, such as the development of projects with high school students (in France), or citizens measuring radioactivity in the environment in Japan or elsewhere, e.g. Safecast (https://blog.safecast.org), OpenRadiation (www.openradiation.org) or RAMESIS (Foijtikova et el, 2019).
**RECOMMENDATION EPR&R 1: BROADEN THE MOTIVATION FOR STAKEHOLDER ENGAGEMENT IN EMERGENCY PREPAREDNESS, RESPONSE AND RECOVERY, IN BOTH PRESCRIPTIONS AND PRACTICE**

Prescriptions for, and practices of, emergency and recovery management should integrate the different types of motivations for stakeholder engagement. Instead of focusing on engagement only as an instrument, the underlying ethical values and its contribution to the quality of decision-making should also be recognised.

**WHY IS THIS NEEDED?**

Motivations for engagement in international and national regulations are not always easy to discern, but appear to be formulated in terms of reaching an end goal, e.g. public information or acceptability of decisions. This motivation may be valuable in itself; however, it misses a wider view on what stakeholder engagement can deliver.

Recognising also the ethical values underlying engagement and the contribution of engagement to the quality of decision-making, can ensure meaningful participation from all relevant stakeholders, at the desired level of involvement.

- The Aarhus Convention underlines the right of the public to participate in environmental decision-making, while recommendations and guidelines (e.g. IAEA, 2018) also call for building and maintaining partnerships and the empowerment of the local community.

In case studies it is also seen that engagement, as envisioned by stakeholders, should exist for other motivations as well, for example, the right to be involved of potentially affected populations.

Recognising these different motivations, can lead to inclusion of stakeholders that otherwise would not be considered or not be willing to engage. In this way, it can lead to more sustainable engagement processes.

**HOW CAN IT BE DONE?**

- Increase awareness of the ethical values underlying engagement (e.g. the right to be involved of those potentially affected) and the contribution of engagement to the quality of decision-making (e.g. co-expertise, sustainability) among emergency and recovery management professionals and other stakeholders.
- Make reference to these values in prescriptions and guidelines and organise stakeholder engagement according to these values (e.g. open the process to all stakeholders, co-construct the process and the outcomes).
- Stimulate debate on motivations for engagement in the process of elaboration and implementation of emergency and recovery plans and related guidance. Connect participation to reflective critique on underlying motivations, at regular intervals, to keep the debate going, reveal and challenge assumptions and create new insights.
- Make use of lessons learned from practices of stakeholder engagement in various stages of emergency preparedness, response and recovery in the elaboration of prescriptions or guidelines.

**WHO SHOULD IMPLEMENT THE RECOMMENDATION?**

Actors drafting regulations and guidelines for emergency preparedness, response and recovery, and stakeholders who initiate a process of engagement in this field. More generally, all stakeholders should reflect on the motivations for (non)engagement.
RECOMMENDATION EPR&R 2: BROADEN THE SCOPE OF “PARTICIPATION” IN EMERGENCY PREPAREDNESS, RESPONSE AND RECOVERY

The scope of participation should be broadened concerning i) the stakeholders involved, by inclusion of new actors, and ii) the forms of participation, by considering also those that go beyond formal institutional approaches.

WHY IS THIS NEEDED?

Previous European projects (e.g. NERIS-TP, PREPARE) highlighted the importance of involving local actors in preparedness for emergency and recovery management. However, in legal prescriptions for EPR&R, stakeholders remain often limited to “emergency managers” (or decision makers) and “affected publics”. Some countries, however, already identified the need for defining stakeholders in a “broader sense” in their national plans.

- The Belgian EPR&R plan defines stakeholders as “any interested party […] that can be affected by the […] consequences of the emergency situation, that has to act to limit its consequences, or that participates to the management of the event”.

From a practice perspective, other stakeholders are also acknowledged, diverging from the limited stakeholder interpretation in many prescriptions, for instance trusted actors, local leaders, nurses, general practitioners, citizen groups, media, parents, teachers, or representative organisations such as trade unions or NGOs. Recognition of these actors as stakeholders is essential for their potential engagement in EPR&R; this recognition should be done by all stakeholders. This gives the opportunity to answer important questions concerning desirable actions in an emergency situation.

- Including new actors opens reflexivity towards questions like: What would parents do in an emergency situation? How to evacuate special care facilities?

For most stakeholders, engagement takes the form of information and, to a lesser extent, consultation, in both prescriptions and practice. Other forms of participation, allowing for inclusion of stakeholders in decision making, are rarely prescribed, seldom formalized and not fully operational in the preparedness phase. Bottom-up participation (e.g. through citizen science) can and does play an important role in EPR&R, as it empowers citizens to play a more active role in emergency management.

Furthermore, broadening participation to actors or networks that are not directly related to EPR&R, but can play a role in emergency management may help overcome the challenges of the limited resources available.

- In Belgium, emergency preparedness actions at local level were initiated also by the local partnerships for radioactive waste disposal.

HOW CAN IT BE DONE?

- Broaden the concepts of “stakeholder” and “participation” in both prescriptions and practice, by including new actors and new forms of participation. By expanding the stakeholders included in decision processes, new forms of participation (e.g. citizen science) will need to be explored to allow for this inclusion. Similarly, by exploring new forms of participation, new stakeholders can be included more easily, and will themselves find their way to the decision process.

- Identify the EPR&R stakeholders for specific contexts (e.g. different phases of the accident, situations, location…), taking into account this broader understanding of stakeholders.

- Identify and engage with actors and networks who play an important role at local level or in the management of other risks (e.g. chemical risks).

- When initiating a stakeholder engagement process, and when evaluating and updating an existing one, take into account both the prescriptions for stakeholder engagement and the expectations of different stakeholders, which can be broader than what is prescribed. This analysis should be done jointly by all stakeholders.

- Stakeholders should be provided with possibilities for moving in and out of engagement, e.g. to join the process at a later moment.

WHO SHOULD IMPLEMENT IT?

Actors drafting regulations and guidelines and stakeholders initiating engagement processes in EPR&R.
RECOMMENDATION EPR&R 3: RECOGNISE THE ROLE OF INFORMAL STAKEHOLDER ENGAGEMENT IN EMERGENCY PREPAREDNESS, RESPONSE AND RECOVERY

Informal stakeholder engagement ranges from informal contacts between experts to citizen led initiatives. These networks play a key role in EPR&R as they respond to specific concerns of EPR&R stakeholders.

WHY IS THIS NEEDED?

Stakeholders should be involved via formal and informal engagement. Not all stakeholders wish to be involved in a formal manner; however, they do wish their voices to be heard and their concerns addressed.

A tension field can exist between formal and non-formal engagement. A key issue related to this tension field is the issue of power, more specifically “who” is in power and can decide who should be involved and to what extent.

Specific attention should be paid to the issue of power in the preparedness phase, as this might differ from the emergency or recovery phases. For instance, some stakeholders are not regularly involved in the preparedness phase, but they are expected to be involved in the recovery actions in case of an accident situation. In this regard, it should be further investigated what is the role of the different stakeholders, and what is the added value for them to participate in the preparedness phase.

Informal stakeholder networks range from informal contacts between experts to citizen led initiatives. Previous experience shows that these informal networks play an important role in emergency preparedness, response and recovery as they respond to the specific concerns of these stakeholders.

HOW CAN IT BE DONE?

- Authorities should identify and provide space for these informal networks, and be open for collaboration.
- The Open Radiation project in France is an initiative of four organisations from different domains (radiation safety, risk education, academia, science education) that centralises measurements of radioactivity in the environment made by citizens and makes them visible through interactive maps.
- The RAMESIS project (Radiation Monitoring Network for Institutions and Schools) was initiated in Czech Republic to develop citizen radiation monitoring networks which can serve as a knowledge base for the later participation in self-help actions in case of a nuclear accident.
- The value of these informal networks, their underlying concerns, and the knowledge and data they produce should be recognised.
- Informal expert networks could be broadened to include citizen groups.
- Consider also the concerns and interests of stakeholders that do not wish to be formally involved in (decision processes on) emergency planning; these concerns can be identified e.g. through surveys, workshops, involvement in exercises, quantitative and qualitative research.
- Even if citizens may not show an active interest in EPR&R (e.g. low participation at Q&A sessions), their concerns and needs should be known and taken into account in emergency planning (Belgian case study).

WHO SHOULD IMPLEMENT IT?

Emergency and recovery management organisations.
**RECOMMENDATION EPR&R 4: INTEGRATE STAKEHOLDER ENGAGEMENT IN EPR&R PLANS AND POLICIES.**

The terms of engagement of the different stakeholders should be established in cooperation with the respective stakeholders, taking into account their preferences.

**WHY IS THIS NEEDED?**

Legal frameworks, including national emergency and recovery plans are in general not specific in terms of how stakeholder engagement should be organised at the different levels of decision making (local, national and international). For instance, it is not clear who should take the initiative to organise a stakeholder network in the preparedness phase if such initiatives are not taken by any actor. Furthermore, if such initiatives are exclusively dependent on the commitment of some actors, they may be unsustainable.

Guidance documents are therefore needed at national level to establish stakeholder engagement processes.

- Experiences with stakeholder engagement, and especially local actors, substantiate the need for establishing a legal framework for public policies on post-accident management. Inclusive governance structures are needed in the form of local-national stakeholder platforms allowing all types of actors (also non-institutional) to influence the agenda and operation of the platforms (Slovak case study).

Moreover, case studies related to the practical implementation of EPR&R plans show that the interaction between the different levels is challenging and interpreted in different countries in different ways.

**HOW CAN IT BE DONE?**

- Foster a participation culture by involving stakeholders in the different phases of elaboration and implementation of EPR&R plans, and be transparent about the impact of their participation on actual decisions.

- European projects such as FARMING, EURANOS and PREPARE played an important role in creating a network of stakeholders that were not used to work together, but should do so in case of a nuclear emergency (Spanish case study).

- Establish responsibilities for setting up stakeholder engagement processes in EPR&R and provide dedicated resources.

- Set up in consultation with stakeholders, the terms of reference for the engagement processes.

- In France a national process for the management of the post-accident phase of a nuclear accident or a radiological emergency (CODIRPA) was established and coordinated by the nuclear regulatory authority. The process has been very flexible, opening the possibilities for participation to variety of organizations and individuals, for joint construction of content, context and further discussions, based on common learning and feedback from all involved. The process has significant results, also due to the very visible role of the regulatory authority.

- Use the outcomes of stakeholder engagement processes to improve EPR&R planning.

- Identify roles and responsibilities for all stakeholders in EPR&R, in consultation with the respective stakeholders, and for the different phases of emergency and recovery management.

- Take into account the different governance levels (local, regional, national and international).

**WHO SHOULD IMPLEMENT THE RECOMMENDATION?**

Organisations responsible with EPR&R: nuclear safety authorities, civil protection, crisis centres, emergency and recovery management authorities at different levels.
**RECOMMENDATION EPR&R 5: ESTABLISH STRATEGIES FOR CONTINUOUS, 2-WAY COMMUNICATION ABOUT EMERGENCY AND RECOVERY PLANNING, TAILORED TO SPECIFIC STAKEHOLDERS FROM BOTH LOCAL AND WIDER AREAS**

This process can be used to enhance preparedness of the various stakeholders for emergency response and recovery, and to help prepare communication material to be used in the event of an accident or incident.

**WHY IS THIS NEEDED?**

Communication about emergency plans includes different aspects, for instance emergency measures, protective actions for the population, roles and responsibilities of institutions, transboundary issues, threat assessments, notifications and alerts. To be effective, communication should be done in a continuous way and be tailored to specific stakeholders.

- In France, CODIRPA is currently preparing leaflets for the population to be used after an accident, with questions/answers they might have regarding daily life after the accident. Another leaflet dedicated to health professionals is also prepared, to help them answer questions that could be raised by the population.

For instance, case studies show that information about what to do in case of a nuclear accident is present at the level of national or local EPR&R plans, but may not be known or understood by citizens.

Participants in the case studies pointed out that feedback provided by stakeholders improves the EPR&R approaches and materials, by providing local knowledge or new insights, and supporting the search for better solutions.

Among others, the importance of broader stakeholder participation (including representatives of local communities, NGO’s, civil society organizations) in emergency exercises has been highlighted. Therefore, it is essential to establish ways for the continuous collection of feedback.

- In Slovakia, secondary schools participate in emergency exercises (Slovak case study)

**HOW CAN IT BE DONE?**

- Set up stakeholder engagement processes to elaborate strategies for proactive and regular communication about emergency and recovery plans and protective actions, including the evaluation of communication effectiveness together with the target stakeholders.
- Develop communication strategies tailored towards the needs of specific stakeholders (e.g. mayors, citizens living close to nuclear installations, health professionals, farmers, NGOs, vulnerable groups such as elder population or pregnant women); identify and use the communication tools most relevant for delivering the information to these stakeholders.

- In Belgium, information campaigns about nuclear emergency actions for school children have been developed by local actors in their municipalities.

- Collect feedback about emergency and recovery plans through surveys, exercises, drills, workshops and other activities and set up processes to adapt the plan accordingly.

- Surveys in Slovenia and Belgium have been carried out to investigate citizens’ awareness of protective actions in case of a nuclear accident.

**WHO SHOULD IMPLEMENT THE RECOMMENDATION?**

Nuclear safety authorities, emergency and recovery management organisations in collaboration with other stakeholders.
RECOMMENDATION EPR&R 6: ELABORATE A STRATEGY TO FOSTER THE DEVELOPMENT OF RADIOLOGICAL PROTECTION CULTURE IN THE PREPAREDNESS PHASE

The strategy should be elaborated at the national level and linked to existing networks of stakeholders.

WHY IS THIS NEEDED?

There is a large variety of stakeholders, at local, national or international level, who should be involved in the preparedness phase of emergency/post-accident situations: public authorities, elected representatives, civil protection, firemen, health professionals, parents, teachers, economic actors, representatives of the population, NGOs, students and others.

It is crucial to develop radiological protection (RP) culture among these types of stakeholders to enable them to cope with the complexity of post-accident management without having had direct experience themselves, and to build capacities to participate and to interact in the process of elaboration of EPR&R plans and exercises.

- In Slovakia, a wide range of stakeholders including NGOs, volunteers, parents and children in kindergartens and secondary schools participate in preparing and conducting educational activities on emergency actions.

Due to the issues to be addressed in EPR&R, RP culture development should rely on a multi-disciplinary approach, combining radiological protection elements with other aspects of post-accident management (e.g. well-being, economic issues, future of the territory).

HOW CAN IT BE DONE?

Elaborate a strategy at the national level, including links with international actions and local initiatives, to set up processes to build or strengthen RP culture among the relevant stakeholders. This strategy can integrate the following actions:

- Identify tools and processes allowing participation of stakeholders at the relevant level, e.g. working groups, seminars, training sessions, nuclear emergency exercises, among others.
- Favour the co-construction of RP culture, relying on the contribution from RP experts together with the stakeholders themselves for the development of skills, knowledge and practical measures combining science, expertise and practical experience.
- Integrate RP culture within the development of a broad safety culture in an all-hazards approach, to help stakeholders to consider risks in a holistic manner.
- Plan to address radiation-induced health effects and more broadly disturbances of daily life induced by an accident.
- Plan to address the ethical issues for the experts and authorities involved in these processes.
- Integrate regular evaluation of the efficiency of the actions in the strategy.
- Support the development of citizen science projects.

WHO SHOULD IMPLEMENT THE RECOMMENDATION?

Organisations responsible with EPR&R: nuclear safety authorities, civil protection, crisis centres, emergency and recovery management authorities at different levels.
Indoor radon

Radon in dwellings, schools, work places and other types of public buildings poses a significant health risk, being one of the most important causes of lung cancer deaths, after smoking. It is estimated that radon causes between 3–14% of all lung cancers in a country, depending on the average radon level and the prevalence of smoking (https://www.who.int/en/news-room/fact-sheets/detail/radon-and-health).

**Actions aiming at reducing exposure** to indoor radon have been carried out by many EU Member States. Information campaigns have been conducted to increase radon awareness and trigger radon measurement and remediation. However, increased awareness does not always lead to action. Stakeholder engagement may contribute to addressing this value-action gap, as it helps contextualise the problem and enables joint problem solving.

**Engage case studies** point out that awareness of radon issues remains low, not only among home owners, but also among professionals such as building constructors, general practitioners and other stakeholders. In public institutions, awareness of the radon problem seems to be higher than for private dwellings, but there is a lack of resources or sometimes willingness to give radon the required level of priority of action. For private owners, there is often uncertainty about how to manage the remediation and how to cover the costs.

It should be noted that occupational exposure has not been significantly investigated in the Engage case studies. The responsibility of the employers is quite different in this situation. Occupational exposure is a special issue and currently HERCA and various national authorities are engaging specific actions in this domain.

The revised European Basic Safety Standards Directive opens opportunities for higher levels of participation of radon stakeholders, including local actors and affected publics. It requires for the first time the involvement of stakeholders in decisions regarding the development and implementation of strategies for managing existing exposure situations. In some countries, transposition of these requirements in national legislations includes different aspects favouring participation, such as: provision of information, development of guidelines, organisation of workshops or other participatory activities, publication of contacts of recommended providers of remediation works, among others.

**In practice**, different stakeholders are recognised, such as public authorities at different governance levels (e.g. municipalities, regional councils, ministry and public bodies in charge of radiological protection, public health, building construction, labour, environment), radiological protection experts, house owners and occupants, workers, building professionals, family doctors, and professional associations of the aforementioned stakeholders. Stakeholder involvement takes various forms, from awareness raising actions to feedback from local communities on action plans, workshops, public meetings, joint inspections, self-tests for radon in homes or citizen science (still rare, but see for example initiatives in Ireland).

The application of a novel method for evaluating radon websites from a stakeholder engagement perspective highlights opportunities to use such communication tools to empower stakeholders to be involved in decision-making related to radon risks in radon prone areas, or to make informed decisions related to radon risk reduction (Perko and Turcanu, 2019).
For radon mitigation in private homes (existing buildings) is the fact that management of radon risks is essentially the responsibility of the home owner and/or user at an individual level. However, as suggested by some case studies, people may be reluctant to face this problem and engage in its resolution, for instance because they consider radon as a natural element and therefore not of concern, or they are worried about the economic consequences (cost of remediation, potentially lower value of property).

Case studies also show that responsible authorities may lack the resources -especially human resources-, and an appropriate organisation with the involvement of all levels of public authorities to effectively perform radon control and provide remediation advice. Additionally, in some countries (e.g. Slovenia) there are only few qualified contractors and municipalities need to first pay themselves the remediation works, being reimbursed by the state later on.

Developing radon culture among the various stakeholders starts with raising awareness of the radon risk -particularly the link between radon and cancer- as a (public) health issue, and providing the necessary elements regarding the protective or remediation measures against radon. Having radon considered as a public health issue is a key point for many stakeholders’ understanding of the regulatory requirements and of the aim of public health programmes dealing with radon.

ENGAGE confirmed that the integration of radon into indoor air quality management, as part of a global public health protection approach (as proposed notably by the WHO, 2009 & 2018), is a key element for local / national authorities as well as the public, building professionals or other stakeholders to commit themselves to radon management processes.
**RECOMMENDATION RADON 1: BROADEN THE MOTIVATION FOR STAKEHOLDER ENGAGEMENT IN INDOOR RADON MANAGEMENT, IN BOTH PRESCRIPTIONS AND PRACTICE**

Prescriptions for and practices of for radon management should integrate the different types of motivations for stakeholder engagement. Instead of focusing on engagement only as an instrument, the underlying ethical values and its contribution to the quality of decision-making should also be recognised.

**WHY IS THIS NEEDED?**

Prescriptions for stakeholder engagement in international and national regulations and guidelines (e.g. European BSS, radon action plans), as well as practices, tend to focus on the use of engagement as a tool to raise awareness of radon risk and to implement recommended mitigation actions.

To ensure meaningful participation from all relevant stakeholders, it is essential to recognise also the ethical values underlying engagement (e.g. the right to be involved of affected publics) and the contribution of engagement to the quality of decision-making (e.g. in terms of co-expertise or sustainability). In turn, this may lead to improved radon management, for instance by recognising the specific needs of different stakeholders.

**HOW CAN IT BE DONE?**

- Increase awareness of the ethical values underlying engagement and the contribution of engagement to the quality of decision-making, among all actors involved in the elaboration of radon action plans; make reference to these values in the national radon action plans.
- Organise stakeholder engagement according to these values (e.g. open the process to all stakeholders, co-construct the process and the outcomes).
- Share and make use of lessons learned from practices of stakeholder engagement in the elaboration and implementation of radon actions to increase this awareness.

**WHO SHOULD IMPLEMENT THE RECOMMENDATION?**

National, regional and local actors responsible with elaboration of radon action plans.

International organisations involved in drafting radon management guidelines and prescriptions.
**RECOMMENDATION RADON 2: INCLUDE IN RADON ACTIONS PLANS A STRUCTURED APPROACH TO STAKEHOLDER ENGAGEMENT IN THE DESIGN, IMPLEMENTATION AND EVALUATION OF ACTIONS**

**WHY IS THIS NEEDED?**

Most radon action plans do not integrate stakeholder engagement in a structured and formalised manner. As a result, stakeholder engagement in the design, implementation and evaluation of radon management actions is not systematic and relies on the willingness of some actors. This may impact the effectiveness and sustainability of actions.

- Stakeholder engagement is often shaped as awareness-raising actions, but the effectiveness of these campaigns is poorly evaluated in terms of increased awareness about radon risk and, more importantly, the application of mitigation actions. (Belgian case study).

The focus of radon actions has often been on raising risk awareness, using communication tools mainly for information provision. The increased attention to stakeholder engagement should also be incorporated in these actions.

In particular, the evaluation of radon actions, jointly with local stakeholders, is a key aspect to enhance the effectiveness of these actions (see also Rec. 4). This includes, among others, testing the effectiveness of risk communications tools (e.g. radon maps) at the local level.

**HOW CAN IT BE DONE?**

- A plan for stakeholder engagement in the design, implementation and evaluation of actions, should be developed as part of the national radon action.
- The stakeholder engagement plan should be based on stakeholder mapping and analysis; this mapping should help identify stakeholders at different governance levels (national, regional, local) to be involved at the different stages of the elaboration implementation and evaluation of actions at national and local levels.
- The definition of stakeholders should be broad enough to include the full range of stakeholders; for example, for remediation of private dwellings, home owners and building professionals, are key stakeholders.
- The creation of dedicated committees composed by representatives of the stakeholder identified could valuable to allow the participation of a broad spectrum of stakeholders.

**WHO SHOULD IMPLEMENT THE RECOMMENDATION?**

National, regional and local actors responsible with elaboration of radon action plans.
**RECOMMENDATION RADON 3: INTEGRATE RADON RISK MANAGEMENT INTO A COMPREHENSIVE ENVIRONMENTAL AND PUBLIC HEALTH PROTECTION APPROACH, WITH ENGAGEMENT OF ALL STAKEHOLDERS CONNECTED TO THESE ISSUES**

This comprehensive approach should be focused on indoor air quality management.

**WHY IS THIS NEEDED?**

Radon is a complex issue, being related, at the same time, to public health, environment, geology, construction techniques, indoor air quality, energy savings, economic aspects, and urbanism. These aspects correspond to many fields and levels of responsibility, private and public.

It would be beneficial to develop a comprehensive approach for addressing radon together with indoor air quality and energy efficiency in the perspective of promoting the quality of buildings in a public environmental and health perspective. This would enhance the effectiveness of radon management by relying on synergies between the different issues and, at the same time, favour the involvement of key stakeholders and the adoption of protective measures.

It could help overcome the challenge that not all radon stakeholders are aware that they are stakeholders.

- The integration of radon into indoor air quality standards is an effective way to constrain the consideration of radon. In Switzerland, a collaboration between the national regulatory authority and the Society of Engineers and Architects led to a revision of Standard 180 (Thermal Protection, Protection against Moisture and Indoor Climate in Buildings) that better reflects radon construction requirements. (Swiss case study).

**HOW CAN IT BE DONE?**

- Identify stakeholders with responsibilities for indoor air quality, public health, energy saving, construction
- Create spaces (or dedicated committees) for interaction among the stakeholders identified, taking into account the need for a common reference frame.
- Integrate radon action plans into public environmental and health policies (e.g. National Environmental Health Action Plans) including indoor air quality management programmes.
- Develop radiological protection culture from the perspective of radon as a public health issue integrated into a more global public environment and health protection approach.

- In Italy actions for increasing awareness about radon health-related behaviour among young generations, have been initiated in schools, in collaboration with radon experts, and from a global health perspective.

**WHO SHOULD IMPLEMENT THE RECOMMENDATION?**

The process should be initiated by the actors responsible for radon action plans, with further elaboration together with identified stakeholders from relevant environmental and public health fields, at national, regional and local levels.
RECOMMENDATION RADON 4: SUPPORT THE DEVELOPMENT OF CONTEXT SPECIFIC, LOCAL/REGIONAL APPROACHES FOR STAKEHOLDER ENGAGEMENT IN RADON MANAGEMENT

WHY IS THIS NEEDED?

Radon measurements and research generally take place at the national level, but mitigations occur at the local level and are very context-specific. Local initiatives, which are now being developed in many countries, are deemed very important, as national campaigns may be less effective, particularly for private houses.

Given that the top-down approach has not been effective for private houses, the utility of risk assessment can be increased by clearly linking it to context sensitive risk-management options, in order to inform the decisions of those in charge of risk mitigation about the available options.

Bottom-up approaches, involving local stakeholders (home owners, local construction workers, municipalities) in the elaboration and implementation of radon management actions, facilitate the adaptation of these actions to the local context.

The efficiency of local actions is reinforced when they are brought together at the regional level. This level is thus important not only to take into account the specificities of a whole territory, but also to allow the sharing of experience between neighbouring municipalities confronted with similar situations, as well as to favour the mutualisation of the resources (e.g. sharing experts, organising training of building professionals, developing measurement campaigns,...)

Local/regional stakeholders should also be involved in the development of radon risk communication tools adapted to the specificities of the local/regional area regarding radon risk. For instance, interactive radon maps are useful tools for raising awareness by showing where the risk is above average. However, they can be misleading at the local level since: i) it is possible to have a high concentration of radon in a building that is located in a green or yellow zone on the map; ii) this categorisation may demobilize the population living in an area that is not referred to as a risk zone on the map.

Large coloured zones suggest uniform radon risk in a local zone, while experience shows the contrary (Belgian case study).

HOW CAN IT BE DONE?

- Adopt a systemic approach in radon action plans, that considers all levels of public authorities (national, regional, local).
- Favour joint assessment of the radon risk situation between local and regional actors.
- Identify stakeholders that can support at local/regional level the implementation of radon management actions and ensure the overall follow-up of the measurement and remediation process. These stakeholders should be recognised by all levels of authority.
- Favour the creation of multi-disciplinary committees for the coordination of radon actions at the regional level.
- Favour the mutualisation of resources at the regional level.
- Initiate actions at local/regional level to strengthen radiological protection culture.
- Develop risk communication tools (e.g. radon maps) in collaboration with local/regional stakeholders and test these tools at local/regional level.
- Connect the local/regional campaigns for radon measurements with the campaigns for raising general public awareness.
- Support the development and implementation of bottom-up, dynamic approaches for radon risk assessment and management at local/regional level, e.g. make radon tests available at local level; support citizen science; establish networks of local radon experts; provide context-specific guidelines for risk mitigation.

WHO SHOULD IMPLEMENT THE RECOMMENDATION?

Initiation by the actors responsible for radon action plans, with further elaboration together with identified stakeholders from relevant environmental and public health fields, at national, regional and local levels.
**RECOMMENDATION RADON 5: DEVELOP MULTIDISCIPLINARY, MULTI-LEVEL, AND MULTI-STAKEHOLDER PARTICIPATORY APPROACHES TO BUILD, ENHANCE AND TRANSMIT RADON RADIOLOGICAL PROTECTION CULTURE**

**WHY IS THIS NEEDED?**

Elaboration and implementation of radon action plans at a national and/or local level would benefit from the engagement of a variety of stakeholders: home owners, building managers, local elected representatives/local communities (e.g. mayors, groups of municipalities), building professionals (organizations, groups and workers in the field of building construction and maintenance), national/local authorities in charge of radiological protection, health, environment or air quality. An important element favouring this engagement is the development of (specific) radon RP cultures. The elements of these RP cultures depend on the type of actions and/or the role of these stakeholders in radon management.

Processes to build RP culture should be based on an inclusive, multidisciplinary approach, to enable mutual sharing knowledge and expertise and to adapt the messages and actions to the target stakeholders.

Developing a comprehensive and participatory approach involving experts from different disciplines as well as different stakeholders from local, regional and national and European levels would facilitate addressing the complexity of protection against radon, as well as the transversal issues and concerns related to this (e.g. urban development or energy policy). Additionally, this would contribute to introducing radon protection as part of a more global public environmental and health issue (see Rec 3).

**HOW CAN IT BE DONE?**

- Processes to build RP culture can be initiated by national or territorial (local, regional) actors; both levels are in fact important, each having a specific role, and should work closely together.
- These processes should involve representatives of the relevant stakeholders, to identify in common the key processes and tools to build and disseminate RP culture (leaflets, training sessions, dedicated meetings, websites...) that will be better adapted to the need of the target stakeholders.
- Involve acknowledged experts in their fields (not only RP experts) that will be involved in actions undertaken to transmit radon RP culture among some categories of stakeholders (e.g. building construction experts and local general practitioners).
- Develop participatory approaches, e.g. by:
  - Setting up multi-disciplinary working groups to elaborate actions for building, enhancing and transmitting RP culture integrating the various issues at stake.
  - Favouring exchange and dialogue between the different stakeholders (see also Rec 2).
  - In the Franche-Comté area (France), working groups have been set up to develop information leaflets and other tools adapted to 3 target groups: population, public authorities and building professionals. Each working group is composed of a common core of RP experts, local councillors, public authorities (regulation and health), academics, together with representatives of the relevant target groups.
  - Using communication tools, such as radon websites, as opportunities for engagement
    - Radon websites can be used as an opportunity for engagement, by providing consistent information supported by engaging stories, allowing for stakeholder feedback and dialogue, providing personalised advice, responsiveness, customized content for different stakeholders groups, transparency and openness.

**WHO SHOULD IMPLEMENT THE RECOMMENDATION?**

Actors responsible with radon action plans, in collaboration with stakeholders from relevant environmental and public health fields, at national, regional and local levels. Additionally, such approaches could be initiated by any stakeholder involved in radon management.
Medical exposures

The importance given to stakeholder engagement in relation to medical exposures to ionising radiation is reflected in formal calls for action (e.g. Bonn Call for Action from IAEA and WHO), as well as the IRPA and HERCA guidelines for stakeholder engagement, among others. These highlight several stakeholders:

- medical professionals directly involved in procedures using ionising radiation;
- hospital management;
- referrers, nurses and other medical professionals who are not directly involved, but may be professionally exposed or interact with the patients;
- manufacturers of medical equipment;
- authorities;
- professional associations of medical specialities at national and international level;
- radiological protection associations;
- patients, caregivers or patient representatives.

ENGAGE RESEARCH RESULTS indicate that cooperation among stakeholders is recognised as necessary to ensure due attention to the justification and optimisation process. Successful engagement of stakeholders professionally involved in the medical use of ionising radiation requires their empowerment and real impact on decisions. It is also pointed out that authorities have to provide the resources necessary for enabling such engagement processes (e.g. time, personnel, dedicated funding).

For patients, it is argued that involvement needs to occur at an early stage, before the decision on the radiological procedure is taken, i.e. at the moment of referral. According to the EU BSS, medical practitioners have the clinical responsibility to communicate about the risks of radiation-induced effects of diagnostic and therapeutic procedures to the patients and other involved individuals, and need to obtain consent for exposing them to radiation. As an important ethical and practical part of engaging with patients, informed (radiation) consent should be conceived not as a simple act of signing a formal document, but as a communication process between the patients and a health care provider. Current practices of informed consent show, however, that for several reasons (e.g. lack of time, communication skills, knowledge about ionising radiation, low awareness) this is often a formality, and does not enable joint decision making.

ENGAGE CASE STUDIES also show that communication with patients is perceived by medical staff as beneficial, since it can improve medical treatment, reduce the concerns of the patients and reduce the dose for patients. It also enables the patients to understand the expected benefits and potential risks of medical exposure. However, in some practices, the extent of explanations provided is rather limited or not fully understood by patients. One reason might be that the topic “communication” is rarely present, or only to a limited extent, in the education and training courses for health professionals and practitioners.

In the medical field, bottom-up engagement is rare but it does occur, for instance in some countries of the Former Soviet Union in the form of opposition to the obligation of performing a chest X-ray through fluorography in order to obtain or renew the driving licence.

The development of tools and methods to foster RP culture for medical professionals who are directly involved in medical procedures using ionising radiation benefitted from an increasing attention since several years. Several guidelines were elaborated by RP Authorities or medical professional associations at national and international levels (notably ESR, IAEA, HERCA, WHO). The ENGAGE Project confirmed the importance of continuous education and training for these professionals, with an emphasis on the need to address the practical aspects of the implementation of medical protocols in order to
optimise occupational and patient radiological protection.

What emerged more particularly from the ENGAGE case studies is the need to reinforce initiatives to develop and promote RP culture for the health professionals who are not directly involved in the implementation of medical procedures using ionizing radiations, but who may be occupationally exposed and/or interact with patients and/or prescribe medical exams. Professionals in this category include nurses, general practitioners or other referrers.

For the patients or the general public, RP culture is a key element facilitating their involvement. Several initiatives have been implemented recently to raise public awareness, for example in Belgium¹, France² or by the IAEA³. Further research would be necessary however in this field, for instance to evaluate the effectiveness of these initiatives.

¹ Initiative in Belgium to raise public awareness about risks and benefits associated with medical exposures to ionising radiation in diagnostic (national campaign).

https://www.pasderayonsansraisons.be/fr

² Leaflet elaborated by a pluralist working group to inform patients on the risks and benefits associated with medical exposures to ionising radiation in diagnostics


³ Resources for patient information developed by IAEA:

https://www.iea.org/resources/rpop/patients-and-public
**RECOMMENDATION MEDICAL 1: ENGAGE INITIATIVES TO DEVELOP AND PROMOTE RADIOLOGICAL PROTECTION CULTURE FOR THE HEALTH PROFESSIONALS WHO ARE NOT DIRECTLY INVOLVED IN MEDICAL PROCEDURES USING IONIZING RADIATIONS BUT MAY BE OCCUPATIONALLY EXPOSED AND/OR INTERACT WITH PATIENTS**

**WHY IS THIS NEEDED?**

This type of professionals (such as nurses, general practitioners or other referrers) usually does not benefit from specific training and education related to the use of ionizing radiations in medical practices and to the related radiological protection actions.

Increasing their understanding of the medical protocols using ionising radiations for therapy or diagnostic purpose will contribute, where relevant, to take care of their own protection, and/or that of patients. It is of particular importance for general practitioners or other referrers, who may be in a position to prescribe a medical procedure using ionising radiation, and should apply the justification principle when selecting the relevant procedure.

As this type of professional may also be in direct and close relationship with patients, acquiring basic knowledge and skills in radiological protection (RP) would allow them to answer patients’ questions, provide advice related to radiological protection and communicate about the risk/benefit aspects of medical use of ionising radiations.

**HOW CAN IT BE DONE?**

- Integrate RP knowledge within the initial and continuous education and training of the health professionals:
  - The components of RP culture for these professionals combine knowledge on radiations and associated health effects, overview of the use of ionizing radiations in the medical field, associated exposure levels and means of protection.
  - RP aspects should not be dealt with in isolation; they should be integrated when addressing care processes which make use of ionising radiation for diagnostic or therapy purposes. They should be based as much as possible on practical and concrete examples.
  - Take the opportunity of internship periods in hospitals to sensitize these professionals to RP practices in the field.
- Provide training on how to communicate with the patients, based on simulation exercises, using examples of questions raised by patients.
- Provide links to external sources of information related to RP in the medical field (websites, handbooks, ...).
- Evaluate the outcomes of the initiatives developed.
  - In Montbéliard (France), the local nurse school introduced in the regular school program a two-hour RP lecture given by the hospital RP expert. The involvement of national actors such as RP authority, Ministry of Health, or nurse professional associations would be necessary to spread the experience at a regional or national level.

**WHO SHOULD IMPLEMENT THE RECOMMENDATION?**

- Pedagogical staff of nurse schools and other relevant initial vocational training institutions of health professionals (local or national level)
- Medical physics experts, Radiological protection Experts of hospitals
- Authorities involved in the specification of education and training programmes for medical staff
- Professional associations of the relevant medical specialties (national or European level)
- Professional associations of Medical physics experts or Radiological protection Experts (national or European level)
**RECOMMENDATION MEDICAL 2: INTEGRATE OR REINFORCE RADIOLOGICAL PROTECTION CULTURE AS PART OF MEDICAL PRACTICES FOR THE MEDICAL PROFESSIONALS WHO ARE DIRECTLY INVOLVED IN MEDICAL PROCEDURES USING IONISING RADIATIONS**

**WHY IS THIS NEEDED?**

It is important to continuously improve the practices of the professionals directly involved in medical procedures giving rise to ionizing radiation (e.g. radiographers, surgeons, cardiologists, radiologists).

RP culture is a key element to have these professionals integrating the radiological risk as an additional criterion in their decision-making process, as well as to better understand and implement processes to optimise the radiological protection of the patients and the whole staff.

RP culture is also important to improve their communication and work with the RP Experts of the hospitals on issues related to patient and staff radiological protection.

- The effect of providing additional training to interventionists participating to fluoroscopically guided procedures is encouraging. As some of them stated, after the completion of the courses they started to use the risk associated with ionizing radiation as an additional criterion in their decision making. They realized that simple, practical measures during their clinical routine could improve their RP performance and benefit the patients, themselves and the rest of the participating personnel (Greek Case study).

**HOW CAN IT BE DONE?**

- Developing continuous education and training programmes integrating RP culture, adapted to the various medical specialities.
- Addressing RP aspects during symposia and conferences organised by / for the various medical specialities.
- Integrating regular internal evaluation of RP practices in the organisation of medical departments and implementing Quality Assurance programmes.
- Evaluating and developing RP culture during the inspections from RP authorities.

**WHO SHOULD IMPLEMENT THE RECOMMENDATION?**

- Hospital management
- Medical physics experts, Radiological Protection Experts of hospitals
- Authorities involved in the specification of education and training programmes for medical staff
- Professional associations of the relevant medical specialties (national or European level)
- Professional associations of medical physics experts or Radiological Protection Experts (national or European level)
- RP authorities in charge of the inspections
RECOMMENDATION MEDICAL 3: CREATE SPACES AND TOOLS FOR PATIENT ENGAGEMENT IN THE MEDICAL USE OF IONISING RADIATION

WHY IS THIS NEEDED?

Different actors in the medical field recognize the importance of moving from provision of information to the patients towards a more participative process, entailing listening to patients’ opinions and choices, and providing them with the opportunity to participate in joint decision making. This is motivated both through a normative and a substantive rationale.

- Main benefits of the effective stakeholder engagement in medical exposure of pregnant women are: a) the prevention of unjustified exposures, b) the optimization of the doses received by the unborn children, and c) the prevention of inadvertent exposures (Greek Case Study)

Involvement needs to occur at an early stage, before the decision on the radiological procedure is taken, i.e. at the moment of referral.

It is suggested that for practical reasons (e.g. time constraints) a graded approach in the degree of patient involvement may be needed. This would imply lower involvement for very low dose/low risk diagnostic procedures (e.g. dental intra-oral radiography, radiography of a finger), to higher involvement for higher dose procedures, such as interventional cardiology, nuclear medicine procedures or radiotherapy.

Concerning communication with the patient, in many cases when patients are informed about risks from radiation exposure in medical procedures, the information is provided by the leading doctor.

- Some patients prefer to receive information some days before therapy in written and/or oral form, others wish to receive the information immediately before the procedure (case study in Romania).

Case studies highlight: potential difficulties encountered by patients in understanding information about ionising radiation (case study in Romania); cases of distrust, or a wish to reconfirm the information provided by the lead doctor with the radiological protection expert of the hospital (Spanish case study); and the need to update publications for patients as they may not be comprehensive in terms of the information provided about ionising radiations and the related risks and benefits (Slovenian case study).

HOW CAN IT BE DONE?

- Create spaces and opportunities for dialogue between patients and the relevant medical professionals (including RP Experts) before and after the implementation of medical procedures using ionising radiation.
- Improve capabilities of medical professionals to dialogue with patients regarding risk/benefits, e.g. by:
  - Including topics about patient involvement, risk communication, and participatory decision-making (in use of IR) in education and training programs of medical professionals.
  - Developing communication materials tailored to the needs of patients. Co-development of these materials with medical professionals, patients’ representatives and communication experts is recommended.

WHO SHOULD IMPLEMENT THE RECOMMENDATION?

- Hospital management
- Medical professionals involved in procedures using ionising radiations
- Medical physics experts, Radiological protection Experts of hospitals
- Authorities involved in the specification of education and training programmes for medical staff
- Professional associations of the medical specialties (national or European level)
- Patients’ associations
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Ethical questions emerging from the ENGAGE project

This section highlights ethical questions relevant to formal types of stakeholder engagement in radiological risk governance. The reflections presented here emerged from the ENGAGE research and the discussions at the final workshop in Bratislava. Their aim is to serve as guidance on responsible stakeholder engagement in general, and in the three application contexts envisaged (emergency preparedness, response & recovery (EPR&R), indoor radon and medical), in particular.

Keeping the principal ethical motivation for stakeholder engagement in mind

It has been stated from the start of the ENGAGE project that “no value judgement is made on which type of participation is considered more valuable or better than another”. From a social sciences and humanities research perspective, thinking in terms of models (and their underlying theories and practical realisations) with an eye on reality is indeed the right perspective. However, reflections on ethics in relation to radiological risk governance in general, and with a focus on stakeholder engagement in particular, would always need to keep the principle of justice in the justification of radiological risk in mind as a central concern, and this from the perspective that radiological risk governance should primarily care for the vulnerable. (Meskens, 2016).

This normative justice view is supported by the Aarhus Convention4 and by the International Commission on Radiological Protection (ICRP, 2018), and can, in a simple way, be formulated as “the right of people to become involved in knowledge generation and decision-making related to situations or practices that might negatively affect them”.

The responsibility for the implementation of this principle lies with “authorities” that have the power and the means to organise stakeholder involvement. Depending on the context, these authorities can be political authorities, management and governing boards (e.g. of hospitals) or medical doctors, among others. The substantive motivation for stakeholder engagement, being that it may result in “better” (improved) knowledge generation and decision making could be also seen as a positive consequence of the implementation of the justice principle (caring for the vulnerable).

With this reasoning, it becomes clear that “the (potentially) affected” would need to be considered as the “primary” stakeholders in radiological risk governance. Scientists, ethics committees, the regulator and representatives from industry and civil society are also relevant stakeholders. They have the “right” to have their voice heard and to contribute to knowledge generation and decision-making; however they are not vulnerable as they act from positions with a specific authority. This means that the motivation for their engagement should be seen mostly as serving improved knowledge generation and decision-making. Following this reasoning, it may be clear that civil society representatives are somewhat of an “in-between” category. As interest groups, they care for a specific interest. This interest may be an “activist” interest, in the sense of a care for the vulnerable (potentially

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Affected by the radiological risk, taking into account that what is considered vulnerable may be citizens or “the environment” in general. That interest can also be a business interest or a specific political or spiritual interest, making these civil society representatives to act from positions with a specific authority.

Although the ethical motivation for stakeholder engagement may be perceived as straightforward and be largely supported, ethical issues remain with the possibility to put it into practice. Standard ethical issues and questions in that sense are:

- **Who is affected? Who is vulnerable?** In the various reflections in the context of the ENGAGE project, the question “what is a stakeholder” was mainly approached from a pragmatic consensus, taking into account the difficulty of grasping the meaning of ‘stakeholder’ in general and the diverse meanings it can have in the specific application contexts. The justice of justification principle helps to “define” stakeholders primarily as those who would have “the right to become involved in knowledge generation and decision making on practices that might negatively affect them”. However, the reasoning above makes clear that this does not necessarily lead to an unambiguous determination of who should be involved and who not. Two challenges in this sense are:
  - How to determine who is affected and who is not? The concept of an “affected community” brings along the challenge to determine its “boundary conditions”.
  - How to determine who is vulnerable and who is not? Citizens, with their limited potential to directly influence policies that might affect them, or patients, in their dependency on medical doctors and specialists, may generally be understood as vulnerable, but one can imagine situations in which also the scientific community or even industry or civil society representation may be “vulnerable”.

- **How to act responsibly towards the future generations who, in their vulnerability, can obviously not be involved in knowledge generation and decision making today?**
- **What about non-human living species?** From a pragmatic practical perspective, only people can be engaged as stakeholder, in the sense that they are capable of reasoning and raising their voice. However, the risk is that this practical perspective becomes locked into an anthropocentric view not sensitive to the fact that also animals and plants are vulnerable. Therefore, from an ecocentric perspective, one could ask the question whether also animals and plants should be seen as stakeholders. The issue of ecocentrism versus anthropocentrism can be solved by stating that stakeholders have not only rights but also responsibilities (animals and plants have no responsibilities). This could be seen as the perspective of “responsible anthropocentrism”, including responsibilities not only for humans but also for animals and plants and the environment in general.
- **What if stakeholders do not want to engage?**

**Ethical issues and questions related to the implementation and organisation of stakeholder engagement in various application contexts**

While the justice principle (of justification as a central concern) is essentially independent from the application context (which means that the normative motivation for stakeholder engagement does not depend on the application context), further rationales on ethics related to the implementation and organisation of stakeholder engagement will need to take into account (or start from) situations or practices typical for the context of application. In this, two attention points are worthwhile to consider:

**Vulnerability and power in the different application contexts**
The situations or practices considered here are the “presence” or application of radiation in the three contexts studied within ENGAGE: emergency preparedness, response & recovery (EPR&R), indoor radon and medical. It may be clear from the previous reasoning that “the vulnerable” denotes different “kinds” of people in the three contexts. In the context of indoor radon, it concerns those living or working in buildings with high radon concentrations. In the medical context, it concerns patients and staff, but also broader publics in the context of general health care policies (e.g. mammography campaigns). Finally, in the case of EPR&R, it concerns the (local) population, first responders or any other stakeholder affected by the consequences of a nuclear accident or its management. In short, thinking about ethics in a specific application context brings along the need for joint reflection on who is vulnerable and who has the authoritative (mandated, legitimate) power to identify and engage those vulnerable and other stakeholders.

From the ethics of stakeholder engagement to engaging stakeholders in deliberating ethical issues

In each application context (EPR&R, indoor radon, medical), ethical issues and questions may emerge that do not relate to (the rationales of) stakeholder engagement directly, but that should also become a topic of concern in stakeholder engagement as such. Typical examples are:

- (medical) ethical choices to be made in the case of a pregnant woman with breast cancer: who decides what?
- (EPR&R) considerations on return of evacuated citizens to a region with still an elevated radiation level: who decides, taking into account uncertainties and values? Should informed consent and autonomy of citizens be the central perspective?
- (EPR&R) evacuation policies: who receives compensation and who does not?
- (indoor radon) risk mitigation for private houses: who decides about what risk is acceptable and for whom? (see e.g. smoking policies)
- (indoor radon) the issue of justice and selection of priorities: do we consider in priority the higher level of concentration or do we put a focus on the collective risk? How to allocate public and private resources for managing health issues related to radon with or without considerations of the other risks (or even energy efficiency)?

A comprehensive overview of ethical issues related to stakeholder engagement as such and of ethical issues that should become a topic of concern in stakeholder engagement goes beyond the scope and aim of the ENGAGE project and of this report. Research has been done in EPR&R and medical contexts already in this sense (see e.g. Malone et al, 2018 and the SHAMISEN and CONFIDENCE projects), and the reader might want to consult the sources mentioned in the references.

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6 The CONFIDENCE Project: research focussed on uncertainties in the area of emergency management and long-term rehabilitation. [https://eu-neris.net/projects/concert/project-concert-confidence.html](https://eu-neris.net/projects/concert/project-concert-confidence.html)

The TERRITORIES Project: research focussed on “enhancing uncertainties reduction and stakeholders involvement towards integrated and graded risk management of humans and wildlife in long-lasting radiological exposure situations”. [https://territories.eu/](https://territories.eu/)

The SHAMISEN Project: research focussed on nuclear emergency situations and in particular on improvement of medical and health surveillance. [https://www.isglobal.org/en/-/shamisen](https://www.isglobal.org/en/-/shamisen)
Final considerations about lessons learned cross-field

The three exposure situations studied in the ENGAGE project differ in many respects, not in the least regarding the stakeholders and frameworks for engagement involved. They also differ in terms of justification of exposure to ionising radiation, as well as the psychological characteristics of the radiological risk (e.g. voluntary vs. involuntary risk, natural vs. man-made; distribution of risks and benefits from exposure perceived as fair or unfair).

The research conducted in the ENGAGE project highlights also several similarities and lessons to be learned regarding stakeholder engagement across different exposure situations. First, in all three exposure contexts the relevance of stakeholder participation, including wider publics, is increasingly recognised by institutional and non-institutional actors. In many (inter)national regulatory frameworks, however, stakeholder engagement – if prescribed – is little elaborated upon, which leads to situations in which it is not always clear why and how stakeholder engagement can and should be interpreted and implemented. Stemming from this, there is uncertainty and potential mismatch of expectations regarding issues such as when to initiate stakeholder engagement, who to involve at which stage, and what to expect from it. Several recommendations presented in this final report (EPR&R 1 and 4; Radon 1 and 2; Medical 1 and 3) at least partially originate from and relate to this issue.

Furthermore, in all three fields a distinction is often made in current prescriptions and practice regarding the formal engagement of professional/institutional stakeholders on the one hand, and broader publics, on the other. In most cases, it is professional/institutional stakeholders who are involved in forms of engagement such as collaboration and joint decision-making. Although a gradual institutional shift can be noticed from the public knowledge deficit frame to dialogue, engagement of wider publics is often seen as a means to raise public awareness and communicate, or to trigger predefined actions. In the field of emergency and recovery management, the ENGAGE project has demonstrated the existence and importance of many different forms of informal stakeholder engagement (see also EPR&R recommendation 3). This incites reflection regarding the existence and possible contribution of informal engagement in the other exposure situations, which has already in some cases been partly demonstrated (e.g. citizen science in radon), but would benefit from further exploration.

Another common theme across the three fields is the call for integrating radiological protection in broader frameworks. For instance, integrating radon risk mitigation in a broader environmental and public health protection approach focused on indoor air quality (see radon recommendation 3); integrating stakeholder engagement into the general, patient-centred, healthcare in the medical sector (see medical recommendations 1, 2, 3); or integrating nuclear emergency and recovery management in multi-hazard approaches to risk and vulnerability management (see EPR&R recommendation 2). This, in turn, highlights the importance of identifying and explicitly considering different stakeholders, and their potential roles and responsibilities in radiological risk governance in the three different exposure situations. This is a particularly relevant issue when exposure situations imply that stakeholders at different governance levels are concerned (see Radon 4, EPR&R 4).

Finally, the three exposure situations are characterized by a need for developing radiological protection cultures in a participatory way. Besides being developed through the participation of stakeholders, RP culture also takes stakeholder engagement as a central condition of radiological protection.
Perspectives for future research and development

Emergency preparedness, response and recovery

1. Explore which stakeholders are “in” or “out” of stakeholder engagement and why

The case studies showed the importance of stakeholders that do not want or cannot participate. Various reasons for non-engagement exist, such as the opportunity to express opposition, to not have to reach a consensus but keep true to their values and beliefs, or to remain objective. The question that remains is “How should EPR&R deal with disengagement and non-participation?”. Connected issues are:

- How to ensure sustainability of engagement processes and transmit the process to future generations?
- What is the role of future generations?
- How to address the lack of resources needed to ensure short and long-term stakeholder engagement?
- How to deal with “non-participation”? These stakeholders may have a stake in emergency preparedness, response and recovery, but wish to remain outside of the decision-making process.
- What is the role of the different stakeholders and what is the added value for them to participate in the preparedness phase?

2. Development of citizen science projects to build radiological protection culture in the preparedness phase

Citizen science activities enabling members of the public to perform their own measurements of radioactivity in the environment have proven to be a key tool to develop RP culture among populations affected by a nuclear accident. Such activities could be also developed among populations not affected by a nuclear accident, as a tool to develop practical RP culture and empower citizens to be engaged in radiological protection decision-making. Possible steps are:

- Collaborating with existing citizen science projects, to understand the motivations, concerns and needs of citizens engaging in such activities in the preparedness phase
- Building a framework to develop citizen science projects, addressing:
  - Engagement processes for joint design
  - Ethical considerations
  - Means to support projects
  - Collaborative processes (production, sharing, analysis of information, ...)
  - Identification of monitoring equipment to be used, where to get it, type of measurements
  - Joint project evaluation
- Development of collaborative structures aiming at:
  - Sharing information
  - Providing explanations on the meaning of measurements
  - Co-construction of RP culture

3. Explore the challenges and opportunities for stakeholder engagement through the use of new information technologies

A first aspect is the social media influence. On the one hand, social media provides an opportunity for engagement in emergency and recovery situations, which needs to be further explored. On the other hand, dealing with disinformation on social media in case of an accident situation can be facilitated by
engaging with media and citizens groups as partners.

Second, new IT such as artificial intelligence could be used to provide customised advice for emergency situations. Such developments should not only be based on technological development but also address the interactions with citizens and other stakeholders. Connected questions are: How to use AI in dialogue processes, and how could it inform the decision making process respecting key values regarding stakeholder participation?

4. Explore the role of participation of local communities in the preparedness phase

The goal of participation of local communities in risk management in the preparedness phase has to be further elaborated, through joint reflection.

5. Ethical considerations of emergency and recovery actions

Recent research reflected on the application of ethical considerations to emergency actions (e.g. evacuation). However, the ensuing practical implications for emergency and recovery planning resulting from this analysis have not been fully addressed.

Radon

1. Develop action research oriented towards improving radon measurement and mitigation at local level with stakeholder engagement

Only a small fraction of the population carries out measurements or applies remediation measures. Action oriented research (e.g. citizen science) opens opportunities for engaging local stakeholders in radon measurement and mitigation.

Action research with case studies is needed to support implementation of the ENGAGE radon recommendations. This could mobilise new research methodologies, based on case studies rather than large surveys, involving interdisciplinary approaches where researchers working on public health development engage with social scientists.

2. Further elaboration of training materials for, and together with, building professionals

Building professionals have a key role to play in the implementation of radon remediation actions. They need to consider radon risk when renovating existing buildings and at the design stage of new buildings (preventive actions) in a global approach of public health (in connection with indoor air quality, energy efficiency, ...). It is thus essential that they benefit from initial training and continuous education integrating radon issues. Various publications, such as reference guidebooks for professionals, already exist in some countries (eg. CSTB 2006) and at the international level (WHO, 2009, 2018). Some training schemes have also been developed for certain types of professionals in different countries. Further developments might however be necessary, according to local or national situations, following the identification of the different types of building professionals who need to take radon into account and who do not benefit from relevant training. They might concern:

- The dissemination / adaptation to local or national situations of existing material.
- The elaboration of new initial training schemes adapted to the type of training institutions: professional high schools, universities of applied sciences
- The development of continuous training education support such as seminars, e-learning, MOOC on radon
- The elaboration and provision of training materials by national authorities and expert bodies, to be built in collaboration with building professionals (need to speak the same language).
- The elaboration of reference guidebooks, specific for different types of building professionals, describing prevention and mitigation methods, according to building characteristics, giving also indications of efficiencies (technical database).
**Medical**

1. **Develop open access sources of information on RP in the medical field to complete initial training of the health professionals who are not directly involved in medical procedure using ionizing radiations but may be occupationally exposed and/or interacting with patients**

   Initial training for these professionals might be of short duration. It is thus important to provide them with the possibility to have access to further information, adapted to their profession.

   The access to this type of information is also necessary to improve the day-to-day practices by providing a regular update of skills and knowledge on RP culture.

   At the international level, the IAEA provides several training materials for health professionals related to the radiological protection of patients. These are openly accessible on the web portal RPOP[^7]. This web portal would benefit from being promoted at the European and national levels. It is however mostly dedicated to the health professionals who are using ionising radiations in medical procedures.

   It would then be useful to develop other training material adapted to the health professionals not involved in such procedures, like nurses or general practitioners, together with the development of information media at the national level which can be used to disseminate this complementary RP knowledge (both theoretical and practical). The following type of media could be envisaged:
   - Webinars and e-learning activities
   - Websites for students and health professionals
   - Special publications
   - Training modules favouring dialogue on RP culture in practice.

2. **Develop risk communication strategies and materials tailored to the needs of patients**

   This study should address questions such as: What constitutes “quality information”, for which patients and in which context? How can considerations related to emotions, sensitivities, religious, cultural aspects be included in risks communication?

4. **Further explore the needs and possibilities to engage patients in informed decision-making**

   This should address a number of standing issues, such as:
   - How are patients represented?
   - What is the role of patients’ representatives?
   - What instruments for patients’ engagement can be developed in practice, both at an individual and system level?
   - What is the possible timing to engage patients and for which procedures?

[^7]: [https://www.iaea.org/resources/rpop](https://www.iaea.org/resources/rpop)
Selected references


For ethical aspects:

EPR&R

The CONFIDENCE Project: research focussed on uncertainties in the area of emergency management and long-term rehabilitation. https://euneris.net/projects/concert/project-concert-confidence.html

The TERRITORIES Project: research focussed on “enhancing uncertainties reduction and stakeholders involvement towards integrated and graded risk management of humans and wildlife in long-lasting radiological exposure situations”. https://territories.eu/

The SHAMISEN Project: research focussed on nuclear emergency situations, in particular on improvement of medical and health surveillance. https://www.isglobal.org/en/-/shamisen

Medical


The recommendations were developed on the basis of document analysis and case studies. The findings from this research were synthesized in a number of transversal themes and discussed with a wide range of stakeholders, among others, during a radiation protection culture workshop in Athens (13-15 February 2019) and the final project workshop in Bratislava (11-13 September 2019).

Thanks are due to the members of the ENGAGE Stakeholder Advisory Board, the participants in the interviews, workshops and roundtables, and all those who provided feedback on the ENGAGE research and recommendations.
Case studies summaries

For emergency preparedness and response:
https://www.engage-concert.eu/-/media/Files/ENGAGE/events/ENGAGE-final-project-workshop/Part1_EPR.pdf?la=en&hash=22CCECDC5CAB5AC4DDC00C38314A5440F52661F8

For medical exposures to ionising radiation:

For indoor radon:
https://www.engage-concert.eu/-/media/Files/ENGAGE/events/ENGAGE-final-project-workshop/Part3_Medical.pdf?la=en&hash=5799B443C137E60BF8AE34A6E752943E95A4FED7