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PIANOFORTE Partnership

European Partnership for Radiation Protection Research

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D3.2 - Stakeholder comments on Executive Board suggestion for call topics & criteria from connected entities (3.1.1), SAB (3.3.1) and online consultations of target groups (3.4.3) for second call

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Abstract

One of the main efforts of the PIANOFORTE partnership is dedicated to the organisation of three competitive Open Calls for research and innovation projects in radiation protection. To do so in a transparent, user-centric manner, a strong focus is to document the way to the selection of call topics. Within the scope of the selection and prioritisation of research topics for the calls, the wider radiation protection community is involved, both internally and externally to the PIANOFORTE partnership. Specifically to this deliverable, the Stakeholder and Advisory Board of the project and a wide range of external stakeholders have been encouraged to contribute to the prioritisation process of the subtopics for the 2st Open Call. The purpose of this deliverable D3.2 is to inform about the methodology, the implementation and the acquired feedback of the stakeholder engagement activities carried out for the preparation of the 2st Open Call.

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1. Introduction

The ambition of the PIANOFORTE Partnership is to improve radiological protection of the public, patients, workers and the environment in all exposure scenarios and to provide solutions and recommendations for optimised protection in accordance with the European Basic Safety Standards (EU BSS).

The general objectives of the partnership will, inter alia, be achieved by the results of PIANOFORTE-funded research and innovation projects in the field of radiation protection. These projects will be selected in the frame of three competitive Open Calls.

The input to define the overarching research priorities of the 2st Open Call, likewise the 1st Open Call, is based on the priorities defined in the Joint Road Map developed during the H2020 CONCERT EJP, but also on the results of ongoing H2020 projects and other European programmes, in particular the SAMIRA action plan.

PIANOFORTE aims to involve all relevant stakeholders at the different stages of the project and targets to assure efficient engagement throughout the project. Consequently, also for the 2st Open Call a wide range of stakeholders has been involved to feedback and comment on the proposed research priorities, i.e. the proposed subtopics of the call. These measures of participation further included the possibility for stakeholders to take part in the ranking of research topics. These activities complement similar undertakings with respect to the European platforms and PIANOFORTE's consortium members.

2. Stakeholder involvement in frame of the 2nd PIANOFORTE Open Call

Within PIANOFORTE, work package two (WP2) leads the efforts to identify and prioritise topics for the Open Calls. For the 2nd Open Call, all research topics not admitted to the 1st call final topics automatically qualified for the 2nd call prioritisation process, and their text was reviewed taking into account the comments received from POMs, SAB and Platforms. All the comments received were individually analysed by WP2, explaining how they have been considered, or why they have not been taken into account in the final text of the corresponding subtopic. This process follows the procedure from the 1st call and will be documented in deliverable D2.2 from WP2 where further detailed information will be available. Further, POMs, the SAB and RP platforms were asked to propose new topics which have not been included in the selection process of the 1st call or merging of them. In addition, they were asked to proposed new criteria to be applied for the prioritisation process to select the topics for the 2nd call. On that basis, PIANOFORTE WP2 selected 8 sub-topics ("shortlist") to be further discussed with the different stakeholder groups. Subsequently, POMs, the SAB and the platforms were invited to rank the topics from the shortlist. In parallel, the external stakeholder consultation ("Topical Online Meetings [TOM]") took place, where stakeholders outside of the partnership were able to discuss, comment and rank the shortlist. After all, the feedback and prioritisation opinions of all stakeholder groups were evaluated and processed to the Executive Board

and finally to the General Assembly to vote on the final topics to be included in the 2nd call. In this overarching prioritisation process, WP3 was responsible to acquire and process the feedback from different stakeholder groups, including the Stakeholder and Advisory Board (SAB), with the aim to gather as much knowledge as possible on the needs of the radiation protection community (cf. Figure 1 on page 6).

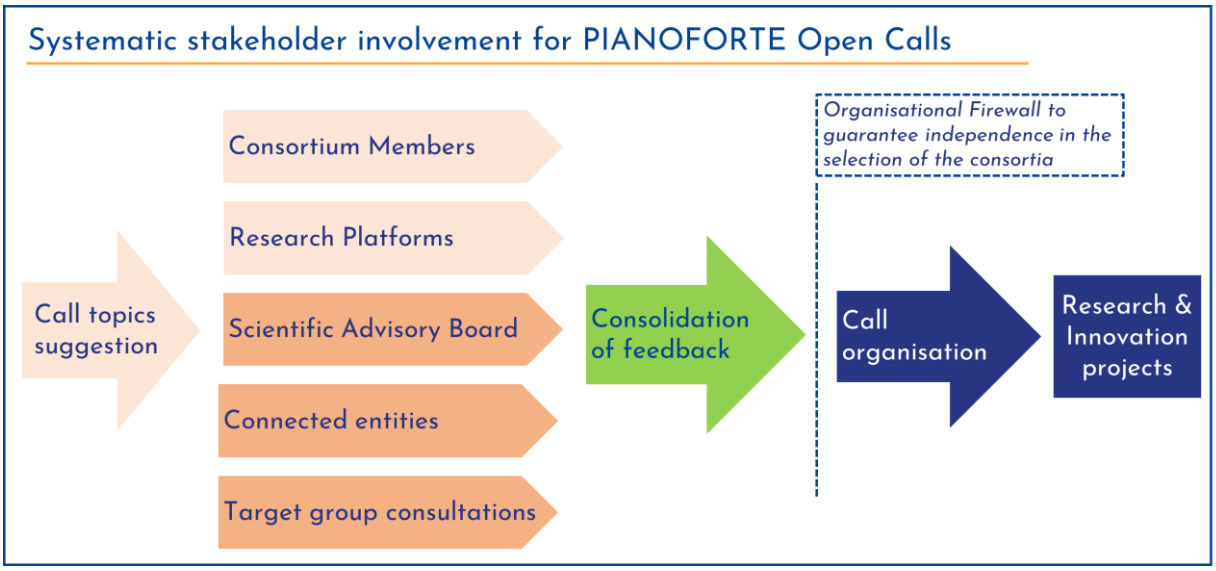

Figure 1: Systematic stakeholder involvement for PIANOFORTE Open Calls

The relevant topics/subtopics which were suggested for the 1st and 2nd PIANOFORTE Open Call are primarily based on the joint research challenges of the CONCERT Joint Roadmap (Figure 2 on page 7), including a harmonisation with the PIANOFORTE objectives and expected outcomes, and taking into account the results and recommendations of current and recently completed European projects on radiation protection.

More details on the research topic prioritisation process for the 2nd call and its methodology will be available in deliverable D2.2 (WP2).

A compilation of all proposed topics/subtopics for prioritisation for the 2st Open Call as well as the topics shortlist is attached to this deliverable (Annex 4.1 Shortlist of topics for the PIANOFORTE 2nd call, starting from page 14).

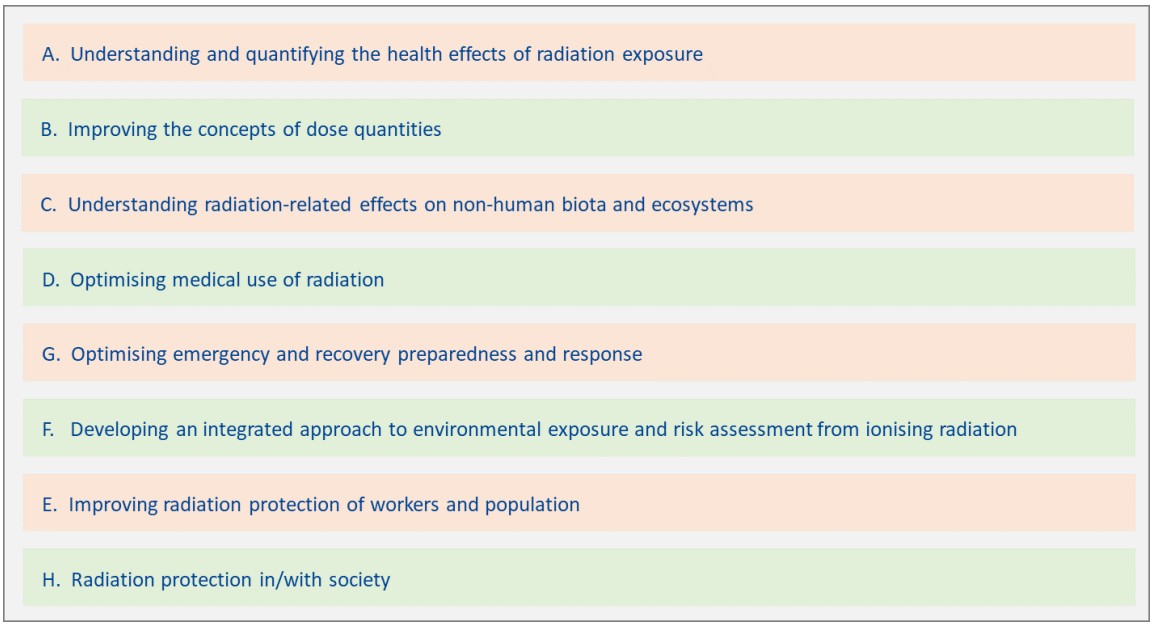

Figure 2: Radiation Protection research challenges identified in the CONCERT Joint Roadmap

2.1 Stakeholder and Advisory Board (SAB)

The SAB was involved in the research topics' prioritisation process also for the 2nd Open Call (for SAB composition and mission see deliverable D3.5). However, the SAB is not involved in the text preparation for PIANOFORTE open competitive calls, the selection of reviewers or the Peer Review Panel meetings and the establishment of the ranked list of eligible projects.

In 2023, the SAB held several meetings supported by WP3 members of which two sessions were explicitly dedicated to evaluate and comment on the prioritised research topics/subtopics suggested for the 2nd Open Call by PIANOFORTE based on the platforms' feedback on the original set of suggested topics. A meeting held in May 2023 was targeted to present the prioritisation process, the subtopics selected, and the template prepared to rank the subtopics proposed. The SAB was asked to provide a consensual ranking, not individual ones, to WP3.

A ranking of the proposed research subtopics was carried out by each SAB member independently (filling the "Form for ranking shortlist"). During the SAB meeting held in October 2023, the SAB members came to a consensus on the ranking which was then delivered to WP3.

2.2 External Stakeholders (Topical Online Meetings, TOM)

Establishing and strengthening a specific PIANOFORTE stakeholder network that is one of the PIANOFORTE communication pillars enabled the partnership to give an open and transparent consultation process on the topics of the open calls to the whole community. Topical Online Meetings

(TOMs) with external stakeholders are planned as an important step in the integration process of the overall PIANOFORTE project and specifically to contribute to the research topic prioritisation.

The TOMs in October 2023 were to present and discuss current research priorities for the 2nd call and to get the opinions and input from external stakeholders on these priorities to ensure better integration of end-users' opinions and needs in radiation protection research. Finally, the October 2023 meetings were also intended to provide a feedback on the main results of the 1st call TOMs in November 2022 to the external stakeholders.

The TOMs were organised as online meetings. After a general introduction of PIANOFORTE and its stakeholder activities, key results, feedback from TOMs 2022, were presented. The overarching research topic prioritisation process and the topics shortlist for the 2nd call were portrayed. After this joint session, two topical break-out sessions were held in parallel, to enable in-depth discussion of the research topics proposed for the 2nd call:

- Topical session 1: Research topics on Radioecology, RP workers and public, Emergency and preparedness, Societal aspects of RP (topics C2, E3, G2 and H3)
- Topical session 2: Research topics on health effects of radiation exposure-radiobiology, Dosimetry, Medical use of IR (topics A2, A3, B1 and D3)

After the discussion during the meetings, stakeholders were asked to provide a written input regarding the topics (comments/reformulation, clarification needs) and a topic ranking from 1-8 (highest to lowest priority) (using the same "Form for ranking shortlist" that POMs, SAB and Platforms).

Overall, 70 stakeholders were registered for the second series of TOMs, while finally about 45 participants from 14 European countries joined the meetings (cf. Figure 3).

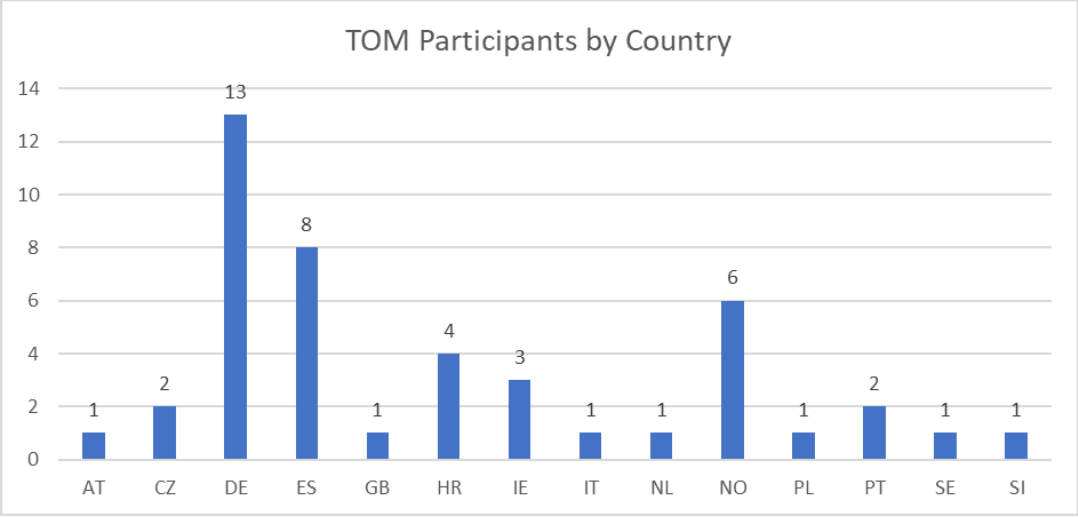

Figure 3: TOM participants by country.

Figure 4 and Figure 5 show the main field of expertise/interest of the participants and their affiliation to different types of organisations. These details have been asked during the TOMs registration process on a voluntary basis.

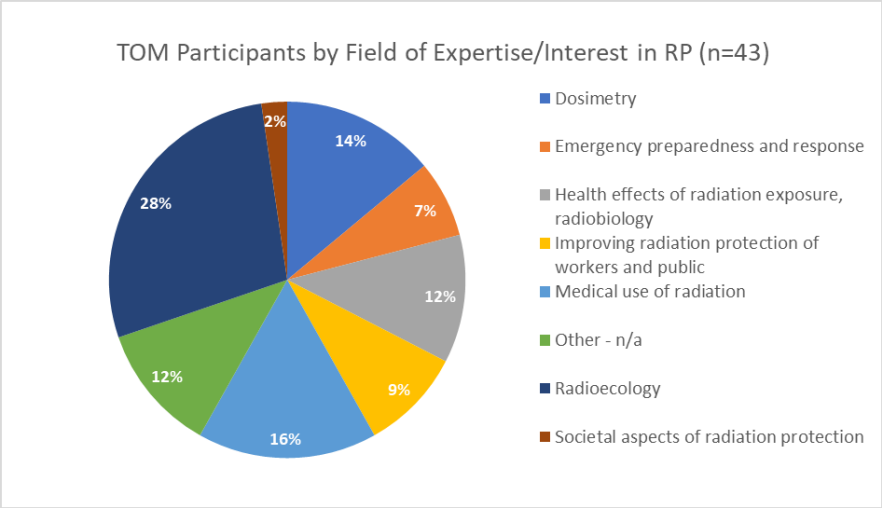

Figure 4: Overview of field of expertise of stakeholders, participants of TOMs.

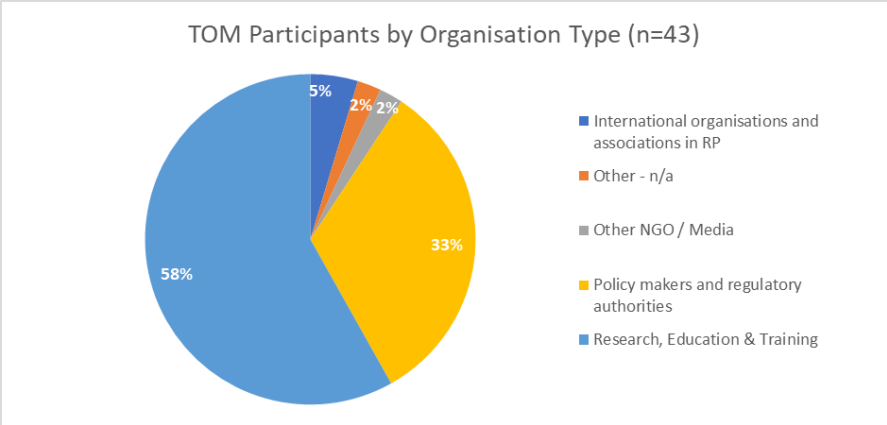

Figure 5: TOM participants by type of organisation.

3. Stakeholder feedback on the research subtopics proposed for the 2nd Open Call

3.1 Stakeholder and Advisory Board (SAB)

The SAB provided a ranking of the topics from the proposed shortlist agreed upon by all its members (one joint ranking, cf. Table 1).

Table 1: SAB Comments and ranking of research topics 2nd call

Short-listed topics 2nd Call	**SAB Ranking** (1 to 8, from highest to lowest priority)	**SAB Comments**
A2. Define how the temporal and spatial variations in dose delivery affect the risk of health effects	1	** Topical and potential high-profile activity. Valuable topic for diagnostic procedures.
A3. Improved understanding of the adverse effects of ionising radiation in medical applications through tailored radiobiological studies focusing on major features of individual variability in the response to radiation-induced damage	3	*** Valuable topic for diagnostic procedures.
B1. To quantify correlations between microscopic energy deposition and radiation damage, including improved measurement and simulation techniques.	8	Could be merged with A2
C2. Determine the effects of ionizing radiation on ecosystem functioning and biodiversity	7	Poor description of the topic in support of the call, when this topic could have been identified as a high and timely priority. If this topic has to be among the selected one, it is encouraged to rewrite it. Too wide and probably not achievable in the middle term Excellent topic but less impactful than others.
D3. Implementation of new and optimised Radiation therapy approaches for better targeting to protect healthy tissues better against detrimental effects of ionising radiation.	2	*** Important topic given the growing importance of RT in cancer treatment.

E3. Development of techniques and methods to go beyond effective dose in case of internal exposures following a nuclear or radiological emergency	5	** Some objectives could be achieved relatively quickly. Practical impact is high.
G2. Ensure readiness and scientific knowledge to support Environmental Impact Assessment and Emergency Preparedness and Response for novel nuclear technologies	6	*** Objectives appear realisable during the grant period.
H3. Sustainable practices and risk management strategies in radiological protection	4	** Objectives could be met relatively quickly Impact on ongoing new BSS might be significant.
** or *** to reflect the degree of importance of the topic in relation to the changing needs of society		

3.2 External stakeholders (Topical Online Meetings, TOMs)

The ranking (1-8, 1= highest priority, 8 = lowest priority) and additional specific topic related comments were received from 16 stakeholders from 11 countries (Czech Republic, Croatia, Germany, Greece, Italy, Ireland, Norway, Poland, Portugal, Spain, UK). As some of the stakeholders had already been represented in the feedback round for POMs earlier, two sets of evaluation were carried out. One involving all meeting participants, and one just including external stakeholders (= without participants affiliated to POM/PIANOFORTE). For the final TOM ranking, only the inputs from external stakeholders have been considered.

The topics provided with the highest scores by TOM participants were (cf. Table 2):

- C2. Determine the effects of ionising radiation on ecosystem functioning and biodiversity.
- E3. Development of techniques and methods to go beyond effective dose in case of internal exposures following a nuclear or radiological emergency.
- A3. Improved understanding of the adverse effects of ionising radiation in medical applications through tailored radiobiological studies focusing on major features of individual variability in the response to radiation-induced damage.

The concrete comments on each of the shortlisted topics which have been received from TOM participants are summarized in Annex 4.4 starting from page 27. Further, the individual rankings are shown in Annex 4.2 on page 25.

Table 2: Ranking of topics of the shortlist by TOM participants

Research topic	**TOM ranking**
A2. Define how the temporal and spatial variations in dose delivery affect the risk of health effects	**6**
A3. Improved understanding of the adverse effects of ionising radiation in medical applications through tailored radiobiological studies focusing on major features of individual variability in the response to radiation-induced damage	**3**
B1. To quantify correlations between microscopic energy deposition and radiation damage, including improved measurement and simulation techniques.	**7**
C2. Determine the effects of ionizing radiation on ecosystem functioning and biodiversity	**1**
D3. Implementation of new and optimised Radiation therapy approaches for better targeting to protect healthy tissues better against detrimental effects of ionising radiation	**4**
E3. Development of techniques and methods to go beyond effective dose in case of internal exposures following a nuclear or radiological emergency	**2**
G2. Ensure readiness and scientific knowledge to support Environmental Impact Assessment and Emergency Preparedness and Response for novel nuclear technologies	**5**
H3. Sustainable practices and risk management strategies in radiological protection	**8**

The following key issues were discussed within the two separate topical sessions:

- Importance of the topic 'H3. Sustainable practices and risk management strategies in radiological protection' has been proved in various radiation exposure situations worldwide. However, it was expressed the opinion that societal aspects overall, including sustainable practices and strategies for risk and communication should be included in all successful international projects. Scepticism was expressed that the added value would be obtained with projects focused only on this topic, separately.
- Having environmental research proposals was highlighted as of high importance since PIANOFORTE funding mechanism is estimated as one of not so many existing regarding radioactivity and radioecology and environmental aspects. Topic 'C2. Determine the effects of ionizing radiation on ecosystem functioning and biodiversity' is seen as significant and overarching, but a suggestion was given that the better scope description should be provided – which processes, how the impact and biodiversity should be account for. Meeting participants had positive opinions about the holistic approach to ecosystem investigation, especially as it is understood that this topic would include not only radioecology and environmental radioactivity, but also consideration of

existing measures for response and preparedness, societal aspects, other than radioactivity stressors, different processes ongoing into ecosystems including humans and biota etc. However, it was suggested to reformulate this research topic (both scope and objectives) as projects can comprise various and complex steps. It could be emphasized in the topic description that biota that does not impact human health should also be investigated (going from anthropocentric to eco-centric approach, as suggested by ICRP, IAEA and others). Furthermore, climate change effects, multiple stressors, types of soil, chemicals should it be integrated into the scope together with radiation effects and chemical effects.

- The topic 'E3. Development of techniques and methods to go beyond effective dose in case of internal exposures following a nuclear or radiological emergency' is considered as important, especially in today's geopolitical and overall world conditions. It was suggested to reformulate the title by saying "…methods to improve the risk assessment and communication'. In the objectives of the topic, issues such as RBE absorbed dose, improved dosimetry, calibration, bioassay of alfa emitters, promoting network of laboratories dealing with dosimetry and public exposure, intercomparing exercises should be added for the clarification and improvement as projects containing these activities would be beneficial.

- High interest was expressed for the topic 'G2. Ensure readiness and scientific knowledge to support Environmental Impact Assessment and Emergency Preparedness and Response for novel nuclear technologies. This topic is seen as significant because of the lack of knowledge around modular reactors is large and needs to be addressed urgently. Suggestions from the stakeholders were to include transport modelling– both in air and sea and to remove the term 'fusion' from the scope. The topic seems like it is still under construction thus the specific challenges could be addressed in more detail.

- The interest was also expressed for the topic 'D3. Implementation of new and optimized radiation therapy approaches for better targeting to protect healthy tissues better against detrimental effects of ionising radiation'. A suggestion was given to better define objectives for the topic, for example it was not clear if biological or physical mechanisms should be investigated or both.

General comments were given on time and financial sources available for the projects and how these would affect the size of proposals, what further can affect the ranking. Additionally, some practical facts for the future proposal development were clarified for the meeting participants on their request.

4. Annex

4.1 Shortlist of topics for the PIANOFORTE 2nd call

This list represents the shortlist based on prioritisation of the subtopics using the agreed prioritization criteria and weighting and the outcome of the discussion of the shortlist with the platforms on 13 October 2023.

Overview of topics

General note: *Under Horizon Europe, "the effective integration of social [sciences and humanities] SSH in all clusters, including all Missions and European partnerships, is a principle throughout the programme" (European Commission, 2022[1]). SSH are considered to be "a key constituent of research and innovation" (idem). In accordance with these principles and the PIANOFORTE commitments and objectives, all* ***projects funded by PIANOFORTE are expected to take into account the social, economic, behavioural, institutional, historical and/or cultural dimensions, as appropriate for the topic addressed. Contributions from one or more SSH disciplines may be required to ensure the social robustness and social impact of the research and innovation chain****.*[2]

A. Understanding and quantifying the health effects of radiation exposure

A2.

Investigating the effects of temporal and spatial variations in dose delivery on the risk of health effects

Scope of the topic

To characterise the differences in quantitative and mechanistic aspects of response dependent on radiation qualities, energy spectra and dose-rates both singly and as mixed fields was identified as a major research need in the First Joint Roadmap which will improve our understanding on the health effects and risks associated with these different exposure scenarios.

Objectives of the topic:

Define how the temporal and spatial variations in dose delivery affect the risk of health effects following radiation exposure through the integration of experimental and epidemiological data and including optimised detection and dosimetry by focusing on one of the following subtopics:

[1] European Commission, 2022. Horizon Europe (HORIZON). Programme guide. https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/programme-guide_horizon_en.pdf

[2] For Guidelines on integration of SSH see PIANOFORTE deliverable 2.6.

- Understanding the link between exposure characteristics (radiation quality, dose and dose-rate, acute and chronic exposures) and the cancer and non-cancer effects and implications for improvement/optimisation of innovative radiotherapy (e.g. FLASH therapy, proton/ion therapy).

- Understanding the effects of intraorgan dose distribution through observations in patients exposed to inhomogeneous dose distributions and experiments with organotypic tissue models.

- Addressing the difference between risks from internal and external exposures through the integration of new knowledge on the effects of chronic exposures, intra-organ dose distribution and radiation quality considering energy deposition at different scales (from intracellular to organs).

In epidemiological studies evaluation of the quality of available dosimetric data and identifying weaknesses and future needs for harmonization and standardization should be included.

Impact of the topic:

This topic addresses three of the PIANOFORTE specific objectives, contributing "To innovate in ionising radiation based medical applications combating cancer and other diseases by new and optimised diagnostic and therapeutic approaches improving patient health and safety and supporting transfer of the R&I outcome to practise." "To improve scientific understanding of the variability in individual radiation response and health risk of exposure." and "To support regulations and implementation of the BSS and improve practices in the domain of low dose exposures of humans and the environment by better understanding and reducing uncertainties in risk estimates."

The topic is a highly interdisciplinary one, since it requires combined expertise in the field of radiobiology, dosimetry, epidemiology, medical applications, which fall in the competence of the different platforms such as MELODI, EURADOS, EURAMED.

The topic is expected to generate new knowledge relevant for the large scientific community, outside radiation science as well. It harbours high innovation potential.

A3.

Improved understanding of the adverse effects of ionising radiation in medical applications through tailored radiobiological studies focusing on major features of individual variability in the response to radiation-induced damage

Scope of the topic:

Risks related to exposure to IR depend on the dose, dose rate, type of IR (ie radiation quality), volume of the body exposed and the type of exposed organs and tissues, each exhibiting different radiosensitivities. Dose-effect relationships may depend on the initial health state, history of previous exposure and lifestyle before and after exposure. Studies focusing on the role of specific target cells, such as stem cells / progenitor cells, the role of genetic and epigenetic factors, microenvironmental factors, sex and age at exposure, co-morbidities, environmental and lifestyle factors and the interactions between these depending on dose levels could contribute to a better understanding of the mechanisms responsible for individual response to radiation at the level of tissue reactions, stochastic effects such as cancer and radiation-induced aging and could help in advancing individualised cancer treatment.

Objectives of the topic:

The topic should investigate mechanisms of individual variations in radiation response as detailed above by focusing on one or several of the following objectives:

- Risks after radiotherapy

- Internal partial body exposure via targeted radionuclide therapy (TRT) with different radiation qualities. In particular, exposure of the bone marrow, kidneys and liver should be considered, as organs with the highest risk of exposure for adverse effects in this type of medical application

- External beam therapies and brachytherapies with different dose rates, fractionation schemes or dose-volume histograms, hypo-fractionated radiation therapy, novel particle therapies (proton, hadron, heavy ion therapies). Since these therapies are often combined with chemotherapy or immunotherapy, synergies between the different therapeutic combinations should be explored at the individual patient level from the point of view of the risk for therapy-related side effects (tissue or stochastic effects) and for maximizing treatment efficiency.

- Risks in children and young adults

A further objective of the topic is to investigate the specific risk of children and young adults after multiple diagnostic exposures related to cardiac catheterization or repeated brain CT scans as well as therapeutic applications for lymphomas or orbito-ocular/central nervous system tumors for long-term cardiovascular damage, cognitive impairment or second primary malignancies.

- Biomarkers of individual risk

Another objective is to seek biomarkers of individual risk through cellular/molecular, and/or systems biological approaches, radiomics investigations, evaluating potential predictive factors and correlating them with health outcomes. In case of studies related to previously identified biomarkers, validation and quality control should be included.

These objectives should be carried out among others by taking use of existing patient datasets and biobanks and by applying relevant preclinical 2D and 3D models, and relevant in vivo models. Where relevant, proposals should include communication among patients, caregivers, medical personnel and other stakeholders in order to empower them for informed decision-making and informed consent.

Impact of the topic:

This topic addresses three of the four PIANOFORTE specific objectives: „Improving patient radiation protection in relation to the use of ionizing radiation in the medical field" and "To improve scientific understanding of the variability in individual radiation response and health risk of exposure" "To support regulations and implementation of the BSS and improve practices in the domain of low dose exposures of humans and the environment by better understanding and reducing uncertainties in risk estimates".

The topic also relates to other non-EURATOM initiatives, in the frame of the mission area "Conquering Cancer – improving the lives of more than 3 million people by 2030 through prevention, cure and for those affected by cancer including their families to live longer and better".

The topic strengthens the link and synergy between radiation protection and medical treatment: towards an improved benefit—risk balance. This topic should be performed by a consortium including both radiation biology experts and medical partners to ensure impact and transferability of this research to the clinic in a swift way.

B. Improving the concepts of dose quantities

B1.

To quantify correlations between microscopic energy deposition and radiation damage, including improved measurement and simulation techniques.

Scope of the topic:

The dependence of biological effectiveness on radiation quality is commonly believed to be related to the differences in the energy deposition pattern on a microscopic and nanoscopic scale. Identification and quantification of the relevant statistical characteristics of the microscopic spatial pattern of interactions (e.g., spatially correlated occurrence of clusters of energy transfer points) are an essential prerequisite for improvement of present dose concepts and understanding the radiation damage mechanism.

Objectives of the topic:

The topic should focus on one or more of the following subtopics:

- Investigating the physical characteristics of energy deposition on microscopic scale with the aim of developing a novel, unified concept of radiation quality as a general physical characteristic of the radiation field that would allow separating the physical and biological components contributing to the eventual biological effects of radiation.

- Developing microdosimetric and nanodosimetric detectors, revising their measurement concepts, and developing a 'gold standard' for track structure simulation codes along with their validation. Establishment of robust uncertainty budgets for micro- and nanodosimetric quantities obtained by measurement or simulation and identification of the major uncertainty sources.

- A comprehensive multi-scale characterization of the physical aspects of radiation energy deposition with quantitative investigation and correlation of track structure with biological effects at molecular and cellular level and their consequences at supra-cellular levels. Radiobiological experiments should be performed with relevant micro- and nanodosimetric metrological methods, thereby facilitating the identification of useful connections for further advancements in radiobiological modelling. The cancer development processes should also be considered in the modelling to obtain an estimation of low dose risk.

Impact of the topic:

This topic addresses two of the PIANOFORTE specific objectives, namely: "To improve scientific understanding of the variability in individual radiation response and health risk of exposure." and "To support regulations and implementation of the BSS and improve practices in the domain of low dose exposures of humans and the environment by better understanding and reducing uncertainties in risk estimates." The topic is expected to generate new knowledge relevant for the large scientific community, outside radiation science as well.

C. Understanding radiation-related effects on non-human biota and ecosystems

C2.

Determine the effects of ionizing radiation on ecosystem functioning and biodiversity

Scope of the topic:

The demonstration of the increased sensitivity of ecosystem processes to ionizing radiation, in comparison with the reported effects at the population level, would strongly question the robustness of risk assessments that rely only on population-effect data. On the other hand, if it is shown that the functional or structural redundancy (biodiversity) of the ecosystems brings greater robustness against the effects of radiation and potential other threats or anthropogenic degradations (multi-contamination, climatic change…), the conservatism of the current assessments would be supported.

Objectives of the topic:

The main objective of the topic is to investigate the effects of ionizing radiation on ecosystem functioning and biodiversity, as well as their potential consequences to human wellbeing (e.g., culture, food consumption, work and recreational activities) by focusing on one or more of the following specific objectives:

- Experimental research on the effects of ionizing radiation on functional processes in controlled conditions (e.g., microcosms and mesocosm studies).

- The reinterpretation (e.g., by ecological modelling) of the reported data on the current state of ecosystems and their temporal evolution in contaminated territories.

- Addressing the economic and socio-cultural dimensions of the impact of ionizing radiation on ecosystem functioning with the aim to provide a coherent framework encompassing both the radiation protection of human and ecosystems.

Impact of the topic:

This topic addresses three of the four PIANOFORTE specific objectives: “To improve scientific understanding of the variability in individual radiation response and health risk of exposure” “To support regulations and implementation of the BSS and improve practices in the domain of low dose exposures of humans and the environment by better understanding and reducing uncertainties in risk estimates” and “To provide the scientific basis to recommendations, procedures and tools for assuring better preparedness to response and recovery from a potential radiological event or nuclear accident and to improve the know-how to manage legacy sites.”

The topic adheres to the missions “Soil health and food” and “Healthy oceans, seas, coastal and inland waters” of Horizon Europe. It is closely connected to the Horizon Europe “Food, natural resources, agriculture, and environment, biodiversity” cluster that among its objectives includes “reducing environmental degradation and pollution”.

Therefore, the topic has a large scientific impact, since knowledge generated will be of interest for the broad scientific community. It also has great innovative potential.

D. Optimising medical use of radiation

D3.

Implementation of new and optimised radiation therapy approaches for better targeting to protect healthy tissues better against detrimental effects of ionising radiation.

Scope of the topic:

As stated in the CONCERT JRM medical use of ionising radiation is recognised as the largest source of exposure of the population in Europe and therefore of concern for society. It is of great importance to optimise radiological protection in medical applications of ionising radiation and to harmonise the practices throughout Europe with respect to the protection of human health from the harmful effects of ionising radiation and the potential benefit of the use of ionising radiation for individual patients.

Adaptive radiation therapy has been developed over the last years. New therapeutic approaches are currently under development like different targeted radionuclide therapies; FLASH therapies or microbeam therapies are being further developed and these and hadron therapies are being evaluated regarding their clinical potential for certain applications. The implementation is still difficult and not applied uniformly across Europe. All of these therapeutic procedures allow for certain diseases potentially treatments that would be suitable to reduce the radiation exposure of healthy tissues while maintaining the cancer / disease control thus potentially avoiding secondary malignancies.

Objectives of the topic:

The proposal should focus on one or several of the following objectives taking use of basic and/or translational research and/or transfer into the clinical practice:

- Optimisation and evaluation of the above mentioned novel radiotherapies regarding their potential protection for healthy tissues especially for high risk groups like paediatric patients.

- A better understanding of the mechanisms of FLASH and microbeam therapy.

- Clinical studies proving the benefits in terms of radiation protection of patients and long term outcome for a variety of clinical entities for hadron therapy and targeted radionuclide therapies.

- For adaptive radiation therapy it has to be investigated how it can be best implemented and what are the clinical prerequisites and the requirements for staff to achieve best possible results in terms of radiation protection of patients.

- Definition of standard application and standard protocols as well as operating procedures for adaptive radiation therapies, targeted radionuclide therapies and hadron therapies.

Impact of the topic:

This topic addresses two of the four PIANOFORTE specific objectives: “To innovate in ionising radiation based medical applications combating cancer and other diseases by new and optimised diagnostic and therapeutic approaches improving patient health and safety and supporting transfer of the R&I outcome to practise.” and “To support regulations and implementation of the BSS and improve practices in the domain of low dose exposures of humans and the environment by better understanding and reducing uncertainties in risk estimates”.

The proposal should contribute to improve the prevention, detection and safe treatment of cancer and to consolidate regulations and improve practices in domains using ionising radiation by capturing low-dose research advances. In the field of medical applications the proposal should provide: (a) new knowledge providing elements to decision-making and risk-benefit analysis; (b) transfer of new optimised medical procedures into clinical practices; (c) elements to pave the way to personalised medicine.

The topic is directly linked to Horizon research area “Mission on cancer”, Europe’s Beating Cancer Plan of HORIZON Europe and the Strategic Agenda for Medical Ionising Radiation Applications (SAMIRA initiative).

It has a large scientific and societal impact being relevant for the broad scientific community.

E. Improving radiation protection of workers and public

E3.

Development of techniques and methods to go beyond effective dose in case of internal exposures following a nuclear or radiological emergency

Scope of the topic:

In order to adequately prepare for and respond to a nuclear or radiological emergency, the capability to estimate absorbed dose to tissues within a specified period of time and how much of this dose could potentially be averted, through interventions, is required.

The key priority, after treatment of life-threatening injuries, is to identify people at risk of developing radiation-induced harmful tissue reactions. Tools are needed not only for emergency preparedness but also for estimating the relevant doses from individual bioassay measurements in the event of an emergency. The monitoring of children and pregnant women and producing dose assessments for them, using appropriate biokinetic and dosimetric models, should be a specific priority.

In case of a severe radiological event, some people might receive significant doses and other doses of no concern. Whatever their dose level, people should be informed about their individual monitoring results, dose and risk estimates. Communicating results just in terms of doses has been shown to be quite ineffective and communicating the risks might well be a better strategy. To support such an approach, tools should be developed, taking into account the most up to date risk models, particularly those based on absorbed doses. Along with the tools, a communication strategy which would be defined with the aid of public health and social science experts should be agreed. Decision makers would also be better informed if risk rather than doses were used.

Finally, whatever the dose level and type of accident, doses should be assessed as accurately and as quickly as possible and this may potentially need to be done for up to tens of thousands of people. With respect to the accuracy of doses a major issue is the characterization of the physico-chemical properties of the radionuclides involved in an incident, as this can have a significant impact on dose estimates. With regard to the need for fast and numerous dose assessments, alternative bioassay measurements and monitoring techniques should be evaluated (e.g. spot urine, nasal swabs, gamma-camera, portable equipment for monitoring in the field), and recommendations issued to select the most appropriate measurement strategy. Even for some key radionuclides like ^{131}I there are still debates on the most appropriate monitoring strategy, especially for early monitoring.

Objectives of the topic:

The research should be focused on one or more of the following objectives:

- Develop techniques, methods and tools enabling rapid assessment of the organ or tissue absorbed doses delivered over a short period of time, taking into account any dose modifying factors which are important for emergency dosimetry (e.g., age, sex, stable iodine intake, health conditions).

- Develop methods and tools to assess any health risks associated with internal exposures and develop guidelines to communicate the results.

- Establish guidelines on the medical follow-up after a contamination that does not require urgent action.

- Develop rapid techniques for individual monitoring and the assessment of the physico-chemical properties of radionuclides.

- Study the uncertainties and variabilities of dose estimates with respect to different bioassay measurements and prepare a global strategy of combined use of all available information.

- Test and disseminate the developed techniques, methods and strategies by conducting international intercomparison exercises and establishing a network of experts and laboratories for sharing expertise and technical capabilities in an emergency.

Impact of the topic:

This topic addresses three of the four PIANOFORTE specific objectives: “To improve scientific understanding of the variability in individual radiation response and health risk of exposure”; “To support regulations and implementation of the BSS and improve practices in the domain of low dose exposures of humans and the environment by better understanding and reducing uncertainties in risk estimates” and “To provide the scientific basis to recommendations, procedures and tools for assuring better preparedness to response and recovery from a potential radiological event or nuclear accident and to improve the know-how to manage legacy sites”.

The topic has multidisciplinary dimensions, since it relates to emergency response, dosimetry, epidemiology and social sciences. Moreover, it goes beyond effective dose for the assessment of individual risk in case of nuclear emergency.

G. Optimising emergency and recovery preparedness and response

G2.

Ensure readiness and scientific knowledge to support Environmental Impact Assessment and Emergency Preparedness and Response for novel nuclear technologies

Scope of the topic:

The emerging and future deployment of Small Modular Reactors (SMR), Advanced Modular Reactors (AMR) and nuclear fusion facilities will leave capability gaps in current environmental assessment data, methodologies and tools for both planned and emergency exposure situations. There is significant diversity in SMR, AMR and fusion technologies, which can include differing reactor designs to those used for existing large-scale nuclear facilities. As an example, this may lead to contributions from radionuclides that are less well studied; potentially different siting criteria for such facilities, e.g., on rivers/lakes/floating reactors or closer to population centres; and the potential for several facilities in closer proximity to each other than existing Nuclear Power Plants.

Objectives of the topic:

This research topic has the objective of identifying the key scientific knowledge gaps for the use of novel nuclear technologies in relation to both Environmental Impact Assessment (EIA) and Emergency Preparedness, Response and Recovery (EPR) purposes to ensure the impacts of such technologies are understood in advance of wider deployment. The proposal should focus on one or more of the following objectives:

- To prioritise the areas for further development drawing on reviews of technological readiness for example to provide approaches, data and adapted or new models to support EIA and EPR issues for novel nuclear technologies, considering their potential uses, and the related risks

- To provide, in the areas of EIA and EPR, more robust science-based demonstration of protection of workers, the public and the environment for the three types of exposure situations (planned,

emergency, existing) and the strategy and scale of deployment of novel nuclear technologies. The limited existing knowledge does not allow for a holistic impact assessment including the consequences (benefits and disadvantages) of the deployment of such technologies. The integration of exposure assessments for both human and biota for such technologies should continue to be developed in the context of such novel technologies.

- To understand / anticipate how public perception about new nuclear technologies would evolve and to develop improved strategies for public information, communications and dialogue/debate

- To consider the occupational radiation protection aspects of such technologies for example of workers during routine operation, maintenance and transport

Impact of the topic:

This topic addresses two of the four PIANOFORTE specific objectives. Regarding the objective "To support regulations and implementation of the BSS and improve practices in the domain of low dose exposures of humans and the environment by better understanding and reducing uncertainties in risk estimates", the work will support several elements of the BSS relating to both emergency preparedness and response regulations as well as those used for planned exposure situations. Regarding the objective "To provide the scientific basis to recommendations, procedures and tools for assuring better preparedness to response and recovery from a potential radiological event or nuclear accident and to improve the know-how to manage legacy sites", the work would improve knowledge to support the preparedness for any radiological events involving novel nuclear technologies.

The topic contributes to several of the EU Missions in HORIZON EUROPE, such as "A Climate Resilient Europe: preparing Europe to climate disruptions and accelerating the transition to a future Europe within safe planetary boundaries" — the basis for the novel energy production methods that are the focus of this topic are ones that can be considered low carbon technologies and thus the research will help inform the safe regulation and use of such technologies; "Restore our Oceans and Waters: regenerating marine and freshwater ecosystems, eliminating pollution and decarbonising the blue economy" — novel energy production technologies will need to be considered in the context of sustainability of their emissions and this research topic will provide data and tools to help inform understanding of the impacts of such emissions; "100 Climate-neutral cities" — technologies such as SMR may enable cities to transition away from higher carbon-emitting energy production technologies, so this proposal should inform on the regulation and safety requirements that need to be considered.

H. Radiation protection in/with society

H3.

Sustainable practices and risk management strategies in radiological protection

Scope of the topic:

Radiation protection options should take into account the wider social, environmental and economic considerations, alongside radiological risk. However, there is currently no overarching theoretical framework to integrate these considerations. While promoting sustainable practices and risk management strategies is in focus in various radiation protection areas and is recognised as a key issue, the understanding and practical application of the concepts differ, and the extent to which the various dimensions are taken into account, particularly the social one, varies. There is a need to develop the

theoretical and practical basis underlying these different sustainability perspectives in radiological protection.

Promoting sustainable radiological risk management practices and strategies in various areas of radiation protection (e.g., reuse of NORM residues, sustainable remediation of contaminated sites, sustainable radiology) is as a key issue on nowadays society. However, the practical application of the concept of sustainability differs. The research topic aims at providing comprehensive theoretical frameworks for promoting sustainable practices and management strategies within the varied radiation protection fields and explore opportunities and challenges for their practical implementation.

The topic acknowledges the cultural, social, and contextual factors that influence sustainability interpretations and emphasizes the importance of inclusivity, collaboration, and mutual understanding in the pursuit of sustainable development in radiation protection. The findings can inform policy development, decision-making processes, and community engagement initiatives, ultimately fostering sustainability in radiation-related activities across diverse contexts.

Objectives of the topic:

The proposal should focus on one or more of the following objectives:

- To explore and analyse the diverse understandings and interpretations of sustainability within different radiation protection fields.

- To examine how various stakeholders, including professionals, communities, and policymakers, conceptualize sustainability and its social, economic, and environmental dimensions.

- To investigate the underlying values, cultural influences, and socio-technical boundaries that shape sustainability perspectives and practices in radiation protection. To this end, the interplay between technological advancements, social systems, and sustainability objectives should be examined.

- To assess the role of participatory approaches in facilitating dialogue, mutual learning, and co-creation of sustainable solutions.

Impact of the topic:

This topic addresses two of the four PIANOFORTE specific objectives: “To support regulations and implementation of the BSS and improve practices in the domain of low dose exposures of humans and the environment by better understanding and reducing uncertainties in risk estimates” and “To provide the scientific basis to recommendations, procedures and tools for assuring better preparedness to response and recovery from a potential radiological event or nuclear accident and to improve the know-how to manage legacy sites”.

By promoting sustainable practices and sustainable risk management strategies, the proposal should provide a theoretical and practical framework ensuring the appropriate “inclusion of [environmental,] societal and ethical dimensions in DSS” (decision support systems). By paying special attention to stimulating dialogue, mutual learning and co-creation the ethical evaluation of stakeholder engagement practices it should also contribute to “Research in effective communication and stakeholder involvement strategies”.

By consolidating regulations and improving practices in domains using ionising radiation through the capture of low-dose research advances in support of the BSS implementation and of the EU Green Deal objectives, the proposal should specifically ensure the sustainable transition “while also protecting citizens’ health from environmental degradation and pollution and addressing air and water quality”.

The topic aligns with the Horizon Europe vision of supporting the UN Sustainable Development Goals. In particular, the ambition to tackle policy priorities and facilitate the uptake of research in decision-making in implementation of the green transition.

The topic connects to the EU Green Deal objectives, specifically to ensure the sustainable transition "while also protecting citizens' health from environmental degradation and pollution and addressing air and water quality".

4.2 Individual ranking by TOM participants*

Topic	UK1	Spain 1	Czech R	Spain 2	Norway	Italy	Ireland	UK 2	Portugal1	Spain 3	Croatia	Greece	Average	Median	Modal value	SUM	TOM Ranking (excluding POM)
A2. Define how the temporal and spatial variations in dose delivery affect the risk of health effects	5	5	4	8	5	6	2	6	5	2	6	8	5,2	5,0	5	15,2	6
A3. Improved understanding of the adverse effects of ionising radiation in medical applications through tailored radiobiological studies focusing on major features of individual variability in the response to radiation-induced damage	7	3	6	5	6	1	1	1	4	4	8	4	4,2	4,0	1	9,2	3
B1. To quantify correlations between microscopic energy deposition and radiation damage, including improved measurement and simulation techniques.	6	6	3	7	7	7	4	4	6	3	7	5	5,4	6,0	7	18,4	7
C2. Determine the effects of ionizing radiation on ecosystem functioning and biodiversity	2	7	5	3	1	2	8	2	2	5	2	6	3,8	2,5	2	8,3	1
D3. Implementation of new and optimised Radiation therapy approaches for better targeting to protect healthy tissues better against detrimental effects of ionising radiation.	8	2	2	4	4	5	3	3	1	1	5	3	3,4	3,0	3	9,4	4
E3. Development of techniques and methods to go beyond effective dose in case of internal exposures following a nuclear or radiological emergency	4	1	1	2	3	8	5	7	7	8	3	2	4,3	3,5	1	8,8	2
G2. Ensure readiness and scientific knowledge to support Environmental Impact Assessment and Emergency Preparedness and Response for novel nuclear technologies	3	4	7	1	2	3	7	5	3	7	4	1	3,9	3,5	3	10,4	5
H3. Sustainable practices and risk management strategies in radiological protection	1	8	8	6	8	4	6	8	8	6	1	7	5,9	6,5	8	20,4	8

* The figure only shows the ranking of TOM participants who were not affiliated to a POM/PIANOFORTE

4.3 Characteristic values and final ranking elaborated from the TOMs

	TOM (only POM/PIANOFORTE external participants)					TOM (all participants, incl. Persons affiliated to POM/PIANOFORTE)				
Topic	**Average**	**Median**	**Modal value**	**SUM TOM**	**TOM Ranking (**	**Average2**	**Median3**	**Modal value4**	**SUM TOMPOM**	**TOM Ranking (**
A2. Define how the temporal and spatial variations in dose delivery affect the risk of health effects	5,2	5	5	15,2	**6**	5,1	5	5	15,1	**5**
A3. Improved understanding of the adverse effects of ionising radiation in medical applications through tailored radiobiological studies focusing on major features of individual variability in the	4,2	4	**1**	9,2	**3**	4,5	4,5	**7**	16,0	**6**
B1. To quantify correlations between microscopic energy deposition and radiation damage, including improved measurement and simulation techniques.	5,4	6	7	18,4	**7**	5,3	5,5	7	17,8	**7**
C2. Determine the effects of ionizing radiation on ecosystem functioning and biodiversity	3,8	2,5	2	8,3	**1**	3,8	3	2	8,8	**1**
D3. Implementation of new and optimised Radiation therapy approaches for better targeting to protect healthy tissues better against detrimental effects of ionising radiation.	3,4	3	3	9,4	**4**	3,6	3,5	5	12,1	**4**
E3. Development of techniques and methods to go beyond effective dose in case of internal exposures following a nuclear or radiological emergency	4,3	3,5	1	8,8	**2**	4,3	3,5	1	8,8	**2**
G2. Ensure readiness and scientific knowledge to support Environmental Impact Assessment and Emergency Preparedness and Response for novel nuclear technologies	3,9	3,5	3	10,4	**5**	3,8	3,5	3	10,3	**3**
H3. Sustainable practices and risk management strategies in radiological protection	5,9	6,5	8	20,4	**8**	5,8	6,5	8	20,3	**8**

4.4 Comments on shortlist of topics obtained after the TOMs in October 2023

* (marked with grey = Comment from persons participating at TOM but affiliated to a POM)

A2. Define how the temporal and spatial variations in dose delivery affect the risk of health effects

- Too generic formulation

- Very ambitious topic overall. The topic text says that the objective must be accomplished by focusing on one of the subtopics. However, the objective is very ambitious and does not seem feasible to accomplish it, by addressing only one of the subtopics described. Moreover, the kind of data needed for the subtopics may be very difficult to obtain, especially regarding the need for volunteers/patients with specific characteristics that need to have been subjected to specific irradiation protocols. On my humble opinion there should be a focus on the use of in vitro models, including 3D models and organotypic models, understand deeply what happens and then attempt to correlate results with what is observed in vivo. This topic should be divided into more than one topic, with more specific, realistic and focused objectives.

A3. Improved understanding of the adverse effects of ionising radiation in medical applications through tailored radiobiological studies focusing on major features of individual variability in the response to radiation-induced damage

- Very important, and maybe some synergies with radioecology if coupled with experiments using animals (but potentially associated with additional ethical considerations though)

- In the objectives that state "risk evaluation" of some clinical procedures, I do not understand how we will determine risk without addressing the factors that are specifically stated in the scope of the topic (Studies focusing on the role of specific target cells, such as stem cells / progenitor cells, the role of genetic and epigenetic factors, microenvironmental factors, sex and age at exposure, co-morbidities, environmental and lifestyle factors and the interactions between these), is it intended to use only models for risk estimation? The "Risks after radiotherapy" objective should be more detailed as all the other objectives are, to give more information on what is intended specifically. In the second objective it is not clear to me, how will the adverse effects on liver, kidneys and bone marrow be assessed and also how will the role of genetic and epigenetic factors and microenvironmental factors be assessed in these organs/tissues. Epigenetic marks and also gene expression alterations or gene mutations can be specific to an organ, tissue or even to a cell, so to have access to that information, we should sample them. Is this feasible?

B1. To quantify correlations between microscopic energy deposition and radiation damage, including improved measurement and simulation techniques.

- I see problem of units used, Gy in this case not working properly …

- Perhaps this could be combined with D3 if related to medical applications?

C2. Determine the effects of ionizing radiation on ecosystem functioning and biodiversity

- A relevant topic, very necessary to complete knowledge at the different ecosystem levels. I consider very important to assess the impact of radioactivity on ecosystem services like, for instance, the impact on pollinators

- Doubts about this topic considering the current description and justification, simply radioactivity, either radiation or radionuclides cannot change the habitat, i.e. abiotic environment, at the level of doses/activity concentration which we can imagine in, even an emergency situation (not considering what is going on in a nuclear reactor). Hence, considering an ecosystem as combination of a biotope (habitat) and biocenosis, all possible effects observed in an ecosystem are caused in general by effects on biocenosis…. As many experiments already done based on so called microcosmos proved. So, the statement "The demonstration of the increased sensitivity of ecosystem processes to ionizing radiation, in comparison with the reported effects at the population level, would strongly question the robustness of risk assessments that rely only on population-effect data" does not make sense (in my opinion). All ecosystem effects must be considered from the perspective of biota (biocenosis) perspective …. What is important to be underlined is to focus on effects on microbiota, which is by far most important to ecosystem functioning than large mammals, however not enough attention is paid to this problem to date. Effects on naked eye visible organisms, mammals, higher plants etc. are most investigated, however their effects on ecosystem are predictable as interaction of such organisms with habitat is simple and well documented in frame of ecology, e.g. interaction between wolves, elks and pines in an isolated island. There is no matter water agent was causing effects on wolves population …However, all of that is only my considerations … What we ca add in this topic is to underline the problem of services provided by an ecosystem and underline the microbiota function and possible effects of radiation caused by radiation (with potential synergy with other pollutants or physical hazards (as caused by climate changes, just follow fashionable topics …)

- Still many knowledge gaps in the field of radioecology, an opportunity to move away from anthropocentric methodologies and combine radiological effect with others (i.e. One Health).

- Should of course include and address the problems of multi-stressor exposure and the impacts of climate change on ecosystems and biodiversity, but we should also invest on doing so in the field, under real radiological and environmental contamination scenarios. We have already a lot of studies performed in controlled environments but very few in the field and this is essential to provide us with a realistic scenario on the impacts of such kind of contamination and climate change conditions at the individual, population and ecosystem level. It seems that we are always doing the same things, we should look for a methodology that allows us to obtain more realistic assessments and also try to use more innovative methodologies and OMICS approaches, which can be very useful for biodiversity impacts assessment. Also, modelling is important but we should also invest on obtaining real data from the field, this will also allow us to test the models that were already conceptualized.

D3. Implementation of new and optimised Radiation therapy approaches for better targeting to protect healthy tissues better against detrimental effects of ionising radiation.

- This is key for developing and implementing new radiation therapy treatments. Is this topic exclusively investigated in Euratom Programme? Or should it receive a wider support on general Horizon Europe Mission "Cancer"?

- Although these therapeutic approaches are essential, I feel this is more about technology development/engineering and fundamental radiological protection as a supporting science

- No specific comments on this one, only that I feel that now for the scientific and also very importantly for the public perception, this is a high priority topic, which materialises the urgent need for new, more efficient and more protective radiation therapies for cancer treatment.

E3. Development of techniques and methods to go beyond effective dose in case of internal exposures following a nuclear or radiological emergency

- Very important element of the emergency preparedness not only at country level, but at EU level

- Regarding objective "- Develop methods and tools to assess any health risks associated with internal exposures and develop guidelines to communicate the results. " there are already methods to measure health risks, so there is the need to evaluate the suitability of the existing methods and determine if there is the need to develop new ones and on what justification. Also, to select the methods to evaluate health risks it is necessary to identify the relevant endpoints to assess for each exposure situation, which will be related to the kind of radiological emergency/accident and radionuclides at stake. Regarding the objective "- Develop rapid techniques for individual monitoring and the assessment of the physio-chemical properties of radionuclides.", by individual monitoring you mean dosimetry? because I think the first objective of this topic already includes that.

- I suggest to split the last bullet point of the objectives with the intercomparing exercises in one bullet point and the network in another (the latter independent from testing and dissemination):
  - Test and disseminate the developed techniques, methods and strategies by conducting international intercomparison exercises
  - Establish a network of experts and laboratories for sharing expertise and technical capabilities in an emergency
  Reasoning: The establishment of a network of laboratories for internal monitoring is an extremely sustainable aspect. Such a network has been longed for by experts and stakeholders for years. This aspect could gain more importance if it presented in a bullet point of its own.

G2. Ensure readiness and scientific knowledge to support Environmental Impact Assessment and Emergency Preparedness and Response for novel nuclear technologies

- Essential to have this question ready before new reactor technologies start to operate given their importance in the decarbonization of the energy production.
  Obviously, nuclear fusion should be out of the scope because the Eurofusion programme should take care of it for nuclear fusion facilities

- I see important to add in the description that the topic is urgent as regulator in many EU countries are under strong pression from industry to give relevant decision about EIA and localisation, but there is no experience and good scientific background in this matter. Also, I see fusion as not fitting to this topic as the RP problems related seems to be completely different, it is important, sure, but not so urgent and should be addressed in a separate topic, if any ..

- Not there yet. It is too early days in my view to place this item higher in the ranking, but it will need to go higher in the ranking in the near future (3-5 years).

H3. Sustainable practices and risk management strategies in radiological protection

- This is directly related with the need to improve optimization of exposures by duly incorporating the social, economic and environmental dimensions, plus sustainability

- I see in the description that an approach based on LCA (life cycle assessment) is a good example to develop a sustainable radiological risk management practices and strategies regardless a specific field of RP application.

- As discussed, I do not think this should be dealt with separately, but instead it embedded in each successful proposal

- Although this topic includes several important aspects for the perception on sustainability in the radiation protection field, if there is the need to reduce the number of topics to be put out in the call, maybe some of the important aspects mentioned here could be included in other topics. This sustainability issue should also be discussed already for the novel nuclear technologies for example and also for the implementation of new and optimised Radiation Therapy approaches.
- This is a very fascinating topic and should be ideally integrated into whatever call topic comes out.