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PIANOFORTE Partnership

European Partnership for Radiation Protection Research

Horizon-Euratom – 101061037

D 2.1 – Research priorities for the first open call

Lead Author: Katalin Lumniczky (NNK)

With contributions from: Anja Almen (SSU), Spyros Andronopoulos (NCSRD), Almudena Real (CIEMAT), Catrinel Turcanu (SCK-CEN), Filip Vanhavere (SCK-CEN)

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Abstract

PIANOFORTE (PF) set as a major priority to launch the first open call as soon as possible, within 10 months from the start of the project (by end of March 2023 at latest). Task 2.1 assembled a list of 17 research topics based on the CONCERT Joint Roadmap game changers reflecting the research priorities of the six European platforms on radiation protection research. The list was sent to platforms first for comments (improvements, changes, replacing topics but not suggestion of additional new topics). Platforms were also asked to rank the topics using scoring criteria provided by Task 2.1. Based on these scores Task 2.1 ranked the topics into very high, high, moderate and low. The list of topics with the priority ranking was sent to POMs, to PF Stakeholder and Advisory Board (SAB) and to external stakeholders for comments on the research topics text and their ranking. Task 2.1 together with WP3 summed up the priority ranking of POMs, SAB and external stakeholders. The feedback received indicated that more than 75% of the topics reached a high degree of consensus in the prioritisation by the different stakeholders. This allowed PF Executive Board to choose three topics, ranked as very high, to be included in the first PF open call. These topics were approved by the PF General Assembly as well. The whole process was done within the time limits set in the Grant Agreement, the final prioritisation process made by WP2 and WP3 was sent to the PF Executive Board in the beginning of December 2022, PF Executive Board decided on the topics to be chosen for the first call on 13 December 2022, while the final approval of the General Assembly was obtained at 17 January 2023.
The chosen three topics are:

- A2: Developing a knowledge base for a better understanding of the disease pathogenesis of ionising radiation-induced cancer to improve human health risk assessment.
- D1: Individualised diagnostic and therapeutic procedures for optimisation of benefit/risk ratios.
- G2: Development of risk assessment and risk management approaches and technological capabilities to cope with scenarios arising from threats due to war or armed conflict situations or natural disasters taking into consideration social, ethical and legal issues.

Content

1. Objective of this deliverable

One of the main objectives of the PF project is to launch three scientific open calls during the duration of the project, to which the radiation protection community could respond in a competitive manner. A specific task within WP2 was dedicated to identify the most pertinent research topics within the area of interest of each of the six radiation protection platforms and to coordinate prioritisation of the research topics based upon consultations with different stakeholders in a transparent manner. Stakeholder consultation was shared between Task 2.1 and WP3. A schematic algorithm of the stakeholder involvement strategy for the prioritisation of research topics to be used in PF open call 1 is included in the PF grant agreement[1] (see *Figure 1*). PF set as a major priority to launch the first open call as soon as possible, within 10 months from the start of the project (by end of March 2023).

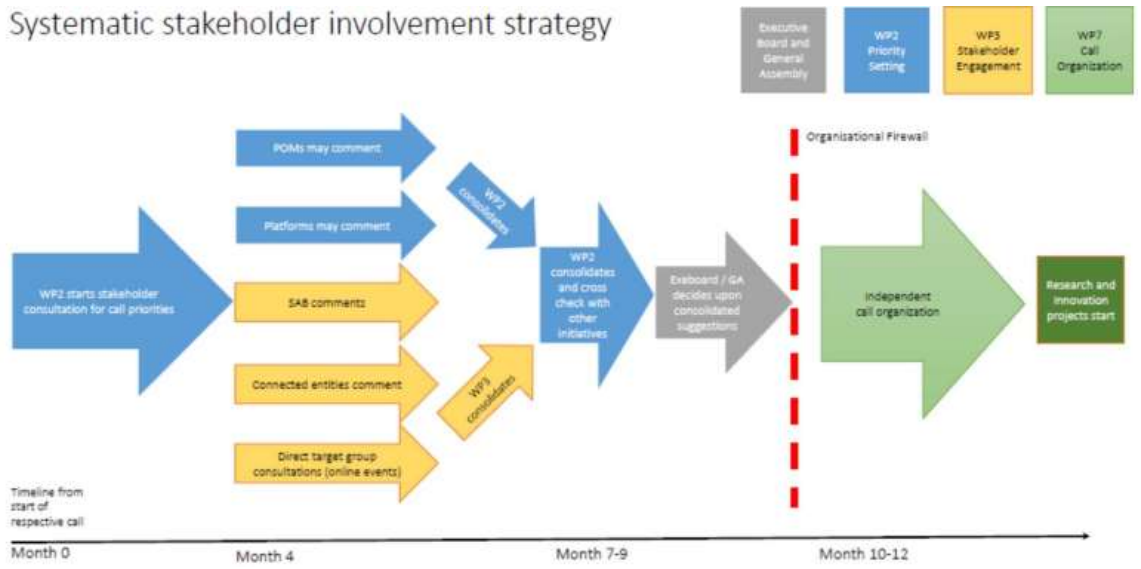


Figure 1: Algorithm of the stakeholder involvement strategy for the prioritisation of research topics to be used in PF open call 1.

Based on this algorithm a prioritisation workflow with deadlines was drafted by Task 2.1 members during PF kick-off meeting (15/06/2022) as follows:

- A first synthesis of research topics and subtopics for prioritisation and requesting feedback from other partners (deadline: 15 September 2022).
- Feedback from platforms (deadline: 5 October 2022).

[1] Grant agreement 101061037-PIANOFORTE

- Integrating feedback from platforms and requesting feedback from POMs, the PF Stakeholder and Advisory Board (SAB) and external stakeholders (deadline: 30 November 2022).
- Integrating feedback from POMs, SAB and external stakeholders (deadline: before Christmas holidays, 2022).
- Finalisation of the document (end of January 2023).

For the detailed description of the prioritisation workflow please see *Annex 1*.

2. A first synthesis of research topics and subtopics for prioritisation and requesting feedback from other partners

Task 2.1 had to identify and prioritise topics for the first open call and integrate the feedback received from platforms, POMs, SAB and external stakeholders within max. 8 months. This short time frame did not allow to organise large-scale consultations with all interested partners, therefore it was decided that identification of subtopics would be based primarily on the joint research challenges and their respective game changers from the CONCERT Joint Roadmap, taking into account PIANOFORTE objectives and expected outcomes. Subtopics related to medical applications were an exception because there were relevant developments in this field since the publication of the Joint Roadmap. The game changers for this domain were based on the EURAMED Strategic Research Agenda (SRA) being assembled in the frame of the EURAMED rocc-n-roll project, as well as on scientific recommendations of the recently closed EURATOM project MEDIRAD.

Based on the above considerations 8 main topics and 17 subtopics were identified (*Annex 2*). In order to help the prioritisation process each topic and subtopic was evaluated based on several criteria as follows:

- Evaluation criteria for topics:
    - importance of the topic,
    - interactions of the topic with other research topics of the Joint Roadmap,
    - redundancy.
- Evaluation criteria for subtopics:
    - game changer: yes/no,
    - links to PF commitments: yes/no,
    - feasibility,
    - relevance:
        - link to PF research priorities,
        - link to PF specific objectives,
        - link to PF expected outcomes,

- links to HORIZON-EURATOM-2021-NRT-01-09 major expected outcomes,
- links to other EURATOM initiatives,
- links to other HORIZON EUROPE initiatives (outside EURATOM),

- impact,
- redundancy with other currently ongoing or recently closed projects,
- sources for funding at European level,

The evaluation of topics and subtopics was performed based on the following documents:

- PIANOFORTE specific objectives and expected outcomes,
- EURATOM call priorities – formulated in the HORIZON-EURATOM-2021-NRT-01-09: European Partnership for research in radiation protection and detection of ionising radiation call text in 2021,
- CONCERT Joint roadmap reflecting the joint research challenges formulated by the RPR platforms (ALLIANCE, EURADOS, EURAMED, MELODI, NERIS, SHARE) – the JRM reflects the view of the platforms at the time of preparing the JRM (2019-2020), except for EURAMED,
- HORIZON Europe priorities,
- EURATOM Scientific and Technical Committee (STC) opinion, position, input
- other EU initiatives (e.g., Samira project),
- EU Joint Research Centre (JRC) in Nuclear safety and security,
- recently closed or currently running EC-funded projects and tenders.

A detailed overview of these documents can be seen in *Annex 3*.

The first version of research topics and subtopics with the evaluation criteria, which was sent to platforms for comments on 15 September 2022 can be seen in *Annex 4*. In conformity with the principle of Horizon Europe regarding the importance of integrating social sciences and humanities (SSH) in EC-funded projects, a note was inserted at the beginning of the document highlighting the need for taking into account SSH-related aspects in the projects funded by PF as well.

Platforms were asked to comment topics and subtopics using the “Priority comment sheet” template (see *Table 1* below).

Contributor (who made the comment)	Page, paragraph	Type of comment: ED (editorial) CO (content topic) SC (evaluation)	Original text/evaluation	New proposed text/evaluation	Comment: why is this change proposed?	Comment from Pianoforte WP2.1 group

Table 1. Priority comment sheet – template to send comments to the suggested topics and subtopics.

In parallel a list of proposed criteria for prioritisation of the subtopics was assembled. This document contained a list of criteria based on which subtopics could be numerically scored by platforms, thus allowing the establishment of a first ranking of the subtopics and it also contained a second list of criteria based on which subtopics could be ranked as of very high-high-medium-low priority by Task 2.1 members. The list of criteria for the numerical scoring of the subtopics was sent to platforms on 15 September and platforms were asked to score the subtopics accordingly. However, the second list of criteria based on which subtopics could be prioritized was not sent to the platforms. The original idea was that based on the numerical scores given by the platforms Task 2.1 will evaluate each subtopic and prioritize it. The reason for not sending the criteria for prioritisation to the platforms was to allow an as objective scoring of the subtopics by the platforms as possible and avoid scoring based on subjective considerations knowing how to score to qualify a subtopic as of high-very high priority. Each platform was asked to score all the subtopics, not only those falling in their area of expertise. The complete document containing the list of criteria for scoring by platforms and the criteria used for prioritisation by Task 2.1 can be seen in *Annex 5*. To facilitate scoring and to allow for a uniform format a template for scoring was sent to platforms (see below *Table 2*).

Please rank all subtopics A1-H1 based on the indicated criteria. Before ranking please consult details on ranking criteria.																		
A detailed evaluation of each subtopic can be found in the file named "Suggested CALL TOPICS for 1st PIANOFORTE Open Call".																		
		A1	A2	A3	A4	B1	C1	C2	D1	D2	D3	E1	F1	F2	F3	G1	G2	H1
	Feasibility																	
	Relevance for PIANOFORTE specific objectives																	
	Relevance for other EU initiatives outside EURATOM																	
	Societal impact																	
	Scientific impact																	
	Redundancy																	
	Sum:																	

Table 2: Template for numerical scoring of subtopics.

In summary the following documents were prepared to be sent to platforms:

- Prioritisation workflow
- Shortlist of suggested topics and subtopics
- Detailed description of suggested topics and subtopics with evaluation
- Documents based on which evaluation of topics and subtopics was performed
- Proposed prioritisation criteria for scoring subtopics for PF call 1
- Template for comments
- Template for scoring

These documents were also sent to the PF Executive Board for comments and approval. The Executive Board approved the documents, a minor comment was made by one member of the Executive Board suggesting to apply only two scores (1 or 2) for both "relevance for PF specific objectives" and "Relevance for other EU initiatives outside EURATOM". The document was revised accordingly (Annex 5 shows the already revised document) and sent to platforms on 15 September 2022. Platforms were asked to give their feedback by 5 October 2022. An onsite meeting between the platforms, Task 2.1

members and PF Executive Board representatives was planned to be held in Estoril, Portugal on 15 October 2022 (during the ERPW2022 meeting).

3. Integrating feedback from platforms

The sheet with the pooled comments made by the platforms and the reply by Task 2.1 can be seen in *Annex 6*. The received comments did not modify substantially the text of the subtopics with the exception of C1, where ALLIANCE suggested to use exactly the wording in the game changer (it was accepted by Task 2.1) and G1-G2, where NERIS suggested an additional topic to reflect on the risk and threats arisen due to the armed conflict in Ukraine (Task 2.1 did not accept the addition of an extra subtopic by NERIS and NERIS was requested to include their suggestion in one of the existing subtopics of Topic G).

All platforms except SHARE scored the subtopics. NERIS scored only subtopics related to Topic G falling in NERIS' competence. The outcome of the scores sent by platforms can be seen in *Annex 7*.

The comments and the scoring provided by the platforms was discussed in a meeting with platforms and PF Executive Board representatives organized in Estoril, Portugal, 15 October, 2022. Regarding the comments made by platforms to the individual topics and subtopics a common agreement could be reached relatively easily based on which Task 2.1 would revise the corresponding documents.

Regarding the scores, as a consensus it was agreed that in principle scores stayed as they were but each platform would analyse the scores received to the topics in its area of interest by the other platforms and if they felt that there were subtopics not correctly scored, they would consult with the respective platform. It was also decided that a second meeting organized online would be organized among Task 2.1 members and platform representatives on 2 November 2022, where prioritisation of the subtopics by platforms would be finalized in order to proceed to the next step of consultation with POMs and other stakeholders. The minutes of the meeting from 15 October 2022 can be seen in *Annex 8*.

Most of the platforms resent their updated scoring while one platform decided not to modify their original scoring. Based on these final scores sent by the platforms, the ranking of the subtopics was done by Task 2.1. This was presented to the platforms, and after some discussion received the approval of platforms. *Annex 9* shows the slides of the presentation, containing the updated scores by platforms, the final prioritisation criteria applied by Task 2.1 and the final ranking of the subtopics based on the platforms scoring. The next steps were the consultations with POMs, SAB and other stakeholders. The annex also shows the steps proposed by Task 2.1 for consultations with POMs.

4. Feedback from POMs, SAB and other stakeholders

After the discussions with the platforms the list of subtopics was updated taking into account the comments received. Feedback was requested from POMs after an e-mail sent by the WP2 leader to all PF POMs (*Annex 10*) on 13/11/2022, to which the following documents were attached:

- 01 INFO Prioritized TOPICS and SUBTOPICS.docx (*Annex 11*)
- 02 FILL OUT Ranking prioritisation.xlsx (*Annex 12*)
- 03 FILL OUT Commenting on prioritisation.docx (see Annex 9)
- 04 Appendix A Documents used for drafting topics and subtopics_1st PIANOFORTE Open Call.docx (see Annex 3)
- 05 Appendix B Methodology for prioritisation of subtopics_1st PIANOFORTE Open Call.docx (see Annexes 5 and 9)
- 06 Appendix C All suggested TOPICS and SUBTOPICS_1st PIANOFORTE Open Call.docx (*Annex 13*)

Before contacting POMs all documents were sent to PF Executive Board for comments and approval. In principle, the procedure and the documents were approved. There was a suggestion from WP3 leader to indicate which attachments are essential for POMs to be consulted and which attachments can be considered as appendices to the essential documents. This was revised accordingly.

In parallel, PF WP3 organised a consultation on the prioritised subtopics for the PF 1st call, both with the Stakeholder and Advisory Board (SAB) members. and with external stakeholders (by Topical online meetings, TOMs).They were provided with the same documents than POMs and asked for the same type of comments on the text and priority ranking (Table 1 and Table 2). The details of this consultation are described in Deliverable 3.1.

The pooled comments received by POMs, SAB and TOMs and replies by Task 2.1 can be seen in *Annex 14*.

The ranking of subtopics from POMs can be seen in *Annex 15*.

In the meantime, prioritisation from SAB and TOMs was also received. The pooled prioritisation ranking of the subtopics can be seen in *Figure 2*.

A great degree of synergy could be seen in the prioritisation of research topics by the four bodies. Four research topics reached overall consensus (A1 – high; A2 – very high; D3 – moderate and F2 – high), while divergent opinions were only seen in case of four topics (B1, C1, C2 and G1), slight differences were noted in the ranking of the rest of the topics.

5. Finalisation of call topics

Based on these evaluations the PF Executive Board, in a meeting held on 13 December 2022, decided to propose for the PF General Assembly (to be held on 17 January 2023) the following three research topics to be included in the first open call: A2, D1 and G2. These three topics were related to priorities identified by MELODI (A2), EURAMED (D1) and NERIS (G2).

Topic	Subtopic	RANKING EVALUATION				POMs: 17 answers	ExeB: Call 1
		Platforms	SAB	TOM	e-Survey preli		
A	A1	HIGH	HIGH	HIGH	6,5	HIGH (2+, 2-)	NO
	A2	VERY HIGH	VERY HIGH	VERY HIGH	6,5	VERY HIGH (2-)	YES
	A3	VERY HIGH	HIGH	VERY HIGH	6,5	VERY HIGH (1-)	CROSS-CUTTING
	A4	HIGH	HIGH	VERY HIGH	6,5	HIGH (3+_ITA)	NO
B	B1	MODERATE	HIGH	HIGH	5,2	MODERATE/HIGH (5+)	NO
C	C1	HIGH	MODERATE	VERY HIGH	4,8	HIGH (2-, 1+)	NO
	C2	MODERATE	HIGH	HIGH	4,8	MODERATE (1+)	NO
D	D1	VERY HIGH	HIGH	VERY HIGH	6,2	VERY HIGH (2-)	YES
	D2	MODERATE	HIGH	HIGH	6,2	HIGH (7+_ITA)	NO
	D3	MODERATE	MODERATE	MODERATE	6,2	MODERATE (4+)	NO
E	E1	MODERATE	MODERATE	HIGH	6,0	MODERATE/HIGH (5+)	NO
F	F1	HIGH	MODERATE	HIGH	5,9	HIGH (1-)	NO
	F2	HIGH	HIGH	HIGH	5,9	HIGH (2+)	NO
	F3	MODERATE	HIGH	MODERATE	5,9	MODERATE (2+)	NO
G	G1	HIGH	MODERATE	VERY HIGH	6,0	HIGH (2+)	NO
	G2	HIGH	HIGH	VERY HIGH	6,0	HIGH/VERY HIGH (7+_ITA, 1-)	YES
H	H1	HIGH	HIGH	HIGH	5,3	MODERATE/HIGH (5-_ITA)	NO

Figure 2: Summary of ranking prioritisation by platforms, POMs, TOMs and SAB.

The final text of the topics proposed by the PF Executive Board and approved by PF GA for the PF Open Research Call 1 is as follows:

A2

Developing a knowledge base for a better understanding of the disease pathogenesis of ionising radiation-induced cancer to improve human health risk assessment.

While the role of DNA damage in the carcinogenic process following ionising radiation exposure has been extensively studied, it is clear that other factors modulate cancer development, such as the cellular and tissue microenvironment, immune status, metabolic processes and epigenetic factors.

The proposals should focus on the investigation of the role of epigenetics, metabolic status, immune status, cellular interactions and microenvironmental effects using biologically relevant experimental *in vivo* or *in vitro* models and/or biologically based models for risk.

Since our current understanding of radiation carcinogenesis is almost exclusively based on high dose ionising radiation, while at low doses other mechanisms may prevail priority should be given to low dose studies.

Proposals may address one or several research areas of the topic.

D1

Individualised diagnostic and therapeutic procedures for optimisation of benefit/risk ratios.

Individualization and optimization of diagnostic and therapeutic procedures with a focus on optimal efficacy in combination with high safety for patients are of high priority. While progress has been made, there is a need for additional research to complement and build upon the work carried out in recent projects.

Imaging of anatomical structures is a major task in clinical practice, therefore improved optimisation is needed in terms of increasing diagnostic efficacy and reducing radiation-induced side effects. In radiotherapy, the aim is also to increase treatment efficacy with reduced toxicity and secondary radiation-induced side effects on health.

The proposal should focus on the development of evidence-based procedures encompassing one or more of the following applications:

- in the diagnostic and imaging field applications such as molecular imaging, interventional procedures or theranostic applications,
- in radiation therapy applications such as various external beam radiotherapy protocols or radiopharmaceutical therapies.

The proposed evidence-based procedures should rely on the assessment of benefits and risks based on patient data.

G2

Development of risk assessment and risk management approaches and technological capabilities to cope with scenarios arising from threats due to war or armed conflict situations or natural disasters taking into consideration social, ethical and legal issues.

This call topic aims to develop risk assessment and risk management approaches and technological capabilities to cope with threats due to war or armed conflict situations or natural disasters, that have not been previously studied, taking into consideration social, ethical and legal issues.

Proposals should focus on identifying and addressing gaps related to one or more of the following objectives within a war, armed conflict or significant natural disaster situation:

- Review of whether the current assumptions made in the existing systems for radiation emergency preparedness and response are resilient in armed conflict, war or natural disaster situations.
- Development of event scenarios relevant to the above situations, including assessment of potential source terms for both attacks on nuclear facilities but also in relation to nuclear detonation scenarios.
- Further improvement, evaluation and operationalization of inverse modelling for localisation and quantification of unknown emission sources of radioactive material, including exploitation of different types of monitoring data, capabilities to handle multiple-source scenarios and potential employment of novel approaches such as artificial intelligence and big-data technologies.
- Uncertainty quantification in the abovementioned scenarios, development of advanced methods to improve calculation efficiency of uncertainties, such as artificial intelligence or machine learning methods, efficient computational and/or statistical methods and the integration of latest developments in risk science.
- Monitoring strategies with mobile and advanced monitors in such armed conflict situations or natural disasters, relying also on a citizen science approach and providing early detection of threats.
- Development of indicators for protective action strategies that can be applied even with little information on the affected area, with consideration of technical and non-technical aspects.
- Development of communication strategies including methods and materials appropriate for use in such situations.
- Social and psychological challenges for emergency responders and citizens and their impacts on the effectiveness of protective actions, the legal foundations and practical arrangements for emergency response and recovery.
- Societal resilience, stakeholder involvement and ethical considerations.

6. Concluding remarks

Task 2.1 assembled a list of 17 research topics based on the CONCERT Joint Roadmap game changers reflecting the research priorities of the six platforms. The number of research topics were not equally distributed among platforms. The reason for this unequal distribution relies in the different number of identified game changers in the CONCERT Joint Roadmap. Four topics (23.5%) belonged to topic A proposed by MELODI, one (5.9%) to topic B proposed by EURADOS, two topics (11.8%) belonged to topic C proposed by ALLIANCE, three topics (17.6%) belonged to topic D proposed by EURAMED, one topic (5.9%) belonged to topic E proposed by EURADOS, three topics (17.6%) belonged to topic F proposed by

ALLIANCE, two topics (11.8%) belonged to topic G proposed by NERIS and one topic (5.9%) belonged to topic H proposed by SHARE. Thus, the most research topics (29.4%) fell in the research priority of ALLIANCE, followed by MELODI (23.5%), EURAMED (17.6%), EURADOS and NERIS (11.8% each) and SHARE (5.9%).

Comments could be sent to improve or change individual subtopics but no new topics could be added to the list. Comments were received by platforms, POMs, SAB and TOMs. Taking into account the criteria assembled by Task 2.1, the platforms scored the 17 subtopics , based on which Task 2.1 performed a ranking of the topics into very high-high-moderate-low. The groups consulted (POMs, SAB and external stakeholder) could only express their opinion on the prioritisation ranking and make suggestions for changes in the text describing the topics. The summary of the prioritisation indicated a high degree of consensus among the different groups consulted (an overall consensus or a high degree of consensus was reached for 76.5% of the research topics and only less than one quarter of the topics were evaluated differently by the groups consulted). In general, suggestions were in the direction of “upgrading” a topic. The final outcome of the prioritisation indicated three topics ranked as very high (A2 and A3 proposed by MELODI and D1 proposed by EURAMED) and there were no topics having low priority.

Based on these priorities PF Executive Board proposed to the GA three topics to be included in Call 1. These topics are:

- A2: Developing a knowledge base for a better understanding of the disease pathogenesis of ionising radiation-induced cancer to improve human health risk assessment.
- D1: Individualised diagnostic and therapeutic procedures for optimisation of benefit/risk ratios.
- G2: Development of risk assessment and risk management approaches and technological capabilities to cope with scenarios arising from threats due to war or armed conflict situations or natural disasters taking into consideration social, ethical and legal issues.

A separate deliverable will analyse lessons learned from the prioritisation process of the research topics for the first open call.

Prioritisation process for the second open call will start in March 2023. A detailed prioritisation workflow will be set together with WP3, which will be applied only after FP Executive Board approval. This time, POMs, SAB and external stakeholders will have the possibility to suggest new topics, which will be reviewed by platforms. Platforms will also be involved in defining the ranking criteria of the topics. Those topics, which were chosen for Call 1 will be excluded from Call 2.

7. Annexes

7.1 List of annexes

Annex 1: Prioritisation workflow

Annex 2: Shortlist of suggested topics and subtopics for PIANOFORTE Call 1 – version sent to platforms for comments on 15 September 2022

Annex 3: Detailed overview of documents based on which research priorities were drafted

Annex 4: Call topics and subtopics – with evaluation, version sent to platforms for comments on 15 September 2022

Annex 5: Proposed prioritisation of subtopics for PF Call 1

Annex 6: Priority comment sheet_combined for all platforms and replies by Task 2.1

Annex 7: Summary of scores received from platforms and discussed on 15 October 2022.

Annex 8: Minutes of the meeting between Task 2.1 members and platforms in Estoril, Portugal on 15/10/2022

Annex 9: Slides of the presentation made for the second round of discussion with platforms on 02/11/2022

Annex 10: Letter sent to POMs with instructions regarding the feedback expected from them

Annex 11: Prioritized TOPICS and SUBTOPICS.docx – sent to POMs and other stakeholders

Annex 12: Ranking prioritisation template for POMs, SAB and other stakeholders

Annex 13: Detailed list of prioritized subtopics – updated after discussion with platforms, sent to POMs and other stakeholders

Annex 14: All comments received by POMs, TOMs and SAB structured along topics

Annex 15: Summary of ranking prioritisation received from POMs

7.2 Annex 1

Prioritisation workflow for the first open call

1. A first synthesis of research topics and subtopics for prioritisation and feedback from other partners

Work is carried out by Task 2.1 partners

Definition of research topics and identifying subtopics

PIANOFORTE set as a major priority to launch the first open call as soon as possible, within 10 months from the start of the project (by end of March 2023). Task 2.1 has to identify and prioritise topics for the first open call and integrate the feedback received from platforms, stakeholders and POMs within max. 8 months. This short time frame does not allow to organise large-scale consultations with all interested partners, therefore it was decided that identification of subtopics will be based primarily on the joint research challenges and their respective game changers from the CONCERT Joint Roadmap, which will be harmonized with PIANOFORTE objectives and expected outcomes and scientific recommendations of recently closed projects such as MEDIRAD. Exception is for topics related to medical applications (Topic D), where topics are based on the currently made EURAMED SRA in the frame of the EURAMED rocc-n-roll project and MEDIRAD scientific recommendations. (At the time of making the CONCERT Joint roadmap and the game changers EURAMED had not have yet an SRA)

A list of 8 topics based on CONCERT Joint Roadmap will be assembled by Task 2.1 members. For each identified topic a short textual evaluation will be provided.

A number of subtopics will be linked to the identified topics. These subtopics will also be textually evaluated. It will be the subtopics that will be prioritised and used for the call text.

In order to help prioritisation of the subtopics the following prioritisation criteria will be used:

1. Feasibility
2. Relevance for PIANOFORTE
3. Relevance at EC level
4. Societal impact
5. Scientific impact
6. Redundancy

IMPORTANT TO NOTE: This priority list will only apply for Call 1. Those subtopics, which are not prioritised very high for the first call, will be considered for Calls 2 and 3. Nevertheless, for Calls 2 and 3 platforms and POMs will get the possibility to suggest new topics, currently not included in the Joint Roadmap.

Deadline for distribution of first priority list to platforms: September 15

2. Feedback from platforms

What kind of feedback are we expecting?

- comments to the textual evaluation of the individual subtopics from the point of view how they adhere to the main priority criteria
- rewording of the subtopics
- replacing proposed subtopics (if the proposed subtopics are not acceptable by the platforms and they cannot be revised, platforms can replace them with justification, why the replacement is needed based on the prioritisation criteria from above). If a subtopic is replaced, a new prioritisation will be made for that particular subtopic. The platforms are requested to replace, if needed maximum 1 subtopic from the whole list, and this subtopic should be linked to their speciality.
- scoring of subtopics based on the provided prioritisation criteria

A template for comments as well as a table for scoring is provided, which should be used to suggest changes and make ranking.

Deadline for receiving the comments from the platforms: October 5, 2022.

A round-table discussion will take place among Task 2.1 members, PIANOFORTE Executive Board members and platforms' representatives on 14 October, 2022 (9h00-13h00). The aim is to discuss the received feedback.

3. Integrating feedback from platforms and requesting feedback from POMs, PF Stakeholder and Advisory Board (SAB) and external stakeholders.

Based on the feedback received from platforms an updated list of topics and subtopics will be made.
Based on the scoring of the subtopics by the platforms the overall ranking of the subtopics will be defined. Four categories will be identified:

Very high
High
Moderate
Low

Task 2.1 will provide a first ranked list of prioritized subtopics and distributed to POMs and stakeholders (via WP3).

What kind of comments are we expecting from POMs and stakeholders?

- comments to the ranking of the individual subtopics based on the prioritisation criteria detailed above (such as "the impact of this subtopic is bigger because....'),

- rewording of the subtopics (with justification why it is needed).

We do not expect subtopic replacements or suggestions of new subtopics.

A template for comments is provided, which should be used to suggest changes.

Deadline for distributing the updated list of priorities to POMs and stakeholders: 31 October 2022.

Deadline for receiving comments from POMs and stakeholders: 30 November 2022.

4. Integrating feedback from POMs (SAB and external stakeholders)

Amended new version of the document containing the views of the POMs, SAB and external stakeholders will be assembled and discussed in the frame of a video conference with WP2 and WP3 members.

Timing: second-third week of December (before Christmas holidays)

5. Finalisation of the document – with regular online consultations among Task 2.1 members (and if needed with WP3)

Deadline: end of January, 2023

7.3 Annex 2

Topics and subtopics for PIANOFORTE Call 1

Overview of topics and subtopics

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[2]). 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****.*

Guidelines for integration of Social Sciences and Humanities in PIANOFORTE funded projects are currently under development and will be made available before the launching of Call 1.

A. Understanding and quantifying the health effects of radiation exposure

A1. Define the risk of ionising radiation-induced non-cancer diseases after low and intermediate doses (below 500 mGy) by understanding disease pathogenesis through assessing near-field, out-of-field and non-targeted effects after therapeutic doses and dose-rates and following interventional radiology. The focus should be on developing a knowledge base on the mechanisms of cardiovascular, cerebrovascular, neurocognitive diseases, metabolic and immune disorders applying biologically-based risk models and/or available human cohorts, followed by related risk perception and risk communication studies. Studies related to ionising radiation-induced cataracts and establishment of new human cohorts are not within the focus of the current call.

Proposals should address one or several objectives of the topic. The topic is suitable for both large and smaller, more focused proposals.

A2. Developing knowledge base for a better understanding of disease pathogenesis of ionising radiation-induced cancer to improve risk assessment. While the role of DNA damage in the

[2] 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

carcinogenic process after IR was extensively studied, by now it is clear that other processes significantly modulate cancer development, such as the role of microenvironment, the immune status, metabolic processes and epigenetic factors.

The proposals should focus on investigating the role of epigenetics, metabolic status, immune status, cellular interactions and microenvironmental effects applying biologically relevant experimental in vivo or in vitro models. Since our current understanding of radiation carcinogenesis is almost exclusively based on high dose IR, while at low doses other mechanisms may prevail priority should be given to low dose studies.

Proposals should address one or several objectives of the topic. The topic is suitable for both large and smaller, more focused proposals.

A3. Developing a knowledge base and analytical tools to understand the major features of variability in the radiation response including radio-sensitivity (tissue reactions), radio-susceptibility (cancers) and radiation-induced aging by focusing on one (or both) of the following subtopics:
- A better understanding of the role of genetic factors, epigenetic factors, sex, co-morbidities, environmental and lifestyle factors and the interactions between these depending on dose levels. Studies should focus on a better understanding of the mechanisms and link to advancing individualised cancer treatment, including communication among patients, caregivers, medical personnel and other stakeholders in order to empower them for informed decision-making and informed consent.
- Seeking biomarkers of individual risk through cellular/molecular, systems biological approaches, radiomics investigations. Evaluating potential predictive factors and correlating them with health outcomes. Biomarker investigations should include validation of proposed biomarkers in suitable cohorts. In case of studies related to previously identified biomarkers validation and quality control should be included.

Larger projects are favoured. Nevertheless, smaller, more focused projects may also be considered.

A4. 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:
- Understanding the link between exposure characteristics (radiation quality, dose and dose-rate, acute and chronic exposures) and the cancer and non-cancer effects.
- 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).

The topic is suitable for both large and smaller, more focused proposals.

B. Improving the concepts of dose quantities

B1. To quantify correlations between track structure and radiation damage, including improved measurement and simulation techniques.

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.

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

- Investigating the physical characteristics of particle track structure 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.

The topic is suitable for both large and smaller, more focused proposals.

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

C1. Characterise the influence of exposures on the populations currently living in radioactive contaminated environments and identify the key factors determining the vast variation in wildlife populations' sensitivity to radiation. Identify and validate biomarkers of exposure and effects that are relevant for effects at the population level.

The topic is suitable for both large and smaller, more focused proposals.

C2. Determine the effects of ionising radiation on ecosystem functioning, as well as potential effects of exposures to human wellbeing (e.g. culture, food consumption, work and recreational activities).

Larger projects are favoured. Nevertheless, smaller, more focused projects may also be considered.

D. Optimising medical use of radiation

D1. Individualise diagnostic as well as therapeutic procedures with regard to optimisation of the benefit/risk ratio. This includes the development of evidence-based procedures and encompasses applications such as molecular imaging, interventional procedures and theranostic applications. Evidence-based procedures should rely on benefit and risk based on patient data rather than on model data wherever feasible.

Smaller, more focused projects are favoured.

D2. Improving the quality of medical imaging and radiation therapy especially but not limited to cancer-treatment. This includes means to i) standardize implementation of optimized applications, e.g. evaluation of radiation dose and image quality integrated in quality assurance ii) set up of reliable AI methodologies for medical applications. Including strategies for testing and validation of data and methods to allow application independent of hospital equipment.

Social, ethical and legal dimensions of the use of AI should also be addressed, in particular, how the use of AI will impact current practices; what the effect will be on the gaps observed between best practice and guidelines, on the one hand, and current practices, on the other; and what the concerns and expectations of patients and other stakeholders are in the context of these technological developments.

The proposed research should contribute to the harmonization and application of technology and, in the context of informed consent, communication throughout Europe. Patient organizations must be involved.

Smaller, more focused projects are favoured.

D3. Implementing EU-wide epidemiological studies of patients to enhance quality and safety of medical radiation applications and developing a knowledge base and analytical tools to better predict and reduce risk of secondary cancer and non-cancer disease in cancer patients treated with radiotherapy.

Well-designed clinical epidemiological studies should conduct long term follow up, and focus on most at risk populations. The results of the clinical epidemiological studies should be used to optimise treatment and imaging protocols and patient follow-up. The studies should consider patient-specific dose modifiers in derivation of dose estimates as appropriate to different settings and can increase capabilities for radiation dose tracking and managing programmes to provide relevant and standardized dose estimates.

The topic should explore ways to improve communication among patients, caregivers, medical personnel and other stakeholders in order to empower them for informed decision-making and consent and improve radiation protection behaviours.

Proposals should address one or more objectives of the topic. The topic is suitable for both large and smaller, more focused proposals.

E. Improving radiation protection of workers and population

E1. Developing a knowledge base and analytical tools to improve radiation protection of workers and the population and thus to contribute to the translation of the BSS into practice by focusing on one or more of the following objectives:

- Development of biokinetic models and personalised dosimetry that will lead to the improvement of the assessment of internal exposure for occupational exposed workers;

- Development of real time practical individual dosimetry of workers by harnessing the developments in new connected technologies, with due account to individual behaviour and social group culture;

- Development of a practical neutron personal dosimeter.

The topic is suitable for both large and smaller, more focused proposals.

F. Developing an integrated approach to environmental exposure and risk assessment from ionising radiation

F1. Robust modelling of radiological contamination in the human food chain, for an integrated dose and risk assessment of post-emergency situations, with focus on building resilient and sustainable societies. The topic should take into account future changes in the European

agricultural practices and the need to further develop marine dispersion and biota transfer models due to the fact that NPPs are often built on the coast and the future tendency of building them on floating vessels.

The topic is suitable mainly for smaller, more focused proposals.

F2. Identifying and quantifying the key processes that influence radionuclide behaviour in existing environmental contamination situations with a special focus on:
- the management and clean-up of existing sites, as well as to the licensing (including social licensing) of future discharges and large quantities of NORM waste.
- developing the modelling basis for accurate dose assessment and establishment of holistic and sustainable remediation approaches.

The topic is suitable for both larger and smaller, more focused proposals.

F3. Integrating risk assessment and management and especially focusing on risk integration for radiation and other stressors. Specific emphasis is required on integrated and holistic risk assessments. There is a need for the improvement and/or development of innovative methods to characterise the source terms to delineate the multiple-hazard footprint (e.g., geostatistical interpretation of environmental, radiological, chemical data) of a site in space and time. Innovative modelling approaches are also needed to support decision making and to identify the most significant sources of uncertainty related to the impact on human and environmental health including social considerations.

Larger projects are favoured. Nevertheless, smaller, more focused projects may also be considered.

G. Optimising emergency and recovery preparedness and response

G1. Improvement of radiological impact assessments, decision support and response and recovery strategies by focusing on one or more of the following aspects:
- the use of AI and big data technologies in radiological impact assessments, in the development / optimisation of measurement strategies, for the calculation (along with other novel methodologies) of uncertainties in model results and for optimization and operationalization of emergency preparedness and response practices; integration of AI and big data technologies in Decision Support Systems for better guidance of the end user in countermeasure strategy definition;

- compilation of the databases that are required by AI technologies, with historic and scenario information - including besides nuclear/radiological accidents, scenarios of new threats, such as war situations;
- improved communication/dialogue with stakeholders due to better information availability, considering data protection regulations (GDPR).

The topic is suitable for medium-sized proposals.

G2. Further development of risk assessment and risk management approaches, technological capabilities to cope with accident scenarios arising from new and future nuclear and radiological technologies and new threats arising from war situations, including further development of monitoring and dosimetry techniques, and taking into consideration social, ethical and legal issues. Proposals should focus on one or more of the following objectives:
- event scenarios, including assessment of potential source terms;
- further improvement, evaluation and operationalization of inverse modelling for localisation and quantification of unknown emission sources of radioactive material, including exploitation of different types of monitoring data, capabilities to handle multiple-source scenarios and potential employment of novel approaches such as AI and big-data technologies;
- operational application of data assimilation (combination of monitoring - including citizen monitoring- and simulation results) for improving the reliability of the operational diagnosis and prognosis of the radiological contamination;
- uncertainty quantification in the abovementioned topics, development of advanced methods to improve calculation efficiency of uncertainties, such as AI/Machine Learning methods, efficient computational and/or statistical methods and the integration of latest developments in risk science;
- monitoring strategies with mobile and advanced monitors, relying also on citizen science approach and providing early detection of threats
- development of indicators for strategies that can be applied even with little information on the affected area, with consideration of technical and non-technical aspects;
- social and psychological challenges for emergency actors and citizens and their impacts on the effectiveness of protective measures, legal basis and practical arrangements for emergency response and recovery;
- societal resilience, stakeholder involvement and ethical considerations.

The topic is suitable for medium-sized proposals.

H. Radiation protection in/with society

H1. Effective translation mechanisms between social and technical dimensions of radiation protection.

The objective of the topic is to investigate how different radiation protection actors perceive the added value of inter- and transdisciplinary collaborations in the field of radiation protection; what their expectations and needs are; what challenges and enablers of collaborations can be found in the different radiation protection fields; and what are the main barriers for the institutional uptake of results from inter- and transdisciplinary collaborations. Projects addressing this topic should contribute to developing systematic approaches to inclusion of societal dimensions within the radiological protection system and methodological innovation enabling inter- and transdisciplinarity in radiation protection research.

The topic is suitable for smaller-, more focused projects, as well as medium-sized projects addressing different radiation protection fields.

7.4 Annex 3

Detailed overview of documents based on which research priorities are drafted

Synthesis is based on the following documents:

- PIANOFORTE specific objectives and expected outcomes
- EURATOM call priorities – formulated in the HORIZON-EURATOM-2021-NRT-01-09: European Partnership for research in radiation protection and detection of ionising radiation call text in 2021
- CONCERT Joint roadmap reflecting the joint research challenges formulated by the RPR platforms (ALLIANCE, EURADOS, EURAMED, MELODI, NERIS, SHARE) – the JRM reflects the view of the platforms at the time of preparing the JRM (2019-2020), except for EURAMED

The following documents and inputs are taken into consideration during the synthesis of call topics and priorities:

- HORIZON Europe priorities
- EURATOM STC opinion, position, input
- other EU initiatives (eg. Samira project)
- EU JRC in Nuclear safety and security
- recently closed or currently running EC-funded projects and tenders

PIANOFORTE (Grant Agreement Document, Annex 1, Part B)

This is the most up-to-date synthesis of the research needs of the RPR community, which based on the joint research challenges formulated in the Joint Roadmaps provides an updated view of primary objectives and expected outcomes assembled in a way to respond to the main priorities of the EURATOM call. Therefore, the objectives and outcomes defined by the project already indicate certain research priorities in alignment with EURATOM and HORIZON EUROPE which do not always follow those in the Joint Roadmap.

The priorities or research needs that will be addressed in the Partnership are as follows (Part B, pp. 8-9):

1. To improve the prevention, detection and safe treatment of cancer

2. To consolidate regulations and improve practices in domains using ionising radiation by capturing low-dose research advances

3. To improve the anticipation and resilience in case of radiological or nuclear event and the management of legacy sites by providing a scientific basis to recommendations, procedures and tools

Scientific specific objectives (Part B, pp. 10-11):

1. 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.

2. To improve scientific understanding of the variability in individual radiation response and health risk of exposure.

3. 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.

4. 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.

Expected outcomes (Part B, pp. 19-20):

1.Improvement in the understanding of the link between exposure characteristics and ionising radiation effects

2. Better knowledge of the main characteristics of the variability in the radiation response

3. Progress in the integration of the different components of radiobiology paving the way to advanced integrative radiobiology

4. Improvement of techniques used to direct radiological population monitoring and indirect monitoring through environment sampling

5. Implementation and use of big data and artificial intelligence techniques in certain fields of radiation protection (such as medical applications, emergency preparedness); awareness of these techniques among the whole community

6. Trained young researchers and career upgrades of researchers and experts in radiation protection

7. Creation of a network of radiation protection research facilities

8. Creation of a FAIR database that will allow future use of data gathered during PIANOFORTE

9. Raising awareness among the radiation protection research community of the importance and added value of the inclusion of social sciences in research projects

10. Strengthening the integration between the six research platforms in radiation protection

11. Support of the implementation of the Basic Safety Standards Directive in the Member States by: (a) improving risk estimates for the justification of practices and optimisation of the radiological protection of all persons concerned; (b) improving radiation protection of workers and the public, in normal and accidental situations, by improving the scientific basis to recommendations, procedures and tools; (c) better acceptance of radiation protection measures in normal and accidental situations; improvement of the understanding of public perception on radiation risk.

12. Improved practices and recommendations for radiation protection professionals

13. In the field of medical applications: (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

14. Improvement of the radiation protection of patients and of the general public in normal and accidental situations

15. Better knowledge on radiation risks

EURATOM call priorities:

This defines a priority list of the EC at the time of the release of the call for RPR partnership for which PIANOFORTE responded (2021). It partly reflects the research priorities of the Joint Roadmap. However, it already contains novel elements not present in the Joint Roadmap (eg. evaluating co-exposures and overlapping risks in risk estimation; introducing a more sophisticated approach of defining individual variability in response to radiation, such as distinguishing between radiation sensitivity and susceptibility, highlighting the role of radiation-induced ageing and immune response; highlighting the need for integrative radiobiology, etc).

The major expected outcomes of the call are:

1. Establishing improved risk estimates for the justification of practices and optimisation of radiological protection of the members of the public, patients, workers and environment in all exposure situations (medical, natural, occupational, accidental, including co-exposure and overlapping risks), in order to support the implementation of the Basic Safety Standards Directive.

2. Advancing state-of-the-art understanding of the link between exposure characteristics (radiation quality, dose and dose-rate) and the cancer and non-cancer effects, including optimised detection and dosimetry.

3. Developing a knowledge base and analytical tools for the major features of variability in the radiation response, including radio-sensitivity (tissue reactions), radio-susceptibility (cancers) and radio-degeneration (ageing), radio-induced immunoresponse, in humans and ecosystems.

4. Advancing integrative radiobiology from basic mechanisms to clinic and epidemiology, including human and social sciences to further characterise and evaluate ionising radiation effects.

5. Providing a scientific basis and establishment of priorities for medical applications of ionising radiation, taking a broad approach to the public health impact, in view of addressing knowledge gaps relevant for decision-making, reinforcing the risk/benefit analysis, advancing individual patient dosimetry, developing recommendations, procedures and tools for improving radiation protection of patients, and supporting effective transfer of new and optimised medical procedures into clinical practice.

6. Providing a scientific basis to recommendations, procedures and tools for improving radiation protection of workers and of the general public in line with the Basic Safety Standards Directive.

7. Providing a scientific basis to recommendations, procedures and tools for assuring and improving preparedness for nuclear and radiological emergency response and recovery, including the improved knowledge about which values need to be accounted for in stakeholder involvement, as well as direct radiological population monitoring and their indirect monitoring through environment sampling and measurement, also based on computational techniques that make use of big data and artificial intelligence.

8. Reinforcing training through research in the field radiation protection and encouraging continuous training and career upgrades

9. Facilitating access to research infrastructure and promoting the integration of data, FAIRisation processes (Findable, Accessible, Interoperable, Reusable)

10. Improving public engagement, the understanding of public perception on radiation risks, identification of different target groups among stakeholders, and the public communication and participation on radiation risks and protection measures, to favour public acceptance of these measures.

CONCERT Joint roadmap with the joint research challenges and the game changers:

This is the currently available most detailed list of consensual research topics and priorities of the European RPR community, which represents the views of the 6 radiation protection research platforms. This document gives an overview of the status of RPR at the time of the

preparation of the document (2019) and identifies major research directions in the different fields of radiation protection for the near future (next 5 years) and in the long run.

The disadvantage of the document is that it represents the status of radiation protection research at the time of the preparation, which by now is minimum 3 years old. It has not been updated since that time. Since research is not static, this is a major drawback of the document. The priority ranking of several of the identified topics might have changed for several reasons such as new scientific findings, changes in radiation protection-related practices, technical progress or due to the fact that in the meantime certain priorities have already been addressed by other projects.

Main research challenges and game changers within the research challenges identified within the Joint Roadmap:

A. Understanding and quantifying the health effects of radiation exposure

A1. Define the risks of non-cancer diseases at low and intermediate dose levels (100 - 500 mGy and below)

- Circulatory effects at near-field / out-of-field therapeutic doses and dose-rates and following interventional radiology
- Cerebrovascular / neurocognitive, metabolic and immune diseases, at progressively lower doses

A2. Integration of epidemiological estimates of cancer risk with a more complete understanding of radiological disease pathogenesis to improve cancer risk assessment

- Defining processes contributing to cancer development after exposure; e.g. role of epigenetics, metabolic status, in single and multiple stressor at low doses and dose-rates
- Definition of target cell populations and cell interactions/microenvironmental effects

A3. Characterisation and quantification of variation in response and risk between population sub-groups/individuals due to genetic factors, sex, co-morbidities, dedicated exposure of disease areas in patients, environmental and lifestyle factors and the interactions between these depending on dose levels.

- Evaluation of potential predictive factors and correlating them with health outcomes.
- To improve the understanding in the difference of the dose response curve shape between males and females, as observed in the LSS cohort
- Integrative radiobiologically oriented systems biology, setup of adverse outcome pathways related to ionising radiation and in combination with other stressors including diseases

- Seeking biomarkers of individual risk through cellular/molecular and systems biological approaches as well as radiomics investigations

A4. Define how the temporal and spatial variations in dose delivery affect the risk of health effects following radiation exposure

- Addressing the difference between risks from acute and chronic exposures through the integration of experimental and epidemiological data applying biologically-based risk models
- To improve the understanding of 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)

<u>B. Improving the concepts of dose quantities</u>

B1. To improve the understanding of spatial correlations of radiation interaction events by improved measurement and simulation techniques

B2. To quantify correlations between track structure and radiation damage

<u>C. Understanding radiation-related effects on non-human biota and ecosystems</u>

C1. Resolving the controversy with regard to the effects on wildlife reported in the Chernobyl and Fukushima exclusion zones

- Characterise the influence of exposures on the populations currently living in contaminated environments (whole exposure assessment, including past exposures)
- Identify the key factors determining the vast variation in wildlife populations' sensitivity to radiation
- Identify and validate biomarkers of exposure and effects that are relevant for effects at the population's level

C2. Determine the effects of radiation on ecosystem functioning

<u>D. Optimising medical use of radiation</u>

D1. Development of new medical applications or optimisation of existing ones depending on disease related applications e.g. interventional procedures, CT based approaches, targeted therapies in nuclear medicine and particle based therapies to improve patient protection relying on corresponding improved dosimetry procedures for individual patients

- New interventional procedures, CT based approaches, targeted therapies in nuclear medicine and particle based therapies
- Molecular imaging, theranostics

D2. Application and development of AI methods to improve patient protection relying on suitable clinical data structures and taking into account the limits of the use of AI especially in the medical field

- development of suitable data structures to be able to use the generated patient data for AI methodologies, to understand the limits of the use of AI especially in the medical field and develop corresponding test configurations
- Ethics when applying AI based methods for decision (support) systems especially regarding radiation based therapies, AI based optimisation of individualised procedures

D3. Investigating key challenges and problems for the transfer of developments into clinical practice, evaluating conditions leading to large differences throughout Europe, defining standards for justification of applications depending on individual patient characteristics and benefit-risk evaluations of procedures including a dedicated education guaranteeing the best possible radiation protection for patients

- Investigating key challenges and problems for the transfer of developments into clinical practice, evaluating conditions leading to large differences throughout Europe, defining standards for justification of applications depending on individual patient characteristics and benefit-risk evaluations of procedures and including a dedicated education and training programme
- Evaluation of newly developed or optimised procedures regarding benefit/risk outcome (evidence based medicine). Development of a framework for clinical transfer and harmonisation.

<u>E. Improving radiation protection of workers</u>

E1. Development of biokinetic models and personalised dosimetry that will lead to the improvement of the assessment of internal exposure

E2. Development of real time practical individual dosimetry of workers by harnessing the developments in new connected technologies

E3. Development of a practical neutron personal dosimeter

<u>F. Integrated approach to environmental exposure and risk assessment from ionising radiation</u>

F1. Deriving a robust prediction of radiological contamination in the human food chain, for an integrated dose and risk assessment of post-emergency situations

- Include future changes in European agricultural practices, and, since NPPs are often build on the coast, and since in the future more NPPs built on floating

vessels are expected, we need further developments in marine dispersion and biota transfer models

F2. Identifying and quantifying the key processes that influence radionuclide behaviour in existing environmental contamination situations

- Management and clean-up of existing sites, as well as to the licensing of future discharges and large quantities of NORM waste
- Developing the modelling basis for accurate dose assessment and establishment of remediation approaches

F3. Integrating risk assessment and management (consistent exposure assessments for humans and wildlife; risk integration for radiation and other stressors)

G. Optimise emergency and recovery preparedness and response

G1. Change of radiological impact assessments, decision support and response and recovery strategy by Artificial Intelligence (AI) and big data

- Use of AI and big data in radiological impact assessments and measurement strategies
- Development of a new DSS that uses AI and big data capabilities to better guide the end user in countermeasure strategy definition
- Databases with historic and scenario information as starting point for decision making in new events, needed for the AI to learn
- Improved communication/dialogue with stakeholders due to better information availability
- Development of methods to combine uncertainties (e.g. Aleatory, Epistemological, Computational) with AI learning mechanisms

G2. Further development of risk assessment and risk management approaches, technological capabilities to cope with novel threats and accident scenarios arising from new and future
nuclear and radiological technologies, including further development of monitoring and dosimetry techniques

- Event scenarios, including assessment of potential source terms and evolution of events
- Inverse modelling, data assimilation
- Monitoring strategies with mobile and advanced monitors, relying on citizen science approach and providing early detection of threats
- Combination of monitoring (including citizen monitoring) and simulation of an updated operational picture
- Development of indicators for strategies that can be applied even with little information on the affected area

- Establishment of dialogue/communication with decision makers and concerned stakeholders to challenge the proposed approach on risk assessment and risk management

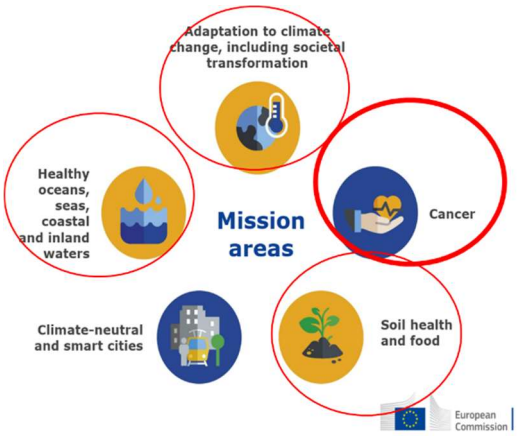
H. Radiation protection in society

H1. Better alignment of research and practice in RP with the values, needs and expectations of society

- Effective research translation mechanisms
- Development of systematic approaches to inclusion of societal dimensions at all levels of the RP system
- Methodological innovation enabling transdisciplinarity in radiation protection research

HORIZON Europe priorities – the "missions"

"A mission is a portfolio of actions across disciplines intended to achieve **a bold and inspirational and measurable goal** within a set timeframe, with **impact** for society and policy making as well as relevance for a significant part of the European population and wide range of European citizens." (Source: updated Horizon Europe presentation, https://ec.europa.eu/info/sites/default/files/research_and_innovation/ec_rtd_he-presentation_062019_en.pdf)



Several elements within the RPR fields can complement the achievement of several of the missions formulated by HORIZON EUROPE (such as cancer; soil health and food; healthy oceans, seas, coastal and inland waters; adaptation to climate change). Nevertheless, RPR has specific priorities as well which are strictly field-specific, and these also need to be taken into account during the prioritisation process.

Other EU initiatives (eg. Samira project)

This is an action plan with three main objectives (securing the supply of medical radioisotopes; improving radiation quality and safety in medicine and facilitating innovation and the technological development of medical ionising radiation applications). It is aimed to complement the Cancer mission of HORIZON EUROPE. Its goals are in great part overlapping with the research priorities formulated by EURAMED in the joint roadmap related to optimising medical use of radiation. Since the action plan also operates by releasing calls and providing financial support to projects, when assembling the priority list for PIANOFORTE open calls, a specific care should be taken for priorities with this field not to overlap with priorities already addressed by Samira in closed, currently open or planned calls.

The action plan defines EU actions in 3 priority areas:

- securing the supply of medical radioisotopes
- improving radiation quality and safety in medicine,
- facilitating innovation and the technological development of medical ionising radiation applications

EURATOM JRC – Nuclear security

(https://joint-research-centre.ec.europa.eu/science-areas/civil-security/nuclear-security_en)

This research topic focuses on radiation preparedness, prevention of misuse of nuclear material, physical protection of nuclear material and CBRN security. While radiation preparedness is represented in both the Joint roadmap and PIANOFORTE objectives, it targets mainly radiation and nuclear accidents and not the misuse of nuclear material or the issue of physical protection. Therefore, this is a research area obviously dealt with within EURATOM, but not represented in the main priorities of the RPR community.

This research topic covers areas such as:

- preparedness, prevention, detection and deterrence of misuse of nuclear material and technology and related training
- environmental protection and monitoring
- CBRN+E security
- Support to the Convention of physical protection of nuclear materials and facilities

Outcomes and recommendations of recently closed calls or objectives of calls running in parallel which need to be considered for possible overlaps

CONCERT (2015-2020, 17.100 k€, funded by by Euratom's research and innovation programme 2013-18) https://www.concert-h2020.eu/

9 sub-projects were funded.

CONFIDENCE (3 years, 6.200 k€)

Main objectives: perform research focussed on uncertainties in the area of emergency management and long-term rehabilitation. It concentrates on the early and transition phases of an emergency, but also considers longer-term decisions made during these phases.

LDLensrad (3 years, 2.500 k€)

Main objectives: how does low dose radiation cause cataracts; is there a dose rate effect, and how does genetic background influence cataract development after radiation exposure. The research will also address the issue of ageing in a sensitive subset of mice and whether lens effects can be viewed as global biomarkers of radiosensitivity.

TERRITORIES (3 years, 4.200 k€)

Main objectives: TERRITORIES targets an integrated and graded management of contaminated territories characterised by long-lasting environmental radioactivity, filling in the needs that emerged after the recent post-Fukushima experience and the publication of International and European Basic Safety Standards. A graded approach, for assessing doses to humans and wildlife and managing long-lasting situations (where radiation protection is mainly managed as existing situations), will be achieved through reducing uncertainties to a level that can be considered fit-for-purpose. The integration will be attained by: Bridging dose and risk assessments and management of exposure situations involving artificial radionuclides (post-accident) and natural radionuclides (NORM); Bridging between environmental, humans and wildlife populations monitoring and modelling; Bridging between radiological protection for the members of the public and for wildlife; Bridging between experts, decision makers, and the public, while fostering a decision-making process involving all stakeholders.

LEU-TRACK (28 months, 1.336 k€)

Main objectives: To investigate the mechanisms and pathways by which bone marrow-derived EVs may induce bone marrow damage, by influencing the communication between various cellular components of the bone marrow, and thus modulate low-dose radiation-induced leukaemia; To perform a detailed and systematic analysis of EV cargo using multiple omics techniques and complex phenotypical approaches with the aim of identifying radiation exposure biomarkers that potentially indicate an increased risk for leukaemia development; To correlate blood-derived EV markers identified in experimental animals with markers present in human leukaemia patients treated with prophylactic irradiation.

PODIUM (24 months, 1.400 k€)

Main objectives: to improve occupational dosimetry using an innovative approach: the development of an online dosimetry application based on computer simulations, without the use of physical dosimeters.

SEPARATE (28 months, 1.740 k€)

Main objectives: to address the relevance of out-of-target effects, from those observed after controlled radiation exposure in the laboratory to the dynamic exposure experienced by humans in typical radiation-exposure scenarios, and deliver a detailed mechanistic understanding of the processes governing the associated risks. The project aims to perform in vivo research focused on the analysis of the effects on brain, heart, and liver following exposure of the lower third of the body, whilst the target organs are shielded.

VERIDIC (24 months, 705 k€)

Main objectives: this project thus focuses on the harmonisation of radiation dose structured report and the validation of skin dose calculation software products in interventional cardiology to optimise the radiation protection of patients.

ENGAGE (24 months, 777 k€)

Main objectives: a) To address the questions of why, when, and how stakeholders are engaged in radiation protection issues; b) To develop novel approaches to analyse stakeholder interactions and engagement and provide guidance to meet the challenges and opportunities identified in response to (a); c) To investigate the processes for enhancing the culture of radiation protection and their role in facilitating stakeholder engagement and develop guidelines for the further development and enhancement of the radiation protection culture; d) To provide recommendations and build a joint knowledge base for stakeholder engagement in radiation protection.

SHAMISEN-SINGS (27 months, 758 k€)

Main objectives: a) Interact with stakeholders to assess their needs and their interest in contributing to dose and health assessment, and evaluate how new technologies could best fulfil their needs. In particular, consider lessons from current issues in Fukushima related to lifting evacuation orders and medical care for vulnerable population; b) Review existing APPs for citizen-based dose measurements, and establish minimum standards of quality; c) Review existing APPs/systems to monitor health and wellbeing and provide feedback to users, and develop a core protocol for a citizen-based study on health, social and psychological consequences of a radiation accident; d) Build upon existing tools to develop the concept/guidelines for one or more APPs that could be used to: monitor radiation; to allow citizens to measure dose, empowering them by providing information about their own doses in different settings, as well as contribute to radiation assessment after an accident, including visualisation of radiation conditions; log behavioural and health information to be used, with appropriate ethics and informed consent, for citizen science studies; to provide a channel for practical information, professional support and dialogue about health, wellbeing and radiation protection.

MEDIRAD (2017-2022, 10 000 k€, funded by by Euratom's research and innovation programme 2013-18) http://www.medirad-project.eu/

Main objectives:

- improve organ dose estimation and registration to inform clinical practice, optimise doses, set recommendations and provide adequate dosimetry for clinical-epidemiological studies of effects of medical radiation
- evaluate and understand the effects of medical exposures, focusing on the two major endpoints of public health relevance: cardiovascular effects of low to moderate doses of radiation from radiotherapy in breast cancer treatment incl. understanding of mechanisms; and long-term effects on cancer risk of low doses from CT in children
- develop science-based consensus policy recommendations for the effective protection of patients, workers and the general public

Main outputs of the MEDIRAD:

- the development of a series of freely-available tools for the scientific and medical communities (such as online tools to determine CT dose and image quality, voxel phantoms, diagnostic reference levels for CT applications in nuclear medicine, dosimetry software packages for molecular radiotherapy)
- the development of prediction models and imaging biomarkers for identifying radiotherapy-treated breast cancer patients at risk of coronary events
- expanded the follow-up of children undergoing CT scans, and managed to set up the first European network for iodine imaging as well as an imaging and dose biobank across partner countries
- developed a series of recommendations that would contribute to improving radioprotection of medical workers and patients across Europe grouped into four major topics:
    - i) consolidation of patient data repositories across Europe;
    - ii) optimisation of radiation-based protocols for diagnostics or therapy;
    - iii) further optimisation of radiation protection for patients and medical workers;
    - iv) future radioprotection research in Europe

MEDIRAD recommendations:

The project elaborated recommendations in four major areas listed below. While areas 1, 2 and 3 "include further research needs specific to the technical fields covered by these recommendations, area 4 focuses on five key research issues which policymakers and relevant research communities are invited to consider".

1. Consolidation of patient data repositories across Europe:

- Develop an interconnected and sustainable system of image and dose repositories at the European level
- Harmonise GDPR implementation in medical radiation protection research
- Enhance awareness regarding radiation protection research among public and patients

2. Optimisation of radiation-based protocols for medical diagnostics or therapy

- Develop robust tools for optimisation of CT scanning and multimodality imaging
- Develop dosimetry-based protocols for molecular radiotherapy across Europe
- Deploy a EU-wide strategy to better predict and reduce secondary cardiovascular risks in breast cancer patients treated with radiotherapy
- Actively promote good practices aimed at reducing cardiovascular risks after breast radiotherapy
- Accelerate the generalised use in clinical practice of modelled total delivered doses to individual patients within Europe

3. Further optimisation of radiation protection for patients and medical workers

- Optimise systems for quantitative imaging irrespective of camera make or model
- Encourage harmonisation of practices through active engagement of health professionals, researchers, health authorities and patients
- Optimise the use of protective equipment to improve radiation protection of medical workers in interventional settings

4. Future research on medical radiation protection in Europe

- Conduct further research into adverse effects of ionising radiation on healthy tissues
- Promote a EU-wide research strategy to use AI for optimising protection in radiation oncology
- Develop biologically-based models to evaluate radiation-induced disease risk
- Conduct large-scale clinical epidemiological follow-up of patients to assess late health effects of radiation
- Investigate new and optimise existing medical imaging procedures to improve benefit/risk ratios and personalised approaches

HYPMED (2016-2021, 5860 k€, funded by Horizon 2020) http://www.hypmed.eu/

Digital Hybrid Breast PET/MRI for Enhanced Diagnosis of Breast Cancer.

HARMONIC (2019-2024,7000 k€, funded by Euratom's research and innovation programme 2019-20) https://harmonicproject.eu/consortium/

Objectives:

- Investigate the late health effects of ionising radiation in children.

- Provide the medical and radiation protection communities with tools for long-term follow-up of children exposed to medical radiation.

- Improve estimates of radiation doses to specific organs.

- Investigate possible biological mechanisms leading to the development of late adverse health effects.

- Establish recommendations to optimise radiotherapy and cardiac fluoroscopy treatments and further reduce radiation doses.

QuADRANT (2020-2022, ? k€, funded by European Commission's Directorate General for Energy) http://www.eurosafeimaging.org/clinical-audit/quadrant/about

The project aims to support Member States in implementing Council Directive 2013/59/Euratom on Basic Safety Standards (BSS) and to advance quality and safety of medical radiation applications in the context of the SAMIRA initiative. Its main objectives are:

1. Review the status of implementation of clinical audits in the Member States;

2. Identify good practices in Member States and available guidance and resources for clinical audits, at national, European and international level;

3. Provide further guidance and recommendations on improving the implementation and integration of clinical audits into national healthcare systems;

4. Identify potential for further coordinated EU action on quality and safety of radiology, radiotherapy and nuclear medicine.

SINFONIA (2020-2024, 6000 k€, funded by Euratom's research and innovation programme 2019-20) https://www.sinfonia-appraisal.eu/

Objectives:

1. Develop dose estimation tools based on personalised dosimetry methods, advanced computational tools, powered by artificial intelligence (AI)

2. Perform research on individual sensitivity to radiation and susceptibility to Second Malignant Neoplasms for risk appraisal in medicine

3. Develop a novel patient radiation risk appraisal tool and estimate uncertainties

4. Conduct research to support radiation risk appraisal for staff, comforters, the public and the environment

5. Develop and operate a platform for dose, imaging and non-imaging data

6. Provide multidisciplinary education and training

CHAIMELEON (2020-2024, 8800 k€, funded by Horizon 2020, SOCIETAL CHALLENGES - Health, demographic change and well-being) https://chaimeleon.eu/#about-project

Main objectives:

1. Provide access to large databases in line with legal and ethical requirements

2. Establish an EU-wide interoperable repository with quality-checked imaging data as a resource for developing and testing AI tools for cancer management

3. Set up a distributed infrastructure building on existing initiatives

4. Explore disruptive harmonisation approaches and provide an online processing pipeline for images harmonisation

5. Implement online processing pipelines enhancing the integrity and interpretability of AI solutions

6. Evaluate and validate the repository internally and externally

7. Perform early clinical external validation of AI-based solutions

8. Ensure the sustainability of the repository beyond the project runtime and build a large and active userbase

EuCanImage (2020-2024, 60.000 k€, funded by Horizon 2020, SOCIETAL CHALLENGES - Health, demographic change and well-being) https://www.eibir.org/projects/eucanimage/

Objectives:

1. Build a FAIR (Findable, Accessible, Inter-operable, Re-usable) cancer imaging platform linked to biological and health repositories for integrated multi-scale AI in clinical oncology.

2. Provide comprehensive and user-friendly data curation, annotation, and hosting tools, as well as training material, to promote future data deposition and scalability of the platform.

3. Build a multi-centre and multi-scale AI development platform for cancer imaging by leveraging the unique expertise of consortium members in radiomics, distributed learning and interpretable AI.

4. Build an AI assessment and benchmarking platform for multi-disciplinary and clinically-driven evaluation of image-based AI solutions for oncology care.

5. Develop the legal framework, as well as innovative solutions, that will enable responsible data sharing and enhanced Open Science within EuCanImage and the cancer research community.

6. Develop a platform that will ultimately contribute to addressing currently unmet clinical needs in personalised cancer care.

7. Disseminate the EuCanImage platform at large to create the largest community of data contributors as well as AI developers, by leveraging the consortium's extensive channels and partnering associations.

RADONORM (2020-2025, 20.000 k€, funded by EURATOM Horizon 2020)
https://www.radonorm.eu/

Objectives:

The proposed multidisciplinary and inclusive research project will target all relevant steps of the radiation risk management cycle for radon and NORM exposure situations. RadoNorm aims to reduce scientific, technical and societal uncertainties by:

- initiating and performing research and technical developments,

- integrating education and training in all research and development activities, and

- disseminating the project achievements through targeted actions to the public, stakeholders and regulators.

Research and technical developments include:

- a better characterisation of exposures of humans (public and workers) and biota to radon and NORM by developing required and still missing measurement methods and protocols for radon and thoron progeny in radon exposure assessments, by acquiring new scientific knowledge on the factors and processes that impact on radon and the transfer of NORM relevant radionuclides at various places and for different spatial scales, by implementing models of transfer and dispersion of radon and NORM
- to provide data for epidemiological studies on absorbed doses and their uncertainties,
- to provide data for biological experiments on doses at different levels of biological organisation (dosimetry and microdosimetry),
- to quantify doses in specific groups with potentially higher sensitivity or higher public concern,
- to generate new knowledge related to the role of spatial dose distribution in radiation risk, and
- to explore how intra-organ dose distribution can be considered in the system of radiation protection

- interaction between radon and smoking for lung cancer,
- risks of radon outside of the lung,
- risks associated with radon exposure during childhood,
- risks from radon and NORM in drinking water,
- mechanisms of radiation action in the disease processes, and
- quantification of various sources of uncertainties in risk inference. Furthermore, we address the major knowledge gaps for the risk assessment of non-human biota related to the
- combined effects of NORM and other stressors, and
- determining adverse outcome pathways leading to such effects.
- to improve and optimise radiation protection of workers, the general public and the environment against the harmful effects of ionising radiation caused by presence of natural radionuclides in natural and work environment utilizing innovative mitigation techniques and systems

EU-JUST-CT (2021-2024, ? k€ funded by European Commission Tender) http://www.eurosafeimaging.org/eu-just-ct

Objectives:

1. Collect up-to-date information about justification of CT examinations in Europe.

2. Develop a common methodology for auditing justification of CT examinations.

3. Carry out co-ordinated pilot audits of justification of CT examinations in a minimum of five different European countries.

4. Discuss the status of justification of CT examinations with the Member States and identify opportunities for further action

PRISMAP (2021-2025, 5500 k€, funded by Horizon 2020, EXCELLENT SCIENCE - Research Infrastructures) https://www.prismap.eu/access/user-projects/

The main objectives are:

1. Provide access to new radionuclides and new purity grades for the medical research

2. Create a common entry port and web interface to the starting research community

3. Enhance clarity and regulatory procedures to enhance research with radiopharmaceuticals

4. Improve the delivered radionuclide data and regulation, along with biomedical research capacity

5. Ensure sustainability of PRISMAP on the long term

It also launches calls for projects where applicants can take use of the following goods, facilities and services:

- Production and delivery of high-purity grade radioisotopes for medical research
- Access to a selection of medical research laboratories to perform the associated research
- Preclinical research techniques in self-service or fully performed as a service

Currently 9 projects are funded.

SIMPLERAD (2022-2024, 300 k€, Samira-related tender)
https://www.eibir.org/projects/simplerad/

The general objectives:

1. Improve the understanding of the links and interdependencies between the European pharmaceutical legislations and Euratom radiation protection requirements

2. Highlight potential barriers to implementation

3. Propose practical guidance and recommendations to advance a coherent implementation of these requirements with respect to the therapeutic use of radiopharmaceuticals

4. Address quality and safety issues related to the current use and introduction of novel therapeutic radiopharmaceuticals into clinical practice, including requirements for dosimetry, the role of MPEs, release of patients from hospital, and management of radioactive waste

iVIOLIN (2022-2024, 940 k€, funded by EU4 Health Programme)

Main objectives:

- to optimise and harmonise oncological imaging procedures in Europe and ensure their broad adoption

- to disseminate the image quality assessment tool developed in MEDIRAD for chest CT in hospitals throughout Europe and adjust it for imaging procedures in the abdominal and pelvic regions, for which no satisfactory tool exists

- commercial software for evaluating patient-specific dose indicators will be cross-validated against more sophisticated dose-evaluation tools for determining organ doses dependent on patient parameters and image settings as developed for chest CT. A combination of image-quality assessment and dose evaluation on the same patient images can allow patient- and indication-specific optimisation with respect to patient radiation protection

- A European database will be established for CT images resulting from different imaging parameters, corresponding patient dose indicators and image quality indicators, and recommendations will be given for these approaches

TRANSAT (2018-2022, 4.000 k€, http://transat-h2020.eu/about-transat/)

Specific objectives:

- Focus on technologies that will help reduce tritium permeation during the conceptual phase of nuclear reactors or devices.
- Improve tritium waste management through innovative measurements that assess both tritium inventory and profile, and through improved mitigation concepts in the case of tritium release above the acceptance criteria of the storage facility.
- Improve the knowledge in the fields of radiobiology, dosimetry, radiotoxicology, genotoxicology and ecotoxicology, and of the environmental consequences in the case of contamination by tritiated products.

7.5 Annex 4

CALL TOPICS and subtopics

TOPICS:

A. Understanding and quantifying the health effects of radiation exposure

B. Improving the concepts of dose quantities

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

D. Optimising medical use of radiation

E. Improving radiation protection of workers and population

F. Developing an integrated approach to environmental exposure and risk assessment from ionising radiation

G. Optimising emergency and recovery preparedness and response

H. Radiation protection in/with society

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). SSH are considered to be "a key constituent of research and innovation" (idem). In accordance with these principles and the PIANOFORTE commitments and objectives,* ***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****.*

Guidelines for integration of Social Sciences and Humanities in PIANOFORTE funded projects are currently under development and will be made available before the launching of Call 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

A. Understanding and quantifying the health effects of radiation exposure

Importance of the topic: Progress made in radiation epidemiology enabled identification of an increased risk of delayed health effects after moderate and low doses already. Nevertheless, a better understanding of the mechanism and pathogenesis of ionising radiation-related

health effects, especially after low doses and manifesting as cancer or non-cancer effects is still lacking, which is indispensable for reducing currently existing uncertainties and project population hazards at individual level. The main goal of this challenge is to "have a comprehensive quantitative and mechanistic understanding of all radiogenic health effects" (CONCERT Joint Roadmap, D3.7) in all exposure scenarios. Research performed in these fields will help in improving risk estimation of health effects after ionising radiation in all exposure situations and will contribute to the implementation of the E.C. BSS Directive, as well as a better risk communication and informed decision making for various stakeholders.

Interactions of Topic A with other research topics of the Joint Roadmap:

-Topic B (Improving the concepts of dose quantities)

- Topic D (Optimising medical use of radiation)

- Topic E (Improving radiation protection of workers and population)

- Topic G (Optimising emergency and recovery preparedness and response, including nuclear security and physical protection of nuclear material)

- Topic H (Radiation protection in/with society)

Redundancy:

Topic A was addressed by several of the recently closed or currently running EC projects. Potential overlaps can only be evaluated at subtopic level given the extremely broad research area covered by this topic.

Importantly, scientific research questions targeted by this topic are addressed almost exclusively by EURATOM at European level, they do not fall in the direct research priorities of HORIZON EUROPE or any other EU-related research initiatives.

In summary:

- Topic A contributes to realisation of 3 out of the 4 specific objectives of PIANOFORTE and several expected outcomes.
- It is of high societal relevance, since it addresses the concerns of the communities exposed to IR in various exposure situations and at various radiation types, doses and dose rates.
- Impact – contributes to a better understanding of health effects of IR, to improving RP recommendations, regulations and practices in the use of IR sources. Impact can be best evaluated at subtopic level.
- Only EURATOM launches scientific calls within the area of Topic A.

- Redundancy and feasibility can only be evaluated at subtopic level.

Subtopics:

A1. Define the risk of ionising radiation-induced non-cancer diseases after low and intermediate doses (below 500 mGy) by understanding disease pathogenesis through assessing near-field, out-of-field and non-targeted effects after therapeutic doses and dose-rates and following interventional radiology. The focus should be on developing a knowledge base on the mechanisms of cardiovascular, cerebrovascular, neurocognitive diseases, metabolic and immune disorders applying biologically-based risk models and/or available human cohorts, followed by related risk perception and risk communication studies. Studies related to ionising radiation-induced cataracts and establishment of new human cohorts are not within the focus of the current call.

Proposals should address one or several objectives of the topic. The topic is suitable for both large and smaller, more focused proposals.

Game changer: yes

Links to PIANOFORTE commitments: yes

Feasibility: feasible

Relevance:
Link of A1 to PIANOFORTE research priorities:
2. To consolidate regulations and improve practices in domains using ionising radiation by capturing low-dose research advances
Link of A1 to PIANOFORTE specific objectives:
2. To improve scientific understanding of the variability in individual radiation response and health risk of exposure.
3. 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.
Link of A1 to PIANOFORTE expected outcomes:
1. Improvement in the understanding of the link between exposure characteristics and ionising radiation effects
2. Better knowledge of the main characteristics of the variability in the radiation response
3. Progress in the integration of the different components of radiobiology paving the way to advanced integrative radiobiology
11. Support of the implementation of the Basic Safety Standards Directive in the Member States by: (a) improving risk estimates for the justification of practices and optimisation of the radiological protection of all persons concerned; (b) improving radiation protection of workers

and the public, in normal and accidental situations, by improving the scientific basis to recommendations, procedures and tools;
14. Improvement of the radiation protection of patients and of the general public in normal and accidental situations
15. Better knowledge on radiation risks

Links to HORIZON-EURATOM-2021-NRT-01-09 major expected outcomes (expected outcomes detailed in separate file):
Outcome 1, 2, 3, 4.

Links to other EURATOM initiatives:
This subtopic is among the major scientific recommendations of MEDIRAD[3].

Links to other Horizon Europe initiatives: -

Impact: study of non-cancer effects induced by low dose radiation is important for a better risk estimation and prediction after low dose exposures. It is equally relevant for any exposure situation.

Redundancy: it is marginally redundant with currently ongoing research projects (HARMONIC, SINFONIA?). It was addressed by several independent research projects within EURATOM FP7 and HORIZON Europe as well as internal calls launched within CONCERT and by MEDIRAD. The most studied non-cancer diseases were cataracts and cardiovascular effects. Much less focus was put on neurocognitive effects, while metabolic and immune disorders were not studied at all.

Source for funding at European level[4]: EURATOM

Overall priority of the subtopic for PIANOFORTE Call 1:

VERY HIGH HIGH MODERATE LOW

[3] Future research on medical radiation protection in Europe:
Conduct further research into adverse effects of ionising radiation on healthy tissues
Promote a EU-wide research strategy to use AI for optimising protection in radiation oncology
Develop biologically-based models to evaluate radiation-induced disease risk
Conduct large-scale clinical epidemiological follow-up of patients to assess late health effects of radiation
Investigate new and optimise existing medical imaging procedures to improve benefit/risk ratios and personalised approaches
(http://www.medirad-project.eu/)

[4] based on projects funded in the last 10 years up to 2022

A2. Developing knowledge base for a better understanding of disease pathogenesis of ionising radiation-induced cancer to improve risk assessment. While the role of DNA damage in the carcinogenic process after IR was extensively studied, by now it is clear that other processes significantly modulate cancer development, such as the role of microenvironment, the immune status, metabolic processes and epigenetic factors.

The proposals should focus on investigating the role of epigenetics, metabolic status, immune status, cellular interactions and microenvironmental effects applying biologically relevant experimental in vivo or in vitro models. Since our current understanding of radiation carcinogenesis is almost exclusively based on high dose IR, while at low doses other mechanisms may prevail priority should be given to low dose studies.

Proposals should address one or several objectives of the topic. The topic is suitable for both large and smaller, more focused proposals.

Game changer: yes

Links to PIANOFORTE commitments: yes

Feasibility: feasible

Relevance:
Link of A2 to PIANOFORTE research priorities:
1. To improve the prevention, detection and safe treatment of cancer
2. To consolidate regulations and improve practices in domains using ionising radiation by capturing low-dose research advances
Link of A2 to PIANOFORTE specific objectives:
2. To improve scientific understanding of the variability in individual radiation response and health risk of exposure.
3. 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.
4. 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.
Link of A2 to PIANOFORTE expected outcomes:
1.Improvement in the understanding of the link between exposure characteristics and ionising radiation effects
2. Better knowledge of the main characteristics of the variability in the radiation response
3. Progress in the integration of the different components of radiobiology paving the way to advanced integrative radiobiology
15. Better knowledge on radiation risks

Links to HORIZON-EURATOM-2021-NRT-01-09 major expected outcomes (expected outcomes detailed in separate file):
Outcome 1, 2, 3, 4.

Links to other EURATOM initiatives:
This subtopic is among the major scientific recommendations of MEDIRAD (see footnote 1).

Link to other Horizon Europe initiatives:
Europe beating cancer plan (the "Cancer" mission)

Impact: A better understanding of radiation carcinogenesis is a key element of risk assessment in radiation protection. From epidemiological point of view significant progress has been achieved in estimating the carcinogenic risk of low dose radiation and certain EURATOM-funded projects have been /are focusing on this aspect of the problem (EPI-CT, MEDIRAD, SINFONIA, HARMONIC, RADONORM). However, epidemiological studies have not been/have barely been backed up by systematic mechanistic studies on radiation carcinogenesis, which are absolutely indispensable for a correct risk estimation and management. Apart of a small internal call within CONCERT with a very limited budget and timeframe, no other projects focused on this issue in the last 5 years (maybe even since DOREMI which ended in 2014). It is highly relevant in the medical field. By understanding the molecular mechanisms of cancer susceptibility at low doses it is also important for environmental and occupational exposures.

Redundancy: none.

Source for funding at European level: EURATOM

Overall priority of the subtopic for PIANOFORTE Call 1:

VERY HIGH HIGH MODERATE LOW

A3. Developing a knowledge base and analytical tools to understand the major features of variability in the radiation response including radio-sensitivity (tissue reactions), radio-susceptibility (cancers) and radiation-induced aging by focusing on one (or both) of the following subtopics:
- A better understanding of the role of genetic factors, epigenetic factors, sex, co-morbidities, environmental and lifestyle factors and the interactions between these depending on dose levels. Studies should focus on a better understanding of the mechanisms and link to advancing individualised cancer treatment, including communication among patients, caregivers, medical personnel and other stakeholders in order to empower them for informed decision-making and informed consent.

- Seeking biomarkers of individual risk through cellular/molecular, systems biological approaches, radiomics investigations. Evaluating potential predictive factors and correlating them with health outcomes. Biomarker investigations should include validation of proposed biomarkers in suitable cohorts. In case of studies related to previously identified biomarkers validation and quality control should be included.

Larger projects are favoured. Nevertheless, smaller, more focused projects may also be considered.

Game changer: yes

Links to PIANOFORTE commitments: yes

Feasibility: In principle, it is feasible to address some aspects of the topic within the timeframe and budget of the open call. Though, given its complexity and high relevance for a comprehensive investigation of the topic, much higher efforts would be optimal, for example in the frame of an independent EU project dedicated solely to this topic. The whole process of biomarker discovery, validation and quality control is not feasible. Though validation of previously identified biomarkers in small-to-medium sized cohorts is feasible.

Relevance:
Link of A3 to PIANOFORTE research priorities:
1. To improve the prevention, detection and safe treatment of cancer
Link of A3 to PIANOFORTE specific objectives:
1. 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.
2. To improve scientific understanding of the variability in individual radiation response and health risk of exposure.
Link of A3 to PIANOFORTE expected outcomes:
2. Better knowledge of the main characteristics of the variability in the radiation response
3. Progress in the integration of the different components of radiobiology paving the way to advanced integrative radiobiology
13. In the field of medical applications: (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
15. Better knowledge on radiation risks

Links to HORIZON-EURATOM-2021-NRT-01-09 major expected outcomes (expected outcomes detailed in separate file):
Outcome 1, 2, 3, 4, 5.

Links to other EURATOM initiatives:
This subtopic is among the major scientific recommendations of MEDIRAD (see footnote 1).

Link to other Horizon Europe initiatives:
Europe beating cancer plan (the "Cancer" mission)

Impact: This is a very important research topic within radiation biology and radiation protection for decades. Although some progress has been achieved in better understanding the individual responses of healthy tissues to IR, basically the question is still open which are the key/basic molecular and cellular determinants that lead to increased radiosensitivity and radiosusceptibility. Without understanding these mechanisms, the development of reliable predictive tests suitable for routine clinical use cannot progress. It is highly relevant in the medical field.

Redundancy: There are no recent projects investigating individual radiosensitivity. The most recent one is Requite (2014-2019) funded by EC health and not EURATOM. Though, some of the recent or currently running EURATOM-funded projects cover some aspects of the topic (MEDIRAD, HARMONIC, SINFONIA). Regarding biomarker studies some recently closed and ongoing projects (eg. HARMONIC, HYPMED, …) as well as former, already closed projects had small tasks dedicated to biomarker research. However, in every case the work was limited to identifying molecules that might be potential biomarkers but their validation has not been performed in the vast majority of the cases.

Source for funding at European level: EURATOM and EC health

Overall priority of the subtopic for PIANOFORTE Call 1*:*

VERY HIGH HIGH MODERATE LOW

A4. 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:
- Understanding the link between exposure characteristics (radiation quality, dose and dose-rate, acute and chronic exposures) and the cancer and non-cancer effects.
- 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).

The topic is suitable for both large and smaller, more focused proposals.

Game changer: yes

Links to PIANOFORTE commitments: yes

Feasibility: it is feasible.

Relevance:
Link of A4 to PIANOFORTE research priorities:
1. To improve the prevention, detection and safe treatment of cancer
2. To consolidate regulations and improve practices in domains using ionising radiation by capturing low-dose research advances
Link of A4 to PIANOFORTE specific objectives:
1. 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 practice.
3. 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.
Link of A4 to PIANOFORTE expected outcomes:
1.Improvement in the understanding of the link between exposure characteristics and ionising radiation effects
3. Progress in the integration of the different components of radiobiology paving the way to advanced integrative radiobiology
11. Support of the implementation of the Basic Safety Standards Directive in the Member States by: (a) improving risk estimates for the justification of practices and optimisation of the radiological protection of all persons concerned; (b) improving radiation protection of workers and the public, in normal and accidental situations, by improving the scientific basis to recommendations, procedures and tools; (c) better acceptance of radiation protection measures in normal and accidental situations; improvement of the understanding of public perception on radiation risk.
12. Improved practices and recommendations for radiation protection professionals
13. In the field of medical applications: (a) new knowledge providing elements to decision-making and risk-benefit analysis; (b) transfer of new optimised medical procedures into clinical practices;
14. Improvement of the radiation protection of patients and of the general public in normal and accidental situations
15. Better knowledge on radiation risks

Links to HORIZON-EURATOM-2021-NRT-01-09 major expected outcomes (expected outcomes detailed in separate file):
Outcome 1, 2, 4, 5, 6.

Links to other EURATOM initiatives:
Link to other Horizon Europe initiatives:

Impact: Most of our mechanistic understanding of the radiobiological processes are based on whole body/partial body external acute exposure. In reality, human exposure to IR is realised by a variety of other scenarios as well, which might substantially impact biological consequences. Therefore, these subtopics are relevant to understand the differences in biological consequences of different exposure situations.

Redundancy: not aware of any.

Source for funding at European level: EURATOM

Overall priority of the subtopic for PIANOFORTE Call 1:

VERY HIGH HIGH MODERATE LOW

B. Improving the concepts of dose quantities

Importance 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 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. Micro- and nanodosimetry have provided experimental and computational techniques for the microscopic characterization of the track structure.

The comprehensive multi-scale characterization of the physical aspects of particle energy deposition will enable a quantitative investigation of the impact of track structure in terms of biological effects. The ability to establish these correlations at the cellular level and investigate the response at supra-cellular organization level will form the basis for the comprehension of the radiation damage mechanism.

The overarching objective is the development of 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.

Interactions of Topic B with other research topics of the Joint Roadmap:

- Topic A (Understanding and quantifying the health effects of radiation exposure)

- Topic C (Understanding radiation-related effects on non-human biota and ecosystems)

- Topic D (Optimising medical use of radiation)

Importantly, scientific research questions targeted by this topic are addressed exclusively by EURATOM at European level, they do not fall in the direct research priorities of HORIZON EUROPE or any other EU-related research initiatives.

In summary:

- Topic B contributes to realisation of 2 out of the 4 specific objectives of PIANOFORTE and several expected outcomes.
- It is of high relevance, since it helps in better understanding the differences in the biological consequences of different radiation qualities.
- Impact – contributes to a better understanding of health effects of IR, to improving RP recommendations, regulations and practices in the use of IR sources.
- Only EURATOM launches scientific calls within the area of Topic B.

Subtopics:

B1. To quantify correlations between track structure and radiation damage, including improved measurement and simulation techniques.
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.
The topic should focus on one or more of the following subtopics:
- Investigating the physical characteristics of particle track structure 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.

The topic is suitable for both large and smaller, more focused proposals.

Game changer: *yes*

Links to PIANOFORTE commitments: yes

Feasibility: it is feasible

Relevance:
Link of B1 to PIANOFORTE research priorities:
1. To improve the prevention, detection and safe treatment of cancer
2. To consolidate regulations and improve practices in domains using ionising radiation by capturing low-dose research advances
Link of B1 to PIANOFORTE specific objectives:
3. 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.
Link of B1 to PIANOFORTE expected outcomes:
1.Improvement in the understanding of the link between exposure characteristics and ionising radiation effects
3. Progress in the integration of the different components of radiobiology paving the way to advanced integrative radiobiology
11. Support of the implementation of the Basic Safety Standards Directive in the Member States by: (a) improving risk estimates for the justification of practices and optimisation of the radiological protection of all persons concerned;
15. Better knowledge on radiation risks

Links to HORIZON-EURATOM-2021-NRT-01-09 major expected outcomes (expected outcomes detailed in separate file):
Outcome 1, 2, 4, 5, 6, 7.

Links to other EURATOM initiatives:

Link to other Horizon Europe initiatives:

Impact: It helps in a better understanding of the mechanism how physical damage is converted into biological damage. Micro and nanodosimetric investigations will lead to methodological progress and will improve molecular dosimetry which will help in reducing currently existing

uncertainties in the biological effects of low doses. The topic is relevant for all exposure scenarios.

Redundancy: the topic is moderately redundant with certain objectives of the RADONORM project.

Source for funding at European level: EURATOM

Overall priority of the subtopic for PIANOFORTE Call 1:

VERY HIGH HIGH MODERATE LOW

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

Importance of the topic: As stated in the JRM: "The need for an explicit demonstration of the protection of the environment (or wildlife) from radioactive releases was recognised during the last decade. Also, human health is in the long-term directly related to the fitness of the ecosystem. Environmental exposures at low dose and dose rate are relevant for many planned exposure situations under normal operation conditions, existing environmental exposure scenarios with regard to legacy and natural radiation, as well as long-term exposures after nuclear or radiological accidents."

Interactions of Topic C with other research topics of the Joint Roadmap:

- Topic A (Understanding and quantifying the health effects of radiation exposure)

- Topic B (Improving the concepts of dose quantities)

- Topic F (Developing an integrated approach to environmental exposure and risk assessment from ionising radiation)

- Topic H (Radiation protection in/with society)

Importantly, scientific research questions targeted by this topic are addressed exclusively by EURATOM at European level, they do not fall in the direct research priorities of HORIZON EUROPE or any other EU-related research initiatives.

This topic adheres to the missions "Soil health and food" and "Healthy oceans, seas, coastal and inland waters" of Horizon Europe. Topic C is closely connected to the Horizon Europe "food, natural resources, agriculture, and environment, biodiversity" cluster that among its objectives is "*reducing environmental degradation and pollution*".

In summary:

- Topic C is reflected in Priority 3 and contributes to the realisation of its scientific objectives 3 and 4 of PIANOFORTE.
- It is of high relevance, since it contributes to a better understanding of the effects of ionising radiation on the environment and the ecosystems.
- Scientific calls within the area of Topic C are launched exclusively by EURATOM. Currently, there is one running project (RadoNorm) with some overlap with the priorities named below.
- Redundancy: Partially with the RadoNorm project (focussed on Radon and NORM).
- Impact. Contributes to a better protection of the environment, helps improving ecosystem fitness, adheres to the "Green deal" program of the EC.
- Feasibility. To be considered at subtopic level.

Subtopics:

C1. Characterise the influence of exposures on the populations currently living in radioactive contaminated environments and identify the key factors determining the vast variation in wildlife populations' sensitivity to radiation. Identify and validate biomarkers of exposure and effects that are relevant for effects at the population level.

The topic is suitable for both large and smaller, more focused proposals.

Game changer: yes

Links to PIANOFORTE commitments: yes

Feasibility: In principle, it is feasible to address some but not all aspects of the topic within the timeframe and budget of the open call.

Relevance:
Link of C1 to PIANOFORTE research priorities:
3. To improve the anticipation and resilience in case of radiological or nuclear event and the management of legacy sites by providing a scientific basis to recommendations, procedures and tools
Link of C1 to PIANOFORTE specific objectives:
3. 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.
4. 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.
Link of C1 to PIANOFORTE expected outcomes:

1.Improvement in the understanding of the link between exposure characteristics and ionising radiation effects
2. Better knowledge of the main characteristics of the variability in the radiation response
4. Improvement of techniques used to direct radiological population monitoring and indirect monitoring through environment sampling
11. Support of the implementation of the Basic Safety Standards Directive in the Member States
15. Better knowledge on radiation risks

Links to HORIZON-EURATOM-2021-NRT-01-09 major expected outcomes (expected outcomes detailed in separate file):
Outcome 1, 3, 7.

Links to other EURATOM initiatives:

Links to other Horizon Europe initiatives:
This topic adheres to the missions "Soil health and food" and "Healthy oceans, seas, coastal and inland waters" of Horizon Europe. Topic C is closely connected to the Horizon Europe "food, natural resources, agriculture, and environment, biodiversity" cluster that among its objectives is "reducing environmental degradation and pollution".

Impact: This subtopic is important to explicitly demonstrate the protection of the environment against ionising radiation. Understanding long-term effects of radiation on the phenotypic and genetic characteristics of the population is crucial to assess the risk of population extinction and its consequence for the maintenance of both genetic biodiversity and species biodiversity. It will contribute to resolve the controversy with regard to the effects on wildlife reported in the Chernobyl and Fukushima exclusion zones. Solving this controversy will have a significant impact on the robustness and the credibility of the system of radiation protection.

Redundancy: It is partially addressed by the RadoNorm project for radon and naturally occurring radionuclides (NOR). No other actual projects are addressing this subtopic.

Source for funding at European level: EURATOM

Overall priority of the subtopic for PIANOFORTE Call 1:

VERY HIGH HIGH MODERATE LOW

C2. Determine the effects of ionising radiation on ecosystem functioning, as well as potential effects of exposures to human wellbeing (e.g. culture, food consumption, work and recreational activities).

Larger projects are favoured. Nevertheless, smaller, more focused projects may also be considered.

Game changer: yes

Links to PIANOFORTE commitments: yes

Feasibility: moderately feasible. The subtopic in its present form is very broad, integrative and multidisciplinary. It reaches beyond the feasibility of the open call both regarding budget and the timeframe.

Relevance:
Link of C2 to PIANOFORTE research priorities:
2. To consolidate regulations and improve practices in domains using ionising radiation by capturing low-dose research advances
Link of C2 to PIANOFORTE specific objectives:
3. 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.
Link of C2 to PIANOFORTE expected outcomes:
1.Improvement in the understanding of the link between exposure characteristics and ionising radiation effects
2. Better knowledge of the main characteristics of the variability in the radiation response
3. Progress in the integration of the different components of radiobiology paving the way to advanced integrative radiobiology
4. Improvement of techniques used to direct radiological population monitoring and indirect monitoring through environment sampling
15. Better knowledge on radiation risks

Links to HORIZON-EURATOM-2021-NRT-01-09 major expected outcomes (expected outcomes detailed in separate file):
Outcome 1, 3, 7.

Links to other EURATOM initiatives:

Links to other Horizon Europe initiatives:
This topic adheres to the missions “Soil health and food” and “Healthy oceans, seas, coastal and inland waters” of Horizon Europe. Topic C is closely connected to the Horizon Europe

"food, natural resources, agriculture, and environment, biodiversity" cluster that among its objectives is "reducing environmental degradation and pollution".

Impact: It will contribute to understanding how radiation effects combine in a broader ecological context at higher levels of biological organisation (trophic interactions, indirect effects at the community level, and consequences for ecosystem functioning). If an increased sensitivity of ecosystem processes (in comparison with the reported effects at the population level) is demonstrated, this 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 of the ecosystems brings greater robustness against the effects of radiation, the conservatism of the current assessments would be confirmed.

One operational outcome, directly relevant to radiation protection of the environment, will be to establish sound scientifically-based ecological protection criteria, thereby underpinning regulations and ensuring that ecosystems and their sub-organisational levels are protected. This is important to society because over-estimation of exposures or effects could lead to unnecessary and costly restrictions or remediation; alternatively, under-estimation of risks may result in detrimental long-term effects for the ecosystems. Additionally, the links between the ecological and social dimensions will be addressed.

Redundancy: No actual projects have addressed this subtopic.

Source for funding at European level: EURATOM

Overall priority of the subtopic for PIANOFORTE Call 1:

VERY HIGH HIGH MODERATE LOW

D. Optimising medical use of radiation

Importance 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. Topic D includes both basic and translational research and transfer into the clinical practice.

Interactions of Topic D with other research topics of the Joint Roadmap:

- Topic A (Understanding and quantifying the health effects of radiation exposure)

- Topic B (Improving the concepts of dose quantities)

- Topic E (Improving radiation protection of workers and population)

- Topic H (Radiation protection in/with society)

Scientific research questions included are also addressed in the on-going Horizon research area "Mission on cancer". It is directly linked to both Europe's Beating Cancer Plan (Action 17) of HORIZON Europe and the Strategic Agenda for Medical Ionising Radiation Applications (SAMIRA initiative).

Various elements of Topic D have been addressed by several of the recently closed or currently running EURATOM projects, such as MEDIRAD (ended 2022), SINFONIA (ending 2024), HARMONIC (ending 2024), SECURO (started 2022), therefore potential overlaps have to be considered and redundancy avoided. The recommendations of closed projects have to be taken into consideration (eg. MEDIRAD). The EURATOM project EURAMED rocc-n-roll will also recommend research needs that have to be considered.

Importantly, scientific research questions targeted by topic D are addressed not exclusively by EURATOM funded research projects at European level. Other EC research initiatives (the Health programme within Horizon Europe, EU4Health, Samira initiative) or research options funded by European professional organisations (such as European Society of Radiology or European Association for Nuclear Medicine) have launched calls on this topic and further open calls are released.

Currently there are several on-going projects in the area of topic D funded by EC initiatives outside EURATOM (eg. QuADRANT project, iVIOLIN, Prismap, INTERACT-Europe, SIMPLERAD, CHAIMELON, EUCANIMAGE).

In summary:

- Topic D contributes to the realisation of 1 specific objective of PIANOFORTE and several expected outcomes.
- It is of high relevance, since medical use of ionising radiation is the largest source of exposure and it addresses the concerns of patients exposed to IR.
- Scientific calls related to the area of topic D are done by European research work programs other than EURATOM as well. Several projects are currently on-going with varying degrees of overlap with topic D.
- Redundancy - needs to be carefully checked at subtopic level.
- Impact – optimised radiation protection and increased efficiency of diagnostic/therapeutic procedures could lower possible adverse health effects contributing to the improvement of existing/development of new methods for diagnosis and treatment.
- Feasibility – needs to be checked at subtopic level

Subtopics:

D1. Individualise diagnostic as well as therapeutic procedures with regard to optimisation of the benefit/risk ratio. This includes the development of evidence-based procedures and encompasses applications such as molecular imaging, interventional procedures and theranostic applications. Evidence-based procedures should rely on benefit and risk based on patient data rather than on model data wherever feasible.

Smaller, more focused projects are favoured.

Game changer: no
The subtopic is part of the new SRA of EURAMED made within EURAMED rocc-n-roll

Links to PIANOFORTE commitments: yes

Feasibility: answering certain domains of the topic is feasible within the timeframe and budget of the open call.

Relevance:
Link of D1 to PIANOFORTE research priorities:
1. To improve the prevention, detection and safe treatment of cancer
Link of D1 to PIANOFORTE specific objectives:
1. 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 practice.
Link of D1 to PIANOFORTE expected outcomes:
5. Implementation and use of big data and artificial intelligence techniques in certain fields of radiation protection (such as medical applications, emergency preparedness); awareness of these techniques among the whole community
13. In the field of medical applications: (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
14. Improvement of the radiation protection of patients and of the general public in normal and accidental situations

Links to HORIZON-EURATOM-2021-NRT-01-09 major expected outcomes (expected outcomes detailed in separate file):
Outcome 1, 5.

Links to other EURATOM initiatives:
The topic partly addresses some of the MEDIRAD technical recommendations

Links to other Horizon Europe initiatives:

The topic is directly linked to both Europe's Beating Cancer Plan (Action 17) of HORIZON Europe and is linked to the Strategic Agenda for Medical Ionising Radiation Applications (SAMIRA initiative).

Impact: This is an important topic mainly for the patients and the medical community which contributes to the development of personalized medicine techniques and approaches and in parallel improves diagnostic and therapeutic efficiency by reducing the risk of medical procedures.

Redundancy: The topic has various degrees of overlaps with currently running or recently closed projects funded by various European sources (mainly EURATOM and HORIZON EUROPE or HORIZON 2020). Such projects are MEDIRAD, SINFONIA, EuCanImage.

Source for funding at European level: EURATOM, HORIZON Europe, EU4Health

Overall priority of the subtopic for PIANOFORTE Call 1:

VERY HIGH HIGH MODERATE LOW

D2. Improving the quality of medical imaging and radiation therapy especially but not limited to cancer-treatment. This includes means to i) standardize implementation of optimized applications, e.g. evaluation of radiation dose and image quality integrated in quality assurance ii) set up of reliable AI methodologies for medical applications. Including strategies for testing and validation of data and methods to allow application independent of hospital equipment.

Social, ethical and legal dimensions of the use of AI should also be addressed, in particular, how the use of AI will impact current practices; what the effect will be on the gaps observed between best practice and guidelines, on the one hand, and current practices, on the other; and what the concerns and expectations of patients and other stakeholders are in the context of these technological developments.

The proposed research should contribute to the harmonization and application of technology and, in the context of informed consent, communication throughout Europe. Patient organizations must be involved.

Smaller, more focused projects are favoured.

Game changer: no
The subtopic is part of the new SRA of EURAMED assembled within EURAMED rocc-n-roll

Links to PIANOFORTE commitments: yes

Feasibility: moderately feasible. Answering certain objectives of the topic is feasible within the timeframe and budget of the open call.

Relevance:
Link of D2 to PIANOFORTE research priorities:
1. To improve the prevention, detection and safe treatment of cancer

Link of D2 to PIANOFORTE specific objectives:
1. 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 practice.
Link of D2 to PIANOFORTE expected outcomes:
5. Implementation and use of big data and artificial intelligence techniques in certain fields of radiation protection (such as medical applications, emergency preparedness); awareness of these techniques among the whole community
13. In the field of medical applications: (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
14. Improvement of the radiation protection of patients and of the general public in normal and accidental situations

Links to HORIZON-EURATOM-2021-NRT-01-09 major expected outcomes (expected outcomes detailed in separate file):
Outcome 1, 5.

Links to other EURATOM initiatives:
The topic partly addresses some of the MEDIRAD technical recommendations

Links to other Horizon Europe initiatives:
The topic is directly linked to both Europe's Beating Cancer Plan (Action 17) of HORIZON Europe and is linked to the Strategic Agenda for Medical Ionising Radiation Applications (SAMIRA initiative).

Impact: optimised radiation protection and increased efficiency of diagnostic/therapeutic procedures could lower possible adverse health effects contributing to the improvement of existing/development of new methods for diagnosis and treatment.

Redundancy: the relevance of the topic was recognised by EURATOM and various EC initiates since currently several ongoing projects overlap at various extents with this subtopic (MEDIRAD, EUCANIMAGE, iVIOLIN, SINFONIA, SIMPLERAD, CHAMELEON). Therefore, overlaps

should be avoided and the new project should build on the already existing capacities. Another aspect is that the topic involves substantial technical development as well, in which companies producing medical equipment for diagnosis and therapy using various ionizing radiation techniques can also be included, therefore funding modalities of public-private partnership should also be promoted.

Source for funding at European level: EURATOM, HORIZON Europe, EU4Health

Overall priority of the subtopic for PIANOFORTE Call 1:

VERY HIGH HIGH MODERATE LOW

D3. Implementing EU-wide epidemiological studies of patients to enhance quality and safety of medical radiation applications and developing a knowledge base and analytical tools to better predict and reduce risk of secondary cancer and non-cancer disease in cancer patients treated with radiotherapy.

Well-designed clinical epidemiological studies should conduct long term follow up, and focus on most at risk populations. The results of the clinical epidemiological studies should be used to optimise treatment and imaging protocols and patient follow-up. The studies should consider patient-specific dose modifiers in derivation of dose estimates as appropriate to different settings and can increase capabilities for radiation dose tracking and managing programmes to provide relevant and standardized dose estimates.

The topic should explore ways to improve communication among patients, caregivers, medical personnel and other stakeholders in order to empower them for informed decision-making and consent and improve radiation protection behaviours.

Proposals should address one or more objectives of the topic. The topic is suitable for both large and smaller, more focused proposals.

Game changer: no
The subtopic is based on MEDIRAD scientific recommendations

Links to PIANOFORTE commitments: yes

Feasibility: identification and follow-up of new cohorts is not feasible within the timeframe and budget of the first call. Follow-up and analysis of already identified cohorts is feasible.

Relevance:

Link of D3 to PIANOFORTE research priorities:

1. To improve the prevention, detection and safe treatment of cancer

Link of D3 to PIANOFORTE specific objectives:

1. 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 practice.
2. To improve scientific understanding of the variability in individual radiation response and health risk of exposure.

Link of D3 to PIANOFORTE expected outcomes:

1.Improvement in the understanding of the link between exposure characteristics and ionising radiation effects
2. Better knowledge of the main characteristics of the variability in the radiation response
11. Support of the implementation of the Basic Safety Standards Directive in the Member States by: (a) improving risk estimates for the justification of practices and optimisation of the radiological protection of all persons concerned;
13. In the field of medical applications: (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
14. Improvement of the radiation protection of patients and of the general public in normal and accidental situations
15. Better knowledge on radiation risks

Links to HORIZON-EURATOM-2021-NRT-01-09 major expected outcomes (expected outcomes detailed in separate file):

Outcome 1, 2, 5.

Links to other EURATOM initiatives:

The topic addresses some of the MEDIRAD scientific recommendations

Links to other Horizon Europe initiatives:

The topic is directly linked to both Europe's Beating Cancer Plan (Action 17) of HORIZON Europe and is linked to the Strategic Agenda for Medical Ionising Radiation Applications (SAMIRA initiative).

Impact: This is an important topic to better understand long-term health consequences of medical diagnostic and therapeutic applications.

Redundancy: Within the therapeutic domain cohorts treated exclusively with radiotherapy for non-cancer reasons have already been identified and are followed. The long-term follow-up of cancer survivors treated with radiotherapy and other therapeutic means has been /is being addressed by several EC-funded projects (PANCARE, CLARIFY, PanCareSurPass,

PanCareSurFup, PanCareFollowUp, …). The long-term risks of diagnostic application of IR has only been addressed by EURATOM in projects such as EPI-CT, MEDIRAD or currently by HARMONIC and partly SINFONIA

Source for funding at European level: EURATOM, HORIZON Europe, EU4Health

Overall priority of the subtopic for PIANOFORTE Call 1:

VERY HIGH HIGH MODERATE LOW

E. Improving radiation protection of workers and population

Importance of the topic: Much research and technical development in radiation protection dosimetry for workers and the public has been carried out. The results of these developments have been transferred to operational radiation protection, including guidelines and technical recommendations. Despite these efforts, a couple of areas exist in which the status is unsatisfactory, necessitating further research to support the implementation of the BSS and improve practices in the domain of low dose exposures of humans and the environment. This will also help in a better acceptance of radiation protection measures in normal and accidental situations; improvement of the understanding of public perception on radiation risk.

Interactions of Topic E with other research topics of the Joint Roadmap:

- Topic B (Improving the concepts of dose quantities)

- Topic F (Developing an integrated approach to environmental exposure and risk assessment from ionising radiation)

- Topic G (Optimising emergency and recovery preparedness and response, including nuclear security and physical protection of nuclear material)

- Topic H (Radiation protection in/with society)

Redundancy: It was addressed by a small project within CONCERT. It partly overlaps with RADONORM and SINFONIA.

Importantly, scientific research questions targeted by this topic are addressed exclusively by EURATOM at European level, they do not fall in the direct research priorities of HORIZON EUROPE or any other EU-related research initiatives.

In summary:

- Topic E contributes to realisation of 1 out of the 4 specific objectives of PIANOFORTE and several expected outcomes.

- It is of high relevance for the radiation protection community, since it contributes to the improvement of radiation protection of workers.
- Impact – contributes to improving RP recommendations, regulations and practices in the use of IR sources.
- Only EURATOM launches scientific calls within the area of Topic A.
- Redundancy and feasibility can only be evaluated at subtopic level.

Subtopics:

E1. Developing a knowledge base and analytical tools to improve radiation protection of workers and the population and thus to contribute to the translation of the BSS into practice by focusing on one or more of the following objectives:
- Development of biokinetic models and personalised dosimetry that will lead to the improvement of the assessment of internal exposure for occupational exposed workers;
- Development of real time practical individual dosimetry of workers by harnessing the developments in new connected technologies, with due account to individual behaviour and social group culture;
- Development of a practical neutron personal dosimeter.

The topic is suitable for both large and smaller, more focused proposals.

Game changer: yes

Links to PIANOFORTE commitments: yes

Feasibility: It is feasible.

Relevance:
Link of E1 to PIANOFORTE research priorities:
2. To consolidate regulations and improve practices in domains using ionising radiation by capturing low-dose research advances
Link of E1 to PIANOFORTE specific objectives:
3. 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
Link of E1 to PIANOFORTE expected outcomes:
4. Improvement of techniques used to direct radiological population monitoring and indirect monitoring through environment sampling
11. Support of the implementation of the Basic Safety Standards Directive in the Member States by: (a) improving risk estimates for the justification of practices and optimisation of the radiological protection of all persons concerned; (b) improving radiation protection of workers and the public, in normal and accidental situations, by improving the scientific basis to

recommendations, procedures and tools; (c) better acceptance of radiation protection measures in normal and accidental situations; improvement of the understanding of public perception on radiation risk.
12. Improved practices and recommendations for radiation protection professionals
14. Improvement of the radiation protection of patients and of the general public in normal and accidental situations

Links to HORIZON-EURATOM-2021-NRT-01-09 major expected outcomes (expected outcomes detailed in separate file):
Outcome 1, 6.

Links to other EURATOM initiatives:

Links to other Horizon Europe initiatives:

Impact: In case of internal contamination it is well known that DTPA increases the excretion of actinides but the dose reduction due to the therapy is currently based on default assumptions that should be improved. Another challenge consists of the reconstruction of the life-long dose estimate for cohorts of workers for whom contamination information is scarce. Models and methods need to be developed to be able to provide reliable dose estimates for both situations.
Most workers are still currently monitored with passive dosimeters. But on-line personal dosimetry is emerging. The mid- or long-term challenge is to allow for a reliable and accurate monitoring of the workers in real time regardless of the protection methods used, and to provide input for the demonstration of compliance to dose limits and the optimal application of the protection principle.
Neutron dosimetry remains a problem, and no good dosimeters are available yet. So improvement in dosimetric characteristics (energy, angular dependence) and field characterisation is needed.

Redundancy: Some elements of the topic were addressed by a small project within CONCERT. There are elements redundant with RADONORM and SINFONIA.

Source for funding at European level: EURATOM

Overall priority of the subtopic for PIANOFORTE Call 1:

VERY HIGH HIGH MODERATE LOW

F. Developing an integrated approach to environmental exposure and risk assessment from ionising radiation

Importance of the topic: As stated in the CONCERT JRM: "Faced with environmental ionising radiation exposure situations where various environmental and human-population related factors strongly interact, holistic approaches to risk assessment are increasingly justified to ensure sustainable and safe use of radioactive substances and to protect both human and ecosystem health. Concurrently, integration of scientific, societal and economic considerations is needed, if more integrated dose and risk assessment approaches are to be developed to meet societal expectations, better inform decision-making and improve risk communication among stakeholders". In addition, ionising radiation is frequently present in the environment together with other contaminants and stressors that may influence its impact. Therefore, it is important to investigate the risk of ionising radiation in presence of other contaminants and stressors in the environment.

Interactions of Topic F with other research topics of the Joint Roadmap:

- Topic A (Understanding and quantifying the health effects of radiation exposure)

- Topic B (Improving the concepts of dose quantities)

- Topic C (Understanding radiation-related effects on non-human biota and ecosystems)

- Topic E (Improving radiation protection of workers and population)

- Topic G (Optimising emergency and recovery preparedness and response, including nuclear security and physical protection of nuclear material)

- Topic H (Radiation protection in/with society)

This topic adheres to the missions "Soil health and food" and "Healthy oceans, seas, coastal and inland waters" of Horizon Europe. Topic F is closely connected to the Horizon Europe "food, natural resources, agriculture, and environment, biodiversity" cluster that among its objectives is "*reducing environmental degradation and pollution*".

Importantly, scientific research questions targeted by topic F are addressed exclusively by EURATOM at European level, they do not typically fall in the direct research priorities of Horizon Europe or any other EU-related research initiatives.

The topic is partially addressed by the RadoNorm project (2020-2025), which focuses on radon and naturally occurring radioactive materials (NORM). It was also partially addressed by the TERRITORIES project within CONCERT. There were also recent projects on investigating contamination with tritium such as TRANSAT.

In summary:

- Topic F is reflected in Priority 3 and contributes to realisation of the scientific objectives 3 and 4 of PIANOFORTE.
- It is of high relevance for the system of radiation protection of humans and the environment.
- Scientific calls within the area of Topic F are launched by EURATOM.
- Redundancy: Low redundancy with RadoNorm, which is focussed only on radon and naturally occurring radionuclides (NORM).
- Impact: Contributes to the development of improved international guidance on the management of legacy sites (e.g. from past NORM activities or accidental exposures); such sites may represent relatively higher exposure scenarios and therefore to a better protection of the environment, adheres to the "Green deal" program of the EC and the sustainable development goals.
- Feasibility: To be considered at subtopic level.

Subtopics:

F1. Robust modelling of radiological contamination in the human food chain, for an integrated dose and risk assessment of post-emergency situations, with focus on building resilient and sustainable societies. The topic should take into account future changes in the European agricultural practices and the need to further develop marine dispersion and biota transfer models due to the fact that NPPs are often built on the coast and the future tendency of building them on floating vessels.

The topic is suitable mainly for smaller, more focused proposals.

Game changer: yes

Links to PIANOFORTE commitments: yes

Feasibility: It is feasible within the timeframe and budget of the open call.

Relevance:
Link of F1 to PIANOFORTE research priorities:
3. To improve the anticipation and resilience in case of radiological or nuclear event and the management of legacy sites by providing a scientific basis to recommendations, procedures and tools
Link of F1 to PIANOFORTE specific objectives:
3. 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.
4. 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.

Link of F1 to PIANOFORTE expected outcomes:
4. Improvement of techniques used to direct radiological population monitoring and indirect monitoring through environment sampling
9. Raising awareness among the radiation protection research community of the importance and added value of the inclusion of social sciences in research projects
11. Support of the implementation of the Basic Safety Standards Directive in the Member States
12. Improved practices and recommendations for radiation protection professionals
14. Improvement of the radiation protection of patients and of the general public in normal and accidental situations
15. Better knowledge on radiation risks

Links to HORIZON-EURATOM-2021-NRT-01-09 major expected outcomes (expected outcomes detailed in separate file):
Outcome 7, 10.

Links to other EURATOM initiatives:

Links to other Horizon Europe initiatives: This topic adheres to the missions "Soil health and food" and "Healthy oceans, seas, coastal and inland waters" of Horizon Europe. Topic F is closely connected to the Horizon Europe "food, natural resources, agriculture, and environment, biodiversity" cluster that among its objectives is "reducing environmental degradation and pollution".

Impact: If successful, the resultant models (largely improved/developed based on a thorough assessment of available data and models) will be applicable in any relevant environment, to its time-evolution, to any human/animal food. They will especially include future changes in European agricultural practices. In addition, the further developments done in marine dispersion and biota transfer models will improve risk assessment for NPPs built on the coast and on floating vessels. Models developed will be transferable, meaning that they will already include the necessary amount of processes that allows model applicability to different scenarios. This will result in optimised management in the emergency and post emergency phase with respect to dose assessment, food chain protection and control, remedial actions, economic and societal impact.

Redundancy: Low redundancy with RADONORM, which is focussed only in radon and naturally occurring radionuclides (NOR).

Source for funding at European level: EURATOM

Overall priority of the subtopic for PIANOFORTE Call 1:

VERY HIGH HIGH MODERATE LOW

F2. Identifying and quantifying the key processes that influence radionuclide behaviour in existing environmental contamination situations with a special focus on:
- the management and clean-up of existing sites, as well as to the licensing (including social licensing) of future discharges and large quantities of NORM waste.
- developing the modelling basis for accurate dose assessment and establishment of holistic and sustainable remediation approaches.

The topic is suitable for both larger and smaller, more focused proposals.

Game changer: yes

Links to PIANOFORTE commitments: yes

Feasibility: It is feasible within the timeframe and budget of the open call.

Relevance:
Link of F2 to PIANOFORTE research priorities:
3. To improve the anticipation and resilience in case of radiological or nuclear event and the management of legacy sites by providing a scientific basis to recommendations, procedures and tools
Link of F2 to PIANOFORTE specific objectives:
3. 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.
4. 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.
Link of F2 to PIANOFORTE expected outcomes:
1.Improvement in the understanding of the link between exposure characteristics and ionising radiation effects
4. Improvement of techniques used to direct radiological population monitoring and indirect monitoring through environment sampling
5. Implementation and use of big data and artificial intelligence techniques in certain fields of radiation protection (such as medical applications, emergency preparedness); awareness of these techniques among the whole community
9. Raising awareness among the radiation protection research community of the importance and added value of the inclusion of social sciences in research projects

11. Support of the implementation of the Basic Safety Standards Directive in the Member States by: (a) improving risk estimates for the justification of practices and optimisation of the radiological protection of all persons concerned;
12. Improved practices and recommendations for radiation protection professionals
14. Improvement of the radiation protection of patients and of the general public in normal and accidental situations
15. Better knowledge on radiation risks

Links to HORIZON-EURATOM-2021-NRT-01-09 major expected outcomes (expected outcomes detailed in separate file):
Outcome 7, 10.

Links to other EURATOM initiatives:

Links to other Horizon Europe initiatives: This topic adheres to the missions "Soil health and food" and "Healthy oceans, seas, coastal and inland waters" of Horizon Europe. Topic F is closely connected to the Horizon Europe "food, natural resources, agriculture, and environment, biodiversity" cluster that among its objectives is "reducing environmental degradation and pollution".

Impact: Development of the modelling basis for accurate dose assessment and establishment of remediation approaches, to contribute to the implementation of the new BSS in relation to the management and clean-up of existing sites, as well as to the licensing of future discharges and large quantities of NORM waste. This is especially important as NORM legacy or operationally impacted sites are often close to human habitation. It is of important added value to society.

Redundancy: Redundancy with RadoNorm (2020-2025), which is focussed only on radon and naturally occurring radionuclides (NORM). Partly redundant with the recently closed TRANSAT project.

Source for funding at European level: EURATOM

Overall priority of the subtopic for PIANOFORTE Call 1:

VERY HIGH HIGH MODERATE LOW

F3. Integrating risk assessment and management and especially focusing on risk integration for radiation and other stressors. Specific emphasis is required on integrated and holistic risk assessments. There is a need for the improvement and/or development of innovative

methods to characterise the source terms to delineate the multiple-hazard footprint (e.g., geostatistical interpretation of environmental, radiological, chemical data) of a site in space and time. Innovative modelling approaches are also needed to support decision making and to identify the most significant sources of uncertainty related to the impact on human and environmental health including social considerations.

Larger projects are favoured. Nevertheless, smaller, more focused projects may also be considered.

Game changer: yes

Links to PIANOFORTE commitments: yes

Feasibility: In principle, it is feasible to address some aspects of the topic within the timeframe and budget of the open call. Though, given its complexity and high relevance for a comprehensive investigation of the topic, much higher efforts would be optimal, for example in the frame of an independent EU project dedicated solely to this topic.

Relevance:
Link of F3 to PIANOFORTE research priorities:
3. To improve the anticipation and resilience in case of radiological or nuclear event and the management of legacy sites by providing a scientific basis to recommendations, procedures and tools
Link of F3 to PIANOFORTE specific objectives:
3. 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.
4. 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.
Link of F3 to PIANOFORTE expected outcomes:
1.Improvement in the understanding of the link between exposure characteristics and ionising radiation effects
4. Improvement of techniques used to direct radiological population monitoring and indirect monitoring through environment sampling
5. Implementation and use of big data and artificial intelligence techniques in certain fields of radiation protection (such as medical applications, emergency preparedness); awareness of these techniques among the whole community
9. Raising awareness among the radiation protection research community of the importance and added value of the inclusion of social sciences in research projects

11. Support of the implementation of the Basic Safety Standards Directive in the Member States by: (a) improving risk estimates for the justification of practices and optimisation of the radiological protection of all persons concerned;
12. Improved practices and recommendations for radiation protection professionals
14. Improvement of the radiation protection of patients and of the general public in normal and accidental situations
15. Better knowledge on radiation risks

Links to HORIZON-EURATOM-2021-NRT-01-09 major expected outcomes (expected outcomes detailed in separate file):
Outcome 7, 10.

Links to other EURATOM initiatives:

Links to other Horizon Europe initiatives: This topic adheres to the missions "Soil health and food" and "Healthy oceans, seas, coastal and inland waters" of Horizon Europe. Topic F is closely connected to the Horizon Europe "food, natural resources, agriculture, and environment, biodiversity" cluster that among its objectives is "reducing environmental degradation and pollution".

Impact: An integrated assessment and management approach will enable 'radiation protection' authorities to make more balanced and sustainable decisions as it will take in the 'whole-picture' rather than making decisions individually for human, wildlife, radiation, chemicals etc. It also represents a more defensible approach when communicating to stakeholders, including the public.

Redundancy: No actual projects have addressed this subtopic.

Source for funding at European level: EURATOM

Overall priority of the subtopic for PIANOFORTE Call 1:

VERY HIGH HIGH MODERATE LOW

G. Optimising emergency and recovery preparedness and response

Importance of the topic: Within the CONCERT JRM it is stated: "In nuclear or radiological emergency management including accidental exposures, medical follow-up and long-term recovery the radiological impact assessment is of prime importance and demands the improvement, development and customisation of several new methodologies and advanced

tools." In brief, the latter concern dispersion / transfer modelling with uncertainties in various environments (including urban) and media (air, water and soil), consideration of new threats (e.g., armed conflicts), new monitoring strategies and technologies (individual, environmental, foods and goods), combination of modelling and monitoring (through, e.g., data assimilation), dosimetry and dose reconstruction, optimization and operationalization of countermeasures and countermeasure strategies, decision making under uncertainties, employment of novel techniques regarding Big Data and Artificial Intelligence, engagement of the public / stakeholders and communication strategies.

Interactions of Topic G with other research topics of the Joint Roadmap:

- Topic A (Understanding and quantifying the health effects of radiation exposure)

- Topic C (Understanding radiation-related effects on non-human biota and ecosystems)

- Topic F (Developing an integrated approach to environmental exposure and risk assessment from ionising radiation)

- Topic H (Radiation protection in/with society)

Importantly, scientific research questions targeted by topic G are addressed exclusively by EURATOM at European level (except for Security-related topics) and they do not typically fall in the direct research priorities of Horizon Europe or any other EU-related research initiatives.

As noted in the PIANOFORTE Description of the Action (Part B) the research that will be performed in this Topic will support the Action plan on the Sendai Framework for disaster risk reduction, will contribute to the EU objective of creating "*a resilient and more stable Europe that protects*", will be closely connected to the Horizon Europe "Civil security for society" cluster that aims at an "improved disaster risk management and societal resilience" through better understanding of natural and man-made disasters and by the development of novel concepts and technologies to counter these risks. It will also be closely connected to activities developed in the "food, natural resources, agriculture, and environment, biodiversity" cluster, one of the objectives of which is "*reducing environmental degradation and pollution*".

Research in Topic G has become of particular relevance lately due to the war in Ukraine, which is a situation that poses new and unusual threats that have not been examined in depth so far.

In summary:

- Topic G covers one of the three priorities or research needs of PIANOFORTE, one of the four scientific specific objectives and contributes to 5 of the 15 expected outcomes of the project.

- It is of high relevance for the system of radiation protection of humans and the environment.
- Scientific calls within the area of Topic F are launched exclusively by EURATOM.
- Redundancy: Specific items of the Topic were partially addressed by CONFIDENCE, TERRITORIES, SHAMISEN-SINGS.
- Impact and relevance: Nuclear safety has significant impact on society, as demonstrated by the major nuclear accidents that have occured and the many more smaller-scale incidents, including recent events of detection of radionuclides from unknown origins, as well as past or potential future use of nuclear technology as warfare. Initiatives by citizens that formed groups for measurement of radioactivity in the environment must be mentioned in this context. The threats posed by the war in Ukraine add a particular relevance to the topic.
- Feasibility: To be considered at subtopic level.

Subtopics:

G1. Improvement of radiological impact assessments, decision support and response and recovery strategies by focusing on one or more of the following aspects:
- the use of AI and big data technologies in radiological impact assessments, in the development / optimisation of measurement strategies, for the calculation (along with other novel methodologies) of uncertainties in model results and for optimization and operationalization of emergency preparedness and response practices; integration of AI and big data technologies in Decision Support Systems for better guidance of the end user in countermeasure strategy definition;
- compilation of the databases that are required by AI technologies, with historic and scenario information - including besides nuclear/radiological accidents, scenarios of new threats, such as war situations;
- improved communication/dialogue with stakeholders due to better information availability, considering data protection regulations (GDPR).

The topic is suitable for medium-sized proposals.

Game changer: *yes*

Links to PIANOFORTE commitments: yes

Feasibility: It is feasible.

Relevance:
Link of G1 to PIANOFORTE research priorities:

3. To improve the anticipation and resilience in case of radiological or nuclear event and the management of legacy sites by providing a scientific basis to recommendations, procedures and tools

Link of G1 to PIANOFORTE specific objectives:

4. 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.

Link of G1 to PIANOFORTE expected outcomes:

4. Improvement of techniques used to direct radiological population monitoring and indirect monitoring through environment sampling

5. Implementation and use of big data and artificial intelligence techniques in certain fields of radiation protection (such as medical applications, emergency preparedness); awareness of these techniques among the whole community

9. Raising awareness among the radiation protection research community of the importance and added value of the inclusion of social sciences in research projects

11. Support of the implementation of the Basic Safety Standards Directive in the Member States by: (a) improving risk estimates for the justification of practices and optimisation of the radiological protection of all persons concerned;

12. Improved practices and recommendations for radiation protection professionals

14. Improvement of the radiation protection of patients and of the general public in normal and accidental situations

15. Better knowledge on radiation risks

Links to HORIZON-EURATOM-2021-NRT-01-09 major expected outcomes (expected outcomes detailed in separate file):

Outcome 7, 10.

Links to other EURATOM initiatives:

Links to other Horizon Europe initiatives: Contributes to the EU objective of creating “a resilient and more stable Europe that protects”, will be closely connected to the Horizon Europe “Civil security for society” cluster that aims at an “improved disaster risk management and societal resilience” through better understanding of natural and man-made disasters and by the development of novel concepts and technologies to counter these risks. It will also be closely connected to activities developed in the “food, natural resources, agriculture, and environment, biodiversity” cluster, one of the objectives of which is “reducing environmental degradation and pollution”.

Impact: See above, in general description of Topic G.

Redundancy: The subtopic has not been addressed by other EURATOM Calls or Projects

Source for funding at European level: EURATOM

Overall priority of the subtopic for PIANOFORTE Call 1:

VERY HIGH HIGH MODERATE LOW

G2. Further development of risk assessment and risk management approaches, technological capabilities to cope with accident scenarios arising from new and future nuclear and radiological technologies and new threats arising from war situations, including further development of monitoring and dosimetry techniques, and taking into consideration social, ethical and legal issues. Proposals should focus on one or more of the following objectives:
- event scenarios, including assessment of potential source terms;
- further improvement, evaluation and operationalization of inverse modelling for localisation and quantification of unknown emission sources of radioactive material, including exploitation of different types of monitoring data, capabilities to handle multiple-source scenarios and potential employment of novel approaches such as AI and big-data technologies;
- operational application of data assimilation (combination of monitoring - including citizen monitoring- and simulation results) for improving the reliability of the operational diagnosis and prognosis of the radiological contamination;
- uncertainty quantification in the abovementioned topics, development of advanced methods to improve calculation efficiency of uncertainties, such as AI/Machine Learning methods, efficient computational and/or statistical methods and the integration of latest developments in risk science;
- monitoring strategies with mobile and advanced monitors, relying also on citizen science approach and providing early detection of threats
- development of indicators for strategies that can be applied even with little information on the affected area, with consideration of technical and non-technical aspects;
- social and psychological challenges for emergency actors and citizens and their impacts on the effectiveness of protective measures, legal basis and practical arrangements for emergency response and recovery;
- societal resilience, stakeholder involvement and ethical considerations.

The topic is suitable for medium-sized proposals.

Game changer: *yes*

Links to PIANOFORTE commitments: yes:
Feasibility: It is feasible.

Relevance:
Link of G2 to PIANOFORTE research priorities:

3. To improve the anticipation and resilience in case of radiological or nuclear event and the management of legacy sites by providing a scientific basis to recommendations, procedures and tools

Link of G2 to PIANOFORTE specific objectives:

4. 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.

Link of G2 to PIANOFORTE expected outcomes:

4. Improvement of techniques used to direct radiological population monitoring and indirect monitoring through environment sampling

5. Implementation and use of big data and artificial intelligence techniques in certain fields of radiation protection (such as medical applications, emergency preparedness); awareness of these techniques among the whole community

9. Raising awareness among the radiation protection research community of the importance and added value of the inclusion of social sciences in research projects

11. Support of the implementation of the Basic Safety Standards Directive in the Member States by: (a) improving risk estimates for the justification of practices and optimisation of the radiological protection of all persons concerned;

12. Improved practices and recommendations for radiation protection professionals

14. Improvement of the radiation protection of patients and of the general public in normal and accidental situations

15. Better knowledge on radiation risks

Links to HORIZON-EURATOM-2021-NRT-01-09 major expected outcomes (expected outcomes detailed in separate file):

Outcome 7, 10.

Links to other EURATOM initiatives:

Links to other Horizon Europe initiatives: Contributes to the EU objective of creating “a resilient and more stable Europe that protects”, will be closely connected to the Horizon Europe “Civil security for society” cluster that aims at an “improved disaster risk management and societal resilience” through better understanding of natural and man-made disasters and by the development of novel concepts and technologies to counter these risks. It will also be closely connected to activities developed in the “food, natural resources, agriculture, and environment, biodiversity” cluster, one of the objectives of which is “reducing environmental degradation and pollution”.

Impact: See above, in general description of Topic G.

Redundancy: Specific items of the subtopic have been partially addressed by CONFIDENCE, TERRITORIES, SHAMISEN-SINGS, for common accident scenarios. However, there is a big gap of research in situations involving armed conflicts.

Source for funding at European level: EURATOM

Overall priority of the subtopic for PIANOFORTE Call 1:

VERY HIGH HIGH MODERATE LOW

H. Radiation protection in/with society

Importance of the topic: The overall objective is to develop evidence-based evaluations of novel or existing radiation protection practices, interventions, technologies or policies, in interaction with stakeholders. To this end, rigorous studies in social sciences and humanities are needed on the implementation of theory and evidence-based radiation protection and the de-implementation of practices that are demonstrated to be of low or no benefit for individuals or for the society. In line with game changer H1, better alignment of research and practice in RP with the values, needs and expectations of society requires, among others : effective research translation mechanisms between the technical and social dimensions of RP; identifying barriers and developing of systematic approaches to inclusion of societal dimensions at all levels of the RP system; - methodological innovation enabling transdisciplinarity in radiation protection research and improved intradisciplinary research related to societal aspects of RP".

Studies need to go beyond the consideration of radiation perceptions or cognitions of targeted individuals as primary research outcome as this has been investigated broadly and has been demonstrated as only one of the many determinants of radiation protection behaviour.

The importance of this topic is stated in the Joint Roadmap for radiation protection research, which argues that social sciences and humanities are needed in radiation protection research to improve the assessment and response to radiation protection challenges and opportunities (Impens, Salomaa et al, 2020). Achieving the general objective of the Partnership to "improve radiological protection of members of the public, patients, workers and environment in all exposure scenarios and provide solutions and recommendations for optimised protection in accordance with the BSS" can only be done with support of SSH research, as this allows identifying and including in the research process the values, expectations and needs of society. SSH research also supports" *citizen involvement activities in a collaborative approach of scientists, regulators and stakeholders*".

Interactions of Topic H with other research topics of the Joint Roadmap:

- Topic A (Understanding and quantifying the health effects of radiation exposure)

- Topic C (Understanding radiation-related effects on non-human biota and ecosystems)

- Topic D (Optimising medical use of radiation)

- Topic E (Improving radiation protection of workers and population)

- Topic F (Developing an integrated approach to environmental exposure and risk assessment from ionising radiation)

- Topic G (Optimising emergency and recovery preparedness and response, including nuclear security and physical protection of nuclear material)

This topic is exclusively covered by EURATOM.

Redundancy: Progress has been made in particular fields (for instance in relation to identifying and communicating social uncertainties in emergency and existing exposure situations or stakeholder engagement and citizen science) in projects such as TERRITORIES, CONFIDENCE, SHAMISEN-SINGS, ENGAGE, and it is also thoroughly addressed in the RadoNorm project in relation to radon and NORM, but there are several areas where there is a strong need for SSH research in order to account for current societal challenges and developments, as outlined above.

In summary:

- Topic H contributes to realisation of 1 out of the 4 specific objectives of PIANOFORTE and several expected outcomes.
- It is of high relevance, since it improves the assessment and response to radiation protection challenges and opportunities
- Impact for societal challenges and developments in radiation protection.
- Only EURATOM launches scientific calls within the area of Topic H.
- Redundancy and feasibility evaluated at subtopic level.

Subtopics:

H1. Effective translation mechanisms between social and technical dimensions of radiation protection.

The objective of the topic is to investigate how different radiation protection actors perceive the added value of inter- and transdisciplinary collaborations in the field of radiation protection; what their expectations and needs are; what challenges and enablers of collaborations can be found in the different radiation protection fields; and what are the main barriers for the institutional uptake of results from inter- and transdisciplinary collaborations. Projects addressing this topic should contribute to developing systematic approaches to

inclusion of societal dimensions within the radiological protection system and methodological innovation enabling inter- and transdisciplinarity in radiation protection research.

The topic is suitable for smaller-, more focused projects, as well as medium-sized projects addressing different radiation protection fields.

Game changer: *yes*

Relevance:
Link of H1 to PIANOFORTE research priorities: three transversal areas of work are recognised as critical in the Partnership proposal that are linked this topic: " understanding existing approaches to RP research and associated systems at the explicit level of societal values, needs and expectations"; "identification of barriers and routes to better alignment between RP research and innovation and those societal dimensions"; and "new methods to effect RP integration with society" .
Link of H1 to PIANOFORTE specific objectives:
3. 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.
Link of H1 to PIANOFORTE expected outcomes:
As a cross-cutting topic, H1 contributes to better integration of radiation protection research with needs
Additionally, it addresses the following PIANOFORTE outcomes:
-". Raising awareness among the radiation protection research community of the importance and added value of the inclusion of social sciences in research projects"
- "Strengthening the integration between the six research platforms in radiation protection and thus the capacity of the community to work in a multidisciplinary framework, which is essential to face the scientific and technical challenges related to the improvement of radiation protection and the development of innovations based on the detection or use of ionising radiation."
-"Delivering on citizens concern and better addressing societal challenges by inclusion of Social Sciences approaches in the definition, conduct and dissemination of knew knowledge and participatory approaches";

Links to HORIZON-EURATOM-2021-NRT-01-09 major expected outcomes (expected outcomes detailed in separate file):
Outcome 1, 6, 10

Links to other EURATOM initiatives: N/A

Links to other Horizon Europe initiatives: Under Horizon Europe, "the effective integration of SSH in all clusters, including all Missions and European partnerships, is a principle throughout the programme" (European Commission, 2022). SSH are considered to be "a key constituent of research and innovation" (idem). It is also suggested that projects should aim for interdisciplinary approaches, with collaboration between SSH disciplines and non-SSH disciplines such as natural sciences, medicine and technology. Furthermore, projects should strive towards social innovation actions, involving the citizens, public authorities, business and industry, and academia in the design, development, and implementation of project products, methods and services (European Commission, 2022), as this "engages and empowers citizens, enhances the resilience of communities, increases the relevance, acceptance and uptake of innovation, and helps foster lasting changes in social practices" (idem).

Feasibility: feasible

Impact: Efforts have been made in recent years to highlight the interconnections between the social and technical dimensions of radiation protection, to stimulate collaboration between disciplines and the involvement of larger stakeholder groups in research and innovation processes. As highlighted in guidance on inter- and trans-disciplinary research, this requires methodological innovation and new, transformative ways of doing day-to-day research, which involves exchanges between disciplines and with societal actors, to identify and explore commonalities and divergence in views, values and expectations. The topic is relevant to the entire radiation protection research community. It will contribute to increasing the relevance and societal uptake of PIANOFORTE funded research, supporting and the inter- and trans-disciplinary collaborations.

Redundancy: None. Previous SSH research investigated collaborative research in non-nuclear fields and formulated lessons learned and guidance for inter- and trans-disciplinary research. However, there has been little research on how the different actors perceive the added value of these collaborations in the field of radiation protection, what the institutional uptake is of research outputs resulting from inter- and transdisciplinary collaborations, and there are no systematic approaches to the inclusion of societal dimensions within the radiological protection system.

Source for funding at European level: EURATOM

Overall priority of the subtopic for PIANOFORTE Call 1:

Priority: **VERY HIGH HIGH MODERATE LOW**

7.6 Annex 5

Prioritisation of subtopics for PIANOFORTE Call 1:

Feasibility: (i.e. the subtopic or certain objectives of the subtopic can achieve significant progress within the available timeframe and budget) assuming that projects within Call 1 last max. 3 years and have an estimated total budget of 3000-3500 k€ for large calls and 1000 k€ for small calls:

- **"2" feasible** – feasible in BOTH timeframe and budget.
- **"1" moderately feasible** - feasible to address only partially the subtopic or certain objectives of the subtopic within the available timeframe and budget.

Relevance for PIANOFORTE specific objectives: (to what extent it adheres to PIANOFORTE priorities and objectives)

- **"2" strong relevance** - Strongly endorsed and specifically mentioned as a priority research topic or overarching objective by PIANOFORTE (it adheres to min. 2 specific objectives of PIANOFORTE)
- **"1" moderate relevance** – endorsed and specifically mentioned as a priority research topic or overarching objective by PIANOFORTE (it adheres to 1 specific objective of PIANOFORTE)

Relevance for other EU initiatives outside EURATOM:

- **"2" relevant** - endorsed and mentioned as a priority research topic by other EU initiatives outside EURATOM (eg. HORIZON EUROPE, EU4HEALTH, etc)
- **"1" not relevant** – not mentioned as a priority research topic by other EU initiatives outside EURATOM (eg. HORIZON EUROPE, EU4HEALTH, etc)

Societal impact

- **"3" high societal impact:** projects likely to have positive impact society wide or positive impact on particular population groups (public, medical, occupational) / environments leading to significant risk reduction or providing significant support for improved radiation protection policies or practice
- **"2" moderate societal impact:** projects likely to have positive impact society wide or positive impact on particular population groups (public, medical, occupational) / environments leading to some risk reduction or providing support for improved radiation protection policies or practices
- **"1" low societal impact:** projects which cannot be directly linked/translated into radiation protection policies

Scientific impact:

- **"3" high scientific impact:** projects most likely providing new research results (data, methods, software, recommendations, guidelines, etc.) of high scientific excellence likely to lead to scientific publications in highly ranked (Q1 and Q2) journals relevant for the large scientific community not only radiation protection research
- **"2" moderate scientific impact:** projects most likely providing new research results (data, methods, software, recommendations, guidelines, etc.) of scientific excellence publishable in radiation - related journals of high impact and relevant for the large radiation protection community
- **"1" low scientific impact:** projects most likely providing highly specialized research results (data, methods, software, recommendations, guidelines, etc.) in the field of radiation protection relevant only for restricted groups within the radiation protection community and which are publishable in specialized journals focusing on radiation protection research

Redundancy: (to what extent the topic has recently been and/or is currently being addressed by other projects) (recently closed projects = projects closed within the last 3 years)

- **"3" non-redundant** - no redundancies with ongoing or recently closed EURATOM and/or other EC-funded projects (projects closed within the last 3 years)
- **"2" partially redundant** - partially addressed by ongoing or recently closed EURATOM-funded or other EC projects but a large part of the topic still not researched
- **"1" redundant** - it has substantial redundancies with recently closed and/or ongoing EURATOM or EC projects

Overall priority of the subtopic for PIANOFORTE Call 1[5]:

- **"4" very high** – it fulfils ALL of the following:
  - scores 13-15 based on the above criteria
  - it is feasible
  - it has strong relevance for both PIANOFORTE and other EC initiatives
  - it has high impact in min one category (societal or scientific)
  - it cannot score "1" for redundancy

- **"3" high** – it fulfils the following criteria
  - scores 10-12
  - it is feasible

[5] This part was not sent to the platforms

  - it has strong relevance for PIANOFORTE or other EC initiatives
  - it has high impact in min one category (societal or scientific)
  - it cannot score "1" for redundancy

- **"2" moderate** – it fulfils the following criteria
  - score 7-9

- **"1" low** - it fulfils the following criteria
  - scores below 7

7.7 Annex 6

Priority comment sheet combined for all platforms including Task 2.1 replies

EURAMED

Contributor (who made the comment)	Page, paragraph	Type of comment: ED (editorial) CO (content topic) SC (evaluation)	Original text/evaluation	New proposed text/evaluation	Comment: why is this change proposed?	Comment from Pianoforte WP2.1 group
Christoph Hoeschen	1, A1 Short list	CO	Define the risk of ionising radiation-induced non-cancer diseases after low and intermediate doses (below 500 mGy)…		According to PIANOFORTE cancer should be the main focus.	Pianoforte also mentions that the bases of the first call is the JRM, and this topic is one of the game changer, that is why it is included in the analyses, so we will keep it in the list. Anyhow, non-cancer effects are also important as side effects in cancer treatment.

Christoph Hoeschen	3, D1 Short list	CO	Smaller, more focused projects are favoured		Some projects need to be larger if the impact should be large like for molecular imaging.	Change to small-to-medium sized projects?
Christoph Hoeschen	4, D2 Short list	CO	Smaller, more focused projects are favoured		Projects with relation to AI applications need to be a bit larger, as clinical data assessment and method development and testing need some time and money	as above
Christoph Hoeschen	4, D3 Short list	CO	Implementing EU-wide epidemiological studies of patients to enhance quality and safety of medical radiation applications and developing a knowledge base and analytical tools to better predict and reduce risk of secondary cancer and non-cancer disease in cancer patients treated with radiotherapy		This had been studied in various projects closed just briefly ago or still running like EPI-CT, MEDIRAD, Harmonic and partly SINFONIA.	Right. Redundancy or partial redundancy will be reflected in the scoring. However, the long-term follow-up of existing cohorts could give important new infos.
Christoph Hoeschen	16, D	CO	Interactions of Topic D with other research topics of the Joint Roadmap: Topics A, B, E, H	Maybe include Topic F3		OK
Christoph Hoeschen	16, D	ED	…Europe and the Strategic Agenda…	Delete extra space between “and” and “the”		OK

Christoph Hoeschen	16, D1	CO	Redundancy - needs to be carefully checked at subtopic level		See comments above. Most projects running so far or ended shortly ago do not cover most of the mentioned topics (molecular imaging, AI-based methods, optimized therapies, interaction with other therapies). Epidemiology had been more extensively investigated	Redundancy or partial redundancy will be reflected in the scoring.This can be discussed in the Friday meeting
Christoph Hoeschen	17, D1	CO	Smaller, more focused projects are favoured		This needs partly larger projects	this comment was already addressed
Christoph Hoeschen	17, D1	CO	Game changer: no	Change to “yes”	I definitely disagree	Misunderstanding: it is meant that this topic is not mentioned in the JRM, this will be changed
Christoph Hoeschen	17, D1	CO	The topic partly addresses some of the MEDIRAD technical recommendations		But not to already performed research	Redundancy or partial redundancy will be reflected in the scoring.This can be discussed in the Friday

Christoph Hoeschen	18, D1	CO	The topic has various degrees of overlaps with currently running or recently closed projects funded by various European sources (mainly EURATOM and HORIZON EUROPE or HORIZON 2020). Such projects are MEDIRAD, SINFONIA, EuCanImage		This is not correct. None of the projects are related to personalized medicine or corresponding optimisation	Within the objectives on the public websites of these projects overlaps with D1 can be identified. Please check the file "Documents used for drafting topics and subtopics" (starting from page 8)
Christoph Hoeschen	18, D2	CO	Game changer: no	Change to "yes"	Will be part of the new EURAMED/Rocc'n'Roll SRA but not done so far	Misunderstanding: it is meant that this topic is not mentioned in the JRM, this will be changed

Christoph Hoeschen	19, D2	CO	The relevance of the topic was recognised by EURATOM and various EC initiates since currently several ongoing projects overlap at various extents with this subtopic (MEDIRAD, EUCANIMAGE, i-VIOLIN, SINFONIA, SIMPLERAD, CHAMELEON)		AI is not covered yet; SINFONIA is only referring to risk assessment (A2), not this topic	Within the objectives on the public websites of these projects overlaps with D2 can be identified, including the use of AI. Please check the file "Documents used for drafting topics and subtopics" (starting from page 8)
John Damilakis	4, A2	ED	… exclusively based on high dose IR, while	Please expand IR	Abbreviations should be expanded at first mention	OK
John Damilakis	17, D1	CO	….. and encompasses applications such as molecular imaging, interventional procedures and theranostic applications.	and encompasses applications such as anatomical imaging including X-ray Computed Tomography technologies and X-ray interventional procedures, molecular imaging, and theranostic applications.	Anatomical imaging is critical to the care of patients at multiple stages of their disease.It is used for diagnosis, follow up, staging, monitoring, screening and image guided radiotherapy. It is the most accessible type of medical imaging. Research on how to individualize these procedures with regard to optimisation of the benefit/risk ratio is of paramount importance.	OK

John Damilakis	17, D1	SC	Smaller, more focused projects are favoured.	The topic is suitable for both large and smaller, more focused proposals.	This is a broad subtopic involving a wide range of medical technologies and multi-disciplinary teams.	OK, see also above
John Damilakis	18, D2	ED	….. in particular, how the use of AI will impact current……	Please expand AI	Abbreviations should be expanded at first mention	OK
John Damilakis	18, D2	SC	Smaller, more focused projects are favoured.	The topic is suitable for both large and smaller, more focused proposals.	This is a broad subtopic involving a wide range of medical technologies and multi-disciplinary teams.	OK
John Damilakis	18, D2	CO	This includes means to i) standardize implementation of optimized applications, e.g. evaluation of radiation dose and image quality integrated in quality assurance ii) set up of reliable AI methodologies for medical applications. Including strategies for testing and validation of data and methods to allow application independent of hospital equipment.	This includes means to i) set up reliable AI methodologies for radiation dose prediction and image quality enhancement, b) strategies for testing and validation of data used for AI/Machine Learning (ML) applications and c) methods to allow generalizability of ML models.	….standardize implementation of optimized applications, e.g. evaluation of radiation dose and image quality integrated in quality assurance: this is part of clinical routine rather than research topic.	OK EURAMED should agree on the final text of D2.
John Damilakis	22, E	SC	E. Improving radiation protection of workers and population and text related to E1	The subtopic (E1) does not include an objective on how to improve radiation protection of the population.	Either amend the title or include a specific objective on radiation protection of the population.	Correct – to be discussed, we remove “population” from the title

Ramona Bouwman	B/B1	SC	Page 9: impact of track structure in terms of biological effect Page 10: To quantify correlations between track structure and radiation damage Page 10: Investigate the physical characteristics of particle track structures	Page 9: impact of microscopic energy deposition in terms of biological effect Page 10: To quantify correlations between microscopic energy deposition and radiation damage Page 10: Investigate the physical characteristics of energy deposition on microscopic scale	In recent work by EURADOS difference are found between MC-code using a condensed history approach and those using track structure code however it is not known if this means that track structure codes are necessarily better. By specifically mention track structure you exclude experience research using useful MC-codes like MCNP.	OK

Ramona Bouwman	D1	SC	Evidence-based procedures should rely on benefit and risk based on patient data rather than on model data wherever feasible.	Evidence-based procedures should rely on benefit and risk based on patient data.	Models (like for example physiology based pharmacokinetic models) can provide useful information based on patient data to develop or optimize procedures for therapeutic use. Radionuclide therapy is a complex therapy with potential high doses, models can be very useful to gain information on the expected and/or delivered dose and be useful to predict patient response. However, it is realized that using complex models may be challenging to be used in the clinic the exclusion of the use of models seems not be appropriately.	OK for us but this was exactly the wording by Christoph EURAMED should agree on the final text of D2.

Ramona Bouwman	D2	SC	Improving the quality of medical imaging and radiation therapy especially but not limited to cancer-treatment. This includes means to i) standardize implementation of optimized applications, e.g. evaluation of radiation dose and image quality integrated in quality assurance ii) set up of reliable AI methodologies for medical applications. Including strategies for testing and validation of data and methods to allow application independent of hospital equipment. Social, ethical and legal dimensions of the use of AI should also be addressed, in particular, how the use of AI will impact current practices; what the effect will be on the gaps observed between best practice and guidelines, on the one hand, and current practices, on the other; and what the concerns and expectations of patients and other stakeholders are in the	Improving the quality of medical imaging and radiation therapy especially but not limited to cancer-treatment. This includes means to i) standardize implementation of optimized applications, e.g. evaluation of radiation dose and image quality integrated in quality assurance ii) set up of reliable computational methodologies such as AI or pharmacokinetic modeling for medical applications. Including strategies for testing and validation of data and methods to allow application independent of hospital equipment. Social, ethical and legal dimensions of the use of these computational methodlogies should also be addressed, in particular, how the use of AI will impact current practices; what the effect will be on the gaps	Artificial intelligence is a relevant hot topic computational tool to improve the quality of especially for medical imaging purposes however, for radionuclide therapy the use or combination of use of multiple computational methodologies might be beneficial.	There was already a suggestion how to change D2. Please harmonize your suggestions.

			context of these technological developments.	observed between best practice and guidelines, on the one hand, and current practices, on the other; and what the concerns and expectations of patients and other stakeholders are in the context of these		

EURADOS

Contributor (who made the comment)	Page, paragraph	Type of comment: ED (editorial) CO (content topic) SC (evaluation)	Original text/evaluation	New proposed text/evaluation	Comment: why is this change proposed?	Comment from Pianoforte WP2.1 group
EURADOS	1, A1	CO	Validation of algorithms should be added in the scope			=We don't understand what is suggested To be discussed in the meeting on Friday
EURADOS	2, A3	CO	Should be more focus on biomarkers			We disagree, since a correct biomarker research starting from the discovery phase and performing validation, QC is a lengthy process, not fitting in the time frame. On the other hand, so far biomarker studies mostly

						focused on investigating biological mechanisms and proposing candidate molecules but never continued further on. This we would like to avoid.
EURADOS	3, A4	CO	The scope is very general, and some aspects should be clarified. For example, it should be mentioned if experimental studies on animals are included?			Within the text of the subtopic experimental data is specifically mentioned. This includes animal experiments as well. No changes are suggested.
EURADOS	3, B1	CO	Seems connected to A4 from EURADOS's point of view. Should be more focussed on specific applications (e.g. radiotherapy, space…)			Right. A possible combination of certain, closely linked subtopics can be discussed at a later stage, when subtopics are finalized No changes are suggested
EURADOS	4, C1	CO	Is such an objective compatible with 2-3 year projects?			Should be reflected in the scoring, no changes are suggested
EURADOS	4, C2	CO	Is such an objective compatible with 2-3 year projects?			as above
EURADOS	5, D1	CO	Expected outputs should be more precisely described. Should be more focussed on disease or treatment ?			No changes are suggested

EURADOS	5, D3	CO	The objectives must be clarified because 3 years is not enough for epidemiological studies			Right. This was recognized, but not included in the text of the subtopic. This topic will be revised to include only existing cohorts, no new cohorts
EURADOS	6, E1	CO	Should be "Improvement" of biokinetic models because we don't start from scratch. Regarding dosemeters, should not focus on neutrons only.			OK, “improvement” will be accepted. The JRM (and EURADOS SRA) is specific focussed for neutron dosimetry. No changes are suggested.
EURADOS	7, F1	CO	Should it mention modelling for distant the use of nuclear weapons?			Nuclear weapons fall in the interest of Topic G.

ALLIANCE

Contributor (who made the comment)	Page, paragraph	Type of comment: ED (editorial) CO (content topic) SC (evaluation)	Original text/evaluation	New proposed text/evaluation	Comment: why is this change proposed?	Comment from Pianoforte WP2.1 group
ALLIANCE	All	CO			Sometimes the interactions between topics are not consistent and bidirectional. For instance, in page 2 no	Thank you. We will revise it and make it coherent.

	25 and 2 (as an example)				interactions between topics A and F are listed, whereas in page 25 interactions between topics F and A are suggested.	
ALLIANCE	5	CO	4. To provide the scientific basis to recommendations, procedures and tools …. to manage legacy sites	Remove this specific objective	The medical setting is a much more relevant setting for the A2 thematic and we would remove reference to objective 4.	We think that a better understanding of cancer risk helps in a better management of the long-term consequences of radiological and nuclear events. We see what you mean and we accept your comment.
ALLIANCE	12	CO	**C.** "Importance of the topic" text	See **>> text below, suggested to replace the current text**.	The text is rather short and generic, and does not remind fully the importance of the topic. It may have some consequences on the scoring of the subtopics. A more comprehensive text issued from the JRM is proposed below.	OK
ALLIANCE	12	SC	**C.** Redundancy: Partially with the RadoNorm project (focussed on Radon and NORM).	Redundancy: Partially with the RadoNorm project (focussed on Radon and NORM) **but that overlap is very limited because RadoNorm**	Ditto.	This will be reflected in the redundancy scoring, and can be discussed on Friday.

				focus on very specific radionuclides and exposure situations		
ALLIANCE	12	CO	**C1.**	Resolving the controversy with regard to the effects on wildlife reported in the Chernobyl and Fukushima exclusion zones	Align with game changer	The subtopic is based on game changer C1, please consult the file "Documents used for drafting the topics and subtopics" as well as CONCERT JRM. To be discussed in the meeting on Friday
ALLIANCE	14		**C2.** Determine the effects of ionising radiation on ecosystem functioning, as well as potential effects of exposures to human wellbeing (e.g. culture, food consumption, work and recreational activities).	**C2.** Determine the effects caused by **artificial** (man-made) and **naturally occurring** radionuclides on **terrestrial and aquatic ecosystems** functioning, as well as potential effects of exposures to human wellbeing (e.g. culture, food consumption, work and recreational activities).	For clarity state both types of ecosystems (terrestrial and aquatic) and the two exposure sources (artificial and natural). To underline importance of aquatic environment, considering „culture, food consumption, work and recreational activities" aquatic ecosystems have the same, at least, importance especially in case of NORM industries releasing huge amount of contaminated produced water. Aspects related to liquid NORM are not adequately addressed in RadoNorm project.	OK

ALLIANCE	14	CO	**C2. …**as well as potential effects of exposures to human wellbeing (e.g. culture, food consumption, work and recreational activities).		Alliance is wondering why this part was added to the original game changer (suggestion from SHARE?). ALLIANCE agree's human wellbeing is important. However, this should not elude the initial intention of this Game Changer: preserving the health of ecosystems per se, whatever the services provided to humans.	OK. We accept this comment. There will be a general note in the call text that some SSH aspects should be included in every topic.
ALLIANCE	22	ED	"Only EURATOM launches scientific calls within the area of Topic A"	"Only EURATOM launches scientific calls within the area of **Topic E**"		OK
ALLIANCE	22	CO	E1. Development of biokinetic models and personalised dosimetry that will lead to the improvement of the assessment of internal exposure for occupational exposed workers	Development of biokinetic models **and associated molecular understanding** and personalised dosimetry that will lead to the improvement of the assessment of internal exposure for occupational exposed workers	Include research on the molecular understanding of contaminants uptake / storage in cells/organs/ and transport in blood, as this can significantly improve the assessment of internal exposure. These researches are not supported elsewhere in the call (proposal to be discussed at the meeting)	Not OK – to be discussed on Friday. This will extend the game changer significantly , and might be better suited as a new topic for the next call.

ALLIANCE	27 and 28	CO	27. the management and clean-up of existing sites, as well as to the licensing (including social licensing) of future discharges and large quantities of NORM waste 28..as well as to the licensing of future discharges and large quantities of NORM waste	the management and clean-up of existing sites, as well as to the licensing (including social licensing) of future discharges and large quantities of **NORM residues** ... as well as to the licensing of future discharges and large quantities of **NORM residues**	NORM residues can become waste but there is also possibility for reuse/recycling	OK

NERIS

Contributor (who made the comment)	Page, paragraph	Type of comment: ED (editorial) CO (content topic) SC (evaluation)	Original text/evaluation	New proposed text/evaluation	Comment: why is this change proposed?	Comment from Pianoforte WP2.1 group
NERIS WG	32, G1	SC	-	<u>Evaluation:</u> Feasibility: 1 Relevance for PIANOFORTE: 2 Relevance for other EU initiatives: 2 Societal impact: 2 Scientific impact: 2 Redundancy: 3		

				Total: 12		
NERIS WG	33-34, G2	SC	-	<u>Evaluation:</u> Feasibility: 2 Relevance for PIANOFORTE: 2 Relevance for other EU initiatives: 3 Societal impact: 2 Scientific impact: 2 Redundancy: 2 Total: 13		
NERIS WG	33	ED	Further development of risk assessment and risk management approaches, technological capabilities to cope with accident scenarios arising from new and future nuclear and radiological technologies and new threats arising from war situations, including further development of monitoring and dosimetry techniques, and taking into consideration social, ethical and legal issues.	Further development of risk assessment and risk management approaches, technological capabilities to cope with accident scenarios arising from new and future nuclear and radiological technologies, including further development of monitoring and dosimetry techniques, and taking into consideration social, ethical and legal issues.	We removed “and new threats arising from war situations” as we propose the splitting of G2 by adding a G2_extra topic (see below)	It was agreed that at this stage no new subtopics can be suggested. If we do not adhere to that, all the other platforms will suggest new topics. Nevertheless, if you wish, you can reformulate the subtopic, to make it more focused on certain objectives relevant for NERIS.
NERIS WG	35, G2 extra	CO	-	The recent war in Ukraine arises new challenges regarding preparedness for, management of and recovery from nuclear and radiological emergencies in the context of war. We suggest to split G2 with a new subtopic named “G2 extra” dedicated to research on armed conflict as originally mentioned in G2, but short-term and	This new game changer must be taken into account for a short-term project in association with Ukrainian and bordering countries	

				with high outcomes, in particular on the implications for public protective actions, monitoring and dosimetry techniques, and considerations on social, ethical and legal issues. The full description of G2_extra is given in the attached document.	researchers, experts and authorities.	
NERIS WG	35, G2 extra	SC	-	Evaluation: Feasibility: 2 Relevance for PIANOFORTE: 2 Relevance for other EU initiatives: 2 Societal impact: 3 Scientific impact: 3 Redundancy: 3 Total:15		

MELODI

Contributor (who made the comment)	Page, paragraph	Type of comment: ED (editorial) CO (content topic) SC (evaluation)	Original text/evaluation	New proposed text/evaluation	Comment: why is this change proposed?	Comment from Pianoforte WP2.1 group

MELODI WG	2, A1	CO		A1. most cohorts of interventional radiology focus on cancer, no yet on non-cancer diseases. Should not focus just on non-cancer diseases		A1 is a game changer targeting only non-cancer diseases
MELODI WG	D3	Co	-	D3. ideally build upon existing cohorts and create new ones just for specific exposure situations of interset		This comment was made by another platform already. The comment is correct, the subtopic needs to be revised.

SHARE

Contributor (who made the comment)	Page, paragraph	Type of comment: ED (editorial) CO (content topic) SC (evaluation)	Original text/evaluation	New proposed text/evaluation	Comment: why is this change proposed?	Comment from Pianoforte WP2.1 group
	Subtopic A1	CO	"related risk perception and risk communication studies"	Suggestion that SHS contribution could aim for more than that; at least RP should be understood broadly. Interesting research questions: E.g. Who are seen to be particular "risk groups" ? What could be the cause of that? Induvial versus collective characteristics? …	The broaden out the understanding of "the social" to be more than about perceptions and misinformation to be corrected trough "appropriate" communication. Could raise the potential societal and scientific impact of projects under this topic	SSH aspects are already included. No new text was suggested. It has to be accepted by MELODI, whether they accept to change the meaning of the game changer A1..
	Subtopic C1 and C2	CO		Both hold a great opportunity for interdisciplinary research projects, including SHS contributions, but it doesn't resonate from the current text. Stronger emphasis on potential for SHS should be encouraged. There is also a strong potential for a citizen science angle in both subtopics which could be added to this call	Could make projects under this topic more relevant and raise the potential societal impact	Alliance disagrees.

	Subtopic D3	CO	“explore ways to improve communication among patients, caregivers, medical personnel and other stakeholders in order to empower them for informed decision-making and consent and improve radiation protection behaviours”	more emphasis could be put on transdisciplinary research and implication of stakeholder groups in the project(s) beyond what is indicated	Could make projects under this topic more relevant and raise the potential societal impact	SSH aspects are already included. No new text was suggested. It has to be accepted by EURAMED, whether they accept to change D3..
	Subtopic F2	CO		A more explicit link to SSH could be made here, e.g. elaborating further on “social licensing”, on social impacts of remediation approaches and on aspects of decision making and governance	Could make projects under this topic more relevant and raise the potential societal and scientific impact	SSH aspects are already included. No new text was suggested. It has to be accepted by the specific platform, whether they accept to change F2..
	Subtopic F3	CO		Similarly, the suggestion “including social considerations” could be further elaborated on	Could raise the potential societal and scientific impact	SSH aspects are already included. No new text was suggested. It has to be accepted by the specific platform, whether they accept to change F2.

7.8 Annex 7

Summary of scores given by the platforms

AVERAGE																		
		A1	**A2**	**A3**	**A4**	**B1**	**C1**	**C2**	**D1**	**D2**	**D3**	**E1**	**F1**	**F2**	**F3**	**G1**	**G2**	**H1**
	Feasibility	1,5	1,75	1,5	1,5	2	1,5	1	2	2	1	2	2	2	1	1,8	1,8	2
	Relevance for PIANOFORTE specific objectives	2	2	2	2	1,25	1,5	1,75	1,75	1,75	2	1,5	2	1,75	2	1,8	1,6	1,75
	Relevance for other EU initiatives outside EURATO	1,75	1,75	2	1,5	1,25	1,25	1,5	2	2	2	1	1,5	1,5	2	2	2,2	2
	Societal impact	2	2	2,25	2	1,75	2,25	2,5	3	2,75	2,5	2	2	2,25	2,25	2,2	2,4	2,75
	Scientific impact	2,75	2,5	2,5	2,75	2,5	2	1,75	2	2	2,5	2	2	2	2	1,8	2,2	1,5
	Redundancy	2,25	2	2	2,5	2,5	2	2,5	1,5	1,25	1,75	2,5	2	2	2,5	2,2	2,2	2
	Sum:	**12,25**	**12,00**	**12,25**	**12,25**	**11,25**	**10,50**	**11,00**	**12,25**	**11,75**	**11,75**	**11,00**	**11,50**	**11,50**	**11,75**	**11,80**	**12,40**	**12,00**

MELODI																		
		A1	**A2**	**A3**	**A4**	**B1**	**C1**	**C2**	**D1**	**D2**	**D3**	**E1**	**F1**	**F2**	**F3**	**G1**	**G2**	**H1**
	Feasibility	2	2	2	2	2	2	1	2	2	1	2	2	2	1	2	2	2
	Relevance for PIANOFORTE specific objectives	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2
	Relevance for other EU initiatives outside EURATO	2	2	2	2	1	1	2	2	2	2	1	2	2	2	2	2	2
	Societal impact	2	3	3	2	2	2	2	3	3	3	2	2	2	2	2	3	3
	Scientific impact	3	3	3	3	2	3	2	2	2	2	2	2	2	2	2	2	2
	Redundancy	2	2	2	2	2	2	3	2	1	2	2	2	2	2	2	2	2
	Sum:	**13**	**14**	**14**	**13**	**10**	**12**	**12**	**13**	**12**	**12**	**11**	**12**	**12**	**11**	**12**	**13**	**13**

EURADOS																		
		A1	**A2**	**A3**	**A4**	**B1**	**C1**	**C2**	**D1**	**D2**	**D3**	**E1**	**F1**	**F2**	**F3**	**G1**	**G2**	**H1**
	Feasibility	2	1	1	2	2	1	1	2	2	1	2	2	2	1	2	2	2
	Relevance for PIANOFORTE specific objectives	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2
	Relevance for other EU initiatives outside EURATOM	2	2	2	2	2	1	1	2	2	2	1	1	1	2	2	2	2
	Societal impact	2	1	2	2	1	2	3	3	2	2	2	2	2	2	2	2	3
	Scientific impact	2	2	2	3	3	1	1	1	2	2	2	1	1	2	2	2	1
	Redundancy	3	2	2	2	3	2	2	1	1	2	3	2	2	2	2	2	2
	Sum:	**13**	**10**	**11**	**13**	**13**	**8**	**10**	**11**	**11**	**11**	**12**	**10**	**10**	**11**	**12**	**12**	**12**

ALLIANCE																		
		A1	**A2**	**A3**	**A4**	**B1**	**C1**	**C2**	**D1**	**D2**	**D3**	**E1**	**F1**	**F2**	**F3**	**G1**	**G2**	**H1**
	Feasibility	1	2	1	1	2	2	1	2	2	1	2	2	2	1	2	2	2
	Relevance for PIANOFORTE specific objectives	2	2	2	2	1	2	1	1	1	2	1	2	2	2	1	1	1
	Relevance for other EU initiatives outside EURATOM	2	1	2	1	1	2	2	2	2	2	1	2	2	2	2	2	2
	Societal impact	2	2	2	2	3	3	3	3	3	3	2	2	3	2	2	3	2
	Scientific impact	3	2	2	2	2	2	2	2	1	3	2	2	2	2	1	2	1
	Redundancy	2	2	2	3	3	3	3	1	1	1	3	2	2	3	2	3	2
	Sum:	**12**	**11**	**11**	**11**	**12**	**14**	**12**	**11**	**10**	**12**	**11**	**12**	**13**	**12**	**10**	**13**	**10**

EURAMED																		
		A1	**A2**	**A3**	**A4**	**B1**	**C1**	**C2**	**D1**	**D2**	**D3**	**E1**	**F1**	**F2**	**F3**	**G1**	**G2**	**H1**
	Feasibility	1	2	2	1	2	1	1	2	2	1	2	2	2	1	2	1	2
	Relevance for PIANOFORTE specific objectives	2	2	2	2	1	1	2	2	2	2	1	2	1	2	2	1	2
	Relevance for other EU initiatives outside EURATOM	1	2	2	1	1	1	1	2	2	2	1	1	1	2	2	2	2
	Societal impact	2	2	2	2	1	2	2	3	3	2	2	2	2	3	3	2	3
	Scientific impact	3	3	3	3	3	2	2	3	3	3	2	3	3	2	2	3	2
	Redundancy	2	2	2	3	2	1	2	2	2	2	2	2	2	3	2	2	2
	Sum:	**11**	**13**	**13**	**12**	**10**	**8**	**10**	**14**	**14**	**12**	**10**	**12**	**11**	**13**	**13**	**11**	**13**

NERIS																		
		A1	**A2**	**A3**	**A4**	**B1**	**C1**	**C2**	**D1**	**D2**	**D3**	**E1**	**F1**	**F2**	**F3**	**G1**	**G2**	**H1**
	Feasibility															1	2	
	Relevance for PIANOFORTE specific objectives															2	2	
	Relevance for other EU initiatives outside EURATOM															2	3	
	Societal impact															2	2	
	Scientific impact															2	2	
	Redundancy															3	2	
	Sum:															**12**	**13**	

7.9 Annex 8

PIANOFORTE Task 2.1 and Platforms representatives Meeting

Friday 14 October 2022 (09:00-13:00 CET) Estoril

Draft minutes

Present: Task 2.1 participants: Filip Vanhavere, Katalin Lumniczky, Catrinel Turcanu, Almudena Real, Anja Almen (online); Platform representatives: ALLIANCE: Hildegarde Vandenhove and Rodolphe Gilbin; EURADOS: Jean Francois Bottolier and Rick Tunner; EURAMED: Christophe Hoeschen and Uta Eberlein; MELODI: Andrzej Wojcik and Nathalie Impens; NERIS: Antony Bexon and Paulo Nunes; SHARE: Tanja Perko. Observer: Liz Ainsbury

Katalin started the presentation of the work done by Task 2.1 participants (see power point)

S8: Katalin mentioned that social sciences and humanities (SSH) should be included in all the proposals. Each proposal will decide to what extent SSH will be included.

Hildegarde mentioned that if all the proposals will have SSH included, maybe H1 subtopic is not needed. Filip answered that Task 2.1 decided to keep it because it is a game changer in the CONCERT Joint Roadmap (JRM). Katalin explained that in most subtopics there is an objective related with SSH. Hildegarde asked if not including SSH in a proposal (e.g., in basic research proposals) could make that the proposal is rejected. Catrinel clarified that the text says that SSH have to be included "as appropriate" and mentioned that it is a requirement for Horizon Europe projects.

Nathalie comments that regarding redundancy, the game changers are very broad and cannot be solved in 3 years and therefore, a follow up project might be needed. How are we going to evaluate redundancy? Katalin explained that in some subtopics there have not been funded projects in many years, while in other subtopics there have been some projects funded, e.g., if there are 5 projects on cardiovascular, of course they will not solve the problem, but it will be better to fund a different subtopic. Filip comments that the redundancy issue will come back in the "comments" from the platforms.

Regarding the "Relevance for other EU initiatives outside EURATOM" Andrzej does not understand why Task 2.1 takes this into account. Katalin explained that it's important to consider that a subtopic is not only important for EURATOM (for radiation protection) but also for other programmes outside EURATOM. Hildegarde says that for her is not strange since this was included in the PF proposal. Tanja mentions that it is important that we show the link with other H-E programmes. Christophe comments that if you do a basic research project, the results may have impact in the future in other programmes outside EURATOM and this is important. Katalin mentions that although we must look for synergies and integration of RP initiatives with other H-E initiatives not to be an "isolated island". Filip highlights that it is written in the PF proposal that we will link with other programmes outside EURATOM.

Christoph comments that "Redundancy" is not clear for him, e.g., MEDIRAD is a medical topic, but there are also MELODI topics in it. This project will not solve the "medical" issues. Katalin explained that Task 2.1 did not only look the title of the projects but also the objectives of the projects to decide about redundancy. If the objectives of the on-going projects are the same that the objectives of the subtopic proposed, we need to consider that there is some redundancy.

Nathalie wants to know if PF can state something that makes that all the platforms receive funds from the open calls. She makes the following example: if priorities of platforms A and B have been selected in the first call, there should be "something" to restrict participation of platforms A and B in next calls, so that only the other platforms can send proposals to the next open calls. Katalin comments that Task 2.1 cannot answer this question. The aim is that each platform will have a chance to get funds. Now the subtopics are "purely" link to platforms, but maybe in next calls we should formulate joint subtopics, so that 2 or more platforms are interested in the subtopic.

Christophe highlights that for MEENAS it will be better to formulate topics that fit to several platforms. The more we are able to cooperate this will make MEENAS stronger. Hildegarde agrees and mentions that the platforms can be considered "expertise centres" and that way we can think together how to solve the radiation protection "problems"/challenges.

Christophe asks how the text for the call will look like. He suggests having a short text, not including all the details. Katalin answers that it is WP7 who will formulate the text of the call, and hopefully it will be written in a way that promotes collaborations between platforms. We can give suggestions but it will be WP7 who write the text. Filip says that the criteria that will be used for evaluating proposals are not within the scope of Task 2.1. The ExB will discuss ways to evaluate proposals. Katalin mentions that WP7 might include a sentence that collaboration among different platforms is encouraged / expected.

Paolo asks what would happen if a subtopic included in the 1st call but is not approved. Can this subtopic be included in the 2nd call? Filip says that he thinks it will be possible, but it has not yet been decided; we will discuss after the first call; in might even be possible to allow follow-up of some projects.

Katalin shows the comments sent by the platforms (S27-S53).

ALLIANCE comments:

Rodolphe explains that RadoNorm redundancy is not only with topic C, but also with SSH and health issues. Katalin answers that this has been taken into account.

Hildegarde comments that C1, as it was formulated, it is too general. ALLIANCE wants to focus on the controversies in Chernobyl and Fukushima.

S31: delete the addition of SHARE. ALLIANCE and SHARE will discuss this point discusses and come to an agreement.

ALLIANCE 22: Regarding E1. Task 2.1 did not agree because it changes the game changer quite a lot. Better to add a topic on this issue in call 2; it's also relevant for patients (now it's only for workers).

ALLIANCE agrees with the way Task 2.1 addressed the comments

EURADOS comments:

1, A1: The person from EURADOS who made this comment was not in the room and the representatives did not know the explanation. It was agreed to delete this comment.

A4: EURADOS: doesn't understand what kind of experiments are those? MELODI asks to keep it as general as it is and it's up to the proposers to fill in with what experiments they wish to do.

5, D3: It was recognized that 3 years not enough for epidemiological studies: it will be revised and mentioned that only existing cohorts will be used Christophe mentioned that if the changed is made, the medical applications will disappear; it's not easy to revise in a meaningful way. Can MELODI provide suggestions?

Jean-Francois suggests making changes in E1. Rick will send a suggestion after discussing with EURADOS. Christophe mentioned that the change will influence the scoring, buy Filip thinks that if the type of dosimeters is not changed, the score should not change.

7, F1. "Nuclear weapons" should be included. Hildegarde mentions that in the JRM all the comments on "attacks" had to be deleted as a "suggestion" of the EC. Before changing the text, we need to check with Jean-Christophe Gariel if this can be addressed.

EURAMED comments:

A1. Christophe asked to have more argumentation, show why this topic a priority? It would be important to mention that "non-cancer effects are also important as side effects if cancer treatment", as mentioned in the response of WP2 to this comment.

D1, D2 agree to change the focus to small –medium size projects! This may also influence feasibility.

18, D1- Christophe clarify that this subtopic is focused on personalized medical treatment.

Nathalie comments that it is difficult to evaluate a game changer if you don't know the topic.

D1: the text will be rewritten. Ok for Task 2.1 . Mention "evidence based models" and that it is a roc-n-roll game changer.

D2. Ok for Task 2.1, but there were 2 proposals slightly different from EURAMED, so EURAMED should agree in the final text and send it to Task 2.1 asap.

B1: Revision done by EURAMED is accepted

D1. ok for task 2.1 and Christophe agrees in making the change proposed.

D3: no new cohorts

MELODI send 2 comments. Ok for Task 2.1

NERIS comments:

NERIS suggested to add a new subtopic, but no new subtopics are accepted. Instead, NERIS can reformulate one of the subtopics. Important to check if the "attacks" can be added. Antony Bexon will reformulate the G2, discuss with ALLIANCE, and send the final text to Task 2.1 asap.

SHARE comments:

Subtopic A1: MELODI agrees in that what SHARE has added is too specific and is more for the proposal that for the priorities. Tanja will send the new text to MELODI for discussion.

C1, C2: ALLIANCE and SHARE will discuss and make a decision.

D3: SHARE has not suggested a new text, but will make a suggestion to EURAMED.

F2, F3. No text was suggested. SHARE has to propose a text and consult with ALLIANCE that has to approve the new text.

It was agreed that by the end of next week: ALL PLATFORMS WILL SEND THE NEW TEXT TO TASK 2.1

SCORES

In S59, in "Very high" the social and scientific impact text has to be corrected (use the text of "high").

Katalin explains that if some platforms gave a score 1 for redundancy, while in the document prepared by WP2 no overlaps where found, then it should be specified which projects they found that had an overlap.

Katalin asks if the platforms agree with the criteria used

Christophe mentions that the feasibility will change for some topics as they are mentioned as small-medium instead of small, but Katalin explains that this will not influence the score because the size of the project was not taken into account for scoring feasibility.

Hildegarde mentions that C1 was not the right game changer, and the new will be more feasible than the old one. She also comments that she agrees with the four categories defined for the subtopics: very high, high, moderate, low.

Tanja says that for SHARE all the subtopics were important and they lacked the technical expertise to evaluate, so they did not score them.

Paolo mentioned that NERIS scored only the subtopics related to their platform.

Hildegarde comments that many of the subtopics are also multi-platform. Difficult to score topics in which you are not expert. Only big organizations within ALLIANCE evaluated all the subtopics (organizations that have expertise in different fields), while others evaluated only the ALLIANCE topics.

Christophe thinks that some subtopics are easier to score than others. He does not agree some of the scales used, because you "over-weight some criteria (e.g., feasibility or redundancy),

for instance for some criteria the scores were 1 or 2 and for others was 1,2 or 3. He suggests looking first what is important for PF.

Hildegarde commented that within the ALLIANCE, when we were analysing the input of the members who sent scores and "a discrepancy" was detected (e.g., all members score 3 and only one member scored 1) ALLIANCE contacted the organization asking to check that there was not a mistake in the score.

Katalin showed the scores sent by ALLIANCE and tried to explain some "inconsistencies" detected by Task 2.1, but it was impossible to explain the work done because the platforms representatives started to complain and expressed diverging opinions. MELODI proposes to keep the scores as such, while most others agree that scores for the more objective criteria (relevance to PF, other initiatives and redundancy) should be adjusted/ corrected.

There are also errors, e.g. giving a score 3 when the possible ones are 1 or 2.

Christophe proposes to send the table prepared by Task 2.1 with all the scores to the platform, including the proposed corrections, and platforms will decide if they agree or not. In addition, we need to agree on how to categorise the subtopics in very high, high, moderate and low.

Filip says that the categorisation procedure was sent to the PF ExB and we did not receive any comment from them.

The question is asked about what will POMs be able to do. Filip answers that POM's will be able to comment on the final assessment (very high, high, etc.) and the whole prioritisation procedure?

Conclusions & Actions to be done:

- Task 2.1 will send the overview of the scoring from all platforms.
- Each platform should check "its" subtopics and look for inconsistencies in the scoring for the following three criteria: relevance for the PF specific objectives, relevance for other EC initiatives outside Euratom and redundancy. The other scores will remain unchanged.
- If the platform has a solid argument why they think there is an inconsistency, they should contact the platform that did the "inconsistent" scoring and ask them if they are willing to change their score. It is then up to the platform that did the scoring to accept the change or not. Remember, that there are scoring criteria distributed to which the scoring should be compared to see if this is inconsistent or not. Also please check the text for each topic again provided by our task group.
- Any changes of scoring on these 3 criteria should be sent to this whole mailing list **latest Friday 21/10 at 12h00 CET**. The changes need to be sent by the platforms that did the scoring, not by the topic "owners". Any late changes will not be accepted.
- The new versions of C1 and G2 should be sent asap (preferable before Monday) to the whole mailing list.
- For subtopics C1 and G2, also changes in scoring can be accepted for the other criteria.

- Task group 2.1 will have a meeting the week after to summarize the new input. After that Task 2.1 we will organize a web meeting with all platforms representatives to have the final discussion.

7.10 Annex 9

Slides of the presentation made for the second round of discussion with platforms

Updated scores by platforms

MELODI

	A1	A2	A3	A4	B1	C1	C2	D1	D2	D3	E1	F1	F2	F3	G1	G2	H1
Feasibility	2	2	2	2	2	2	1	2	2	1	2	2	2	1	2	2	2
Relevance for PIANOFORTE specific objectives	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2
Relevance for other EU initiatives outside EURATOM	2	2	2	2	1	1	2	2	2	2	1	2	2	2	2	2	2
Societal impact	2	3	3	2	2	2	2	3	3	3	2	2	2	2	2	3	3
Scientific impact	3	3	3	3	2	3	2	2	2	2	2	2	2	2	2	2	2
Redundancy	2	2	2	2	2	2	3	2	1	2	2	2	2	2	2	2	2
Sum:	**13**	**14**	**14**	**13**	**10**	**12**	**12**	**13**	**12**	**12**	**11**	**12**	**12**	**11**	**12**	**13**	**13**

EURADOS

	A1	A2	A3	A4	B1	C1	C2	D1	D2	D3	E1	F1	F2	F3	G1	G2	H1
Feasibility	2	1	1	2	2	2	1	2	2	1	2	2	2	1	2	2	2
Relevance for PIANOFORTE specific objectives	2	2	2	2	1	2	1	1	1	2	1	2	2	2	1	1	1
Relevance for other EU initiatives outside EURATOM	1	2	2	1	1	2	1	2	2	2	1	2	2	2	2	2	2
Societal impact	2	1	2	2	1	2	3	3	2	2	2	2	2	2	2	2	3
Scientific impact	2	2	2	3	3	1	1	1	2	2	2	1	1	2	2	2	1
Redundancy	2	2	2	3	2	2	3	1	1	2	3	2	2	3	2	2	2
Sum:	**11**	**10**	**11**	**13**	**10**	**11**	**10**	**10**	**10**	**11**	**11**	**11**	**11**	**12**	**11**	**11**	**11**

ALLIANCE

	A1	A2	A3	A4	B1	C1	C2	D1	D2	D3	E1	F1	F2	F3	G1	G2	H1
Feasibility	1	2	1	1	2	2	1	2	2	1	2	2	2	1	2	2	2
Relevance for PIANOFORTE specific objectives	2	2	2	2	1	2	1	2	2	2	1	2	2	2	1	1	1
Relevance for other EU initiatives outside EURATOM	2	1	2	1	1	2	2	2	2	2	1	2	2	2	2	2	2
Societal impact	2	2	2	2	3	3	3	3	3	3	2	2	3	2	2	3	2
Scientific impact	3	2	2	2	2	2	2	2	1	3	2	2	2	2	1	2	1
Redundancy	2	2	2	3	3	3	3	1	1	1	3	2	2	3	2	3	2
Sum:	**12**	**11**	**11**	**11**	**12**	**14**	**12**	**11**	**10**	**12**	**11**	**12**	**13**	**12**	**10**	**13**	**10**

EURAMED

	A1	A2	A3	A4	B1	C1	C2	D1	D2	D3	E1	F1	F2	F3	G1	G2	H1
Feasibility	1	2	2	1	2	2	1	2	2	1	2	2	2	1	2	1	2
Relevance for PIANOFORTE specific objectives	2	2	2	2	1	2	2	2	2	2	1	2	2	2	2	1	2
Relevance for other EU initiatives outside EURATOM	1	2	2	1	1	1	1	2	2	2	1	1	1	2	2	2	2
Societal impact	2	2	2	2	1	2	2	3	3	2	2	2	2	3	3	2	3
Scientific impact	3	3	3	3	3	2	2	3	3	3	2	3	3	2	2	3	2
Redundancy	2	2	2	3	2	2	2	2	1	2	2	2	2	3	2	2	2
Sum:	**11**	**13**	**13**	**12**	**10**	**11**	**10**	**14**	**13**	**12**	**10**	**12**	**12**	**13**	**13**	**11**	**13**

NERIS

	A1	A2	A3	A4	B1	C1	C2	D1	D2	D3	E1	F1	F2	F3	G1	G2	H1
Feasibility															1	2	
Relevance for PIANOFORTE specific objectives															2	2	
Relevance for other EU initiatives outside EURATOM															2	2	
Societal impact															2	3	
Scientific impact															2	3	
Redundancy															3	3	
Sum:															**12**	**15**	

<u>Integrating feedback from platforms to finalize the text of subtopics for the next step (to be sent to POMs and stakeholders)</u>

Shortlist of updated subtopics

File sent to platforms
- every platform should check whether the subtopics linked to them contain all the changes we agreed on.

FEEDBACK needed by Friday, 4 November 2022.
No new changes are accepted.

Suggested list of topics and subtopics

File sent to platforms
- every platform should check whether the document contains all the changes we agreed on.

FEEDBACK needed by Friday, 4 November 2022.
No new changes are accepted.

Based on the scoring of the subtopics by the platforms the priority of the subtopics was defined. Four priority categories were identified:

- ***Very high***
- ***High***
- ***Moderate***
- ***Low***

<u>Overall priority of the subtopic for PIANOFORTE Call 1:</u>

"4" very high – it fulfils ALL of the following:
- scores 12-15 based on the above criteria
- it is feasible ≥1,5
- it has strong relevance for both PIANOFORTE and other EC initiatives ≥1,5 AND '≥1,5
- it has high impact in min one category (societal or scientific) ≥2,5 OR '≥2,5
- it has to score min. 1.5 in redundancy ≥1,5

"3" high – it fulfils ALL of the following criteria
- scores 11-11.99
- it has to score above 1.0 in feasibility >1,0
- it has strong relevance for PIANOFORTE or other EC initiatives ≥1,5 OR '≥1,5
- it has to score above 2 in min one category from societal and scientific i >2,0 OR '>2,0
- it has to score above 1.0 in redundancy >1,0

"2" moderate – it fulfils the following criteria
- scores 10-10.99

"1" low - it fulfils the following criteria
- scores below 10

Average and prioritized ranking

AVERAGE																	
NO SHARE		A1	A2	A3	A4	B1	C1	C2	D1	D2	D3	E1	F1	F2	F3	G1	G2	H1
	Feasibility	1,5	1,8	1,5	1,5	2,0	2,0	1,0	2,0	2,0	1,0	2,0	2,0	2,0	1,0	1,8	1,8	2,0
	Relevance for PIANOFORTE specific objectives	2,0	2,0	2,0	2,0	1,0	2,0	1,5	1,8	1,8	2,0	1,3	2,0	2,0	2,0	1,6	1,4	1,5
	Relevance for other EU initiatives outside EURATOM	1,5	1,8	2,0	1,3	1,0	1,5	1,5	2,0	2,0	2,0	1,0	1,8	1,8	2,0	2,0	2,0	2,0
	Societal impact	2,0	2,0	2,3	2,0	1,8	2,3	2,5	3,0	2,8	2,5	2,0	2,0	2,3	2,3	2,2	2,6	2,8
	Scientific impact	2,8	2,5	2,5	2,8	2,5	2,0	1,8	2,0	2,0	2,5	2,0	2,0	2,0	2,0	1,8	2,4	1,5
	Redundancy	2,0	2,0	2,0	2,8	2,3	2,3	2,8	1,5	1,0	1,8	2,5	2,0	2,0	2,8	2,2	2,4	2,0
	Sum:	**11,75**	**12,00**	**12,25**	**12,25**	**10,50**	**12,00**	**11,00**	**12,25**	**11,50**	**11,75**	**10,75**	**11,75**	**12,00**	**12,00**	**11,60**	**12,60**	**11,75**
	RANKING CRITERIA	H	VH	VH	H	M	H	M	VH	M	M	M	H	H	M	H	H	H

Requesting feedback from POMs and stakeholders

The documents used for the prioritization process (Shortlist of subtopics, Suggested list of topics and subtopics; Documents used for drafting topics and subtopics, Prioritization criteria for scoring by platforms, ...), together with the priority ranking of subtopics will be distributed to POMs (via WP2) and stakeholders (via WP3).

What kind of comments are we expecting from POMs and stakeholders?

- Comments to the content of subtopics (rewording of the subtopics with justifications why it is needed; other editorial comments)

  We do not expect subtopic replacements or suggestions of new subtopics.

- To express their opinion whether they agree or disagree with the priority ranking of the subtopics. In case of disagreement justification is needed

The documents will be sent to the PF Executive Board in advance for approval.

Contributor (who made the comment)	Page, paragraph	Type of comment: ED (editorial) CO (content topic)	Original text/evaluation	New proposed text/evaluation	Comment: why is this change proposed?	Comment from Piano WP2.1 group

PIANOFORTE research priorities: RANKING EVALUATION

Name of the contributor/organization:

Topic	Subtopic	RANKING EVALUATION		
		PIOANOFORTE ranking	Agree or Disagree	If disagree, argue why
A	A1			
	A2			
	A3			
	A4			
B	B1			
C	C1			

7.11 Annex 10

Letter to POMs

Dear PIANOFORTE POMs,

As you all know, one of the main activities of PIANOFORTE partnership is to launch open calls to fund research projects on radiation protection. The first open call is currently under preparation. PIANOFORTE Task 2.1 has made a prioritized list of potential research topics to be considered for the 1st Open Call, which is sent in attachment (doc 01). We would much appreciate receiving your comments and feedback on the proposed priorities.

We would like to summarize for you the main steps that led to this priority list.

1. PIANOFORTE Task 2.1, based on the 8 research challenges of the CONCERT Joint Roadmap[1], identified 17 subtopics that were recognised as game changers either in the CONCERT Joint Roadmap or in the recent SRA of the EURAMED platform defined in the frame of the EURAMED rocc-n-roll project, or were major scientific recommendations of the recently closed MEDIRAD project.

2. These subtopics were evaluated based on 6 criteria:

- feasibility

- relevance for PIANOFORTE specific objectives

- relevance for other EC initiatives outside EURATOM

- societal impact

- scientific impact

- redundancy

The detailed evaluation of each of the 17 subtopics can be found in the document “06 Appendix C All Suggested TOPICS and SUBTOPICS_1st PIANOFORTE Open Call” accompanied by a supporting document, which helped this evaluation process (called “04 Appendix A Documents used for drafting topics and subtopics_1st PIANOFORTE Open Call”), both of which are sent to you in attachment.

3. The European Radiation Protection Platforms (ALLIANCE, EURADOS, EURAMED, MELODI, NERIS, SHARE) were asked to score the subtopics based on the above 6 criteria using the proposed evaluation procedure described in the document “05 Appendix B Methodology for prioritisation of subtopics_1st PIANOFORTE Open Call”.

4. Based on the average scores given by the Platforms and by applying a classification system setting minimal requirements for each priority level, Task 2.1 ranked the 17 subtopics in 4 categories:

- very high priority

- high priority

- moderate priority

- low priority

See more details on the classification process in the attached file “05 Appendix B Methodology for prioritisation of subtopics_1st PIANOFORTE Open Call”.

PIANOFORTE Task 2.1 would like to ask for your feedback on the prioritized list of subtopics as follows:

1. Give comments or suggest changes to the text of the subtopics by rewording or other editorial comments, if you consider this appropriate. Please always justify the changes and comments made. We kindly ask you not to make significant changes to the content of the subtopics, nor to suggest new subtopics or replace the existing ones. Such new or significantly changed topics can be suggested at a later stage and will be considered in the second and third call. All the comments and changes should be provided using the attached template (“04 FILL OUT Commenting on prioritisation.docx”).

2. Give your opinion (agree or disagree) on the PIANOFORTE ranking of the subtopics, using the attached excel file (“03 FILL OUT Ranking prioritisation.xlsx”). If you disagree, please justify why. Do not give numerical scores to the subtopics, this procedure was done with the Platforms.

Please send your comments not latest than December 7 to: lumniczky.katalin@osski.hu lumniczky.katalin@nnk.gov.hu and filip.vanhavere@sckcen.be

As a result of your feedback an updated list of prioritized subtopics will be made. A similar procedure will also be done with WP3 to get feedback from the stakeholders. After that, a final list of prioritized subtopics will be presented to PIANOFORTE Executive Board, who will make the final decision of the subtopics to be included for the 1st Open Call. The decision made by the Executive Board will have to be approved by the PIANOFORTE General Assembly.

We also want to state clearly that subtopics not selected for this first call, will be taken up for the prioritisation procedure for calls 2 and 3.

Thank you very much for your active contribution in the prioritisation process of the subtopics for the 1st PIANOFORTE Open Call and we look forward to receiving your feedback in due time before the deadline.

Best regards,

Katalin Lumniczky,

on behalf of PIANOFORTE Task 2.1 members (Almudena Real Gallego, Catrinel Turcanu, Anja Almen, Spyros Andronopoulos, Filip Vanhavere)

7.12 Annex 11

Updated prioritized TOPICS and SUBTOPICS – sent to POMs and other stakeholders

Topics and subtopics for PIANOFORTE Call 1

Overview of topics and subtopics

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[6]). 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****.*

Guidelines for integration of Social Sciences and Humanities in PIANOFORTE funded projects are currently under development and will be made available before the launching of Call 1.

A. Understanding and quantifying the health effects of radiation exposure

A1. HIGH PRIORITY

Define the risk of ionising radiation-induced non-cancer diseases after low and intermediate doses (below 500 mGy) by understanding disease pathogenesis through assessing near-field, out-of-field and non-targeted effects after therapeutic doses and dose-rates and following interventional radiology. The focus should be on developing a knowledge base on the mechanisms of cardiovascular, cerebrovascular, neurocognitive diseases, metabolic and immune disorders applying biologically-based risk models and/or available human cohorts, followed by related social,

[6] 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

psychological and communication studies. Studies related to ionising radiation-induced cataracts and establishment of new human cohorts are not within the focus of the current call.

Proposals should address one or several objectives of the topic. The topic is suitable for both large and smaller, more focused proposals.

A2. VERY HIGH PRIORITY

Developing knowledge base for a better understanding of disease pathogenesis of ionising radiation-induced cancer to improve risk assessment. While the role of DNA damage in the carcinogenic process after IR was extensively studied, by now it is clear that other processes significantly modulate cancer development, such as the role of microenvironment, the immune status, metabolic processes and epigenetic factors.

The proposals should focus on investigating the role of epigenetics, metabolic status, immune status, cellular interactions and microenvironmental effects applying biologically relevant experimental in vivo or in vitro models. Since our current understanding of radiation carcinogenesis is almost exclusively based on high dose IR, while at low doses other mechanisms may prevail priority should be given to low dose studies.

Proposals should address one or several objectives of the topic. The topic is suitable for both large and smaller, more focused proposals.

A3. VERY HIGH PRIORITY

Developing a knowledge base and analytical tools to understand the major features of variability in the radiation response including radio-sensitivity (tissue reactions), radio-susceptibility (cancers) and radiation-induced aging by focusing on one (or both) of the following subtopics:

- A better understanding of the role of genetic factors, epigenetic factors, sex, co-morbidities, environmental and lifestyle factors and the interactions between these depending on dose levels. Studies should focus on a better understanding of the mechanisms and link to advancing individualised cancer treatment, including communication among patients, caregivers, medical personnel and other stakeholders in order to empower them for informed decision-making and informed consent.
- Seeking biomarkers of individual risk through cellular/molecular, systems biological approaches, radiomics investigations. Evaluating potential predictive factors and correlating them with health outcomes. Biomarker investigations should include validation of proposed biomarkers in suitable cohorts. In case of studies related to previously identified biomarkers validation and quality control should be included.

Larger projects are favoured. Nevertheless, smaller, more focused projects may also be considered.

A4. HIGH PRIORITY

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:

- Understanding the link between exposure characteristics (radiation quality, dose and dose-rate, acute and chronic exposures) and the cancer and non-cancer effects.
- 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).

The topic is suitable for both large and smaller, more focused proposals.

B. Improving the concepts of dose quantities

B1. MODERATE PRIORITY

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

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.

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.

The topic is suitable for both large and smaller, more focused proposals.

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

C1. HIGH PRIORITY

Resolving the controversy with regard to the effects on wildlife reported in the Chernobyl and Fukushima exclusion zones. Many studies have reported no significant effects of radiation on wildlife (e.g. in the Chernobyl and Fukushima exclusion zones), whereas others reported significant radiation effects on different wildlife populations at very low dose rates (even below natural background exposure). The re-interpretation and achievement of robust, consensus-based data on the long-term ecological effects attributable to radiation in those emblematic contaminated territories would have a very significant impact on the robustness and credibility level of the radiation protection of the environment (e.g., robustness of 'no-effect' benchmark dose-rates). Priorities are to characterise the influence of exposures on the populations currently living in contaminated environments, through (1) robust exposure assessments (considering past exposures and including internal exposure, heterogeneity, differing radiation qualities) and considering other stress factors; (2) the identification of the key factors determining the vast reported variation in wildlife populations' sensitivity to radiation; (3) the identification and validation of biomarkers of exposure and effects that are relevant for effects at the population's level.

The topic is suitable for both large and smaller, more focused proposals.

C2. MODERATE PRIORITY

Determine the effects of ionising radiation on ecosystem functioning and biodiversity, as well as their potential consequences to human wellbeing (e.g. culture, food consumption, work and recreational activities).

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 comforted. Although the subject is very broad, some targeted studies are achievable within a reasonable timeframe: experimental research on the effects of ionizing radiation on functional processes is expected in controlled conditions (e.g. microcosms and mesocosm studies), as well as the reinterpretation (e.g. by ecological modelling) of the reported data on of the current state of ecosystems and their temporal evolution in contaminated territories.

Moreover, the consequences of the impact on ecosystem functioning may have many dimensions, not only biophysical, but also economic and socio-cultural. Those societal issues are also to be addressed, in the aim to provide finally a coherent framework encompassing both the radiation protection of human and ecosystems.

Larger projects are favoured. Nevertheless, smaller, more focused projects may also be considered.

D. Optimising medical use of radiation

D1. VERY HIGH PRIORITY

Individualise diagnostic as well as therapeutic procedures with regard to optimisation of the benefit/risk ratio. This includes the development of evidence-based procedures and encompasses applications such as molecular imaging, interventional procedures and theranostic applications. As imaging of anatomical structures is a major task in clinical practice, corresponding optimisation in terms of benefit/risk ratio is also crucial and relevant research should be included to complement and build upon the initial work carried out in recent projects. Evidence-based procedures should rely on benefit and risk based on patient data.

The topic is suitable for both larger and smaller, more focused proposals.

D2. MODERATE PRIORITY

Improving the quality of medical imaging and radiation therapy especially but not limited to cancer-treatment. This includes means to i) set up of reliable computational methodologies such artificial intelligence (AI) methods for medical applications including radiation dose prediction and image quality enhancement and e.g. pharmacokinetic modelling, ii) strategies for testing and validation of data and methods used for AI/Machine Learning (ML) applications or modelling and c) methods to allow generalizability of ML models to allow application independent of hospital equipment.

Social, ethical and legal dimensions of the use of AI and other computational models should also be addressed, in particular, how the use of AI will impact current practices; what the effect will be on the gaps observed between best practice and guidelines, on the one hand, and current practices, on the other; and what the concerns and expectations of patients and other stakeholders are in the context of these technological developments.

The proposed research should contribute to the harmonization and application of technology and, in the context of informed consent, communication throughout Europe. Patient organizations must be involved.

The topic is suitable for both larger and smaller, more focused proposals.

D3. MODERATE PRIORITY

Implementing EU-wide epidemiological studies of patients to enhance quality and safety of medical radiation applications and developing a knowledge base and analytical tools to better predict and reduce risk of secondary cancer and non-cancer disease in cancer patients treated with radiotherapy.

Well-designed clinical epidemiological studies should conduct long term follow up, and focus on most at risk populations. The results of the clinical epidemiological studies should be used to optimise treatment and imaging protocols and patient follow-up. The studies should consider patient-specific dose modifiers in derivation of dose estimates as appropriate to different settings and can increase capabilities for radiation dose tracking and managing programmes to provide relevant and standardized dose estimates. Only already existing cohorts should be considered, building up new cohorts does not fit in the timeframe and budget of the call.

The topic should explore ways to improve communication among patients, caregivers, medical personnel and other stakeholders in order to empower them for informed decision-making and consent and improve radiation protection behaviours.

Proposals should address one or more objectives of the topic. The topic is suitable for both large and smaller, more focused proposals.

E. Improving radiation protection of workers and population

E1. MODERATE PRIORITY

Developing a knowledge base and analytical tools to improve radiation protection of workers and thus to contribute to the translation of the BSS into practice by focusing on one or more of the following objectives:

- Improvement of biokinetic models and personalised dosimetry that will lead to the improvement of the assessment of internal exposure for occupational exposed workers;

- Development of real time practical individual dosimetry of workers by harnessing the developments in new connected technologies, with due account to individual behaviour and social group culture;

- Development of a practical neutron personal dosimeter.

The topic is suitable for both large and smaller, more focused proposals.

F. Developing an integrated approach to environmental exposure and risk assessment from ionising radiation

F1. HIGH PRIORITY

Robust modelling of radiological contamination in the human food chain, for an integrated dose and risk assessment of post-emergency situations, with focus on building resilient and sustainable societies. The topic should take into account future changes in the European agricultural practices and the need to further develop marine dispersion and biota transfer models due to the fact that NPPs are often built on the coast and the future tendency of building them on floating vessels.

The topic is suitable mainly for smaller, more focused proposals.

F2. HIGH PRIORITY

Identifying and quantifying the key processes that influence radionuclide behaviour in existing environmental contamination situations with a special focus on:
- the management and clean-up of existing sites, as well as to the licensing (including social licensing) of future discharges and large quantities of NORM residues.
- developing the modelling basis for accurate dose assessment and establishment of holistic and sustainable remediation approaches.

The topic is suitable for both larger and smaller, more focused proposals.

F3. MODERATE PRIORITY

Integrating risk assessment and management and especially focusing on risk integration for radiation and other stressors. Specific emphasis is required on integrated and holistic risk assessments. There is a need for the improvement and/or development of innovative methods to characterise the source terms to delineate the multiple-hazard footprint (e.g., geostatistical interpretation of environmental, radiological, chemical data) of a site in space and time. Innovative modelling approaches are also needed to support decision making and to identify the most significant sources of uncertainty related to the impact on human and environmental health including social considerations.

Larger projects are favoured. Nevertheless, smaller, more focused projects may also be considered.

G. Optimising emergency and recovery preparedness and response

G1. HIGH PRIORITY

Improvement of radiological impact assessments, decision support and response and recovery strategies by focusing on one or more of the following aspects:
- the use of AI and big data technologies in radiological impact assessments, in the development / optimisation of measurement strategies, for the calculation (along with other novel methodologies) of uncertainties in model results and for optimization and operationalization of emergency preparedness and response practices; integration of AI and big data technologies in Decision Support Systems for better guidance of the end user in countermeasure strategy definition;
- compilation of the databases that are required by AI technologies, with historic and scenario information - including besides nuclear/radiological accidents, scenarios of new threats, such as war situations;
- improved communication/dialogue with stakeholders due to better information availability, considering data protection regulations (GDPR).

The topic is suitable for medium-sized proposals.

G2. HIGH PRIORITY

Development of risk assessment and risk management approaches and technological capabilities to cope with scenarios arising from threats due to war or armed conflicts situations, which have not been studied so far, taking into consideration social, ethical and legal issues. Proposals should focus on identifying and addressing missing links related to one or more of the following objectives within a war, armed conflict or significant natural disaster situation:

- Review of whether the current assumptions made in the existing systems for radiation emergency preparedness and response are resilient in armed conflict or natural disaster situations

- Development of event scenarios, including assessment of potential source terms for both attacks on nuclear facilities but also in relation to nuclear detonation scenarios;
- Further improvement, evaluation and operationalization of inverse modelling for localisation and quantification of unknown emission sources of radioactive material, including exploitation of different types of monitoring data, capabilities to handle multiple-source scenarios and potential employment of novel approaches such as AI and big-data technologies;
- Uncertainty quantification in the abovementioned scenarios, development of advanced methods to improve calculation efficiency of uncertainties, such as AI/Machine Learning methods, efficient computational and/or statistical methods and the integration of latest developments in risk science;
- Monitoring strategies with mobile and advanced monitors in such armed conflict situations, relying also on a citizen science approach and providing early detection of threats;
- Development of indicators for protective action strategies that can be applied even with little information on the affected area, with consideration of technical and non-technical aspects;
- Development of communication strategies including methods and material appropriate for use in such situations;
- Social and psychological challenges for emergency actors and citizens and their impacts on the effectiveness of protective actions, legal basis and practical arrangements for emergency response and recovery;
- Societal resilience, stakeholder involvement and ethical considerations.

The topic is suitable for medium or large-sized proposals.

H. Radiation protection in/with society

H1. HIGH PRIORITY

Effective translation mechanisms between social and technical dimensions of radiation protection.

The objective of the topic is to investigate how different radiation protection actors perceive the added value of inter- and transdisciplinary collaborations in the field of radiation protection; what their expectations and needs are; what challenges and enablers of collaborations can be found in the different radiation protection fields; and what are the main barriers for the institutional uptake of results from inter- and transdisciplinary collaborations. Projects addressing this topic should contribute to developing systematic approaches to inclusion of societal dimensions within the radiological protection system and methodological innovation enabling inter- and transdisciplinarity in radiation protection research.

The topic is suitable for smaller-, more focused projects, as well as medium-sized projects addressing different radiation protection fields.

7.13 Annex 12

Ranking prioritisation

PIANOFORTE research priorities: RANKING EVALUATION

Name of the contributor/organization:

Topic	Subtopic	RANKING EVALUATION		
		PIANOFORTE ranking	Agree or Disagree	If disagree, argue why
A	A1	HIGH		
	A2	VERY HIGH		
	A3	VERY HIGH		
	A4	HIGH		
B	B1	MODERATE		
C	C1	HIGH		
	C2	MODERATE		
D	D1	VERY HIGH		
	D2	MODERATE		
	D3	MODERATE		
E	E1	MODERATE		
F	F1	HIGH		
	F2	HIGH		
	F3	MODERATE		
G	G1	HIGH		
	G2	HIGH		
H	H1	HIGH		

7.14 Annex 13

Detailed list of prioritized subtopics – updated after discussion with platforms, sent to POMs and other stakeholders

CALL TOPICS and subtopics

TOPICS:

A. Understanding and quantifying the health effects of radiation exposure

B. Improving the concepts of dose quantities

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

D. Optimising medical use of radiation

E. Improving radiation protection of workers and population

F. Developing an integrated approach to environmental exposure and risk assessment from ionising radiation

G. Optimising emergency and recovery preparedness and response

H. Radiation protection in/with society

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). SSH are considered to be "a key constituent of research and innovation" (idem). In accordance with these principles and the PIANOFORTE commitments and objectives,* ***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****.*

Guidelines for integration of Social Sciences and Humanities in PIANOFORTE funded projects are currently under development and will be made available before the launching of Call 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

A. Understanding and quantifying the health effects of radiation exposure

Importance of the topic: Progress made in radiation epidemiology enabled identification of an increased risk of delayed health effects after moderate and low doses already. Nevertheless, a better understanding of the mechanism and pathogenesis of ionising radiation-related health effects, especially after low doses and manifesting as cancer or non-cancer effects is still lacking, which is indispensable for reducing currently existing uncertainties and project population hazards at individual level. The main goal of this challenge is to "have a comprehensive quantitative and mechanistic understanding of all radiogenic health effects" (CONCERT Joint Roadmap, D3.7) in all exposure scenarios. Research performed in these fields will help in improving risk estimation of health effects after ionising radiation in all exposure situations and will contribute to the implementation of the E.C. BSS Directive, as well as a better risk communication and informed decision making for various stakeholders.

Interactions of Topic A with other research topics of the Joint Roadmap:

-Topic B (Improving the concepts of dose quantities)

- Topic C (Understanding radiation-related effects on non-human biota and ecosystems)

- Topic D (Optimising medical use of radiation)

- Topic E (Improving radiation protection of workers and population)

- Topic F (Developing an integrated approach to environmental exposure and risk assessment from ionising radiation)

- Topic G (Optimising emergency and recovery preparedness and response)

- Topic H (Radiation protection in/with society)

Redundancy:

Topic A was addressed by several of the recently closed or currently running EC projects. Potential overlaps can only be evaluated at subtopic level given the extremely broad research area covered by this topic.

Importantly, scientific research questions targeted by this topic are addressed almost exclusively by EURATOM at European level, they do not fall in the direct research priorities of HORIZON EUROPE or any other EU-related research initiatives.

In summary:

- Topic A contributes to realisation of 3 out of the 4 specific objectives of PIANOFORTE and several expected outcomes.
- It is of high societal relevance, since it addresses the concerns of the communities exposed to IR in various exposure situations and at various radiation types, doses and dose rates.

- Impact – contributes to a better understanding of health effects of IR, to improving RP recommendations, regulations and practices in the use of IR sources. Impact can be best evaluated at subtopic level.
- Only EURATOM launches scientific calls within the area of Topic A.
- Redundancy and feasibility can only be evaluated at subtopic level.

Subtopics:

A1. Define the risk of ionising radiation-induced non-cancer diseases after low and intermediate doses (below 500 mGy) by understanding disease pathogenesis through assessing near-field, out-of-field and non-targeted effects after therapeutic doses and dose-rates and following interventional radiology. The focus should be on developing a knowledge base on the mechanisms of cardiovascular, cerebrovascular, neurocognitive diseases, metabolic and immune disorders applying biologically-based risk models and/or available human cohorts, followed by related social, psychological and communication studies. Studies related to ionising radiation-induced cataracts and establishment of new human cohorts are not within the focus of the current call.

Proposals should address one or several objectives of the topic. The topic is suitable for both large and smaller, more focused proposals.

Game changer: yes

Links to PIANOFORTE commitments: yes

Feasibility: feasible

Relevance:

Link of A1 to PIANOFORTE specific objectives:

2. To improve scientific understanding of the variability in individual radiation response and health risk of exposure.

3. 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.

Links to other EURATOM initiatives:

This subtopic is among the major scientific recommendations of MEDIRAD[7].

[7] Future research on medical radiation protection in Europe:
Conduct further research into adverse effects of ionising radiation on healthy tissues
Promote a EU-wide research strategy to use AI for optimising protection in radiation oncology
Develop biologically-based models to evaluate radiation-induced disease risk
Conduct large-scale clinical epidemiological follow-up of patients to assess late health effects of radiation
Investigate new and optimise existing medical imaging procedures to improve benefit/risk ratios and personalised approaches
(http://www.medirad-project.eu/)

Links to other Horizon Europe initiatives: -

Impact: study of non-cancer effects induced by low dose radiation is important for a better risk estimation and prediction after low dose exposures. It is equally relevant for any exposure situation.

Redundancy: it is marginally redundant with currently ongoing research projects (HARMONIC, SINFONIA?). It was addressed by several independent research projects within EURATOM FP7 and HORIZON Europe as well as internal calls launched within CONCERT and by MEDIRAD. The most studied non-cancer diseases were cataracts and cardiovascular effects. Much less focus was put on neurocognitive effects, while metabolic and immune disorders were not studied at all.

Source for funding at European level[8]: EURATOM

Overall priority of the subtopic for PIANOFORTE Call 1: **HIGH**

A2. Developing knowledge base for a better understanding of disease pathogenesis of ionising radiation-induced cancer to improve risk assessment. While the role of DNA damage in the carcinogenic process after IR was extensively studied, by now it is clear that other processes significantly modulate cancer development, such as the role of microenvironment, the immune status, metabolic processes and epigenetic factors.

The proposals should focus on investigating the role of epigenetics, metabolic status, immune status, cellular interactions and microenvironmental effects applying biologically relevant experimental in vivo or in vitro models. Since our current understanding of radiation carcinogenesis is almost exclusively based on high dose IR, while at low doses other mechanisms may prevail priority should be given to low dose studies.

Proposals should address one or several objectives of the topic. The topic is suitable for both large and smaller, more focused proposals.

Game changer: yes

Links to PIANOFORTE commitments: yes

Feasibility: feasible

Relevance:

Link of A2 to PIANOFORTE specific objectives:

2. To improve scientific understanding of the variability in individual radiation response and health risk of exposure.

[8] based on projects funded in the last 10 years up to 2022

3. 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.

Links to other EURATOM initiatives:

This subtopic is among the major scientific recommendations of MEDIRAD (see footnote 1).

Link to other Horizon Europe initiatives:

Europe beating cancer plan (the "Cancer" mission)

Impact: A better understanding of radiation carcinogenesis is a key element of risk assessment in radiation protection. From epidemiological point of view significant progress has been achieved in estimating the carcinogenic risk of low dose radiation and certain EURATOM-funded projects have been /are focusing on this aspect of the problem (EPI-CT, MEDIRAD, SINFONIA, HARMONIC, RADONORM). However, epidemiological studies have not been/have barely been backed up by systematic mechanistic studies on radiation carcinogenesis, which are absolutely indispensable for a correct risk estimation and management. Apart of a small internal call within CONCERT with a very limited budget and timeframe, no other projects focused on this issue in the last 5 years (maybe even since DOREMI which ended in 2014). It is highly relevant in the medical field. By understanding the molecular mechanisms of cancer susceptibility at low doses it is also important for environmental and occupational exposures.

Redundancy: none.

Source for funding at European level: EURATOM

Overall priority of the subtopic for PIANOFORTE Call 1: **VERY HIGH**

A3. Developing a knowledge base and analytical tools to understand the major features of variability in the radiation response including radio-sensitivity (tissue reactions), radio-susceptibility (cancers) and radiation-induced aging by focusing on one (or both) of the following subtopics:

- A better understanding of the role of genetic factors, epigenetic factors, sex, co-morbidities, environmental and lifestyle factors and the interactions between these depending on dose levels. Studies should focus on a better understanding of the mechanisms and link to advancing individualised cancer treatment, including communication among patients, caregivers, medical personnel and other stakeholders in order to empower them for informed decision-making and informed consent.

- Seeking biomarkers of individual risk through cellular/molecular, systems biological approaches, radiomics investigations. Evaluating potential predictive factors and correlating them with health outcomes. Biomarker investigations should include validation of proposed biomarkers in suitable

cohorts. In case of studies related to previously identified biomarkers validation and quality control should be included.

Larger projects are favoured. Nevertheless, smaller, more focused projects may also be considered.

Game changer: yes

Links to PIANOFORTE commitments: yes

Feasibility: In principle, it is feasible to address some aspects of the topic within the timeframe and budget of the open call. Though, given its complexity and high relevance for a comprehensive investigation of the topic, much higher efforts would be optimal, for example in the frame of an independent EU project dedicated solely to this topic. The whole process of biomarker discovery, validation and quality control is not feasible. Though validation of previously identified biomarkers in small-to-medium sized cohorts is feasible.

Relevance:

Link of A3 to PIANOFORTE specific objectives:

1. 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.

2. To improve scientific understanding of the variability in individual radiation response and health risk of exposure.

Links to other EURATOM initiatives:

This subtopic is among the major scientific recommendations of MEDIRAD (see footnote 1).

Link to other Horizon Europe initiatives:

Europe beating cancer plan (the “Cancer” mission)

Impact: This is a very important research topic within radiation biology and radiation protection for decades. Although some progress has been achieved in better understanding the individual responses of healthy tissues to IR, basically the question is still open which are the key/basic molecular and cellular determinants that lead to increased radiosensitivity and radiosusceptibility. Without understanding these mechanisms, the development of reliable predictive tests suitable for routine clinical use cannot progress. It is highly relevant in the medical field.

Redundancy: There are no recent projects investigating individual radiosensitivity. The most recent one is Requite (2014-2019) funded by EC health and not EURATOM. Though, some of the recent or currently running EURATOM-funded projects cover some aspects of the topic (MEDIRAD, HARMONIC, SINFONIA). Regarding biomarker studies some recently closed and ongoing projects (eg. HARMONIC,

HYPMED, …) as well as former, already closed projects had small tasks dedicated to biomarker research. However, in every case the work was limited to identifying molecules that might be potential biomarkers but their validation has not been performed in the vast majority of the cases.

Source for funding at European level: EURATOM and EC health

Overall priority of the subtopic for PIANOFORTE Call 1: **VERY HIGH**

A4. 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:

- Understanding the link between exposure characteristics (radiation quality, dose and dose-rate, acute and chronic exposures) and the cancer and non-cancer effects.

- 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).

The topic is suitable for both large and smaller, more focused proposals.

Game changer: yes

Links to PIANOFORTE commitments: yes

Feasibility: it is feasible.

Relevance:

Link of A4 to PIANOFORTE specific objectives:

1. 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 practice.

3. 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.

Links to other EURATOM initiatives: -

Link to other Horizon Europe initiatives: -

Impact: Most of our mechanistic understanding of the radiobiological processes are based on whole body/partial body external acute exposure. In reality, human exposure to IR is realised by a variety of other scenarios as well, which might substantially impact biological consequences. Therefore, these subtopics are relevant to understand the differences in biological consequences of different exposure situations.

Redundancy: not aware of any.

Source for funding at European level: EURATOM

Overall priority of the subtopic for PIANOFORTE Call 1: **HIGH**

B. Improving the concepts of dose quantities

Importance 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 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. Micro- and nanodosimetry have provided experimental and computational techniques for the microscopic characterization of the track structure.

The comprehensive multi-scale characterization of the physical aspects of particle energy deposition will enable a quantitative investigation of the impact of microscopic energy deposition in terms of biological effect. The ability to establish these correlations at the cellular level and investigate the response at supra-cellular organization level will form the basis for the comprehension of the radiation damage mechanism.

The overarching objective is the development of 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.

Interactions of Topic B with other research topics of the Joint Roadmap:

- Topic A (Understanding and quantifying the health effects of radiation exposure)

- Topic C (Understanding radiation-related effects on non-human biota and ecosystems)

- Topic D (Optimising medical use of radiation)

- Topic E (Improving radiation protection of workers and population)

- Topic F (Developing an integrated approach to environmental exposure and risk assessment from ionising radiation)

Importantly, scientific research questions targeted by this topic are addressed exclusively by EURATOM at European level, they do not fall in the direct research priorities of HORIZON EUROPE or any other EU-related research initiatives.

In summary:

- Topic B contributes to realisation of 2 out of the 4 specific objectives of PIANOFORTE and several expected outcomes.
- It is of high relevance, since it helps in better understanding the differences in the biological consequences of different radiation qualities.
- Impact – contributes to a better understanding of health effects of IR, to improving RP recommendations, regulations and practices in the use of IR sources.
- Only EURATOM launches scientific calls within the area of Topic B.

Subtopics:

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

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.

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.

The topic is suitable for both large and smaller, more focused proposals.

Game changer: *yes*

Links to PIANOFORTE commitments: yes

Feasibility: it is feasible

Relevance:

Link of B1 to PIANOFORTE specific objectives:

3. 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.

Links to other EURATOM initiatives: -

Link to other Horizon Europe initiatives: -

Impact: It helps in a better understanding of the mechanism how physical damage is converted into biological damage. Micro and nanodosimetric investigations will lead to methodological progress and will improve molecular dosimetry which will help in reducing currently existing uncertainties in the biological effects of low doses. The topic is relevant for all exposure scenarios.

Redundancy: the topic is moderately redundant with certain objectives of the RADONORM project.

Source for funding at European level: EURATOM

Overall priority of the subtopic for PIANOFORTE Call 1: **MODERATE**

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

Importance of the topic: As stated in the JRM, the need for an explicit demonstration of the protection of the environment (or wildlife) from radioactive releases was recognised during the last decade. Also, human health is in the long-term directly related to the fitness of the ecosystem. Environmental exposures at low dose and dose rate are relevant for many planned exposure situations under normal operation conditions, existing environmental exposure scenarios with regard to legacy and natural radiation, as well as long-term exposures after nuclear or radiological accidents. However, most of the available knowledge used to derive benchmarks for the radiation effects on wildlife is related to the risk to individual organisms, whereas populations, ecological functions and structure, and the

preservation of biodiversity are more relevant endpoints from an environmental protection perspective and should be the focus of future studies. On the other hand, there is considerable scientific disagreement on the actual extent of the radiation effects on wildlife populations in contaminated areas that questions the robustness, the representativeness and the scientific consensus of actual diagnostic tools with regard to the long-term consequences of radiation exposure on non-human biota and ecosystems. This controversy has major implications for the robustness and the credibility of the system of radiation protection and resolving it would be a major game changer. The potential of stakeholder engagement practices (such as engaging citizens through citizen science) could also be explored. It would help in addressing the different understandings of radiation protection of the environment, as well as the sociological analysis of uncertainties between and within various stakeholder groups.

Interactions of Topic C with other research topics of the Joint Roadmap:

- Topic A (Understanding and quantifying the health effects of radiation exposure)

- Topic B (Improving the concepts of dose quantities)

- Topic F (Developing an integrated approach to environmental exposure and risk assessment from ionising radiation)

- Topic G (Optimising emergency and recovery preparedness and response)

- Topic H (Radiation protection in/with society)

Importantly, scientific research questions targeted by this topic are addressed exclusively by EURATOM at European level, they do not fall in the direct research priorities of HORIZON EUROPE or any other EU-related research initiatives.

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

In summary:

- Topic C is reflected in Priority 3 and contributes to the realization of its scientific objectives 3 and 4 of PIANOFORTE.
- It is of high relevance, since it contributes to a better understanding of the effects of ionising radiation on the environment and the ecosystems.
- Scientific calls within the area of Topic C are launched exclusively by EURATOM. Currently, there is one running project (RadoNorm) with some overlap with the priorities named below.
- Redundancy: Partially with the RadoNorm project (focussed on Radon and NORM).
- Impact. Contributes to a better protection of the environment, helps improving ecosystem fitness, adheres to the “Green deal” program of the EC.
- Feasibility. To be considered at subtopic level.

Subtopics:

C1. Resolving the controversy with regard to the effects on wildlife reported in the Chernobyl and Fukushima exclusion zones.

Many studies have reported no lasting significant long-term effects of radiation on wildlife (e.g. in the Chernobyl and Fukushima exclusion zones), whereas others reported significant radiation effects to date on different wildlife populations at very low dose rates (even below natural background exposure). The re-interpretation and achievement of robust, consensus-based data on the long-term individual, population and ecological effects attributable to radiation in those emblematic contaminated territories would have a very significant impact on the robustness, understanding and credibility level of the radiation protection of the environment (e.g., robustness of 'no-effect' benchmark dose-rates, robustness of methodology). This impact would be even greater in including stakekolders' perceptions and views on effects on the environment, on the importance of environmental protection and on environmental protection goals.

Priorities are to determine and characterise the effect of exposures on the populations currently living in contaminated environments, through (1) robust dosimetry and exposure assessments (considering past exposures and including internal exposure, heterogeneity, differing radiation qualities) thereby also considering other stress factors; (2) the identification of the key factors determining the vast reported variation in wildlife populations' sensitivity to radiation or effects observed; (3) the identification and validation of biomarkers of exposure and effects that are relevant for effects at the population's level. As a 4th objective we will set out to reexamine and establish, in concertation with UNSCEAR and ICRP, robust benchmarks for environmental protection.

The topic is suitable for both large and smaller, more focused proposals.

Game changer: yes

Links to PIANOFORTE commitments: yes

Feasibility: It is feasible to address the topic within the timeframe and budget of the open call, through the re-interpretation of existing data (with improved dosimetric and exposure characterizations) and targeted research achievement on the effects that are relevant at the population's level.

Relevance:

Link of C1 to PIANOFORTE specific objectives:

3. 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.

4. 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.

Links to other EURATOM initiatives:

Links to other Horizon Europe initiatives:

This topic adheres to the missions "Soil health and food" and "Healthy oceans, seas, coastal and inland waters" of Horizon Europe. Topic C is closely connected to the Horizon Europe "food, natural resources, agriculture, and environment, biodiversity" cluster that among its objectives is "reducing environmental degradation and pollution".

Impact: This subtopic is important to explicitly demonstrate the protection of the environment against ionising radiation. Understanding long-term effects of radiation on the phenotypic and genetic characteristics of the population is crucial to assess the risk of population extinction and its consequence for the maintenance of both genetic biodiversity and species biodiversity. It will contribute to resolve the controversy with regard to the effects on wildlife reported in the Chernobyl and Fukushima exclusion zones. Solving this controversy will have a significant impact on the robustness and the credibility of the system of radiation protection.

Redundancy: No other actual projects are addressing this subtopic.

Source for funding at European level: EURATOM

Overall priority of the subtopic for PIANOFORTE Call 1: **HIGH**

C2. Determine the effects of ionising radiation on ecosystem functioning and biodiversity, as well as their potential consequences to human wellbeing (e.g. culture, food consumption, work and recreational activities).

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 comforted. Although the subject is very broad, some targeted studies are achievable within a reasonable timeframe: experimental research on the effects of ionizing radiation on functional processes is expected in controlled conditions (e.g. microcosms and mesocosm studies), as well as the reinterpretation (e.g. by ecological modelling) of the reported data on of the current state of ecosystems and their temporal evolution in contaminated territories.

Moreover, the consequences of the impact on ecosystem functioning may have many dimensions, not only biophysical, but also economic and socio-cultural. Those societal issues are also to be addressed, in the aim to provide finally a coherent framework encompassing both the radiation protection of human and ecosystems.

Larger projects are favoured. Nevertheless, smaller, more focused projects may also be considered.

Game changer: yes

Links to PIANOFORTE commitments: yes

Feasibility: moderately feasible. The subtopic in its present form is very broad, integrative and multidisciplinary. It reaches beyond the feasibility of the open call both regarding budget and the timeframe.

Relevance:

Link of C2 to PIANOFORTE specific objectives:

3. 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.

Links to other EURATOM initiatives:

Links to other Horizon Europe initiatives:

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

Impact: It will contribute to understanding how radiation effects combine in a broader ecological context at higher levels of biological organisation (trophic interactions, indirect effects at the community level, and consequences for ecosystem functioning). If an increased sensitivity of ecosystem processes (in comparison with the reported effects at the population level) is demonstrated, this 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 of the ecosystems brings greater robustness against the effects of radiation, the conservatism of the current assessments would be confirmed.

One operational outcome, directly relevant to radiation protection of the environment, will be to establish sound scientifically-based ecological protection criteria, thereby underpinning regulations and ensuring that ecosystems and their sub-organisational levels are protected. This is important to society because over-estimation of exposures or effects could lead to unnecessary and costly restrictions or remediation; alternatively, under-estimation of risks may result in detrimental long-term effects for the ecosystems. Additionally, the links between the ecological and social dimensions will be addressed.

Redundancy: No actual projects have addressed this subtopic.

Source for funding at European level: EURATOM

Overall priority of the subtopic for PIANOFORTE Call 1: **MODERATE**

D. Optimising medical use of radiation

Importance 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. Topic D includes both basic and translational research and transfer into the clinical practice.

Interactions of Topic D with other research topics of the Joint Roadmap:

- Topic A (Understanding and quantifying the health effects of radiation exposure)

- Topic B (Improving the concepts of dose quantities)

- Topic E (Improving radiation protection of workers and population)

- Topic F (Developing an integrated approach to environmental exposure and risk assessment from ionising radiation)

- Topic H (Radiation protection in/with society)

Scientific research questions included are also addressed in the on-going Horizon research area "Mission on cancer". It is directly linked to both Europe's Beating Cancer Plan (Action 17) of HORIZON Europe and the Strategic Agenda for Medical Ionising Radiation Applications (SAMIRA initiative).

Various elements of Topic D have been addressed by several of the recently closed or currently running EURATOM projects, such as MEDIRAD (ended 2022), SINFONIA (ending 2024), HARMONIC (ending 2024), SECURO (started 2022), therefore potential overlaps have to be considered and redundancy avoided. The recommendations of closed projects have to be taken into consideration (eg. MEDIRAD). The EURATOM project EURAMED rocc-n-roll will also recommend research needs that have to be considered.

Importantly, scientific research questions targeted by topic D are addressed not exclusively by EURATOM funded research projects at European level. Other EC research initiatives (the Health programme within Horizon Europe, EU4Health, Samira initiative) or research options funded by European professional organisations (such as European Society of Radiology or European Association for Nuclear Medicine) have launched calls on this topic and further open calls are released.

Currently there are several on-going projects in the area of topic D funded by EC initiatives outside EURATOM (eg. QuADRANT project, iVIOLIN, Prismap, INTERACT-Europe, SIMPLERAD, CHAIMELON, EUCANIMAGE).

In summary:

- Topic D contributes to the realisation of 3 specific objective of PIANOFORTE and several expected outcomes.

- It is of high relevance, since medical use of ionising radiation is the largest source of exposure and it addresses the concerns of patients exposed to IR.
- Scientific calls related to the area of topic D are done by European research work programs other than EURATOM as well. Several projects are currently on-going with varying degrees of overlap with topic D.
- Redundancy - needs to be carefully checked at subtopic level.
- Impact – optimised radiation protection and increased efficiency of diagnostic/therapeutic procedures could lower possible adverse health effects contributing to the improvement of existing/development of new methods for diagnosis and treatment.
- Feasibility – needs to be checked at subtopic level

Subtopics:

D1. Individualise diagnostic as well as therapeutic procedures with regard to optimisation of the benefit/risk ratio. This includes the development of evidence-based procedures and encompasses applications such as molecular imaging, interventional procedures and theranostic applications. As imaging of anatomical structures is a major task in clinical practice, corresponding optimisation in terms of benefit/risk ratio is also crucial and relevant research should be included to complement and build upon the initial work carried out in recent projects. Evidence-based procedures should rely on benefit and risk based on patient data.

The topic is suitable for both larger and smaller, more focused proposals.

Game changer: yes

The subtopic is a game changer as part of the new SRA of EURAMED prepared in the frame of the EURAMED rocc-n-roll project

Links to PIANOFORTE commitments: yes

Feasibility: answering certain domains of the topic is feasible within the timeframe and budget of the open call.

Relevance:

Link of D1 to PIANOFORTE specific objectives:

1. 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 practice.

2. To improve scientific understanding of the variability in individual radiation response and health risk of exposure.

3. 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.

Links to other EURATOM initiatives:

The topic partly addresses some of the MEDIRAD technical recommendations

Links to other Horizon Europe initiatives:

The topic is directly linked to both Europe's Beating Cancer Plan (Action 17) of HORIZON Europe and is linked to the Strategic Agenda for Medical Ionising Radiation Applications (SAMIRA initiative).

Impact: This is an important topic mainly for the patients and the medical community which contributes to the development of personalized medicine techniques and approaches and in parallel improves diagnostic and therapeutic efficiency by reducing the risk of medical procedures.

Redundancy: The topic has various degrees of overlaps with currently running or recently closed projects funded by various European sources (mainly EURATOM and HORIZON EUROPE or HORIZON 2020). Such projects are MEDIRAD, SINFONIA, EuCanImage. However, the redundancy is limited, since neither MEDIRAD nor SINFONIA are looking into individualized clinical care with respect to develop new or optimise molecular imaging processes or have been or are looking into theranostics at all. SINFONIA is looking for risk assessment, not any kind of optimisation of procedures, MEDIRAD was focussed on chest CT optimisation and dosimetry as well as epidemiological studies for cancer and non-cancer effects of standard diagnostic or therapeutic use of ionising radiation. There is no individual patient care optimisation. The mentioned projects did not look into clinical implementation at all. EuCanImage will provide a database, a platform, but is not doing any medical radiation protection research included.

Source for funding at European level: EURATOM, HORIZON Europe, EU4Health

Overall priority of the subtopic for PIANOFORTE Call 1: **VERY HIGH**

D2. Improving the quality of medical imaging and radiation therapy especially but not limited to cancer-treatment. This includes means to i) set up of reliable computational methodologies such artificial intelligence (AI) methods for medical applications including radiation dose prediction and image quality enhancement and e.g. pharmacokinetic modelling, ii))strategies for testing and validation of data and methods used for AI/Machine Learning (ML) applications or modelling and c)

methods to allow generalizability of ML models to allow application independent of hospital equipment.

Social, ethical and legal dimensions of the use of AI and other computational models should also be addressed, in particular, how the use of AI will impact current practices; what the effect will be on the gaps observed between best practice and guidelines, on the one hand, and current practices, on the other; and what the concerns and expectations of patients and other stakeholders are in the context of these technological developments.

The proposed research should contribute to the harmonization and application of technology and, in the context of informed consent, communication throughout Europe. Patient organizations must be involved.

The topic is suitable for both larger and smaller, more focused proposals.

Game changer: yes

The subtopic is a game changer as part of the new SRA of EURAMED prepared in the frame of the EURAMED rocc-n-roll project

Links to PIANOFORTE commitments: yes

Feasibility: moderately feasible. Answering certain objectives of the topic is feasible within the timeframe and budget of the open call.

Relevance:

Link of D2 to PIANOFORTE specific objectives:

1. 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 practice.

2. To improve scientific understanding of the variability in individual radiation response and health risk of exposure.

3. 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.

Links to other EURATOM initiatives:

The topic partly addresses some of the MEDIRAD technical recommendations

Links to other Horizon Europe initiatives:

The topic is directly linked to both Europe's Beating Cancer Plan (Action 17) of HORIZON Europe and is linked to the Strategic Agenda for Medical Ionising Radiation Applications (SAMIRA initiative).

Impact: optimised radiation protection and increased efficiency of diagnostic/therapeutic procedures could lower possible adverse health effects contributing to the improvement of existing/development of new methods for diagnosis and treatment.

Redundancy: the relevance of the topic was recognised by EURATOM and various EC initiates since currently several ongoing projects overlap at various extents with this subtopic (MEDIRAD, EUCANIMAGE, iVIOLIN, SINFONIA, SIMPLERAD, CHAMELEON). Therefore, overlaps should be avoided and the new project should build on the already existing capacities. Another aspect is that the topic involves substantial technical development as well, in which companies producing medical equipment for diagnosis and therapy using various ionizing radiation techniques can also be included, therefore funding modalities of public-private partnership should also be promoted.

Source for funding at European level: EURATOM, HORIZON Europe, EU4Health

Overall priority of the subtopic for PIANOFORTE Call 1: **MODERATE**

D3. Implementing EU-wide epidemiological studies of patients to enhance quality and safety of medical radiation applications and developing a knowledge base and analytical tools to better predict and reduce risk of secondary cancer and non-cancer disease in cancer patients treated with radiotherapy.

Well-designed clinical epidemiological studies should conduct long term follow up, and focus on most at risk populations. The results of the clinical epidemiological studies should be used to optimise treatment and imaging protocols and patient follow-up. The studies should consider patient-specific dose modifiers in derivation of dose estimates as appropriate to different settings and can increase capabilities for radiation dose tracking and managing programmes to provide relevant and standardized dose estimates. Only already existing cohorts should be considered, building up new cohorts does not fit in the timeframe and budget of the call.

The topic should explore ways to improve communication among patients, caregivers, medical personnel and other stakeholders in order to empower them for informed decision-making and consent and improve radiation protection behaviours.

Proposals should address one or more objectives of the topic. The topic is suitable for both large and smaller, more focused proposals.

Game changer: no

The subtopic is based on MEDIRAD scientific recommendations

Links to PIANOFORTE commitments: yes

Feasibility: identification and follow-up of new cohorts is not feasible within the timeframe and budget of the first call. Follow-up and analysis of already identified cohorts is feasible.

Relevance:

Link of D3 to PIANOFORTE specific objectives:

1. 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 practice.

2. To improve scientific understanding of the variability in individual radiation response and health risk of exposure.

Links to other EURATOM initiatives:

The topic addresses some of the MEDIRAD scientific recommendations

Links to other Horizon Europe initiatives:

The topic is directly linked to both Europe's Beating Cancer Plan (Action 17) of HORIZON Europe and is linked to the Strategic Agenda for Medical Ionising Radiation Applications (SAMIRA initiative).

Impact: This is an important topic to better understand long-term health consequences of medical diagnostic and therapeutic applications.

Redundancy: Within the therapeutic domain cohorts treated exclusively with radiotherapy for non-cancer reasons have already been identified and are followed. The long-term follow-up of cancer survivors treated with radiotherapy and other therapeutic means has been /is being addressed by several EC-funded projects (PANCARE, CLARIFY, PanCareSurPass, PanCareSurFup, PanCareFollowUp, …). The long-term risks of diagnostic application of ionizing radiation (IR) has only been addressed by EURATOM in projects such as EPI-CT, MEDIRAD or currently by HARMONIC and partly SINFONIA

Source for funding at European level: EURATOM, HORIZON Europe, EU4Health

Overall priority of the subtopic for PIANOFORTE Call 1: **MODERATE**

E. Improving radiation protection of workers and population

Importance of the topic: Much research and technical development in radiation protection dosimetry for workers and the public has been carried out. The results of these developments have been transferred to operational radiation protection, including guidelines and technical recommendations. Despite these efforts, a couple of areas exist in which the status is unsatisfactory, necessitating further research to support the implementation of the BSS and improve practices in the domain of low dose exposures of humans and the environment. This will also help in a better acceptance of radiation protection measures in normal and accidental situations; improvement of the understanding of public perception on radiation risk.

Interactions of Topic E with other research topics of the Joint Roadmap:

- Topic A (Understanding and quantifying the health effects of radiation exposure)

- Topic B (Improving the concepts of dose quantities)

- Topic D (Optimising medical use of radiation)

- Topic F (Developing an integrated approach to environmental exposure and risk assessment from ionising radiation)

- Topic G (Optimising emergency and recovery preparedness and response)

- Topic H (Radiation protection in/with society)

Redundancy: It was addressed by a small project within CONCERT. It partly overlaps with RADONORM and SINFONIA.

Importantly, scientific research questions targeted by this topic are addressed exclusively by EURATOM at European level, they do not fall in the direct research priorities of HORIZON EUROPE or any other EU-related research initiatives.

In summary:

- Topic E contributes to realisation of 1 out of the 4 specific objectives of PIANOFORTE and several expected outcomes.
- It is of high relevance for the radiation protection community, since it contributes to the improvement of radiation protection of workers.
- Impact – contributes to improving RP recommendations, regulations and practices in the use of IR sources.
- Only EURATOM launches scientific calls within the area of Topic E.
- Redundancy and feasibility can only be evaluated at subtopic level.

Subtopics:

E1. Developing a knowledge base and analytical tools to improve radiation protection of workers and thus to contribute to the translation of the BSS into practice by focusing on one or more of the following objectives:

- Improvement of biokinetic models and personalised dosimetry that will lead to the improvement of the assessment of internal exposure for occupational exposed workers;

- Development of real time practical individual dosimetry of workers by harnessing the developments in new connected technologies, with due account to individual behaviour and social group culture;

- Development of a practical neutron personal dosimeter.

The topic is suitable for both large and smaller, more focused proposals.

Game changer: *yes*

Links to PIANOFORTE commitments: yes

Feasibility: It is feasible.

Relevance:

Link of E1 to PIANOFORTE specific objectives:

3. 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

Links to other EURATOM initiatives:

Links to other Horizon Europe initiatives:

Impact: In case of internal contamination it is well known that DTPA increases the excretion of actinides but the dose reduction due to the therapy is currently based on default assumptions that should be improved. Another challenge consists of the reconstruction of the life-long dose estimate for cohorts of workers for whom contamination information is scarce. Models and methods need to be developed to be able to provide reliable dose estimates for both situations.

Most workers are still currently monitored with passive dosimeters. But on-line personal dosimetry is emerging. The mid- or long-term challenge is to allow for a reliable and accurate monitoring of the workers in real time regardless of the protection methods used, and to provide input for the demonstration of compliance to dose limits and the optimal application of the protection principle.

Neutron dosimetry remains a problem, and no good dosimeters are available yet. So improvement in dosimetric characteristics (energy, angular dependence) and field characterisation is needed.

Redundancy: Some elements of the topic were addressed by a small project within CONCERT. There are elements redundant with RADONORM and SINFONIA.

Source for funding at European level: EURATOM

Overall priority of the subtopic for PIANOFORTE Call 1: **MODERATE**

F. Developing an integrated approach to environmental exposure and risk assessment from ionising radiation

Importance of the topic: As stated in the CONCERT JRM: "Faced with environmental ionising radiation exposure situations where various environmental and human-population related factors strongly interact, holistic approaches to risk assessment are increasingly justified to ensure sustainable and safe use of radioactive substances and to protect both human and ecosystem health. Concurrently, integration of scientific, societal and economic considerations is needed, if more integrated dose and risk assessment approaches are to be developed to meet societal expectations, better inform decision-making and improve risk communication among stakeholders". In addition, ionising radiation is frequently present in the environment together with other contaminants and stressors that may influence its impact. Therefore, it is important to investigate the risk of ionising radiation in presence of other contaminants and stressors in the environment.

Interactions of Topic F with other research topics of the Joint Roadmap:

- Topic A (Understanding and quantifying the health effects of radiation exposure)

- Topic B (Improving the concepts of dose quantities)

- Topic C (Understanding radiation-related effects on non-human biota and ecosystems)

- Topic D (Optimising medical use of radiation)

- Topic E (Improving radiation protection of workers and population)

- Topic G (Optimising emergency and recovery preparedness and response)

- Topic H (Radiation protection in/with society)

This topic adheres to the missions "Soil health and food" and "Healthy oceans, seas, coastal and inland waters" of Horizon Europe. Topic F is closely connected to the Horizon Europe "food, natural resources, agriculture, and environment, biodiversity" cluster that among its objectives is "*reducing environmental degradation and pollution*".

Importantly, scientific research questions targeted by topic F are addressed exclusively by EURATOM at European level, they do not typically fall in the direct research priorities of Horizon Europe or any other EU-related research initiatives.

The topic is partially addressed by the RadoNorm project (2020-2025), which focuses on radon and naturally occurring radioactive materials (NORM). It was also partially addressed by the TERRITORIES project within CONCERT. There were also recent projects on investigating contamination with tritium such as TRANSAT.

In summary:

- Topic F is reflected in Priority 3 and contributes to realisation of the scientific objectives 3 and 4 of PIANOFORTE.
- It is of high relevance for the system of radiation protection of humans and the environment.
- Scientific calls within the area of Topic F are launched by EURATOM.
- Redundancy: Low redundancy with RadoNorm, which is focussed only on radon and naturally occurring radionuclides (NORM).
- Impact: Contributes to the development of improved international guidance on the management of legacy sites (e.g. from past NORM activities or accidental exposures); such sites may represent relatively higher exposure scenarios and therefore to a better protection of the environment, adheres to the "Green deal" program of the EC and the sustainable development goals.
- Feasibility: To be considered at subtopic level.

Subtopics:

F1. Robust modelling of radiological contamination in the human food chain, for an integrated dose and risk assessment of post-emergency situations, with focus on building resilient and sustainable societies. The topic should take into account future changes in the European agricultural practices and the need to further develop marine dispersion and biota transfer models due to the fact that NPPs are often built on the coast and the future tendency of building them on floating vessels.

The topic is suitable mainly for smaller, more focused proposals.

Game changer: yes

Links to PIANOFORTE commitments: yes

Feasibility: It is feasible within the timeframe and budget of the open call.

Relevance:

Link of F1 to PIANOFORTE specific objectives:

3. 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.

4. 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.

Links to other EURATOM initiatives:

Links to other Horizon Europe initiatives: This topic adheres to the missions "Soil health and food" and "Healthy oceans, seas, coastal and inland waters" of Horizon Europe. Topic F is closely connected to the Horizon Europe "food, natural resources, agriculture, and environment, biodiversity" cluster that among its objectives is "reducing environmental degradation and pollution".

Impact: If successful, the resultant models (largely improved/developed based on a thorough assessment of available data and models) will be applicable in any relevant environment, to its time-evolution, to any human/animal food. They will especially include future changes in European agricultural practices. In addition, the further developments done in marine dispersion and biota transfer models will improve risk assessment for NPPs built on the coast and on floating vessels. Models developed will be transferable, meaning that they will already include the necessary amount of processes that allows model applicability to different scenarios. This will result in optimised management in the emergency and post emergency phase with respect to dose assessment, food chain protection and control, remedial actions, economic and societal impact.

Redundancy: Low redundancy with RADONORM, which is focussed only in radon and naturally occurring radionuclides (NOR).

Source for funding at European level: EURATOM

Overall priority of the subtopic for PIANOFORTE Call 1: **HIGH**

F2. Identifying and quantifying the key processes that influence radionuclide behaviour in existing environmental contamination situations with a special focus on:

- the management and clean-up of existing sites, as well as to the licensing (including social licensing) of future discharges and large quantities of NORM residues.

- developing the modelling basis for accurate dose assessment and establishment of holistic and sustainable remediation approaches.

The topic is suitable for both larger and smaller, more focused proposals.

Game changer: *yes*

Links to PIANOFORTE commitments: yes

Feasibility: It is feasible within the timeframe and budget of the open call.

Relevance:

Link of F2 to PIANOFORTE specific objectives:

3. 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.

4. 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.

Links to other EURATOM initiatives:

Links to other Horizon Europe initiatives: This topic adheres to the missions "Soil health and food" and "Healthy oceans, seas, coastal and inland waters" of Horizon Europe. Topic F is closely connected to the Horizon Europe "food, natural resources, agriculture, and environment, biodiversity" cluster that among its objectives is "reducing environmental degradation and pollution".

Impact: Development of the modelling basis for accurate dose assessment and establishment of remediation approaches, to contribute to the implementation of the new BSS in relation to the management and clean-up of existing sites, as well as to the licensing of future discharges and large quantities of NORM waste. This is especially important as NORM legacy or operationally impacted sites are often close to human habitation. It is of important added value to society.

Redundancy: Redundancy with RadoNorm (2020-2025), which is focussed only on radon and naturally occurring radionuclides (NORM). Partly redundant with the recently closed TRANSAT project.

Source for funding at European level: EURATOM

Overall priority of the subtopic for PIANOFORTE Call 1: **HIGH**

F3. Integrating risk assessment and management and especially focusing on risk integration for radiation and other stressors. Specific emphasis is required on integrated and holistic risk assessments. There is a need for the improvement and/or development of innovative methods to characterise the source terms to delineate the multiple-hazard footprint (e.g., geostatistical interpretation of environmental, radiological, chemical data) of a site in space and time. Innovative modelling

approaches are also needed to support decision making and to identify the most significant sources of uncertainty related to the impact on human and environmental health including social considerations.

Larger projects are favoured. Nevertheless, smaller, more focused projects may also be considered.

Game changer: yes

Links to PIANOFORTE commitments: yes

Feasibility: In principle, it is feasible to address some aspects of the topic within the timeframe and budget of the open call. Though, given its complexity and high relevance for a comprehensive investigation of the topic, much higher efforts would be optimal, for example in the frame of an independent EU project dedicated solely to this topic.

Relevance:

Link of F3 to PIANOFORTE specific objectives:

3. 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.

4. 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.

Links to other EURATOM initiatives:

Links to other Horizon Europe initiatives: This topic adheres to the missions “Soil health and food” and “Healthy oceans, seas, coastal and inland waters” of Horizon Europe. Topic F is closely connected to the Horizon Europe “food, natural resources, agriculture, and environment, biodiversity” cluster that among its objectives is “reducing environmental degradation and pollution”.

Impact: An integrated assessment and management approach will enable ‘radiation protection’ authorities to make more balanced and sustainable decisions as it will take in the ‘whole-picture’ rather than making decisions individually for human, wildlife, radiation, chemicals etc. It also represents a more defensible approach when communicating to stakeholders, including the public.

Redundancy: No actual projects have addressed this subtopic.

Source for funding at European level: EURATOM

Overall priority of the subtopic for PIANOFORTE Call 1: **MODERATE**

G. Optimising emergency and recovery preparedness and response

Importance of the topic: Within the CONCERT JRM it is stated: "In nuclear or radiological emergency management including accidental exposures, medical follow-up and long-term recovery the radiological impact assessment is of prime importance and demands the improvement, development and customisation of several new methodologies and advanced tools." In brief, the latter concern dispersion / transfer modelling with uncertainties in various environments (including urban) and media (air, water and soil), consideration of new threats (e.g., armed conflicts), new monitoring strategies and technologies (individual, environmental, foods and goods), combination of modelling and monitoring (through, e.g., data assimilation), dosimetry and dose reconstruction, optimization and operationalization of countermeasures and countermeasure strategies, decision making under uncertainties, employment of novel techniques regarding Big Data and Artificial Intelligence, engagement of the public / stakeholders and communication strategies.

Interactions of Topic G with other research topics of the Joint Roadmap:

- Topic A (Understanding and quantifying the health effects of radiation exposure)

- Topic C (Understanding radiation-related effects on non-human biota and ecosystems)

- Topic E (Improving radiation protection of workers and population)

- Topic F (Developing an integrated approach to environmental exposure and risk assessment from ionising radiation)

- Topic H (Radiation protection in/with society)

Importantly, scientific research questions targeted by topic G are addressed exclusively by EURATOM at European level (except for Security-related topics) and they do not typically fall in the direct research priorities of Horizon Europe or any other EU-related research initiatives.

As noted in the PIANOFORTE Description of the Action (Part B) the research that will be performed in this Topic will support the Action plan on the Sendai Framework for disaster risk reduction, will contribute to the EU objective of creating "*a resilient and more stable Europe that protects*", will be closely connected to the Horizon Europe "Civil security for society" cluster that aims at an "improved disaster risk management and societal resilience" through better understanding of natural and man-made disasters and by the development of novel concepts and technologies to counter these risks. It will also be closely connected to activities developed in the "food, natural resources, agriculture, and environment, biodiversity" cluster, one of the objectives of which is "*reducing environmental degradation and pollution*".

Research in Topic G has become of particular relevance lately due to the war in Ukraine, which is a situation that poses new and unusual threats that have not been examined in depth so far.

In summary:

- Topic G covers one of the three priorities or research needs of PIANOFORTE, one of the four scientific specific objectives and contributes to 5 of the 15 expected outcomes of the project.

- It is of high relevance for the system of radiation protection of humans and the environment.
- Scientific calls within the area of Topic F are launched exclusively by EURATOM.
- Redundancy: Specific items of the Topic were partially addressed by CONFIDENCE, TERRITORIES, SHAMISEN-SINGS.
- Impact and relevance: Nuclear safety has significant impact on society, as demonstrated by the major nuclear accidents that have occured and the many more smaller-scale incidents, including recent events of detection of radionuclides from unknown origins, as well as past or potential future use of nuclear technology as warfare. Initiatives by citizens that formed groups for measurement of radioactivity in the environment must be mentioned in this context. The threats posed by the war in Ukraine add a particular relevance to the topic.
- Feasibility: To be considered at subtopic level.

Subtopics:

G1. Improvement of radiological impact assessments, decision support and response and recovery strategies by focusing on one or more of the following aspects:

- the use of AI and big data technologies in radiological impact assessments, in the development / optimisation of measurement strategies, for the calculation (along with other novel methodologies) of uncertainties in model results and for optimization and operationalization of emergency preparedness and response practices; integration of AI and big data technologies in Decision Support Systems for better guidance of the end user in countermeasure strategy definition;

- compilation of the databases that are required by AI technologies, with historic and scenario information - including besides nuclear/radiological accidents, scenarios of new threats, such as war situations;

- improved communication/dialogue with stakeholders due to better information availability, considering data protection regulations (GDPR).

The topic is suitable for medium-sized proposals.

Game changer: yes

Links to PIANOFORTE commitments: yes

Feasibility: It is feasible.

Relevance:

Link of G1 to PIANOFORTE specific objectives:

4. 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.

Links to other EURATOM initiatives:

Links to other Horizon Europe initiatives: Contributes to the EU objective of creating "a resilient and more stable Europe that protects", will be closely connected to the Horizon Europe "Civil security for society" cluster that aims at an "improved disaster risk management and societal resilience" through better understanding of natural and man-made disasters and by the development of novel concepts and technologies to counter these risks. It will also be closely connected to activities developed in the "food, natural resources, agriculture, and environment, biodiversity" cluster, one of the objectives of which is "reducing environmental degradation and pollution".

Impact: See above, in general description of Topic G.

Redundancy: The subtopic has not been addressed by other EURATOM Calls or Projects

Source for funding at European level: EURATOM

Overall priority of the subtopic for PIANOFORTE Call 1: **HIGH**

G2. Development of risk assessment and risk management approaches and technological capabilities to cope with scenarios arising from threats due to war or armed conflicts situations, which have not been studied so far, taking into consideration social, ethical and legal issues. Proposals should focus on identifying and addressing missing links related to one or more of the following objectives within a war, armed conflict or significant natural disaster situation:

- Review of whether the current assumptions made in the existing systems for radiation emergency preparedness and response are resilient in armed conflict or natural disaster situations
- Development of event scenarios, including assessment of potential source terms for both attacks on nuclear facilities but also in relation to nuclear detonation scenarios;
- Further improvement, evaluation and operationalization of inverse modelling for localisation and quantification of unknown emission sources of radioactive material, including exploitation of different types of monitoring data, capabilities to handle multiple-source scenarios and potential employment of novel approaches such as AI and big-data technologies;

- Uncertainty quantification in the abovementioned scenarios, development of advanced methods to improve calculation efficiency of uncertainties, such as AI/Machine Learning methods, efficient computational and/or statistical methods and the integration of latest developments in risk science;
- Monitoring strategies with mobile and advanced monitors in such armed conflict situations, relying also on a citizen science approach and providing early detection of threats;
- Development of indicators for protective action strategies that can be applied even with little information on the affected area, with consideration of technical and non-technical aspects;
- Development of communication strategies including methods and material appropriate for use in such situations;
- Social and psychological challenges for emergency actors and citizens and their impacts on the effectiveness of protective actions, legal basis and practical arrangements for emergency response and recovery;
- Societal resilience, stakeholder involvement and ethical considerations.

The topic is suitable for medium or large-sized proposals.

Game changer: *yes*

Links to PIANOFORTE commitments: yes:

Feasibility: It is feasible.

Relevance:

Link of G2 to PIANOFORTE specific objectives:

4. 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.

Links to other EURATOM initiatives:

Links to other Horizon Europe initiatives: Contributes to the EU objective of creating “a resilient and more stable Europe that protects”, will be closely connected to the Horizon Europe “Civil security for society” cluster that aims at an “improved disaster risk management and societal resilience” through better understanding of natural and man-made disasters and by the development of novel concepts

and technologies to counter these risks. It will also be closely connected to activities developed in the "food, natural resources, agriculture, and environment, biodiversity" cluster, one of the objectives of which is "reducing environmental degradation and pollution".

Impact: See above, in general description of Topic G.

Redundancy: Specific items of the subtopic have been partially addressed by CONFIDENCE, TERRITORIES, SHAMISEN-SINGS, for common accident scenarios. However, there is a big gap of research in situations involving armed conflicts.

Source for funding at European level: EURATOM

Overall priority of the subtopic for PIANOFORTE Call 1: **HIGH**

H. Radiation protection in/with society

Importance of the topic: The overall objective is to develop evidence-based evaluations of novel or existing radiation protection practices, interventions, technologies or policies, in interaction with stakeholders. To this end, rigorous studies in social sciences and humanities are needed on the implementation of theory and evidence-based radiation protection and the de-implementation of practices that are demonstrated to be of low or no benefit for individuals or for the society. In line with game changer H1, better alignment of research and practice in RP with the values, needs and expectations of society requires, among others : effective research translation mechanisms between the technical and social dimensions of RP; identifying barriers and developing of systematic approaches to inclusion of societal dimensions at all levels of the RP system; - methodological innovation enabling transdisciplinarity in radiation protection research and improved intradisciplinary research related to societal aspects of RP".

Studies need to go beyond the consideration of radiation perceptions or cognitions of targeted individuals as primary research outcome as this has been investigated broadly and has been demonstrated as only one of the many determinants of radiation protection behaviour.

The importance of this topic is stated in the Joint Roadmap for radiation protection research, which argues that social sciences and humanities are needed in radiation protection research to improve the assessment and response to radiation protection challenges and opportunities (Impens, Salomaa et al, 2020). Achieving the general objective of the Partnership to "improve radiological protection of members of the public, patients, workers and environment in all exposure scenarios and provide solutions and recommendations for optimised protection in accordance with the BSS" can only be done with support of SSH research, as this allows identifying and including in the research process the values, expectations and needs of society. SSH research also supports" *citizen involvement activities in a collaborative approach of scientists, regulators and stakeholders*".

Interactions of Topic H with other research topics of the Joint Roadmap:

- Topic A (Understanding and quantifying the health effects of radiation exposure)

- Topic C (Understanding radiation-related effects on non-human biota and ecosystems)

- Topic D (Optimising medical use of radiation)

- Topic E (Improving radiation protection of workers and population)

- Topic F (Developing an integrated approach to environmental exposure and risk assessment from ionising radiation)

- Topic G (Optimising emergency and recovery preparedness and response)

This topic is exclusively covered by EURATOM.

Redundancy: Progress has been made in particular fields (for instance in relation to identifying and communicating social uncertainties in emergency and existing exposure situations or stakeholder engagement and citizen science) in projects such as TERRITORIES, CONFIDENCE, SHAMISEN-SINGS, ENGAGE, and it is also thoroughly addressed in the RadoNorm project in relation to radon and NORM, but there are several areas where there is a strong need for SSH research in order to account for current societal challenges and developments, as outlined above.

In summary:

- Topic H contributes to realisation of 1 out of the 4 specific objectives of PIANOFORTE and several expected outcomes.
- It is of high relevance, since it improves the assessment and response to radiation protection challenges and opportunities
- Impact for societal challenges and developments in radiation protection.
- Only EURATOM launches scientific calls within the area of Topic H.
- Redundancy and feasibility evaluated at subtopic level.

Subtopics:

H1. Effective translation mechanisms between social and technical dimensions of radiation protection.

The objective of the topic is to investigate how different radiation protection actors perceive the added value of inter- and transdisciplinary collaborations in the field of radiation protection; what their expectations and needs are; what challenges and enablers of collaborations can be found in the different radiation protection fields; and what are the main barriers for the institutional uptake of results from inter- and transdisciplinary collaborations. Projects addressing this topic should contribute to developing systematic approaches to inclusion of societal dimensions within the radiological protection system and methodological innovation enabling inter- and transdisciplinarity in radiation protection research.

The topic is suitable for smaller-, more focused projects, as well as medium-sized projects addressing different radiation protection fields.

Game changer: *yes*

Relevance:

Link of H1 to PIANOFORTE specific objectives:

3. 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.

Links to other EURATOM initiatives: N/A

Links to other Horizon Europe initiatives: Under Horizon Europe, "the effective integration of SSH in all clusters, including all Missions and European partnerships, is a principle throughout the programme" (European Commission, 2022). SSH are considered to be "a key constituent of research and innovation" (idem). It is also suggested that projects should aim for interdisciplinary approaches, with collaboration between SSH disciplines and non-SSH disciplines such as natural sciences, medicine and technology. Furthermore, projects should strive towards social innovation actions, involving the citizens, public authorities, business and industry, and academia in the design, development, and implementation of project products, methods and services (European Commission, 2022), as this "engages and empowers citizens, enhances the resilience of communities, increases the relevance, acceptance and uptake of innovation, and helps foster lasting changes in social practices" (idem).

Feasibility: feasible

Impact: Efforts have been made in recent years to highlight the interconnections between the social and technical dimensions of radiation protection, to stimulate collaboration between disciplines and the involvement of larger stakeholder groups in research and innovation processes. As highlighted in guidance on inter- and trans-disciplinary research, this requires methodological innovation and new, transformative ways of doing day-to-day research, which involves exchanges between disciplines and with societal actors, to identify and explore commonalities and divergence in views, values and expectations. The topic is relevant to the entire radiation protection research community. It will contribute to increasing the relevance and societal uptake of PIANOFORTE funded research, supporting and the inter- and trans-disciplinary collaborations.

Redundancy: None. Previous SSH research investigated collaborative research in non-nuclear fields and formulated lessons learned and guidance for inter- and trans-disciplinary research. However, there has been little research on how the different actors perceive the added value of these collaborations in the field of radiation protection, what the institutional uptake is of research outputs resulting from inter- and transdisciplinary collaborations, and there are no systematic approaches to the inclusion of societal dimensions within the radiological protection system.

Source for funding at European level: EURATOM

Overall priority of the subtopic for PIANOFORTE Call 1: **HIGH**

7.15 Annex 14

All comments received by POMs, TOMs and SAB structured along topics

SAB: Stakeholder and Advisory Board
TOM: Topical Online Meeting with stakeholders

Contributor (who made the comment)	Page, paragraph	Type of comment: ED (editorial) CO (content topic)	Original text/evaluation	New proposed text/evaluation	Comment: why is this change proposed?	Comment from Pianoforte WP2.1 group
SAB	P1	CO	Contributions from one or more SSH disciplines may be required to ensure the social robustness		What is the social robustness of the R&I chain?	not relevant
SCK CEN SCK-BE	A1	CO	Define the risk of ionising radiation-induced non-cancer diseases after low and intermediate doses (below 500 mGy) by understanding disease pathogenesis through assessing near-field, out-of-field and non-targeted effects after therapeutic doses and dose-rates and following interventional radiology. The focus should be on developing a	Please replace with "followed by related social, psychological and communication studies ~~if~~ appropriate" WHERE Include "neurodevelopmental"	Mechanistic studies would be typically performed in vitro and in vivo models (e.g. to validate the biological mechanism). We don't see how such mechanistic studies could be logically followed by "related social, psychological and communication studies". It should also be possible to submit a small, focused multi-omics project for a very clear and specific radiation-induced health effect (i.e. microcephaly/neurodevelopmental defect), without including social studies. Include "neurodevelopmental":	Task 2.1 agrees.The text of A1 will be revised accordingly.

			knowledge base on the mechanisms of cardiovascular, cerebrovascular, neurocognitive diseases, neurodevelopmental, metabolic and immune disorders applying biologically-based risk models and/or available human cohorts, followed by related social, psychological and communication studies. Studies related to ionising radiation-induced cataracts and establishment of new human cohorts are not within the focus of the current call. Proposals should address one or several objectives of the topic. The topic is suitable for both large and smaller, more focused proposals.		- the developing brain is probably the most radiosensitive organ - neurodevelopmental defects (e.g. microcephaly) after prenatal radiation exposure is the only congenital health effect from radiation - it has a well known dose-response curve - the outcome can be seen within days (in mice and human organoids) to weeks (in humans) as opposed to e.g. cardiovascular diseases which take months (in mice) to years (in humans) to develop (if they do).	
SAB	P1 A1	CO	.... available human cohorts, **followed by related social, psychological and communication studies.**		The meaning of this part of the sentence is unclear. The link with SSH has to be better articulated (in all the subtopics). SAB suggests to make an upfront statement on the need to include SSH in proposals at the most appropriate time.	Task 2.1 agrees and SSH has been articulated as an upfront statement. The text of the A1 topic will be revised accordingly.
SAB	P1 A1	CO	Define the risk of ionising radiation-induced non-cancer diseases after low and intermediate doses (below 500 mGy)	Define the risk of ionising radiation-induced non-cancer diseases after **very low,** low and intermediate doses (below 500 mGy)	Correspond to the vast majority of diagnostic procedures	Task 2.1 will use the terminology of low doses as

						defined by UNSCEAR[9]
SAB	P1 A1	CO	„field and non-targeted effects after therapeutic doses and dose-rates and following interventional radiology"	field and non-targeted effects after therapeutic doses and dose-rates and following **diagnostic procedure**s and nterventional radiology	Correspond to the vast majority of medical procedures using IR	Text will be revised.
SAB	P1 A1	CO	Define the risk of ionising radiation-induced non-cancer diseases after low and **intermediate** doses (below 500 mGy) by understanding disease pathogenesis.	Define the risk of ionising radiation-induced non-cancer diseases after low and **moderate** doses (below 500 mGy) and **dose rates** by understanding disease pathogenesis		Task 2.1 will use the terminology of low doses as defined by UNSCEAR, please see also above.
SAB	P1 A1	CO	... applying biologically-based risk models and/or available human cohorts.	... applying biologically-based risk models and/or **(molecular) epidemiological approaches based on** available human cohorts,		Task 2.1 agrees. Text will be modified accordingly.
TOM Mehmet Ruhi Onur EURAMED / ESR /	A1- 1	ED	Define the risk of ionising radiation-induced non-cancer diseases after low and intermediate doses (below 500 mGy) by understanding disease	Define the risk of ionising radiation-induced non-cancer diseases after low and intermediate doses (below 500 mGy) by understanding disease pathogenesis through assessing near-	I would like add diagnostic imaging studies since cumulative dose of diagnostic imaging studies may approach to interventional procedure doses.	This was already addressed above.

[9] *Sources, Effects and risks of ionizing radiation. UNSCEAR 2012 Report*

Annex A. Attributing health effects to ionizing radiation exposure and inferring risks. Page 23, Table 1. Terminology for bands of radiation dose used in this report https://www.unscear.org/unscear/en/publications/2012.html

Hacettepe University, Ankara /Turkey			pathogenesis through assessing near-field, out-of-field and non-targeted effects after therapeutic doses and dose-rates and following interventional radiology.	field, out-of-field and non-targeted effects after therapeutic doses and dose-rates and following interventional radiology as well as in patients underwent diagnostic radiologic procedures and exposed nonignorable dose.		
RIVM (Fieke Dekkers)	A2	CO	The proposals should focus on investigating the role of epigenetics, metabolic status, immune status, cellular interactions and microenvironmental effects applying biologically relevant experimental in vivo or in vitro models.	The proposals should focus on investigating the role of epigenetics, metabolic status, immune status, cellular interactions and microenvironmental effects applying biologically relevant experimental in vivo or in vitro models and/or biologically based models for risk.	Since the aim of the topic is to contribute to better risk estimates (Developing knowledge base for a better understanding of disease pathogenesis of ionising radiation-induced cancer to improve risk assessment.), it makes sense to include a link from biological experiments to risk.	We agree with this suggestion.
SAB	P1 A2	CO	The proposals should focus on investigating the role of epigenetics, metabolic status, immune status, cellular interactions and microenvironmental effects applying biologically relevant experimental in vivo or in vitro models. Since our current understanding of radiation carcinogenesis is almost exclusively based on high dose IR, while at low doses other mechanisms may prevail priority should be given to low dose studies.	The role of repeated examinations an of single x-rays should be considered	Repeated examinations particularly with CT raised concerns about the cumulative exposure	The call text already states that priority should be given to low dose studies. We consider that X-ray investigations fall into this category.
SAB	P1 A2	CO	Developing knowledge base for a better understanding of disease		Clarify text. Human health risk assessment? Human cancer risk assessment? Other?	We modify the text specifying

			pathogenesis of ionising radiation-induced cancer to **improve risk assessment**			human health risk assessment.
SAB	P1 A2	CO	The proposals should focus on investigating the role of epigenetics, metabolic status, immune status, cellular interactions and microenvironmental effects **applying** biologically relevant experimental in vivo or in vitro models.	The proposals should focus on investigating the role of epigenetics, metabolic status, immune status, cellular interactions and microenvironmental effects **implementing** biologically-relevant experimental in vivo or in vitro models.		We suggest changing the text to: "using" biologically relevant…
SAB	P1 A2	CO	Since our current understanding of radiation carcinogenesis is almost exclusively based on high dose IR, while at low doses other mechanisms may prevail, priority should be given to **low dose studies**.		Some indications on dose rates should be given. This comment applies to the majority of subtopic descriptions (I haven't copied it everywhere)	The focus is to better understand the mechanism ofcarcinogenesis after low dose exposure. It is up to the applicants to address this issue as they consider. Specifying the dose rate would make the call description too specific.
TOM Mehmet Ruhi Onur	A2- 2	ED	The proposals should focus on investigating the role of epigenetics, metabolic status,	The proposals should focus on investigating the role of epigenetics, metabolic status, immune status,	Nutritional status of patients especially oncology patients is being more increasingly emphasized in recent literature in the prognosis of patients. The effect of nutritional	Nutritional status or diet is an external risk

EURAMED / ESR / Hacettepe University, Ankara /Turkey			immune status, cellular interactions and microenvironmental effects applying biologically relevant experimental in vivo or in vitro models.	nutritional status (such as sarcopenia) cellular interactions and microenvironmental effects applying biologically relevant experimental in vivo or in vitro models.	status of humans to the sensitivity to ionizing radiation is not well well studied yet.	factor that can interphere with radiation carcinogenesis. Nevertheless, there are several other external factors that interphere with radiation carcinogenesis. It would make the call text too specific and too restrictive, therefore we suggest not to include it. Nevertheless, this does not exclude submission of proposals which investigate the combined effect of radiation and diet on the carcinogenic process.
TOM	Topic A2	CO			This comment is only for you to take into account that for molecular biology based projects, namely those that	We thank for this comment.

Joana Lourenço (University of Aveiro) Portugal					target epigenetics, even for relatively smaller projects, the budget requested is often high, as molecular biology techniques like "OMICS", and especially those that target epigenetics, are often very expensive. This comment applies to all the topics that will need the application of such techniques.	We agree these investigations are expensive. Applicants should take these costs into consideration to fit within the limits of the call.
SCK CEN	A3	CO	Developing a knowledge base and analytical tools to understand the major features of variability in the radiation response including radio-sensitivity (tissue reactions), radio-susceptibility (cancers) and radiation-induced aging by focusing on one (or both) of the following subtopics: - A better understanding of the role of genetic factors, epigenetic factors, sex, co-morbidities, environmental and lifestyle factors and the interactions between these depending on dose levels. Studies should focus on a better understanding of the mechanisms and link to advancing individualised cancer treatment, including communication among patients, caregivers, medical personnel and other stakeholders in order to empower them for	Studies should focus on a better understanding of the mechanisms and, for larger projects, should link to advancing individualised cancer treatment, including communication among patients, caregivers, medical personnel and other stakeholders in order to empower them for informed decision-making and informed consent.	If the focus is on “better understanding of the mechanisms”, for smaller projects it should not be necessary to expand to communication with patients, etc, idem for focused mechanistic projects.	In principle, Task 2.1 agrees with this comment. Nevertheless, this change is also dependent if the final call conditions make a distinction between small and large projects. Final call text will be revised accordingly.

			informed decision-making and informed consent. - Seeking biomarkers of individual risk through cellular/molecular, systems biological approaches, radiomics investigations. Evaluating potential predictive factors and correlating them with health outcomes. Biomarker investigations should include validation of proposed biomarkers in suitable cohorts. In case of studies related to previously identified biomarkers validation and quality control should be included. Larger projects are favoured. Nevertheless, smaller, more focused projects ADDRESSING ONLY PARTS OF THE ABOVE OBJECTIVES may also be considered.			
NCSRD - GR	Page 2, Topic A3, 2nd bullet	CO	Seeking biomarkers of individual risk through cellular/molecular, …	Seeking biomarkers of individual risk <u>including exposure to different radiation qualities</u> through cellular/molecular, …	Different radiation qualities are currently used or examined so research on variability in corresponding response is also needed.	Basically, this is a correct suggestion but at present there are no reliable biomarkers to detect individual sensitivity to

						any kind of radiation exposure, it might be too early to focus on biomarkers of different radiation qualities.
SAB	P2 A3	CO	Developing a knowledge base and analytical tools to understand the major features of variability in the radiation response including radio-sensitivity (tissue reactions), radio-susceptibility (cancers) and radiation-induced aging		To improve clarity by indicating whether referring to high doses or low doses, since the radiosensitivity mechanisms will be different.	Task 2.1 agrees. Text will be revised accordingly.
TOM Joana Lourenço (University of Aveiro) Portugal	Topic A3	CO			Care should be taken, when asking for larger projects within this topic and focusing on all the objectives proposed, because of the budget needed to successfully and properly address them. These are very big and ambitious objectives that will need the application of a lot molecular biology techniques. What I mean is that you need to be careful with your expectations and on the budget distribution to ensure that the teams will be able to accomplish them.	In principle, Task 2.1 agrees. Nevertheless, it is not the competence of Task 2.1 to decide on budget. Based on the final call conditions call text will be revised in a ay to be feasible.
NNK, HU	2/A4	CO	Define how the temporal and spatial variations in dose delivery affect the risk of health effects	Define how the temporal and spatial variations in dose delivery affect the risk of health effects following	I do not have problem with the overal scoring of this topic. However I do not see the importance of the subtopic "Understanding the effects of intraorgan dose	Task 2.1 does not agree with this suggestion.

			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: - Understanding the link between exposure characteristics (radiation quality, dose and dose-rate, acute and chronic exposures) and the cancer and non-cancer effects. - 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). The topic is suitable for both large and smaller, more focused proposals.	radiation exposure through the integration of experimental and epidemiological data and including optimised detection and dosimetry by focusing on one of the following subtopics: - Understanding the link between exposure characteristics (radiation quality, dose and dose-rate, acute and chronic exposures) and the cancer and non-cancer effects. ~~- 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). The topic is suitable for both large and smaller, more focused proposals.	distribution through observations in patients exposed to inhomogeneous dose distributions and experiments with organotypic tissue models". This might have only a very small importance in the volume effects of therapeutic irradiations considering the deterministic effects which occur only at very high doses.	Inhomogeneous dose distributions might be relevant for a better understanding of ionizing radiation induced helth effects.

DSA-NO	A4 and D3	CO		Relevant calls for tender covering epidemiological studies based on medical exposure, should include an evaluation of the quality of available dosimetric data and identifying weaknesses and future needs for harmonization and standardization.	In epidemiological studies (and other studies) where the aim is to quantify the risk associated with exposure to ionizing radiation, access to high quality dosimetric data is needed. National dose-index registers from medical exposure can in the future provide actual dose data, and in some countries also individual dose data. Harmonized and structured dosimetric data in the dose-index registries is a prerequisite for high quality research and establishment of large cohorts across European countries. Evaluation of current data quality and identification of the future needs to increase the level of data quality should therefore considered to be included in relevant studies. Summary of identified weaknesses will give valuable knowledge and input for future work to ensure harmonized and structured dosimetric data across Europe.	Relevant comment but no new text is proposed.
ISS and ENAT-IT	6, A4	CO	A4. 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: - Understanding the link between exposure characteristics (radiation quality, dose and dose-rate, acute and chronic exposures) and the cancer and non-cancer effects. - Understanding the effects of intraorgan dose distribution	A4. 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: 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/optimization of innovative radiotherapy (e.g., FLASH therapy, proton/ion therapy).	Radiation quality and dose rate are key issues in innovative radiotherapies, such as hadron therapy and FLASH therapy, which were not mentioned in the current text.	Task 2.1 agrees. Text will be revised accordingly.

			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). The topic is suitable for both large and smaller, more focused proposals. HIGH *<u>Relevance:</u>*	- 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). The topic is suitable for both large and smaller, more focused proposals. VERY HIGH PRIORITY Relevance: Systematic investigations, considering endpoints relevant for the other subtopics, can currently be conducted to cover doses and dose rate scenarios that have not yet been studied, using existing state-of-the-art infrastructures at the European level. The information that can be collected is crucial to validate the LNT model and for the improvement/optimization of innovative radiation therapy (e.g., FLASH Therapy, proton/ion therapy). This subtopic is among the major scientific recommendations of		

				MELODI, EURADOS and EURAMED and can only be funded by EURATOM.		
TOM Alegria Montoro Hospital La Fe de Valencia (Spain)	TOPIC A	CO	A. "…"quantifying" Sub-topic A4:		Quantification by dosimetry is consider in A.4… With what kind of dosimetry? physical? biological? I believe that biodosimetry should be cited or considered to quantify biological effects	Text will be revised in a way to be included biodosimetry as well.
TOM Alegria Montoro Hospital La Fe de Valencia (Spain)	TOPIC A	CO	non-targeted effects are considered in sub-topic A1 with High Priority		Non target effects and other out-of-field should be studies and consider in any topic when radiotherapy is considered…	We do not undertand what the exact suggestion is. Nevertheless, Task 2.1 will keep in mind to revise text in a way to include non-targeted effects in each subtopic where relevant.
TOM Alegria Montoro Hospital La Fe de Valencia (Spain)	TOPIC A AND D	CO	RADIOTHERAPHY- FLASH effect		There is a growing interest in the study of radiation biology in Ultra-high Dose Rates. As Nolan Esplen, University of Victoria, Canada, explain in the abstract for the next webinar: https://us02web.zoom.us/webinar/register/WN_D4wybkJJTqulp1BqZUH_6w „The potential for improved normal-tissue outcomes (i.e. FLASH effect), paired with isoeffective tumor control and the ability to freeze target motion, has thus made FLASH an attractive candidate for widening the therapeutic window in curative RT." ..."the radiobiological mechanisms	No new text is proposed. This comment has already been raised and addressed above.

					which underlie the FLASH effect, and the beam parameters required to reproducibly elicit it, remain to be elucidated" Study of biological effects, in this novel medical application, should be considered in some of the Topics of this important call, either in topic A or D.	
GIG (on behalf Poland)	3/C1	CO	Resolving the controversy with regard to the effects on wildlife reported in the Chernobyl and Fukushima exclusion zones. Many studies have reported no significant effects of radiation on wildlife (e.g. in the Chernobyl and Fukushima exclusion zones), whereas others reported significant radiation effects on different wildlife populations at very low dose rates (~~even below natural background exposure~~). The re-interpretation and achievement of robust, consensus-based data on the long-term ecological effects attributable to radiation in those emblematic contaminated territories would have a very significant impact on the robustness and credibility level of the radiation protection of the environment (e.g., robustness of 'no-effect' benchmark dose-rates). Priorities are to characterise the influence of exposures on the populations currently living in contaminated environments,	Resolving the controversy with regard to the effects on wildlife reported in the Chernobyl and Fukushima exclusion zones. Many studies have reported no significant effects of radiation on wildlife (e.g. in the Chernobyl and Fukushima exclusion zones), whereas others reported significant radiation effects on different wildlife species even at very low dose rates.The re-interpretation and achievement of robust, consensus-based data on the long-term ecological effects attributable to radiation in those emblematic contaminated territories would have a very significant impact on the robustness and credibility level of the radiation protection of the environment (e.g., robustness of 'no-effect' benchmark dose-rates). Priorities are to characterise the influence of exposures on the populations currently living in contaminated environments, through (1) robust exposure assessments (considering past exposures and including internal exposure,	There is no possibility to observe the effects caused by exposure below the background ..That does not make sense …. Effects on population depends on the number of individuals affected or/and habitat/food chain changes, regardless what was the agent causing effects on individuals. Therefore effects on populations are subject to separate, mainly statistical, investigations, apart from an agent affecting individuals (consider that state-of-art human RP is focused on individuals, the concept of population dose has been abandoned). The attention should be paid to specific wildlife species, that really can react on exposure in different way.	Effects have been reported at dose-rates below the values of the background dose rates (One example: Møller and Mousseau, 2009, determined an LD50 for butterfly larvae of 0.192 mGy d-1, a dose rate lower than the range of natural background values described in terrestrial ecosystems Changing "populations"

			through (1) robust exposure assessments (considering past exposures and including internal exposure, heterogeneity, differing radiation qualities) and considering other stress factors; (2) the identification of the key factors determining the vast reported variation in wildlife populations' sensitivity to radiation; (3) the identification and validation of biomarkers of exposure and effects that are relevant for effects at the population's level.	heterogeneity, differing radiation qualities) and considering other stress factors; (2) the identification of the key factors determining the vast reported variation in wildlife species' sensitivity to radiation; (3) the identification and validation of biomarkers of exposure and effects that are relevant for effects characteristic to specific wildlife species.		by "species" will chain the aim of the subtopic
DSA-NO	3,6, C1	ED	The re-interpretation and achievement of robust, consensus-based data on the long-term ecological effects attributable to radiation in those emblematic contaminated territories would have a very significant impact on the robustness and credibility level of the radiation protection of the environment (e.g., robustness of 'no-effect' benchmark dose-rates).	The establishment of reliable, consensus-based conclusions on the long-term ecological effects attributable to radiation in those emblematic contaminated territories would have a very significant impact on the robustness and credibility of radiological environmental risk assessment methodologies (e.g., validity of 'no-effect' benchmark dose-rates).	It is somewhat confusing talking about the "re-interpretation of robust, consensus-based data" (or just data ?) and the "achievement of ……data" is strangely worded. "the robustness and credibility level of the radiation protection of the environment". More specifically, I presume the authors are alluding to the credibility of radiological environmental risk assessment methodologies ? The way the text is originally written the reader might misunderstand this to question whether radiation protection of the environment is credible, per se. This would involve other, additional arguments of e.g. a philosophical and legal nature.	Agree with the suggestion and the arguments for the change
DSA-NO	4,1, C2	ED	.....the conservatism of the current assessments would be comforted	…….the conservatism of the current assessments would be supported	Strange use of the word "comforted"	AGREE
DSA-NO	4,1, C2	ED	......of the reported data on of the current state	…. of the reported data on the current state	Typo :"...on of...."	AGREE

SAB	P4C2	CO	Those societal issues are also to be addressed, in the aim to provide finally a coherent framework encompassing both the radiation protection of human and ecosystems.		The meaning of the sentence is not clear. Any text related to linking with societal aspects needs to be more explicit in terms of what is expected (in all subtopics)	AGREE, but not suggestion is given
Salvatore di maria IST-PO	Subtopic D1	CO	Subtopic D1	Adding the following sentence: With the increasing use of radiopharmaceuticals both for imaging and radiotherapy, there is a need to improving and optimizing internal dosimetry protocols, since the present knowledge is not at the same level as for external radiation exposure.	There is a need to increase the knowledge for personalized internal dosimetry protocols, since in this field there is not the same knowledge as in external exposure. Radionuclide activity-based protocols should be converted into radiation dosimetry-based protocols, in order to have better correlation between radiation and biological effects, helping to correlate data for external exposure with data for internal exposure.	The original text already includes this.
SCK CEN	D1	CO	Individualise diagnostic as well as therapeutic procedures with regard to optimisation of the benefit/risk ratio. This includes the development of evidence-based procedures and encompasses applications such as molecular imaging, interventional procedures and theranostic applications. As imaging of anatomical structures is a major task in clinical practice, corresponding optimisation in terms of benefit/risk ratio is also crucial and relevant research should be included to complement and build upon the initial work carried out in recent projects. Evidence-based procedures should	Individualise diagnostic as well as therapeutic procedures with regard to optimisation of the benefit/risk ratio. ~~in terms of~~ FOR RT THIS CAN MEAN increasing treatment efficacy and reducing toxicity or secondary radiation effects. This includes the development of evidence-based procedures and encompasses applications such as molecular imaging, interventional procedures, theranostic applications and radiation therapy. As imaging of anatomical structures is a major task in clinical practice, corresponding optimisation of the benefit/risk ratio is also crucial and relevant research should be included to complement and build upon the initial work carried out in	The topic focusses on the individualisation of diagnostic and therapeutic procedures, but the further detailed description only focuses on imaging tasks. The scope of this topic (optimisation of medical exposures with regards to an improved benefit/risk ratio) can certainly be extended to other applications then only imaging. The fast evolution in treatment modalities and resulting delivery complexities in external beam therapy also introduce challenges in clinical practice to improve the benefit for the patient and decrease its risk. The way the topic is described now, addressing specific benefit-risk ratios, without much detail about specific procedures it could be interpreted more as a question of medical justification, and should then as part of evidence based medicine be largely linked to general medical research instead of radiation protection research. The suggestions made attempt to better describe that optimization in the medical use of ionizing radiation can have a huge impact on the general and individualised	The comment was included in the most recent version of the call text

			rely on benefit and risk based on patient data.	recent projects. In external beam radiation therapy, LET-based treatment planning optimisation for both tumour and OARs is needed in the field and will contribute to the improvement of the individual patient benefit/risk ratio. Evidence-based procedures should rely on benefit and risk based on patient (exposure) data.	radiation exposure and that it is not about the justification principle, justifying the application of the medical procedures.	
SAB	P 4 D1	CO	Individualise diagnostic as well as therapeutic procedures with regard to optimisation of the benefit/risk ratio	Individualise diagnostic as well as therapeutic procedures with regard to optimisation of the benefit/risk ratio **including single x-ray diagnostic procedure and repeated CT scans**	To revisit the benefit risk of the vast majority of medical procedures	This suggestion is already included in the original call text. We do not think it should be specifically emphasized because that would change the focus of the topic.
TOM Mehmet Ruhi Onur EURAMED / ESR / Hacettepe University, Ankara /Turkey	D1- 1	ED	This includes the development of evidence-based procedures and encompasses applications such as molecular imaging, interventional procedures and theranostic applications.	This includes the development of evidence-based procedures including justification projects regarding ionising radiation used procedures and encompasses applications such as molecular imaging, interventional procedures and theranostic applications.	As I mentioned in the online meeting, justification process of imaging and interventional studies is the first step in optimization of whole dose reduction strategyin imaging processes.	We think as correctly stated in this comment the justification process is part of optimisation, therefore it does not need to be specifically

						mentioned in the call text.
TOM Michael Lassmann EANM	D1	ED/CO	Individualise diagnostic as well as therapeutic procedures with regard to optimisation of the benefit/risk ratio. This includes the development of evidence-based procedures and encompasses applications such as molecular imaging, interventional procedures and theranostic applications. As imaging of anatomical structures is a major task in clinical practice, corresponding optimisation in terms of benefit/risk ratio is also crucial and relevant research should be included to complement and build upon the initial work carried out in recent projects. Evidence-based procedures should rely on benefit and risk based on patient data.	Imaging of anatomical structures is a major task in clinical practice, corresponding optimisation in terms of benefit/risk ratio is crucial and relevant research should be included to complement and build upon the initial work carried out in recent projects. Individualization and optimization of other diagnostic and therapeutic procedures with a focus on optimal efficacy in combination with high safety for patients is of high priority. This includes the development of evidence-based procedures and encompasses applications such as molecular imaging, interventional procedures, theranostic applications and radiopharmaceutical therapies. Evidence-based procedures should rely on benefit and risk based on patient data.	The wording is unclear	The comment has been included in the final version of the call text.
DSA-NO	4,6, D2	ED	This includes means to		Either includes or means ? or is the interpretation ”a means” as in an approach or system to achieve a result ? In fact the whole sentence needs checking so that a verb follows each point i), ii) etc. For example ”to i) set up reliable....” is OK but ”to ii) strategies for testing” is not.	AGREE. The text changed according to the proposal
DSA-NO	4,6, D2	ED	or modelling and c) methods to allow generalizability	or modelling and iii) methods to allow generalizability	Typo : ”...c)....” ”...iii)....”	AGREE, as above
NCSRD BFS-GE	Page 4, D2	CO	Improving the quality of medical imaging and radiation therapy		With regard to the aims of the topic, the focus should not be that strong in terms of AI methods. For nuclear	No new text is proposed. The

			especially but not limited to cancer-treatment. This includes means to i) set up of reliable computational methodologies such artificial intelligence (AI) methods for medical applications including radiation dose prediction and image quality enhancement and e.g. pharmacokinetic modelling, ii) strategies for testing and validation of data and methods used for AI/Machine Learning (ML) applications or modelling and c) methods to allow generalizability of ML models to allow application independent of hospital equipment. Social, ethical and legal dimensions of the use of AI and other computational models should also be addressed, in particular, how the use of AI will impact current practices; what the effect will be on the gaps observed between best practice and guidelines, on the one hand, and current practices, on the other; and what the concerns and expectations of patients and other stakeholders are in the context of these technological developments.		medical applications other methods like population models, mixed-effect models etc are of higher importance. That is true specifically for PRLT, which gets more and more important in terms of tumour treatment. Currently, the pharmaceutical industry develops a lot of new therapeutic radiopharmaceuticals which deserve for personalised application to avoid radiation injuries to vitals whilst maximising the impact of tumour treatment. Here, we need innovative approaches.	efficacy of treatment including radiopharmaceuticals is included in topic D1.
SAB	P 4 D2	CO	Improving the quality of medical imaging and radiation therapy	**Developing methods for image quality objective and automatic**		The concept is part of the

			especially but not limited to cancer-treatment	**assessment, and i**mproving the quality of medical imaging and radiation therapy especially but not limited to cancer-treatment		original text (AI and ML is part of a concept that is objective and automatic)
SAB	P4 D2	CO	Improving the quality of medical imaging and radiation therapy especially but not limited to cancer-treatment.		It is important to increase the quality of imaging, but it is also important to reduce the dose received by the patient (benefit for the patients).	Radiation protection could be regarded as included in the word "quality". If not the text could be altered: Improvning quality and radiation safety…"
TOM Mehmet Ruhi Onur EURAMED / ESR / Hacettepe University, Ankara /Turkey	D2 - 2	ED	on the one hand, and current practices, on the other; and what the concerns and expectations of patients and other stakeholders are in the context of these technological developments.	on the one hand, and current practices, on the other; and what the concerns and expectations of patients and other stakeholders are in the context of these technological developments. This projects may also be focused on how dose management system data may be helpful in optimization of radiological procedures since dose management systems include and present all imaging acquisition data.	Dose management systems provide enormous data about imaging studies that we can use in justification and optimization of imaging studies.	Dose mangagment system could be a tool. However, it is an established tool that do not need to be mentioned specificially.
SCK CEN	D3	CO	The topic should explore ways to improve communication among	The topic should explore **collaborative** ways to improve **the engagement**	Engagement includes but is broader than communication. Several recent projects related to medical applications in	AGREE The text changed

			patients, caregivers, medical personnel and other stakeholders in order to empower them for informed decision-making and consent and improve radiation protection behaviours.	**with, and** communication among, patients, caregivers, medical personnel and other stakeholders in order to empower them for informed decision-making and consent and improve radiation protection behaviours.	the radiation protection field emphasized the importance of switching from one-way communication to engagement. The text of the topic already mentions that the purpose is **to empower** the patients, caregivers, etc, which is in line with these recommendations. The correct term to refer to such forms of participation is then "engagement". Furthermore, inclusion of knowledge from various stakeholders is recognised as essential to develop ethically acceptable and socially responsive approaches. Therefore the word "collaborative".	according to the proposal
SAB	P5 D3	CO	Only already existing cohorts should be considered, building up new cohorts does not fit in the timeframe and budget of the call.		SAB questioned whether focussing on existing cohorts is adequate. SAB thinks that there is a need to set up new epidemiological studies with current radiotherapy techniques.	The consensus reached was that building up new cohorts does not fit in the timeframe and budget of the call .
SAB	P5 D3	CO	The topic should explore ways to improve communication among patients, caregivers, medical personnel and other stakeholders in order to empower them for informed decision-making and consent and improve radiation protection behaviours.		Not clear what is expected.	The text has been re-phrased.
TOM Alegria Montoro Hospital La Fe de	TOPIC D3	CO	A3: "Biomarker investigations should include validation of proposed biomarkers in suitable cohorts."		Variability in individual radiation response is one of the specific objectives in PIANOFORTE. Validation has not been performed in the majority of the cases, and being a high priority medical application, validation of biomarkers focused in radiotherapy it would be high priority for patients and their quality of live, and more with the	No new text suggested.

Valencia (Spain)			D3: „in cancer patients treated with radiotherapy."		unknowledge of of the biological effects of future FLASH therapies.	
TOM Joana Lourenço (University of Aveiro) Portugal	Topic D3	CO	.		I do not think that "radiotherapy" should be the only focus in this topic, because several diagnosis methods that use ionising radiation also can expose people to considerable doses and some of those methods are used much more often then they probably should be	The topic only includes radiotherapy as indicated initially by EURAMED. This will be discussed and potentially revised.
DSA-NO	E1	CO and ED	Improving radiation protection of workers and population	Improving radiation protection of workers and the population There is a need for changes as the population is only mentioned in title, but not in relevant bullet point and text below – there is no population aspects.	It is important subtopic and the population should be properly included in line with workers.	Accept: there will be an aspect on the population in one of the subtopics (see below)
TOM Oliver Meisenberg, CBRN Response Department, District of Munich, Germany	E1	CO	Improvement of biokinetic models and personalised dosimetry that will lead to the improvement of the assessment of internal exposure for occupational exposed workers;	Improvement of biokinetic models and personalised dosimetry that will lead to the improvement of the assessment of internal exposure for occupational exposed workers, of responders to radiological accidents and of members of the population;	Following radiological and nuclear accidents, there is an enormous demand for internal monitoring of responders and members of the population but still a lack of knowledge how to satisfy this demand by a large number of measurements (with the exception of radioiodine measurements, which was covered by research projects in the last years). This demand is expressed neither in Topic E nor in Topic G. Additionally, this amendment would harmonise the text of Subtopic E1 with the title of Topic E, where the population is also mentioned.	Accept
TOM Oliver Meisenberg,	E1	CO	… to improve radiation protection of workers and thus to contribute…	… to improve radiation protection of workers, responders to accidents and	Same as above.	Accept

CBRN Response Department, District of Munich, Germany				members of the population and thus to contribute…		
TOM Alegria Montoro Hospital La Fe de Valencia (Spain)	TOPIC E	CO	"Improving radiation protection of workers and population"		There is only one subtopic for this topic, and I consider that the radiological protection of workers and the population, based on the importance of this topic, should be high *vs* moderate. In addition, the subtopics of this topic do not mention at any time the strategy for the population, only for workers... What do you mean with "analytical tools"? The link of E1 to PIANOFORTE specific objectives should also include 4 because in the importance of the topic it talks about accidents.	The population will be included, see above. No other changes are suggested
TOM Alegria Montoro Hospital La Fe de Valencia (Spain)	TOPIC E	CO	"Improving radiation protection of workers and population": improve practices in the domain of low dose exposures of humans and the environment."		Why only low doses exposure? …."radiation protection measures in normal and accidental situations"… accident situations in the industry (pe. gammagraphy) have occurred with moderate and high doses... and this would be where an improvement should be made in the perception of radiation risk.	Not accepted: adding accident dosimetry aspects would change and enlarge the topic significantly, which was not the intention of the platforms
TOM Alegria Montoro	TOPIC E	CO	"Improving radiation protection of workers and population"		Related Impact (pag. 22 of 35): I find it very interesting that this point is dealt with here about the Medical Countermeasures (MCMs).	No changes suggested. Accident exposures,

Hospital La Fe de Valencia (Spain)			.... In case of internal contamination it is well known that DTPA increases the excretion of actinides but the dose reduction due to the therapy is currently based on default assumptions that should be improved.		Contamination is not mentioned in the importance of topic, only exposure or the use of radiation mitigators, but here in the impact yes. I miss in the topics and subtopics the use of MCMs for the protection or mitigation of the effects of radiation in patients who undergo explorations with ionizing radiation.... “cohorts of workers for whom contamination information”… Information about contamination is not only important for workers, but also about exposure... …”Most workers are still currently monitored with passive dosimeters. But on-line personal dosimetry is emerging”… anything about biodosimetry? neither in this topic nor in the others... I think its application is very important and not only for emergencies, also for workers and patients	patient exposures and biodosimetry are deliberately not included in the topic, as they were not considered a game changer in the Joined roadmap. They can be added if suggested by the platforms for the next calls
SAB	P6 F1 F2 F3	CO			The 3 F subtopics are poorly written and explained, and they need to be better defined to know the expectation of the research in these subtopics (The topic and underlying challenges are better explained in Appendix C). Not a lot of thinking has been given to F subtopics. Difficult to see the innovation and originality. Lack of clarity on what it is expected from scientists/research.	TAKE INTO ACCOUNT THIS COMMENT WHEN WRITING F TOPIC/SUBTOPICS FOR THE 2ND OPEN CALL
SCK CEN	F1	CO	The topic should take into account future changes in the European agricultural practices and the need to further develop marine dispersion and biota transfer models due to the fact that NPPs are often built on the coast and the	The topic should take into account future changes in the European agricultural practices, **sustainable development considerations,** and the need to further develop marine dispersion and biota transfer models due to the fact that NPPs are often built	The topic mentions that the focus is on „building resilient and sustainable societies”. It is thus essential to include the broader framework, which also has implications on changes in agricultural practices.	AGREE

			future tendency of building them on floating vessels.	on the coast and the future tendency of building them on floating vessels.		
GIG (on behalf Poland)	6/F1	CO/ED	Robust modelling of radiological contamination in the human food chain, for an integrated dose and risk assessment of post-emergency situations, with focus on building resilient and sustainable societies. The topic should take into account future changes in the European agricultural practices and the need to further develop marine dispersion and biota transfer models due to the fact that NPPs are often built on the coast and the future tendency of building them on floating vessels.	Robust modelling of radiological contamination in the human food chain, for an integrated dose and risk assessment of post-emergency situations, with focus on building resilient and sustainable societies. The topic should take into account future changes in the European agricultural practices and the need to further development of marine and freshwater dispersion and biota transfer models due to the fact that NPPs are often built on the coast and the tendency of building of SME or nuclear-powered floating vessels.	Besides marine environment, fresh water ecosystem should be considered as they are even more sensitive to potential contamination	Agree.
DSA-NO	6,1, F1	CO	Robust modelling of radiological contamination in the human food chain, for an integrated dose and risk assessment of post-emergency situations, with focus on building resilient and sustainable societies.	Robust modelling of radiological contamination in the human food chain, for an integrated dose and risk assessment of post-emergency situations, with focus on developing reliable and practicable approaches.	The original focus seems quite ambitious, and rather nebulous, given the proposed R&D theme.	Agree
DSA-NO	6,1, F1	CO and ED	The topic should take into account future changes in the European agricultural practices and the need to further develop marine dispersion and biota transfer models due to the fact that NPPs are often built on the coast and the future tendency of building them on floating vessels.	The topic should take into account future changes in European agricultural practices and fisheries management (including fish farming). There is also a requirement to further develop marine dispersion and biota transfer models, reflecting the fact that nuclear power plants, NPPs, are often sited at coastal locations and	If some of the thematic focus is on marine systems, consideration should also be given to (changing in view of climate change) fisheries management.	Agree

				there has been a recent tendency of building NPPs on floating vessels.		
SAB	P6 F1	CO	... due to the fact that NPPs are often built on the coast and the future tendency of **<u>building</u>** them on floating vessels.	... due to the fact that NPPs are often built on the coast and the future tendency of **embarking** them on floating vessels.		Rewording to be considered – ask a native English speaker
GIG (on behalf Poland)	6/F2	CO/ED	Identifying and quantifying the key processes that influence radionuclide behaviour in existing environmental contamination situations with a special focus on: - the management and clean-up of existing sites, as well as to the licensing (including social licensing) of future discharges and large quantities of NORM residues. - developing the modelling basis for accurate dose assessment and establishment of holistic and sustainable remediation approaches.	Identifying and quantifying the key processes that influence radionuclide behaviour in existing environmental contamination situations with a special focus on: - the management and clean-up of existing sites, as well as to the licensing (including social licensing) of future discharges and large quantities of NORM residues. - the management and the licensing (including social licensing) of discharges of liquid NORM residues into marine as well as fresh water ecosystems - developing the modelling basis for accurate dose assessment and establishment of holistic and sustainable remediation approaches.	The problem of liquid NORM is extremaly important, not addressed adequately in on going RadoNorm project	Agree that liquid NORM is important, but also is important solid NORM. Consultation with ALLIANCE is needed before revising the text.
SAB	P7 G2	CO	- Development of communication strategies including methods and material appropriate for use in such situations; - Social and psychological challenges for emergency actors and citizens and their impacts on the effectiveness of		These bullet points (last 3 of the list) included in G2 should be VERY HIGH priority	This is not a comment to the text, it relates to prioritisation ranking

			protective actions, legal basis and practical arrangements for emergency response and recovery; Societal resilience, stakeholder involvement and ethical considerations.			
TOM Oliver Meisenberg, CBRN Response Department, District of Munich, Germany	G2	CO	… for both attacks on nuclear facilities but also in relation to nuclear detonation scenarios;	… for attacks on nuclear facilities, but also in relation to nuclear detonation scenarios as well as for the irregular use of radioactive material in attacks against the population;	As far as I understand, Topic G is meant to cover a wide range of possible belligerent uses of radioactive materials. This might not be restricted to uses of nuclear weapons and attacks against nuclear facilities, but also so-called irregular warfare, in which radioactive materials is released in order to expose the population using radiological dispersal and exposure devices but also e.g. by the release of radioactivity into the drinking-water supply.	The topic does not aim on focusing on the investigation of consequences of terrorist actions. The consequences of nuclear attacs on the population are addresses by several objectives of this topic. Therefore, we prefer not changing the text of the topic.
TOM Alegria Montoro Hospital La Fe de	TOPIC G	CO			Biodosimetry is not mentioned in this emergency topic either. The importance and relevance are not only for nuclear safety, but also for radiological safety. the largest number of accidents and the most serious have taken place in the industrial sector	To be consulted with NERIS before revising the text.

Valencia (Spain)						
TOM Alegria Montoro Hospital La Fe de Valencia (Spain)	TOPIC G	CO	"optimization and operationalization of countermeasures and countermeasure strategies"		Are they referring to MCMs? if they refer to radioprotectors and radiomitigators, they are not developed in the subtopics... but rather these countermeasures are referred to, their study and application in case of emergencies should be taken into account	No new text is proposed.The text will be revised to clarify to what countermeasures the topic refers to.
SCK CEN	H1		Projects addressing this topic should contribute to developing systematic approaches to inclusion of societal dimensions within the radiological protection system and methodological innovation enabling inter- and transdisciplinarity in radiation protection research.	Projects addressing this topic should contribute to developing systematic approaches to inclusion of societal dimensions within the radiological protection system and methodological innovation enabling inter- and transdisciplinarity in radiation protection research. Add: Case studies could notably take into consideration, but are not limited to, research topics addressed in the first PIANOFORTE call.	This topic is highly important since it has the potential to impact in a positive way all future research projects within PIANOFORTE. Integration of technical and social aspects leads to improved radiation protection and ensures that radiation protection research and it outcomes, are ethically acceptable, sustainable and socially responsible. Although the topic is formulated from an SSH perspective, it requires case studies. For highest impact, these case studies could be linked to the topics addressed by projects accepted in the first PIANOFORTE call.	DISAGREE It is not clear to what extent projects that will receive funding in Call 1 will include SSH and collaborations between SSH and non-SSH disciplines. Therefore we cannot recommend that case studies address topics included in the first call.
SAB	P8 H1	CO	The objective of the topic is to investigate how different radiation protection actors perceive the	The objective of the topic is to investigate how different radiation protection actors perceive the added	There should not be a confusion between collective risks as during war for example and medical benefits and risks for individuals	DISAGREE This topic addresses

			added value of inter- and transdisciplinary collaborations in the field of radiation protection	value of inter- and transdisciplinary collaborations in the field of radiation protection **and to develop risks prediction models based on their stratification**		transdiscplinarity in radiation protection research, i.e. collaborations across discplines and with various scientific and non-scientific actors. The comment points to a very specific aspect of radiation protection. Individual proposals should decide whether to address this aspect or not.
SAB	P8 H1	CO	Effective translation mechanisms between social and technical dimensions of radiation protection. The objective of the topic is to investigate		The subtopic is difficult to understand without going back to Appendix C. It should be improved using the information included in Annex C.	Agree, but there is no concrete suggestion given. The recommendation will be communicated to SHARE in

						view of improvement of the topic for Call 2.

7.16 Annex 15

Prioritisation ranking of POMs

		PIANOFORTE ranking	EPA, IR	SMWK, GE	IRSN, FR	UKHSA, UK	SCK, BE	NNK, HU	GIG, PL	CEA, FR	EEAE, GR	DSA, NO	HZDR_HGF, GE	IST, PO	ISS, IT	NCSRD, GR	ENEA, IT	BfS, GE	INFN, IT	PIANOFORTE Task 2.1 ranking - based on POMs evaluation
A	A1	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	MODERATE	MODERATE	HIGH	VERY HIGH	HIGH	VERY HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH
	A2	VERY HIGH	VERY HIGH	VERY HIGH	VERY HIGH	VERY HIGH	VERY HIGH	VERY HIGH	HIGH	VERY HIGH	VERY HIGH	VERY HIGH	HIGH	VERY HIGH	VERY HIGH	VERY HIGH	VERY HIGH	VERY HIGH/HIGH	VERY HIGH	VERY HIGH
	A3	VERY HIGH	VERY HIGH	VERY HIGH	? (very high)	VERY HIGH	VERY HIGH	VERY HIGH	VERY HIGH	VERY HIGH	VERY HIGH	VERY HIGH	HIGH	VERY HIGH	VERY HIGH	VERY HIGH	VERY HIGH	VERY HIGH	VERY HIGH	VERY HIGH
	A4	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	? (very high)	VERY HIGH	HIGH	VERY HIGH	HIGH	VERY HIGH	HIGH
B	B1	MODERATE	MODERATE	MODERATE	HIGH	MODERATE	MODERATE	MODERATE	HIGH	HIGH	MODERATE	HIGH	MODERATE	HIGH	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE	HIGH
C	C1	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	MODERATE	MODERATE/LOW	HIGH	HIGH	VERY HIGH	HIGH	HIGH		HIGH	HIGH	HIGH		HIGH
	C2	MODERATE	MODERATE	MODERATE	HIGH	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE		MODERATE	MODERATE	MODERATE		MODERATE
D	D1	VERY HIGH	VERY HIGH	VERY HIGH	VERY HIGH	VERY HIGH	VERY HIGH	VERY HIGH	VERY HIGH	HIGH	VERY HIGH	VERY HIGH	HIGH	VERY HIGH	VERY HIGH	VERY HIGH	VERY HIGH	VERY HIGH	VERY HIGH	VERY HIGH
	D2	MODERATE	MODERATE	MODERATE	HIGH	MODERATE	MODERATE	MODERATE	MODERATE	HIGH	MODERATE	HIGH	MODERATE	MODERATE	HIGH	MODERATE	HIGH	HIGH	HIGH	HIGH
	D3	MODERATE	MODERATE	MODERATE	HIGH	MODERATE	MODERATE	MODERATE	HIGH	HIGH	MODERATE	HIGH	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE
E	E1	MODERATE	MODERATE	MODERATE	? (high)	MODERATE	MODERATE	MODERATE	HIGH	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE	HIGH	MODERATE	MODERATE	MODERATE	HIGH	HIGH
F	F1	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	LOW	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH
	F2	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	VERY HIGH	VERY HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH
	F3	MODERATE	MODERATE	MODERATE	HIGH	MODERATE	MODERATE	MODERATE	HIGH	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE		MODERATE	MODERATE	MODERATE		MODERATE
G	G1	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	VERY HIGH	VERY HIGH	HIGH	HIGH		HIGH	HIGH	HIGH		HIGH
	G2	HIGH	HIGH	HIGH	HIGH	HIGH	VERY HIGH	HIGH	HIGH	MODERATE	VERY HIGH	HIGH	VERY HIGH	HIGH	VERY HIGH	VERY HIGH	HIGH	VERY HIGH	VERY HIGH	VERY HIGH
H	H1	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	MODERATE/LOW	HIGH	HIGH	MODERATE	HIGH	HIGH	MODERATE	HIGH	MODERATE	HIGH	MODERATE	HIGH