ORIENT- NM

Organisation of the European Research Community on Nuclear Materials

A Coordination and Support Action in Preparation of a Co-Funded European Partnership on Nuclear Materials

This project has received funding from the Euratom research and training programme 2019/2020 under grant agreement No. 899997

Start date of project	01/10/2020
Duration	30 months
Reporting period	2 - 01/04/2022 – 30/03/2023

Work Package 5 –Dissemination and Communication

Deliverable 5.7:

Public summary of the 2nd ORIENT-NM Workshop with stakeholders on a possible Co-funded European Partnership on nuclear materials

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Date of issue	30/06/2022
Date of final approval	12/07/2022
Date of revision	19/09/2022
Date of revisio approval	26/09/2022

Dissemination Level		
PU	Public	X
CO	Confidential, only for partners of the ORIENT-NM Action and the EC	

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List of abbreviations

AFCEN	Association française pour les règles de conception, de construction et de surveillance en exploitation des matériels des chaudières électro-nucléaires
AMPEA	Advanced Materials and Processes for Energy Applications
CEP	Co-Funded European Partnership
CEP-NM	CEP on Nuclear Materials
CORDEL	Cooperation in Reactor Design Evaluation and Licensing (WNA Working Group)
CRP	Coordinated Research Project
D4E	Digitalization for Energy
DONES	DEMO-Oriented Neutron Source
EC	European Commission
EERA	European Energy Research Alliance
EM4I	Energy Materials for Innovation
EMCC	European Materials Characterization Council
EMMC	European Materials Modelling Council
ENEN	European Nuclear Education Network
EPERC	European Pressure Equipment Research Council
ESFRI	European Strategy Forum on Research Infrastructures
ETSON	European Technical Safety Organisations Network
FIDES	Framework for In-pile Fuel and Material Irradiation
FORATOM	"The voice of the nuclear industry in Europe"
H2020	Horizon 2020 (previous framework programme)
GA	General Assembly
GIF	GenerationIV International Forum
IAEA	International Atomic Energy Agency
IG	Innovation Group
JHOP2040	Jules Horowitz Operation Plan to 2040
LTO	Long-term operation
MS	Member States
MST	Management Support Team
MTR	Materials Testing Reactors
MYRRHA	Multi-purpose hYbrid Research Reactor for High-tech Applications
NEA	Nuclear Energy Agency
OECD	Organisation for Economic Cooperation and Development
OFFER	eurOpean platForm For accEssing nucleaR R&d facilities
RL	Research Line
SAB	Scientific Advisory Board
SRA	Strategic Research Agenda
SMR	Small modular reactor
SNETP	Sustainable Nuclear energy Technology Platform

Public Summary

General

The second ORIENT-NM Workshop on a possible Co-funded European Partnership (CEP) on nuclear materials was held on 31 May 2022, in hybrid (in-person and online) format, as part of FISA & EURADWASTE 2022, the 10th Euratom Conference on Fission Safety of Reactor Systems and Radioactive Waste Management. This conference took place in Lyon, France, from 30 May to 3 June 2022, under the scope of the French Presidency of the Council of the European Union and was hosted by the Région Auvergne-Rhône-Alpes.

The event gathered official representatives from the European Commission and a number of Member States (MS), among which Croatia, France, Italy, Lithuania, the Netherlands, Portugal, Romania, Spain, and Sweden. Moreover, other stakeholders that were present at the conference represented research organisations, nuclear associations and industries.

The objective of this second workshop was to present the work performed in ORIENT-NM, taking into account the input received in the 1st Workshop (see Milestone MS10/MS5.2). This included establishing the Strategic Research Agenda, the governance and the implementation plan for the partnership, as well as a plan of interaction with external stakeholders. It was the occasion to receive the comments, and possibly the explicit support, of the attending MS representatives.

The coordinator and work-package leaders of ORIENT-NM conducted the presentations followed by a discussion, as shown in the agenda in the Annex. **At the end of the Workshop, six MS, namely Croatia, France, Italy, Romania, Spain and Sweden, explicitly supported the launch of a partnership on nuclear materials within the boundaries described in the presentations**.

Content of the presentations

1 – The context

ORIENT-NM has been dialoguing with several stakeholders on two occasions: in the preparatory meeting with MS representatives on 13 September 2021, and at the 1st Workshop with Stakeholders, on 22-23 November 2021. Back then, the analysis of the MS programmes concerning nuclear energy until 2040 and beyond had been presented as a starting point to identify the priorities of the CEP on Nuclear Materials (CEP-NM). The Vision Paper and the first version of the Strategic Research Agenda (SRA) were released, as well as the so-called Materials' ID Cards, which summarise the issues to be addressed for the materials belonging to four of the seven classes into which nuclear materials have been classified (see **Figure 1)**.

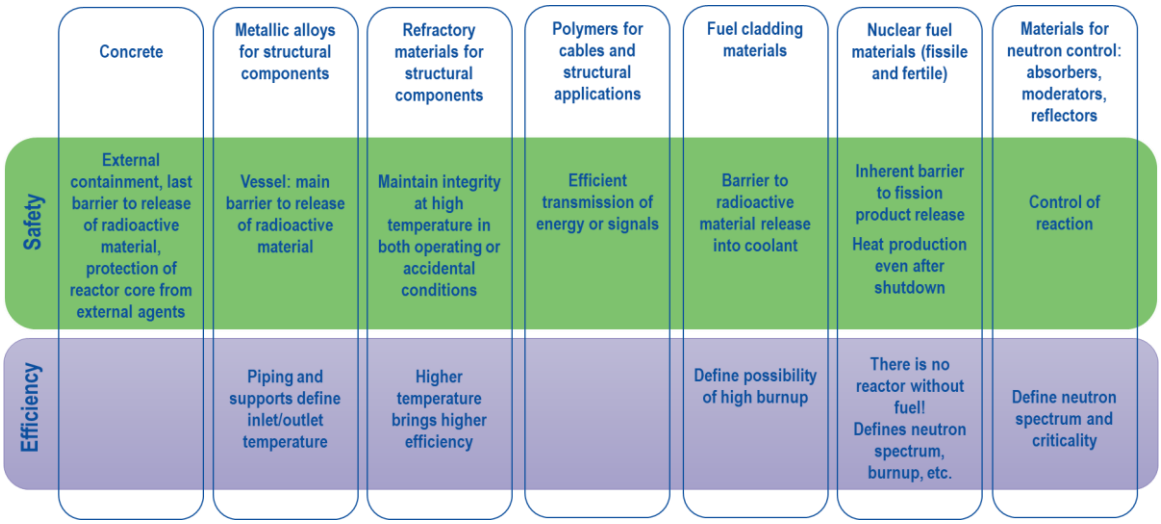

Figure 1. *Seven classes of nuclear materials and how their performance affects the safety and efficiency of current and future nuclear power plants. Materials ID cards were produced only for concrete, metallic alloys for structural components, fuel cladding materials and fuel materials.*

In parallel, the governance structure, legal issues and implementation aspects, including education and training, have been addressed at a draft level, as well as the protocols of interaction with external stakeholders, such as international organisations, European associations, bodies dealing with standardisation or safety, other energy technologies (fusion, non-nuclear), and nuclear infrastructures.

In the current European context, based on the analysis that has been performed, the mission of the nuclear materials science community and of a CEP on nuclear materials should be to support, through R&D activities:

- Safe and affordable LTO of current generation reactors
- Increasingly safe design, licensing and construction of Gen III+ new builds
- Deployment of light water SMRs within the next decade
- Reduction of time and costs for the design, licensing and construction of competitive next generation (GenIV) nuclear reactors, including advanced SMRs, within the time horizon of 2040

For these purposes, the keywords are:

- Accelerated development & qualification capabilities, advanced digital technologies
- Predictive methodologies, continuous monitoring, supply chain and advanced manufacturing
- Multidisciplinarity, competence building, benefits for fusion and non-nuclear energy

2 – The vision and the SRA

The unifying vision developed in ORIENT-NM can be summarised as follows:

- Nuclear power will be maintained in Europe until 2040 and beyond through LTO, power uprates and new builds.
- Small and medium size modular reactors and advanced designs are considered as game-changers throughout the continent.
- In order to understand and monitor materials behaviour in operation, and improve materials performances, research has a crucial role to play, to continuously enhance the safety, efficiency and economy of nuclear energy.
- Research needs to be boosted to accelerate the development, manufacturing and qualification of innovative nuclear materials and so reduce their time to market.
- A paradigm shift from the traditional "observe and qualify" to the modern "design and control" materials science approach is needed, which is enabled by advanced digital techniques and suitable models.
- An integrated nuclear materials research programme, i.e. a partnership, needs to be set up to make coordinated use of assets spread across MS to give continuity to the pursued research lines
- In order to produce fruitful results for all, including non-nuclear countries, the chosen research lines are transversal to all classes of nuclear materials:
  - inherent multidisciplinary approach
  - maintains and builds competences
  - cross-cutting nature to equally serve all nuclear energy national strategies
  - benefits for fusion and non-nuclear energy

The perimeter of the CEP-NM activities is described in **Figure 2**:

- The activities will be organised within five research lines, which are transversal to all materials classes, namely: (1) Materials qualification: testing, characterisation and design rules; (2) Advanced materials, processing and manufacturing; (3) Modelling and advanced microstructural characterisation; (4) Non-destructive examination, monitoring and inspection; (5) Standardization & Quality Assurance, Knowledge & Data Management.
- The focus will be on the four classes of materials for which ID Cards could be produced: concrete, metallic alloys for structural components, fuel cladding materials and fuel materials. For the other three classes (refractory alloys, polymers and materials for neutron control), only strategic programming activities will be considered, while any dedicated project will have to find space outside the partnership.
- Fruitful interaction and mutual benefit are expected in terms of methodologies with the fusion energy and non-nuclear energy communities, which have in common the fact that materials are exposed to extreme operating conditions (beyond irradiation: high temperatures and temperature gradients, aggressive chemical environments, complex loads distributions …). Cross-cutting fission-fusion materials projects may be considered, inside or outside the partnership perimeter.

Materials issues may be addressed in projects external to the Partnership that are overall dedicated to problems other than materials science, e.g., projects dedicated to specific reactor systems that include qualification aspects or projects dedicated to

safety assessments where materials enter but are not the main focus. The Partnership will not focus on any specific nuclear system.

Figure 2. *Illustration of the perimeter of activities of the Partnership on nuclear materials and interaction with the outside world.*

In a time horizon of a decade, the Partnership aims at developing: (1) Nuclear-oriented test-beds; (2) Nuclear-oriented materials acceleration platforms (MAPs); (3) Advanced predictive methodologies; (4) Advanced materials health monitoring; (5) Nuclear materials databases.

3 – The governance, the structure, the resources

The chosen model is the Co-funded European Partnership, similar to EuroFUSION, EURAD, CONCERT (now PIANOFORTE), etc. The expected EC funding rate is 55%, and the rest are matching funds from MS. In this co-funding scheme:

- The agreement is signed by Programme owners (ministries, funding agencies...) or Programme Managers (usually large national research institutes), which receive a mandate from the Programme Owners.
  - This has not been entirely successful in other CEPs: not a strong enough mandate was given to mandated organisations to decide about the complementary funding.
- Complementary funding agreements must be binding (for both partners and affiliated parties).
  - National legislation and research programme structures need to be taken into account carefully.

Several legal issues remain, however, to be addressed.

The envisaged governance structure is shown in **Figure** 3. It is a fairly standard one, with emphasis not only on scientific excellence (scientific advisory board, SAB) but also on innovation (innovation group, IG). The SAB will be a "Standard" advisory body formed by experts in charge of assessing the activities with scientific and technical backgrounds as emanations of R&D environments. In contrast, the IG will be

composed of experts in disciplines generally not managed by researchers, namely, leading business, supporting entrepreneurship and commercialising technology, in connection with materials development and/or nuclear energy, as an emanation of industrial and innovation environments.

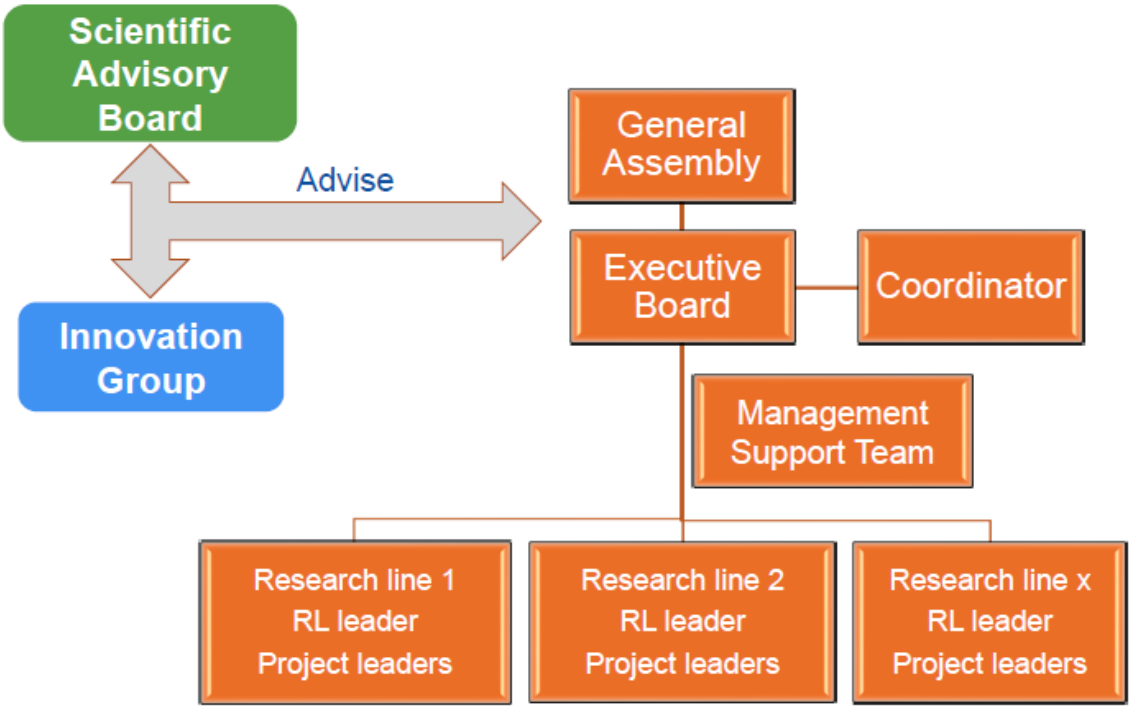

Figure 3. *Governance structure envisaged for the Partnership.*

The cost of the CEP is the sum of functioning costs and the cost of research performed in projects that are part of the research lines of the Partnership. The advantage is that there is no need for complex internal structures in the case of internal projects, as one single GA and one single management support team operate for all. This will give more resources for research, provided that an economy of scale is reached and the support is significantly higher than the functioning costs.

A crucial decision to be made is whether to adopt the "macroproject model" or the" internal call" model:

- Macroproject model: implies either sufficient resources to cover all research lines for all materials and applications (unlikely) or consensual pre-selection of case studies (pre-defined selected projects)
  - Advantage: work can start immediately;
  - Disadvantage: it may prove very difficult to agree on pre-defined case studies.
- Internal call model: it is the only choice when resources are limited
  - Advantage: the proposed projects are the result of broad spontaneous convergence, thus introducing a competitive dimension and selects the best proposal based on defined criteria;
  - Disadvantage: calls need to be managed, and research work cannot start immediately when the partnership starts.

The latter drawback can be remedied by consensually identifying a few projects that can start immediately as a pre-requisite for the work to be done within the various research lines.

An analysis of the expenditure for nuclear materials-related projects in H2020 within the perimeter of the Partnership yields an overall cost of 93 M€, which can be better used in a Partnership because of the centralisation of administration and ancillary functions.

4 – Interaction with stakeholders and use of infrastructures

The external stakeholder with which the Partnership on nuclear materials will interact can be divided into four groups:

1. International organisations (IAEA, OECD/NEA, GIF, …) and European associations (FORATOM, ENEN, … as well as EERA and SNETP)
2. Bodies dealing with standardisation and design codes, data and knowledge management, safety and regulation, …
3. Other energy technologies: fusion and non-nuclear
4. Nuclear materials research facilities and infrastructures

1.
A particularly close connection can be set up with OECD/NEA, due to the existence of several NEA working parties with scopes that overlap with those of the Partnership, ranging from data format and management to nuclear materials modelling and E&T initiatives. In addition, the NEA-led FIDES initiative (Framework for In-pile Fuel and Material Irradiation) is an important one to have a direct connection with neutron irradiation infrastructures and, potentially, access to them. Through IAEA, relevant coordinated research projects (CRP) on issues of interest for the partnership may be launched, so that the community involved in some specific activities that are running within the Partnership may be enlarged to contributions from anywhere in the world, with mutual benefit. The interaction with GIF may be set up through experts participating in technical meetings of system steering committees.
FORATOM can act as a springboard and amplifier of CEP activities towards industry through networking events. ENEN may offer contact with students and universities, and its mobility programmes can be used to exchange researchers between organisations involved in the CEP.

2.
Contacts have been taken with organisations such as AFCEN, CORDEL, EMCC, EMMC, EPERC, ETSON. These are very different organisations, covering aspects ranging from standardisation and licensing to data format, ontologies, and safety. The benefit for them of collaborating with a CEP concerns, for example, the definition of guidelines for new test standardisation and harmonisation of qualification procedures, reaching a critical mass of researchers involved and sharing R&D facilities (these are the defining pillars of test-beds). From the point of view of data management, the Partnership can benefit from the work done in bodies such as EMCC and EMMC on format, ontologies and use of artificial intelligence for data analysis. These bodies enable the collaboration to be extended beyond the nuclear sector and Europe.

3.
The connection with fusion energy will also be particularly close. At the 1st workshop, it emerged that: "The partnership should interact with the fusion community, by organising joint actions in which a structured dialogue for cross-fertilisation should be established between the two communities (i.e. fission and fusion)". Plenty of cross-cutting issues have been identified in the case of materials, also by participating in the IAEA initiative dedicated precisely to this goal (preparatory meetings in October 2021 and March 2022, technical meeting on 6-10 June 2022). While there will be no overlap or interference with the activities on materials pursued in EUROfusion, cross-cutting issues may be addressed in dedicated projects outside the perimeter of both partnerships (EUROfusion and the CEP-NM), which will benefit from the methodological advances achieved within it.

The connection with non-nuclear energy technologies turned out to be closer than expected. In the framework of the EM4I (Energy Materials for Innovation) initiative, which was launched within EERA by three joint programmes (AMPEA, DfE and NM) and with the participation of several others (solar themal energy, bioenergy, fuel cells and hydrogen, geothermal energy, energy storage, as well as E3S, on economic and social aspects), five workshops have been organised, dedicated to topics of cross-cutting interest. While most commonalities have been identified with energy technologies in which materials are exposed to harsh operating conditions, the workshops revealed that the approaches selected in the partnership are common to materials science applied to an extensive range of technologies, also beyond the energy world. This is demonstrated by the Materials 2030 Manifesto, published in February 2022, with high-rank signatories from research and industry in Europe.

4.
Finally, in terms of infrastructures, the most prominent ones are irradiation facilities. Currently, in Europe, only three materials testing reactors (MTR) are in operation: BR2 in Belgium, HFR in the Netherlands and LVR-15 in the Czech Republic, while several ion irradiation facilities exist in several countries. After 2030, four neutron irradiation facilities are expected to become operative: the Pallas reactor (replacing HFR in the Netherlands), the Jules Horowitz reactor (JHR) in France, MYRRHA in Belgium and DONES in Spain. The last three are part of the ESFRI roadmap. These will open new irradiation possibilities, including specifically for fusion. The JHOP2040 coordination and support action is in charge of designing the plan to use the 6% access right to JHR of Euratom. It is also addressing the issue of proposing a plan for the use of the operating MTR. Both are certainly of interest to the Partnership. To access these facilities, the Partnership may use the possibilities offered by the OFFERR Euratom coordination and support action, which is about to start and disposes of funds to support access to all nuclear facilities and infrastructures. FIDES represents another possible framework via NEA.

Discussions and statements[1]: workshop outcome

1 – Highlights of items discussed in the workshop

a) Role of modelling and modern digital tools in connection with advanced and accelerated qualification: This role has been questioned. In response, it has been pointed out that it is possible, and is happening, e.g., in France and the USA, to involve regulators as end-users of methods that combine irradiation experiments with advanced simulation tools, as is done for the severe accident studies. The goal is to be as predictive as possible with models in order to limit the number of irradiations that are needed. This is essential also because nowadays the safety requirements have increased. Irradiating in one transient is nolonger enough. The safety authorities want know about many details of the processes that take place during irradiation, under many conditions, which may be difficult or extremely costly to explore or measure experimentally. Thus, simulation codes that enable in-depth analyses beyond experimental possibilities are required. Digital twins, which are already in use, are examples of the same principle applied to monitoring: predictive models help control the components' functionality. If regulators accept codes, then they can be used for qualification as done already. Improved understanding can be used for the qualification of materials and the identification of appropriate design rules.
It has been objected that the nuclear field deals with complicated processes and need many data that are difficult to obtain. Therefore, it is challenging to imagine a scenario where "design and control" is always possible. However, while it is clear that this shift will not happen overnight, tools such as artificial intelligence do enable the community to advance faster. They can be imbibed with physical information and help close the current knowledge gaps. Other technologies are already benefitting from these approaches to develop better materials and processes (batteries, nanomaterials, PV, ...). Even though the nuclear materials' community faces more safety requirements than other technologies, it does not mean that the physical problems at hand in those technologies are any easier. If it can work for those technologies, it can also work for the nuclear technology.

b) Models for partnership functioning: It has been proposed that the example of EUROfusion can be used, as it has been operating successfully for many years. There are, however, differences. For example, the role of industry. IIn EUROfusion industrial partners only execute tasks, while in this partnership their role should be more proactive, with potentially more delicate issues of IPRs. Another critical difference is the level of funding, which is about one order of magnitude more significant in the case of EUROfusion. Such funding level enables EUROfusion to use the macroproject approach, with some space for prospective materials within

[1] NOTA BENE: This section is based on the recording of the meeting. Unfortunately, during about 15 minutes the connection was lost, so part of the discussion could not be reconstructed. Moreover, since not all questions and answers could be properly heard, the topics addressed are summarized, without giving details about who asked and who answered. This is therefore a summary and not a transcription.

projects selected through internal calls (enabling research programme). The same may be difficult for the presently discussed partnership. Moreover, EUROfusion has only one system as a goal system and this simplifies the situation as there is no internal competition between different systems.

c) Possibility of participation by organisations not part of the partnership: the partnership contemplates three participants' categories: 1) main beneficiaries, 2) affiliated entities, and 3) third parties. Each MS will be represented by a ministry's mandated organisation, which will be the primary beneficiary. Each of them will have a cluster of affiliated entities through an agreement of collaboration. For affiliated entities, the same rules as for the main beneficiary hold; in particular, in-kind contributions are possible. Finally, third parties will be able to enter the partnership at any time, but a cash-matching fund requisite will apply.

d) Priorities and expenses decisions: Some participants expressed a perception of lack of clarity concerning how decisions will be taken in the partnership, considering the different interests of the various countries. However, clarifications were put forward. Of course, each beneficiary needs to be convinced of the added value of a partnership compared to several disconnected projects, especially from a continuity perspective.. If this principle is accepted, there should be confidence in the fact that decisions on priorities and budget will be taken within the partnership according to its structure and the rules agreed upon by all beneficiaries, as set out in the consortium agreement. Each country will have its say. If there are internal calls, these will also be steered and evaluated in clear directions by this same decision-making structure.
Although each country has different nuclear interests, all nuclear systems will be represented through the relevant countries with a stake in each of them. However, it is essential to consider resource availability, which entails that not all topics can be covered. The partnership will therefore 'proceed by case studies, based on which a good level of agreement and consensus can be reached. Anything that is not system-dependent will be a good case study, the goal being to show the progress that the methodology applied offers also for systems that are not addressed. Otherwise, the criterion for choosing case studies will be the extendibility of the results to a wider range of applications.
How and when will this be decided? In the macroproject case, the decision needs to be made at the beginning; in the internal call model, a competition is introduced using the choice criterion stated above. Calls will follow an evaluation process. Moreover, yearly revisions of the plan will take place. Fragmentation and redundancy will be avoided. In the past, in disconnected projects that were dedicated to different systems, similar methods and even tests were performed twice for different applications: this will not occur here.The emphasis will be on the acceleration of research advances and the reduction of time to market.
In connection with the criterion of extendibility, it has been questioned that,e.g., a facility for qualification can be flexible and extendible, if it has been thought for one system. However, in this partnership, the key will be to integrate several infrastructures, in different laboratories, under the same umbrella and together provide the sought flexibility.

e) Funding the use infrastructures, especially for irradiation. The partnership financing scheme can only provide up to 55% reimbursement from the European Commission. This was identified as a problem for any service provider: not only irradiation providers, but also the industry at large, and any actor that cannot rely on matching funds from the MS (including small universities). The co-funded partnership as an instrument is not thought for including organisations that cannot count on national money. However, similarly to what was done in previous framework programmes, the EC officer pointed out that there are alternatives to address this in practice. What happens in practice is simply that each organisation declares its costs and the commission reimburses part of it. Flexibility may exist within the partnership: e.g., in EUROfusion services from industry and irradiation experiments are paid 100%, because other tasks (generally related with the use of large infrastructures that are heavily subsidised at national level, e.g., tokamaks) are reimbursed at a smaller rate.
The EC officer also noticed that the principle of the partnership is that it is a convergence of national programmes, thus also the irradiation facility owner should have its interest in performing the irradiation and so pay only 45% instead of 100%, as the case would be if the experiment was done outside the partnership. This is clearly working in other partnerships and, if anything, is not a specific problem of this one. Key are the convergence of national interests and the willingness to collaborate. It is true that in a macroproject situation it may happen that there is a need for an irradiation as pure service; in contrast, if the irradiation programme comes from a call for proposals, then it will be the result of a convergence and thus reimbursed like in any other project. In any case, it is unlikely that there will be irradiations in the first 5 years of programme. But, if an irradiation programme is considered very important for the partnership and the irradiation can be only done by a service provider, then the financing model can be revised to reserve money to pay 100% for the irradiation, at the price of lower reimbursements for other tasks, as is done in EUROfusion: it's a decision of the general assembly. Moreover, schemes such as OFFER and FIDES may be used. If the provider is 100% paid, the results will be the property of the paying consortium. Finally, the programme will be flexibly run with yearly revisions, especially in the internal call model. ORIENT-NM is open to proposals from MS experience about how to best run the partnership. If needed, as part of ORIENT-NM, another meeting will be organised with the interested MS to clarify still unresolved points and further advance on them, before writing the proposal.

2 – Statements from MS representatives

After the presentations and the relevant discussion, six member states representatives made a statement about the work done in ORIENT-NM and the opportunity to set up a co-funded partnership dedicated to nuclear materials.

Catalin Ducu (RO) - From the Romanian Institute for Nuclear Research.

The position of Romania on the initiative that is prepared and discussed in ORIENT-NM is favourable. Romania started already to develop its own infrastructures to test materials for the lead fast reactor. Recommendation: it is important to include accident

tolerant nuclear fuel in the SRA of the CEP. Romania already started an internal project on fuel retubing for Cernavoda, to get prepared for two new units round 2030. If the taxonomy passes at the EC level, it will be necessary to have fuel inside the CEP.

Marco Ripani (IT) – Member of the Euratom programme committee for fission.

Italy supports the ORIENT-NM initiative as appropriate for a wider involvement of European research institutions, for a more effective planning of medium-long term activities and to be able to make better use of existing experimental infrastructures and laboratories located in various MS. Italy supports in particular R&D initiatives on materials for new nuclear technologies, with benefits also for fusion and energy technologies beyond nuclear power. Italy considers the use of self-learning and artificial intelligence as fundamental for the development and characterization of innovative materials, beyond the state of the art, to do better than with existing materials. This initiative will contribute to affirm the European leadership on these topics, and will support dissemination and education and training.

Per Seltborg (SE) - Representing the Swedish regulator and member of the fission programme committee.

Generally, Sweden is positive with the partnership, it is seen as a good opportunity to bring forces together and collaborate to find common goals, not to have research too scattered. Co-funding is complicated in Sweden because of the different Swedish structure: there is a regulator and there are universities, there is no TSO, so co-funding is a bit challenging. It is also challenging to find how to be represented in a partnership: Sweden is working on that also for other partnerships, not only for this one, e.g., for EURAD. It also remains to be seen how to involve the Swedish industry, which is for example involved in SMILES, Halden (previously), but is currently not in FIDES, so there will be a need to connect with these programmes. At the moment, it is not completely clear how the partnership will relate with those programmes, but there is good thinking about that.

Tonči Tadić (HR) – From Ruđer Bošković Institute.

Croatia supports the ORIENT-NM programme to promote the necessary synergy between research infrastructures in the EU. Croatia is very actively involved in the DONES programme (starting DONES construction) and developed its own dual beam facilities for nuclear materials' irradiation (one of four EU facilities, together with Rossendorf, Saclay and Manchester). Croatia will be happy to make use of these facilities within the partnership. Recent irradiations performed in Croatia are a good example of how such a programme may work: materials developed in a different country were irradiated in Croatia and characterised in a third country, all within the EU, with joint European outcome. This synergy is the idea behind the philosophy of ORIENT-NM. The EU definitely needs a consistent long-term programme on nuclear materials and Croatia supports it. Proposal: collaborate with Japan and not forget Ukranians, who can still be participating in the planned activities with the means they may have. They have been with us in all our previous discussions.

Stéphane Grandjean (FR) - Nuclear energy officer at the French Ministry for Higher Education and Research.

On behalf of the French delegation, he congratulated with ORIENT-NM for the work done to produce vision paper and SRA, consistently with the SRA of the SNETP and of

the EERA JPNM. The main objective of the Euratom-funded CSA, which is to prepare an EU partnership based on coordinated orientations, is now reached, and the result complies with the global approaches supported by the EU and the MS in the field of research, innovation and higher education. EU partnerships have been identified as the main tool to improve open, inclusive and participatory scientific cooperation. So, the French delegation fully supports the next launching of a co-funded European partnership on nuclear materials, as part of the next Euratom programme. Recommendations: in the context of innovative materials' development, priority should be on fuel design and performance, and research should be extended from the structural materials studied in the INNUMAT project to new families of materials, in particular to advanced fuel materials, to ensure continuity in this key domain. The qualification of evolutionary fuel (ATF for example) could require more than 10 years, so innovative fuel for advanced SMR may take decades, without collaborative work. Supported by the vision paper, the partnership should focus on the use of digital solutions to reduce time to market for innovation. For evolutionary and innovative fuel, dedicated experiments and infrastructures are required, particularly for characterization after irradiation. A partnership will enhance international collaboration for the next decade: this is of utmost importance to keep increasing the safety of nuclear systems. What achieved through the traditional "observe and qualify" approach, and through the modern materials design, basic science and modelling approach for materials engineering, should be encouraged at the appropriate in the future.

Enrique González (ES) - Acting as programme committee officer representing Spain.

Spain supports the initiative and the documents produced by ORIENT-NM. There will be benefit from more discussion on some of the topics, e.g., model of macroproject versus internal calls, which may raise some difficulty with some national legislations, but also will enable more open and more diverse research. There should be also some discussion about commonalities versus specific applications. Discussion will also be needed to finalize the financial side. With these suggestions, Spain is convinced of the importance of a cu-funded EU programme on nuclear materials in support of nuclear technologies. So, Spain supports the proposal of this CEP as part of the current Euratom programme.

Conclusion

The 2nd ORIENT-NM workshop, held in concomitance with the FISA and EURADWASTE 2022 Conference, provided the occasion for a fruitful exchange between the community involved in the project and the representatives of members states and other stakeholders. The work done so far was explained and several points discussed to provide clarifications. The explicit support with recommendations received from official representatives of six member states opens the way to the actual inclusion of this action in the Euratom work programme.

Several decisions about the partnership structure still need to be made, e.g., macroproject versus internal call. There is awareness of the difficulty of foreseeing all possible clashes between the way the partnership is organised and national legislations. Other partnerships before have tried to solve some of these issues and this partnership should learn from that previous experience.

Based on the support received, as confirmed above, ORIENT-NM work may or not overlap with the preparation of the proposal for the upcoming Euratom work-programme. The education and training programme and, importantly, the way to involve industries and associations still need to be defined. At any rate, the goal of ORIENT-NM was to explore and prepare. There could be changes between the conclusions of ORIENT-NM and the actual proposal and the final agreement if changes are needed.

Finally, the EC officer clarified that, if the partnership on materials is launched, there will be a call for a proposal to be written by MS mandated organisations, on which they all will have to agree. The minimum amount of participating MS is six, although there should be more, which will be beneficial. The core group will lead the proposal. The budget will be defined between the EC and the MS, via the programme committee. Once it is fixed, there are no possibilities for it to change. The proposal will receive comments from the MS and, in case of discrepancies, they are generally solved by suitable compromises.

Annex – Agenda of the 2nd Workshop

31 May 2022

14:00 - 15:30	**ORIENT-NM Context** Lorenzo Malerba, CIEMAT, ORIENT-NM Coordinator **ORIENT-NM Vision Paper and Strategic Research Agenda** Marjorie Bertolus, CEA **Partnership structure, governance and analysis of resources** Lorenzo Malerba, CIEMAT, on behalf of Petri Kinnunen, VTT **Interaction with stakeholders and infrastructures** Angelika Bohnstedt, KIT
15:30 - 16:00	**Coffee Break**
16:00 - 17:00	**Member State Representatives' comments and recommendations** C. Ducu (RO), M. Ripani (IT), P. Seltborg (SE), T. Tadić (HR), S. Grandjean and F. Legendre (FR)
17:00 - 18:00	**Q&A, discussion and conclusions** All
18:00	**Workshop closure**

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This project has received funding from the Euratom research and training programme 2019/2020 under grant agreement No. 899997