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Abstract

This report documents the work undertaken in CONCERT sub-subtask 9.3.3.3 (Work Package 3, task 3.3, subtask 3.3.1 of the TERRITORIES project) that deals with stakeholder involvement in decision-making processes associated with the management of contaminated territories characterized by long-lasting exposures. In particular, it aims at anticipating stakeholder concerns and needs, by confronting them with the possible decisions – accounting for the uncertainties – that could be taken according to existing local, national, international decision-making processes, doctrines and frameworks related to mid and long-term recovery. To exchange with local actors on this topic, several workshops have been set up in Europe. In France, a stakeholders’ panel has been organized by CEPN and IRSN in collaboration with the Local Commission of Nuclear Information (CLIN) of Blayais Nuclear Power Plant. Thus, this report aims to detail the main outcomes raised from this panel.

The French stakeholders’ panel was organised in Bordeaux on 11th and 12th of December 2018. During the first day, testimonies and feedback experiences were reported by Japanese and Belarusian stakeholders involved in the rehabilitation of living conditions after the Fukushima and Chernobyl accidents. During the second day, the panel composed of local French actors (local elected people, winegrowers and vineyard unions, farmers, representatives of the local Chamber of Agriculture, the Regional Health Agency, Local Commissions of Nuclear Information, members of environmental protection associations, etc.) discussed about health, social and environmental issues which could be at stake in their territory, as well as the conditions for the recovery of economic activities (e.g. agricultural recovery). More specifically, uncertainties that the local stakeholders would face following a hypothetical nuclear accident at the Blayais Nuclear Power Plant have been described and discussed by the local interested parties. For the simulation of this hypothetical event, OPAL – a specific tool developed by IRSN for improving awareness of Local Actors toward post-accident issues - was used and the potential impacts and consequences on the territory were placed in the French context of post-accident management (e.g. using post-accident zoning criteria as proposed by CODIRPA in its ”Policy elements for post-accident management in the event of a nuclear accident”)

Discussions were organized in four working sessions, bringing together a plurality of stakeholders. Their discussions focused on the following topics:

- The monitoring of the radiological situation,
- The becoming of the agricultural sector,
- The challenges of restoring the residents’ quality of life,
- The conservation and the recovery of socioeconomic activities.

On the basis of these discussions as well as those carried out in other countries, key lessons and recommendations will be prepared for the final reports of the TERRITORIES project. These recommendations will focus on how to manage existing exposure situations to consider the different uncertainties that local actors face in the medium and long term.

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1 General Introduction

Within the European research project TERRITORIES, the overall objective of the Work Package 3 (WP3) is to analyse how uncertainty impacts decision-making processes in long-lasting radiological exposure situations. Particularly, it aims to identify which uncertainties concern the different stakeholders and most influence their decisions and choices, and in which way stakeholder engagement or other governance mechanisms could facilitate good decision making in the face of such uncertainty. The first step of the TERRITORIES WP3 aimed to analyze feedbacks experience from current long-lasting exposure situations, concerning both post-accident situations and contaminations by Naturally Occurring Radioactive Materials (NORMs). The results of this first analysis, compiled in the deliverable D.9.65 'Decision processes/pathways', allow to identify and present which kind of uncertainties cause higher concerns of populations living in contaminated territories. Based on this first analysis, next subtasks of the TERRITORIES WP3 are aiming to discuss with stakeholders about these first results. The idea has been also to collect their expectations and concerns related to long-lasting exposure situations, by confronting them with decisions – accounting for the uncertainties – that could be taken according to existing local, national, international decision-making processes. Then, to exchange with local stakeholders on this topic, several panels have been set up in Europe.

In France, a workshop dedicated to post-accident management was held on December 11-12, 2018. Co-organized by the Local Commission of Nuclear Information of Blayais Nuclear Power Plant (CLIN), the Institute of Radiological Protection and Nuclear Safety (IRSN) and the Nuclear Protection Evaluation Center (CEPN), this workshop was divided in two back-two-back meetings, bringing together local stakeholders from the Blayais region (Médoc, Gironde). More precisely, on December 11, Japanese and Belarusian stakeholders involved in the recovery of territories affected by the Fukushima and Chernobyl accidents presented their own experiences. Their testimonies mainly focused on the difficulties and challenges they have faced living in territories contaminated by a nuclear accident. On December 12, some local stakeholders have been invited to discuss about a hypothetical accident scenario at the Blayais Nuclear Power Plant. Then, based on the discussions of the first day, these stakeholders debated on the medium and long-term issues and the uncertainties that local population may be confronted with for the management and rehabilitation of their territory.

This report aims to detail the main results raised from the French workshop as well as the different types of uncertainties highlighted during the discussions.

2 Overall methodology

2.1 Focus on a particular territory

Within the TERRITORIES deliverable D.9.65 ‘Decision processes/pathways’, the analysis from post-Chernobyl and post-Fukushima situations has clearly shown that various manifestations of uncertainties are at stake and can embark different topics as for instance:

- radiological characterization and impact assessment,
- zoning of affected areas,
- feasibility and effectiveness of the remediation options,
- health consequences,
- socio-economic and financial aspects,
- quality of future life in the territory,
- social trust.

Therefore, for the French stakeholder panel, the methodology consisted in further addressing how uncertainties listed above could influence stakeholder’s decisions and choices. In that perspective, it was proposed to discuss with local stakeholders the issues related to living in contaminated territories.
and the associated uncertainties as for instance: socio-economic recovery, quality of future life in the territory, etc. To that extent, it has been decided to organize the French stakeholder panel on a particular territory, namely the Bordeaux region, where the Blayais Nuclear Power Plant (NPP) is located (see Figure 1). This territory was selected since several socio-economic issues are at stake in the vicinity of the Blayais NPP. Among them, the most emblematic are (see Figure 1):

- The Bordeaux vineyard;
- The local agricultural production (e.g. asparagus of Blayais);
- The pine forest industry;
- The seaside tourism;
- The Bordeaux metropolis.

Figure 1: Map of the different French vineyards (a) and Socio-economic activities in the Bordeaux region (b)
2.2 The target stakeholders

The organization of the stakeholder panel in the Bordeaux region was a real opportunity to interact directly with local interested parties. Therefore, it has been decided to constitute the panel by bringing together local decision-makers, local stakeholders involved in the various economic sectors of the Bordeaux region and stakeholders involved in life of local communities (environmental NGOs, etc.). The target stakeholders that have been invited to participate to the panel are the following:

- Local elected people;
- Members of the CLIN of Blayais NPP;
- Local farmers, winegrowers;
- Environmental NGOs;
- Representatives from the wine sector, tourism, forest industry, etc.

2.3 Organisation of a two-day workshop

The French stakeholder panel has been organised in the form of a two-day workshop, on 11th and 12th of December 2018 in Bordeaux city. CEPN and IRSN have led this workshop, with the collaboration of the CLIN of Blayais.

For the 1st day, on December 11, Japanese and Belarusian stakeholders living in contaminated territories were invited to share their own experiences and express the various difficulties they faced to recover their activities. Thus, this first day was open to all participants interested in the Japanese and Belarusian testimonies and willing to discuss with them. Therefore, the day was divided between plenary sessions with presentations, discussions with the speakers and general discussion on the challenges associated with living in contaminated territories (for more details, see section 3).

For the 2nd day, on December 12, the choice was made to limit the number of participants to about fifteen local stakeholders who had preferably already participated to the exchanges of the first day. On this basis, the idea was to discuss with them any uncertainties they might face living in a territory affected by a nuclear accident. In this way, it has been decided to start working by presenting a hypothetical accident scenario at the Blayais NPP. Afterwards, participants were distributed in two subgroups to discuss about the uncertainties they may face for the rehabilitation of their territory (for more details, see section 4).

3 Main outcomes from the first day of the workshop

3.1 General organization of the meeting and presentation of the participants

The first day of the workshop was attended by more than thirty participants. As it is illustrated in the Figure 2, participants were distributed as follows:

- members of the CLIN of Blayais NPP, CLI of Golfech (Local Commission of Information of the Golfech NPP, located around 160 km from Bordeaux city);
- members of ANCCLI (National Federation of Local Commission of Information);
- members of CODIRPA;
- local elected people;
- members of local associations;
- representatives of the local wine sector;
- representatives of the Nuclear Safety Authority, the Institute of Radiological Protection and Nuclear Safety and the nuclear operator EDF.
To introduce this workshop, a general presentation of the workshop’s context and the TERRITORIES project was made. Subsequently, the floor was given to the Japanese and Belarusian stakeholders who shared their experiences living in territories affected by the Chernobyl and the Fukushima accidents. After these testimonies, participants took the occasion to discuss all together about the issues at stake in the management of a post-accident situation, and notably for the case of the Blayais region.

3.2 Synthesis of the testimonies from Japanese and Belarusian stakeholders

To illustrate the complexity of post-accident situations and the various uncertainties at stake, four Japanese and one Belorusian stakeholders shared their own experiences. Their testimonies are summarized in the paragraphs below.
3.2.1 ‘Connecting Science and Life with Trust’ – Ryoko ANDO (Ethos in Fukushima)

Ryoko ANDO, native from Hiroshima, is a resident of Iwaki town who, following the Fukushima accident, worked closely with the Suetsugi community (nearby Iwaki city) and created the association "Ethos in Fukushima". Her presentation gave a description of the difficulties that the Suetsugi villagers faced as a result of the nuclear accident.

Following the Fukushima accident, the village of Suetsugi - located at 27 km from the NPP- was classified as a sheltering area from March 12 to April 22, 2011. However, on March 13, 2011, the mayor of Suetsugi decided to evacuate the community and villagers left for areas not affected by the accident. Following the lifting of the sheltering order (April 22, 2011), residents have progressively returned to live in Suetsugi. In April 2014, around 400 people (about 100 homes) were living in Suetsugi again.

Ryoko ANDO also revealed that following the Fukushima accident, public progressively lost trust in the announcements made by the government and official institutions. In fact, information disseminated by the official institutions did not correspond to the expectations of the local population. For instance, the Suetsugi residents, would have liked to get practical and concrete information on their particular situation: ‘Can our children play outside?’, ‘What is the exact level of contamination in my garden?’, etc. But, in the absence of this specific information, and not knowing how to interpret the results provided by the official institutions, residents considered their environment as potentially dangerous.

To cope with this situation, initiatives have been taken by the Suetsugi community, involving the inhabitants themselves to assess the radiological situation of their living spaces. In this way, three types of radioactivity measurements have been implemented:

- Measurements of external exposure with an individual dosimeter, the D-Shuttle;
- Measurements of internal exposure, thanks to whole-body counters (WBC);
- Measurements of samples of foods such as fruits, vegetables and meat thanks to easy-to-use equipment which have been made available in the municipality hall of Suetsugi, allowing each inhabitant to measure the products from their vegetable garden, forest mountain wild plants, etc.

For these different kinds of measurements, radiation protection experts committed themselves to analyze, interpret and explain the results to the Suetsugi residents. According to Ryoko ANDO, these dialogues have allowed inhabitants to better catch the real situation at stake. Progressively, experts have helped residents to get answers to their concerns and expectations, which have largely contributed to improve their living conditions and have helped them to regain control of their daily life.

However, Ryoko ANDO, insisted on the fact that, today, the situation is far from being solved, even if the measurement results are almost systematically below the detection limit. Indeed, it appears that the ambient dose rate remains higher than before the accident. In such a context, Suetsugi residents have to stay vigilant and to pursue the radioactivity measurements. According to them, this situation is unfair compared to other Japanese people who do not live in contaminated territory, and do not have to worry about radioactivity during their daily life.
3.2.2 ‘Damages of Fresh and Processed Fruit Industries Imposed by the 2011 Fukushima Dai-ichi Nuclear Power Plant Accident - The Case of Anpokaki (Semi-dried Persimmon) in Date City’ – Hiroshi TAKAHASHI (Fukushima Miraî Agricultural Cooperative)

Hiroshi TAKAHASHI works at the Fukushima Miraî Agricultural Cooperative, and he is in charge of the promotion of agricultural products in the Date District. His presentation described the various difficulties faced by the Anpokaki (semi-dried Persimmon) producers following the Fukushima accident.

The Fukushima Miraî Agricultural Cooperative has been created in 2016 and gathers the former agricultural cooperatives of Fukushima, Date, Soma and Adachi districts. With more than 94,000 producers, the Fukushima Mirai cooperative essentially sells fruits and vegetables. In 2010, in the four districts, total annual sales were around 36.9 billion JPY (i.e. about 300 million euros). However, the Fukushima accident affected the sales, which at the end of 2011 were only 23.8 billion JPY. Hiroshi TAKAHASHI informed that decontamination actions have been implemented since the end of 2011. At the same time, control strategies have been developed to ensure the good quality of the products. Nowadays, the annual sales of the cooperative Fukushima Mirai are still impacted by the accident. For instance, in 2017, total sales were only 28.1 million yen (against 36.9 billion JPY in 2010).

It turns out that the fallout from the Fukushima accident affected particularly the production of kakis which had to be stopped for almost 2 years. In 2012, first countermeasures were implemented and consisted in cleaning all the fruit trees with high pressure water. Soils of each field had also been progressively decontaminated. Hiroshi TAKAHASHI informed that the production of kakis has been progressively reestablished since 2013. Therefore, the production increases year by year. To ensure the radiological quality of the production, fruits are measured at different stages of growth (green fruit, mature fruit, harvested fruit, etc.). In addition to these measurements, a non-destructive testing system has been set up since 2013 to measure the fruits after drying. In this way, trays of anpokakis are systematically screened before being sold. When anpokakis trays are below the reference threshold (50 Bq/kg), a label certifying the radiological quality of the product is stuck on it. Otherwise, the tray is discarded. In 2013, 0.15% of anpokakis trays exceeded the reference threshold. In 2016, the rate declined to 0.05%.

Hiroshi TAKAHASHI also insisted on the fact that all these actions (decontamination work, control devices, etc.) have been carried out in cooperation with representatives of the government, the Fukushima prefecture, members of local municipalities as well as members of various agricultural cooperatives. The cost of the decontamination work and the control strategy has been funded by TEPCO, as part of the compensation system.

In addition to ensuring the radiological quality of their products, Hiroshi TAKAHASHI also indicated that the anpokaki producers have implemented innovative processes aiming to improve the overall quality of their products (larger, seedless anpokakis, etc.).

To conclude, Hiroshi TAKAHASHI pointed out that the dried persimmon (anpokaki) is an emblematic product of the Date region. Therefore, the Fukushima accident had a limited impact on the product’s image. Then, the sale price felt slightly when anpokakis returned on the market, but it is now back to normal. Nevertheless, the number of anpokaki sales remains lower than before 2011, due to the fact that the production did not return to its former level as many producers have left the region.

3.2.3 ‘The recovery of agricultural activities in the Yamakiya village (Kawamata district)’ - Akihiko HIRONO (Horticulturist) & Tetsuo YASUTAKA (AIST)

Akihiko HIRONO is a horticulturist and he used to work in the Tokyo market. In 2015, he decided to take over the flower farm of his parents, located in the Yamakiya village (located 40 km from the Fukushima Dai-ichi Nuclear Power Plant) and specialized in the production of lisianthus (Eustoma), which is a flower used in traditional Japanese art (ikebana). It should be noticed that following the Fukushima accident, the Yamakiya village has been evacuated from 2011 to 2017, and Yamakiya farmers experienced various difficulties to restart their activities.
Before the Fukushima accident, about 1,100 people lived in the Yamakiya village. Today, about 300 people have returned to live in Yamakiya since the evacuation order was lifted (March 31, 2017). Most of the returnees are over 65 years old.

Akihiko HIRONO pointed out that the decontamination work in the Yamakiya village started in 2013 and ended in 2017, before the lifting of the evacuation order. As the flower farm of the HIRONO family is mainly composed of greenhouses, it was not really impacted by the radioactive deposits resulting from the Fukushima accident. However, as a precautionary measure, the decision was taken by the HIRONO family to remove the upper layer of greenhouse soils (5 cm). The first Eustoma flowers produced after the accident (2013) were also measured to ensure that the level of contamination did not exceed 100 Bq/kg (i.e. the maximum permissible level officially established for foodstuff only). As the results were below this level, the HIRONO family decided to restart their flower production in 2014 before the lifting of evacuation order.

In 2015, Akihiko HIRONO and his parents sold 70,000 flowers, and since 2016, sales have increased to around 100,000 flowers per year. Akihiko HIRONO insisted on the fact that the image of Eustoma flower has not been affected by the Fukushima accident and so, the selling price remains the same than before the accident.

Conversely, the production of vegetables (spinach) and rice grown in Yamakiya since 2017 suffers much more from the loss of image. Moreover, since the producers have restarted their activities, they are also facing difficulties regarding the lack of manpower and so, they can’t find workers to help them to carry out the daily agricultural activities (e.g. cleaning irrigation canals of rice fields, etc.).

According to Akihiko HIRONO, the future of Yamakiya remains uncertain and many challenges are still at stake. Indeed, Akihiko HIRONO insisted on the fact that less than 30% of the Yamakiya villagers have returned to live in the village. It seems that young and active people have rebuilt their lives elsewhere and do not wish to come back to Yamakiya. Akihiko HIRONO also emphasized that the socio-economic fabric of the village remains unattractive: lack of health care, schools, job opportunities, etc. Therefore, efforts need to be made, for the coming years, to increase attractiveness of the territory and to rebuild a living community.

Tetsuo YASUTAKA is an expert at the National Institute of Advanced Industrial Science and Technology (AIST). Following the Fukushima accident, he was asked to answer to radioecological issues related to the transfer of cesium into the soils of affected territories. Thus, in 2013, Tetsuo YASUTAKA got involved in Yamakiya community, notably to help producers to restart their agricultural activities as well as to address their concerns.

For over 5 years, Tetsuo YASUTAKA has been involved in the Yamakiya community as a radiological protection expert. Although the initial missions of Tetsuo YASUTAKA were mainly focused on radioecological studies to support the recovery of agricultural activities, his role subsequently changed over time. Indeed, Tetsuo YASUTAKA received a lot of requests from people wishing to return living in Yamakiya and wondering about the radiological quality of their environment. Therefore, Tetsuo YASUTAKA tried to answer their questions by implementing complementary radiological studies. In this way, the radiological quality of drinking water, wild products, as well as the ambient dose rate of Yamakiya territory have been assessed with the cooperation of the local inhabitants. Afterwards, exchanges between experts and Yamakiya residents have been organized and allowed to discuss the results of the various scientific studies which had been implemented.

Today, Tetsuo YASUTAKA considers that the major difficulty of Yamakiya is the lack of manpower to help farmers in their daily activities. He also feels that the concerns of residents have changed. Indeed, nowadays, Yamakiya villagers are no more questioning the radiological quality of their territory but rather its lack of attractiveness and the weakness of its socio-economic fabric. To comply with such difficulties, Tetsuo YASUTAKA is seeking to mobilize volunteers to form a network aiming to help Yamakiya farmers.

More recently, Tetsuo YASUTAKA has started to work with the community of Futaba, whose territory has been categorized as a “difficult-to-return zone”. More specifically, he tries to maintain a link
between dispersed community members. For instance, a typical flower of Futaba (e.g. Higanbana) has been planted in Yamakiya to allow the Futaba evacuees to continue to enjoy some of their local habits.

To conclude, Tetsuo YASUTAKA emphasized that Yamakiya returnees are motivated, dynamic and have initiated various actions to revitalize their territory. Although they were focused on their community right after the Fukushima accident, Yamakiya villagers are now beginning to open themselves, trying to take care of other communities and to mutualize their efforts with communities confronted with the same difficulties (e.g. Towa and Iitate communities).

3.2.4 ‘Countermeasures implemented in Belarus after the Chernobyl accident to reduce the radiological contamination in agricultural sectors’ – Andreï MOSTOVENKO (RIR)

Andreï Mostovenko is the head of the Laboratory for Ecological and Economic Evaluation and Efficiency of countermeasures at the Research Institute of Radiology (RIR) in Gomel, Belarus. More precisely, he works on the various agricultural countermeasures implemented in Belarus following the Chernobyl accident, as well as on the evaluation of their effectiveness.

Andreï MOSTOVENKO presented different maps of the soil contamination (by cesium 137) in Belarus, in 1986, 2016 and a projection to 2046. These maps clearly show that the area of contaminated territory has decreased by a factor of about 1.5 since the Chernobyl accident (1986). Meanwhile, the maximum permissible levels (MPL) in foodstuff has also been reduced several times (by a factor of about 5), in order to comply with the optimization process. It should be noted that the Republic of Belarus is the only country among those affected by the Chernobyl accident to have maintained a national rehabilitation program over the years. The economic rehabilitation effort is currently costing 2 million dollars per day. The main components of the rehabilitation system are:

- Implementation of radiological measurements in fields, forests and villages;
- Organization of the radiological monitoring system for foodstuff, agricultural raw materials and fodder;
- Implementation of countermeasures to ensure that agricultural productions respect the official reference levels;
- Organization of trainings for professionals (doctors, educators, etc.), as well as for the population, in order to develop a practical culture of radiological protection.

In 2017, about 11 million controls of contamination were carried out. The objective of the radiological control system is to ensure that agricultural products are all below the reference levels. This control system is carried out at three levels: the official control implemented by the government, the quality control developed by the food sectors, and the individual control done by the population itself, thanks to the public centers.

The various countermeasures implemented in the agricultural sectors have led to significant reductions of the contamination, particularly during the first five-year plan (1991-1995). Since then, these countermeasures have been regularly pursued with good results. For example, from 2013 to 2017, controls made in milk produced in the public collective farms (kolkhozes) show no results above the reference level (MPL=100 Bq/L).

Based on its long experience, the RIR has carried out numerous scientific studies to identify, for example, which are the most effective agro-technical options to decontaminate the agricultural fields, or which vegetables are accumulating the most cesium 137, etc. In parallel, RIR has developed software for the long-term prediction of radioactive transfers in plants and agricultural products (TFagro), or to evaluate the cost-effectiveness of various countermeasures (AgroOptimization).

To support the development of a practical radiological protection culture among the population, RIR has also created and technically supported local measurement centers located in several villages within the contaminated territories. Moreover, campaigns of WBC are still organized regularly. Regarding the results of WBC, there is improvements of the situation. Indeed, less and less children are contaminated at high levels. Currently, the internal contamination comes mainly from mushrooms and other wild
products coming from the forest. For instance, in 2018, some mushrooms have been measured at over 36,000 Bq/kg and a wild boar at more than 1,000,000 Bq/kg.

3.3 General discussion

After the Japanese and Belarusian testimonies, a general discussion between the participants and the various speakers took place. The discussions focused mainly on raising awareness and disseminate information on the potential radiological consequences of a nuclear accident to local elected people and the population living near the Blayais NPP. The Japanese and Belarusian speakers shared their feedback experiences, pointing out notably the fact that information on radiological consequences of a nuclear accident should be adapted to the targeted audience, and should be done in a proper balance. Indeed, it has been noticed that this kind of information can sometimes create a form of anxiety among the population, raising sort of ‘exaggerated’ concerns in a ‘normal’ situation. It also appears from discussions with the audience that raising awareness in ‘peacetime’ is complex. Indeed, it turns out that, not confronted with radiological issues in its daily life, population seems not quite interested in this subject and so, is not willing to exchange on this topic.

However, Japanese and Belarusian speakers stressed that pedagogical work with pupils can be a good way to disseminate information. Discussions also underlined the fact that training on management of a nuclear emergency situation must be reinforced with health professionals (doctors, nurses, etc.) as well as with local elected people who, in the event of an accident, will be in front line to answer the various questions of the inhabitants.

4 Main outcomes from the second day of the workshop

4.1 General organization of the meeting and presentation of the participants

As mentioned before, the second day of the French workshop was limited to 15 stakeholders from the Bordeaux region, some of whom already attended the first day of the workshop. Among these participants, there were:

- farmers;
- winegrowers;
- CLI and ANCCLI members;
- local elected people;
- environmental NGOs;
- members of local associations;
- representatives of wine industry and of the Chamber of agriculture.

For this second day, the participants were invited to discuss the medium and long-term issues that they could face to revitalize their territory, following a nuclear accident at the Blayais NPP. To start these discussions, a hypothetical scenario accident at the Blayais NPP has been presented to the participants. Then, a synthesis of the Japanese and Belarusian testimonies shared the first day has also been presented, allowing all participants to have in mind the complexity of post-accident situations. Afterwards, the participants have been divided in two working groups, in order to further discuss about 4 subjects at stake in contaminated territories (see section 4.3).

4.2 Presentations of the hypothetical accident scenario and the French context of post-accident management

As an introduction, the timeline of a nuclear accident has been presented to all participants (see Figure 4). It was highlighted that, in the framework of the TERRITORIES project, there is a particular focus on the long-term phase. This phase begins when the radiological situation is sufficiently characterized to allow authorities and local communities to make decisions about the future of the contaminated
territory. From there, actions can be implemented to accompany the recovery of the socio-economic activities, and work for the return of the population.

In France, the post-accident management have been defined in the framework of the CODIRPA doctrine\(^2\). Therefore, a reminder on this doctrine has been presented to the participants, detailing notably the 3 zones of its post-accident zoning (see Figure 5):

- **The relocation perimeter (PE)** where residents must be relocated for an indefinite period. This perimeter is defined according to the ambient dose rate. The indicator is the projected effective doses, not including ingestion. For the beginning of the post-accidental phase, this indicator is calculated over the first month following the end of the releases and authorities may opt to relocate the residents if the indicator exceeds the guidance value of 10 mSv. Then, for the transition phase, the projected effective doses is calculated for the 12-month period following the end of the releases (from the second to the thirteenth month) and once again, authorities may decide to relocate population if the indicator exceeds 10 mSv.

- **The area for the protection of the population (ZPP)** is defined as an area within which actions are planned to reduce the contamination as low as possible: restrictions of commercialization and consumption of locally produced foodstuffs, starting cleaning up actions, etc. The population can live in this area. The initial definition of the ZPP is made on the most disadvantageous of the two following exposure indicators: (i) the projected effective dose received during the first month following the end of the releases, including ingestion, and the guidance value is approximately 10 mSv; (ii) the projected thyroid equivalent dose received over the first month following the end of the releases should not exceed 50 mSv. Then, for the transition phase, the indicator for the ZPP is stated in projected effective dose over 12 months following the end of the releases (from second to thirteenth month), considering all the exposure pathways. Once again, the guidance value is approximately 10 mSv.

- **The area for the control and surveillance of foodstuffs (ZST)**. This zone is more extended and opened to an economic market. Specific surveillance of food and agricultural products is implemented, based on the MPLs established by the EU (EURATOM regulations). The consumption of local foodstuffs from vegetable gardens, orchards, hunting or fishing is also limited.

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\(^2\) Policy elements for post-accident management in the event of nuclear accident, drawn up by the Steering committee for managing the post-accident phase of a nuclear accident (5 October 2012)
Following this reminder, the hypothetical accident scenario at the Blayais NPP has been detailed. In fact, this accident scenario consists in a medium-sized core meltdown, occurring during summer. As the meteorological conditions consider the existence of 2 wind directions (north-east / south-west), the radioactive deposits impact two main areas of the region (see Figure 6):

- a first area located in Gironde department, at the southwest of Blaye at the north-west of Bordeaux;
- a second area located mainly in Charente-Maritime department, on the other side of the estuary, at the north of Blaye.

On this basis, the post-accident zoning is illustrated in Figure 7.
Figure 7: The post-accident zoning and the socio-economic aspects of the Bordeaux region
4.3 The main arising uncertainties

On the basis of the hypothetical accident scenario at the Blayais NPP, its post-accident zoning and the socio-economic issues at stake in the Bordeaux region (see Figure 7), participants were invited to discuss about the following topics:

- The monitoring of the radiological situation,
- The becoming of the agricultural sector,
- The challenges of restoring the residents’ quality of life,
- The conservation and the recovery of socio-economic activities.

For these discussions, participants were divided in two working groups. In this way, participants expressed their views on the uncertainties and the difficulties they may face in case of a post-accident situations. The main outcomes of these discussions are summarized in the following paragraphs.

4.3.1 The monitoring of the radiological situation

From mistrust towards authorities and official experts to a duplication of initiatives to measure the radioactivity

In the event of an accident at the Blayais NPP, participants agreed to say that the government and official institutions would face a strong mistrust from the population. Given the various issues at stake in the Bordeaux region (vineyards, agriculture, tourism, etc.), initiatives to measure radioactivity would surely be taken by many different types of stakeholders. First, institutional actors and experts will try to characterize the radiological situation and so, will implement different measurements. The population itself will also seek to better characterize the radioactivity in their own living spaces. According to the participants, farmers and winemakers would also implement various controls of radioactivity in order to evaluate the effectiveness of the implemented countermeasures, as well as to ensure the radiological quality of their products.

Thus, many stakeholders will be involved to measure the radioactivity. All these initiatives would be implemented with different objectives, but nonetheless, they will be complementary.

Towards an integrated radiological surveillance system
Given the diversity of radioactivity measurements that would be implemented, the participants believe that it would be necessary to ensure that all the results are considered as a whole. So, the participants wonder how to coordinate all these results? And how to integrate all the data into only one system? Indeed, according to the participants, it would be relevant to have a legitimate structure that would seek to integrate all the results in order to notably analyze the trends over time.

The discussions also highlighted that control procedures would be important to ensure that measurement protocols are respected and therefore that results are reliable. According to the participants, the population may not have the means to respect strict measurement protocols, as professionals do. Then, participants think that experts should accompany people on the field to train them to measure radioactivity and analyze the results.

Give a meaning to the radioactivity measurements

Participants emphasized that "radioactivity" and the way it can be measured are concepts poorly understood by the public. Wondering how to better inform people and raise awareness on these aspects, participants pointed out the following possibilities:

- Implement training sessions for schools and high schools, notably by offering practical radioactivity measurement workshops;
- Develop information campaigns among farmers and winegrowers to explain to them the main principles of radioactivity and the way it can be measured. Feedback from the post-Chernobyl and post-Fukushima situations, particularly on the implemented countermeasures would also be interesting for them.

Train local stakeholders

In the event of an accident at the Blayais NPP, the participants highlighted that key local stakeholders (as for instance local elected people, medical doctors or even pharmacists) would be in the front line to answer to the population’s concerns about health effects of the radioactivity, the becoming of the territory, etc. However, participants believe that these local stakeholders are not ready to handle such a situation. Thus, participants strongly encourage the establishment of information and training campaign for these key actors during the preparedness phase.

Need to rely on stakeholders already involved in raising awareness

To conclude the discussions on this topic, participants pointed out that stakeholders such as CLIN of Blayais, or ANCCLI may play a key role by raising awareness on radioactivity issue among the general public. In fact, according to the participants, CLIN of Blayais, anchored in the territory, could be at the initiative of training programs involving different targeted stakeholders as for instance: winegrowers, schools or local stakeholders (local elected people, medical doctors, pharmacists, etc.).

4.3.2 The becoming of the agricultural sector

A major impact: the loss of image

In the event of an accident at the Blayais NPP, participants agreed to say that the wine sector would be one of the first economic sectors to be affected, as it represents one-sixth of the jobs in the region. Therefore, the economic impact would be immediate and it is possible that it sustainably concerns all the vineyards of Bordeaux. Sales of other wines such as Cognac and Pineau des Charentes that are produced at a short distance N.-E. to the plant would also be affected and more generally, there is a risk that the nuclear accident has an economic impact on the entire wine production at the national scale.

Regarding the other agricultural sectors, participants thought that they would also be affected by the occurrence of the accident. The working groups notably pointed out the fact that there may be a risk of stigmatization for some products bearing the same name of the Blayais NPP, as for instance: asparagus of Blayais. In fact, this was already observed in 1999 following a flooding at NPP. Following this incident, asparagus of Blayais immediately suffered from loss of image, causing a serious economic impact which lasted for about three years (sales decline).
Towards targeted and appropriate information

In such a context, participants considered that it would be necessary to develop key and common messages, jointly prepared with wine unions, the nuclear operator, authorities and experts. The overall goal of this communication process would be to inform as quickly as possible reliable, accurate and non-contradictory information. Information about the precise area affected by the radioactive deposits and its precise delimitation would also be essential to avoid generalization and stigmatization of the whole Bordeaux region. According to the participants, only a pluralistic and coherent communication between the stakeholders, and transparent information would help to save the image of the local products.

Towards the recovery of the agricultural activities

During the discussions, winegrowers and farmers pointed out that they are not aware of possible countermeasures to implement in the event of a nuclear accident. Therefore, many questions have been raised by the panelists:

- In the event of a nuclear accident, would it be necessary to stop the production of wine? If so, for how long?
- Which protocols would have to be implemented to decontaminate or reduce soil contamination or vineyards or grapes contamination? Can we produce uncontaminated wine even if the vineyard soil is contaminated?
- Would systematic removal of the topsoil be necessary? Because for some vineyards, topsoil is not thick and its withdrawal would ruin the specificity and the quality of the wine.
- Would grape-pickers be exposed to ionizing radiation? If so, how to protect them?

Faced with these questions, the participants highlighted the fact that producers need to be trained to understand the decontamination processes, and the way how radioactive contamination can evolve over time, notably with the different stage of production. In this way, the possibility to organize dialogues between producers and experts has been mentioned and supported by all the participants.

Regarding the type of information which should be disseminated in case of a nuclear accident, producers have mentioned that information on the real contamination levels in fruits or in soil could help them in their recovery processes. In addition, the evolution of the contamination over time could also be a precious information for them.

Strong need of support

The participants mentioned that in the past, at the occasion of various natural climate disasters (frost, hail, drought, etc.) mutual solidarity among producers and more particularly, among winegrowers was shown. Therefore, in light of these previous experiences, participants are convinced that in the case of a nuclear accident at the Blayais NPP, similar solidarity processes would be implemented.

In addition, participants thought that it would be important to set up as soon as possible dialogues between experts and producers, in order to prepare the key messages to be disseminated to the public and producers, in case of a nuclear accident. Participants also believe that from now, CLIN of Blayais could play a key role, trying to gather all the interested parties and try to develop a harmonized communication approach.
4.3.3 The challenges of restoring the quality of life

What is quality of life?

In preamble, the participants agreed on the fact that the ‘quality of life’ can be defined as a sort of serenity, allowing the possibility of having prospects, a future. However, it has been pointed out that ‘quality of life’ is quite a philosophical concept, which depends on values and expectations of each individual. Thus, according to the participants, in the case of a post-accident situation, not all inhabitants would behave in a uniform way. For instance, some people would decide to leave the territory (self-evacuation) to never come back. On the contrary, other people, might want to stay, either by choice or lack of funds to go elsewhere. For instance, in the case of an accident at the Blayais NPP, participants thought that winegrowers, who own family vineyards from generation to generation, might want to stay, trying to restart their own activities.

Elements contributing to the quality of life

According to the participants, before considering the restoration of the quality of life, it is necessary to ensure that living in contaminated territories is safe and that there is no longer risks of health impacts. An absolute transparency, a sustainable communication about health issues, and the comprehensive presentation of the actual radiological situation, including levels of contamination (in air, water, food, etc.) would be also essential.

Participants also believe that, to help people to return living in contaminated territories, the situation of these areas should be equivalent or even better than the one preceding the accident; even if participants believe that “nothing will be the same again”. The quality of life would depend directly on the possibility to enjoy essential infrastructures as for instance: school, public transport, health care, etc. The attractiveness of the territory and in particular job opportunities, can also largely contribute to the improvement of the quality of life.

Levers to recover the quality of life

According to the two working groups, restoring individual quality of life would depend on restoring the quality of "living together". Thus, local and national associations may be the driving force to revitalize contaminated territories. These associations can indeed help to support people having psychological, social, cultural or professional difficulties. These associations can also be important to launch local collective projects aiming to improve the future of these territories and more generally the living conditions of its inhabitants. However, participants have highlighted the fact that these projects (designed by and for inhabitants) would have to be financially supported. Also, some participants wonder what could be the sustainability of these kind of local projects over time.

The second lever which has been raised is the action of the public authorities. Indeed, according to the participants, public authorities would have to ensure that the situation in contaminated territories is equivalent (or even better) to the situation preceding the accident. Thus, public authorities would have to commit themselves to finance new infrastructures, support and redeploy the local economy. However, the participants wondered how, in such a situation, the public authorities would have the necessary human and financial resources to implement all the necessary actions.

Structures of dialogues with experts, can also be a lever, allowing local inhabitants to interact with them and try to get answers to their questions and concerns. But beyond that, participants believe that the population would need wider support coming from the rest of France. Actions of solidarity and promotion of the territory might help, notably to avoid any stigmatization of the Bordeaux region. Similarly, participants thought that the maintenance of tourist attractiveness can improve the quality of life, as one participant said: "we feel good where everyone says that here is a good place to live".


4.3.4 The conservation and the recovery of socio-economic activities

The case of the wine sector

The participants reminded that wine sector is the major socio-economic activity in the Blayais region. The occurrence of a nuclear accident would certainly have an economic impact on the sector and they wondered how much would cost this impact.

The two working groups also underlined that in the case of an evacuation, the lack of wine maintenance may have devastating effects on vineyards which would require many years of work to be restored. But, participants pointed out that, one of the first obstacles to achieve this work would surely be the lack of manpower. Indeed, it turns out that nowadays, winegrowers already face a lack of manpower. Therefore, the occurrence of a nuclear accident would further limit the recruitment of seasonal employees.

However, some participants, wished to emphasize that, in the event of a nuclear accident, winegrowers would be forced to rethink the entire wine sector, seeking to implement innovative processes: mechanization or robotization, planting new grape varieties, etc.

The case of the tourism sector

During these discussions, participants highlighted the importance of tourist activities in the Bordeaux region, attracting each year thousands of national and international visitors. In fact, there are different tourist activities: seaside tourism along the southern Atlantic coast, wine tourism, or even cultural tourism around Bordeaux city. According to the participants, the occurrence of an accident at the Blayais NPP would impact the tourism sector as a whole. However, it is difficult to assess concretely what would be the real impact of the accident: would the entire coastline be impacted? would the Royan/La Rochelle area (north of the Gironde estuary) also be affected by the occurrence of the accident?

According to the participants, the levers to limit the impact of the accident on this sector remains difficult to find as a lot of uncertainties are at stake.

Other socio-economic activities of the region

It appears from the discussions that other activities in the Blayais region could also be impacted by a nuclear accident. For instance, the issue of the forest has been mentioned several times: how to support recreational activities in forests (mushroom picking, hunting, etc.)? How to limit the impact of the accident on the wood sector?

The impacts of the accident on the maritime port of Bordeaux, as well as on market gardening, cattle or sheep farming have also been raised by the participants. They wondered in particular how to help the recovery of such activities, not emblematic of the region, that could be developed anywhere else in France.

Participants also raised the fact that the Blayais NPP currently employs 1,400 people and has created many jobs in the region. In the event of an accident, its closure would also have a strong socio-economic impact. Therefore, participants wondered about the social consequences of such closure in this rural area.

What support for the socio-economic actors?

In summary, participants agreed that the economic losses related to the decline of the tourist attractiveness and the impact on agricultural activities would be very important. But these impacts rise too many questions and uncertainties that are difficult to anticipate in order to define levers in advance.

However, discussions stressed out that there is a need to be prepared as early as possible for the economic support of local actors, as for instance winegrowers and farmers. Indeed, participants assumed that they would suffer from loss of earnings, directly related to their production decreases and the lack of sales of their products. In such a context, economic compensation would be needed to compensate this loss of earnings, but also to implement countermeasures and control procedures. Therefore, participants strongly encourage authorities to create a compensation fund, which could be quickly available in the event of a nuclear accident.
5 Conclusion

The French workshop has clearly highlighted interesting discussions regarding the uncertainties and concerns that local actors may be faced with, in post-accident situation. The first day of the workshop, dedicated to share the experiences of Japanese and Belarusian stakeholders was a real added value for the different participants. Indeed, Japanese and Belarusian testimonies have helped participants to better catch the complexity and the various issues which are at stake in post-accident situations.

During the second day of the workshop, focused on the particular case of the Blayais region, discussions have highlighted key elements. First, participants have acknowledged the need to be prepared for the management of a post-accident situation and the need to involve various local stakeholders. Participants particularly insisted on the need to organize information campaigns towards different audiences as for instance:

- **Schools** to raise awareness among children and students on radioactivity and the way to measure radioactivity;
- **Local mediators** (e.g. medical doctors, local elected people, pharmacists, etc.) to inform and train them about the management of post-accident and the various issues and concerns they may be confronted with in the event of an accident;
- **Producers and winegrowers** to inform them about the various countermeasures which could be implemented in case of an accident.

To that end, participants also highlighted the key role of the CLIN of Blayais NPP, which is already working to inform the public and local elected people living around the Blayais NPP. Besides, some contacts between CLIN of Blayais NPP and some economic actors have been made during this workshop, and might lead to actions in the coming months.

In terms of perspectives, it should be mentioned that, on the basis of this report and those elaborated by the other European panels, work is now focused on developing key lessons and recommendations. These recommendations, to be published by the end of 2019, will focus on how to manage existing exposure situations to consider the different uncertainties that local actors face in the medium and long term.